RESOLVING EMOTIONAL CONFLICTS IN HEALTHY ADOLESCENT POPULATION

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RESOLVING EMOTIONAL CONFLICTS
IN HEALTHY ADOLESCENT POPULATION

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ABSTRACT

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Emotional, cognitive and physical attitudes of children reshape when they reach adolescence. According to the literature, maturation of response inhibition, an important component of conflict resolution begins stabilizing at approximately 14 years, and adult levels of processing speed is reached at 15 years old. To the best of our knowledge there exists no study that measures adolescent performance in a Turkish population for conflict resolution. In this study, we wanted to explore how adolescents handle emotional conflicts by developing a task in which affective facial expressions displayed on the background create congruent or incongruent conditions with respect to the emotional load of the Turkish words displayed on the foreground. In this new "Word-face Stroop" experiment, conflicts between emotional words and emotional facial expressions should be suppressed in order to indicate whether the

given word is positive, negative or neutral. Another task, the classical Stroop task is also administered as a basic test to measure performance for cognitive conflict resolution. Our expectations were that the adolescents between 14-16 years of age will be able to achieve resolving emotional conflicts. We also expected that the control group, young adults, will show better performance than adolescents in terms of response time and number of correct responses. As a result, in both group of subjects, and in both classical and Word-face Stroop tasks, significant congruency effect has been detected such that response times were faster and number of correct responses were larger for congruent cases compared to incongruent cases. However, there were no significant differences between adolescents and young adults in terms of both performance metrics, namely response times and correct responses. Thus, our first hypothesis was confirmed: the adolescents between 14-16 years-old (middle adolescent) could achieve resolving emotional conflicts. We also found that adolescents' behavioral results have reached adult-level performance. To the best of our knowledge this is the first study that investigates the emotional Stroop effect in a Turkish adolescent population.

Keywords: Conflict resolution, emotional conflict resolution, Stroop task, Word-Face Stroop task, adolescence.

ÖZ

SAĞLIKLI ERGEN POPÜLASYONUNDA
DUYGUSAL ÇELİŞKİ ÇÖZÜMLEME

Aruntaş, Meryem Arzu
Yüksek Lisans, Bilişsel Bilimler Bölümü
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Şubat 2013, 79 sayfa

Çocukların duygusal, bilişsel ve fiziksel davranışları ergenliğe geçtiklerinde tekrar şekillenmektedir. Literatüre göre, çelişki çözümlemenin önemli bir parçası olan tepki ketlemesinin olgunluğu yaklaşık olarak 14 yaşında sabitlenmeye başlamakta, ve yetişkinlerin hız işleme seviyelerine ise 15 yaşında erişilmektedir. Bildiğimiz kadarı ile Türk popülasyonunda, ergenlerin performansını çelişki çözümleme açısından inceleyen her hangi bir çalışma bulunmamaktadır. Bu çalışmada, arka planda duygusal yüz ifadeleri ile ön planda duygusal yükü bulunan Türkçe kelimelerin kullanılmasıyla, uyumlu ve uyumsuz durumlar yaratarak, ergenlerin duygusal çelişkilerle nasıl başa çıktıklarını ortaya çıkarmak istedik. Bu yeni, "Kelime-Yüz Stroop" deneyinde, verilen kelimelerin pozitif, negative ya da nötr olduğunu belirtmek için, duygusal kelimeler ile duygusal yüz ifadelerinin arasındaki çelişkinin

bastırılmış olması gerekmektedir. Bir başka deney olan klasik Stroop deneyi de bilişsel çelişki çözümlemeyi ölçmek için ayrıca uygulanmıştır. Bizim beklentimiz 14-16 yaş arasındaki ergenlerin duygusal çelişki çözümlemeyi başarabilecekleriydi. Ayrıca, genç yetişkinlerden oluşan kontrol grubunun da, cevap süresi ve doğru cevap sayısı açısından ergenlerden daha iyi bir performans sergileyeceklerini bekledik. Sonuç olarak, her iki denek grubunda da hem klasik Stroop testi hem de "Kelime-Yüz Stroop" testinde de önemli bir uyumluluk etkisi yakalanmıştır; uyumsuz durumlara kıyasla, uyumlu durumlarda cevap süreleri daha hızlı ve doğru cevap sayısı da daha fazladır. Ancak, performans ölçümlerinde, bilhassa cevaplama süresi ve doğru cevap sayısında, ergenler ve genç yetişkinler arasında pek belirgin bir fark gözlemlenmemiştir. Sonuç olarak, 14-16 yaş arası (orta ergenlik dönemi) ergenler duygusal çelişki çözümlemeyi başarabilmişlerdir, böylece ilk hipotezimiz doğrulanmıştır. Ayrıca, ergenlerin davranışsal sonuçlarının yetişkin seviyesinde bir performansa eriştiğini de ortaya çıkardık. Bildiğimiz kadarı ile, çalışmamız, Türk ergen popülasyonunda duygusal Stroop etkisini inceleyen ilk çalışmadır.

Anahtar Sözcükler: Çeliski çözümleme, duygusal çeliski çözümleme, Stroop deneyi, Kelime-Yüz Stroop deneyi, Ergenlik dönemi.

To My Mom and Dad

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CHAPTER 1

INTRODUCTION

Although emotional experiences faced during adolescence are possibly restrained within the developmental period, emotional skills and abilities gained in this period are supposed to last throughout in adulthood and play important part in shaping and improving emotional functioning. Moreover, these abilities include responsiveness to mixed, conflicting and sophisticated feelings in emotional dissemblance and ability to build empathy in maturity level. Mixed and ambivalent feelings are not surprising for adults although younger children are rather stranger to these experiences. Children with cognitive skills of early adolescence can acknowledge simultaneous coexistence of conflicting feelings. Harter and Buddin (1987) suggest five sequential stages of development. At the end of these stages, children are able to understand the nature of simultaneous conflicting feelings. At first stage where the children are at their youngest phase, interpretation of mixed feelings is absent. Then, when children get older, they start to describe experiencing different feelings but having difficulties distinguishing between them based on their goals to achieve. Up until level 4 (approximately age 12), children cannot clearly express two conflicting feelings stimulated by the same target simultaneously. After this skill is achieved, more sophisticated emotional experience, especially in the interpersonal nature is explored (Adams & Berkonsky, 2003).

When we look at previous researches, there are lots of studies about emotions, especially for recognizing facial expressions in adolescents. However, according to our knowledge there are no experimental studies investigating how emotional

conflicts are resolved in healthy adolescent population in Turkey. This research is the first one to explore how adolescents handle emotional conflicts. The main aims of this study are to develop a task to measure emotional conflicts in adolescents and also to investigate the behavioral differences between healthy adolescents and adult populations in emotional conflict resolution.

We are curious about whether 14-16 year-old adolescents (middle adolescence) will be able to achieve resolving emotional conflicts and whether young adults show better performance than adolescents.

In the context of this study, the following test and experiments were designed and conducted. First, a screening test was conducted to select healthy adolescents to participate in the experiments. For this purpose, K-SADS-PL was applied.

In Experiment 1, participants were asked to complete the classic Stroop task. It is a basic test which is used to measure the time difference between spelling words and naming their colors. In experiment 2, Word-face Stroop Task (Haas, Omura, Constable & Canli, 2006; Başgöze, 2008) is conducted to observe emotional inhibition effects in the resolution of emotional conflicts. This is a task which exclusively creates emotionally congruent and incongruent situations between emotional words and emotional facial expressions.

There are two conditions in the experiment:

1. In congruent situations, positive words are shown on positively affective faces; negative words are shown on negatively affective faces.

2. In incongruent situations, positive words are shown on negatively affective faces and vice versa.

In addition, in the experiment, there is another condition used as a baseline. In this situation, neutral words are shown on neutral faces. Each subject is expected to decide on the valence (positive, negative or neutral) of the emotional words.

This thesis consists of 4 chapters. In the next chapter, an overview of the literature on conflict resolution and performance of adolescents in executive tasks such as Stroop will be presented. In Chapter 3, behavioral experiments and results on adolescent and adult populations will be explained. Then, the results of the each experiment will be discussed in reference to the previous studies and a conclusion part is included in chapter 4.

CHAPTER 2

LITERATURE REVIEW

The word ‘adolescence’ comes from *adolescere* in Latin which means growing into maturity. Adolescence should be viewed as process of gaining behaviors and beliefs to belong to the society. It can also refer to a period of physical and sociocultural development offering an idea and attitude towards life (Rogers, 1972).

When children reach puberty, they make significant progress at behavioral cognitive levels as well as developmental changes in the brain (Blakemore, 2006). This progress can be explained by emergent differences when reaching puberty:

- Behavioral Differences
- Brain Development Differences (It is explained in detail in Appendix A).

Adolescents go through several changes in emotion regulation, understanding the concept of reward and risk, and response inhibition; while the structure and function of brain changes. It was once believed that all these happened in earlier adolescence and were directly linked to pubertal maturation. However, this is not the case. During the ages 11-20, adolescents continue their development (Figure 1) (Steinberg, 2005).

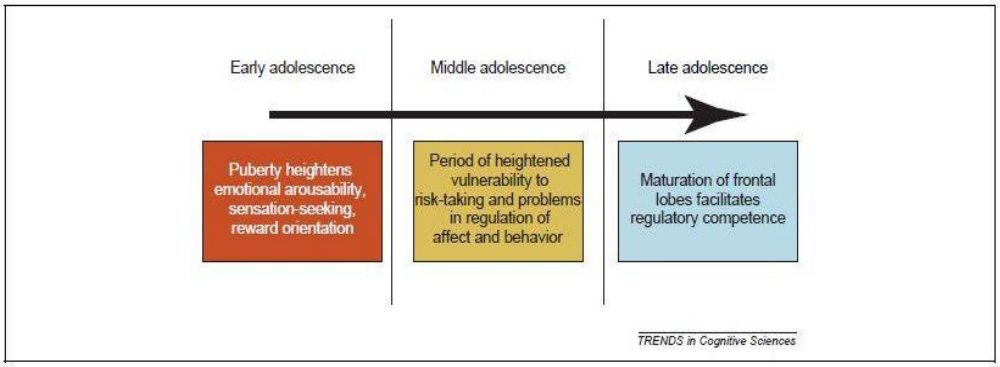

Figure 1 Phases of adolescence related to affective behavior (Steinberg, 2005).

In order for adolescents to develop socially and be able to function in society properly, they need perform emotional identification, which is an important stage in their development (Philippot & Feldman, 1990; Vicari, Snitzer Reilly, Pasqualetti, Vizzotto, & Caltagirone, 2000; Herba & Phillips, 2004). To understand normal human emotional behavior, Phillips et al. (2003) has worked on animal and human lesions as well as human neuroimaging. After collating all the findings, they came up with three processes which can help us understand emotional experience.

1- Major emotional cues are identified,
2- A response to these cues as well as an affective state is produced,
3- Through above mentioned processes, the affective state and behavior is regulated (for example, inhibition of processes (1) and (2)).

When these stages are completed, an individual is ready to function properly within a society knowing how to act and react in interaction with other people (Herba & Phillips, 2004).

The ability to distinguish between true emotions in facial expressions is an important component of social behavior. In addition, performance of adolescents continues to develop on tasks for executive functions during adolescence. In the next section, facial expression and executive function in adolescents will be explained in detail.

2.1. Facial Expression Recognition in Adolescents

Surprisingly, while there are developmental improvements in cognitive abilities in adolescence, there are also temporal developmental declines on some tasks. For example, previous studies have shown that accuracy on a face recognition task increases during childhood (10-11 years old); declines in early adolescence (14-16 years old) and then increases after early adolescence (Carey, S., Diamond, R., & Chandler, L., 1980; Spear, 2010). In addition, adolescent girls are less successful than younger or older girls in face recognition tasks (Diamond, R., Crey, S., & Back, K.J., 1983; Spear, 2010).

A more recent study about temporal decline in performance was conducted by McGivern and colleagues in 2002. The task in this study was matching of faces and emotional expressions in words. Participants were shown pictures of the same individual with a happy, sad, angry and neutral face. There was a separate set of words: 'happy', 'angry', 'sad', and 'neutral'. Subjects were asked to tell whether the picture and word matched for the same emotion. After being presented with this instruction set, subjects were shown the stimuli alone to determine whether they matched the previous set. In the next stage, subjects were shown a combination of face and word. They were asked to decide if the two matched or not. Regardless of gender, it took more time for adolescents at the age of 11 and 12 to make correct decisions. Afterwards, until age 15, reaction time decreased and then reached a stable value at that age. In addition, task performance improved until early adolescence (11-12 years old) and within this time, a decline was seen in performance. The performance increased in mid-adolescence (after 15 years old). The changes in performance are explained related to puberty. However these studies lack in explaining the contributions of pubertal hormones to the decrease of performance on facial and emotional perception, since differentiation of pubertal state from age is not investigated (Spear, 2010). Furthermore, the amygdala is known to have important role while evaluating the emotional content of facial expressions (Baird, et al., 1999), so the participation of amygdala in such tasks need to be studied in detail.

2.2. Executive Functions in Adolescents

Individuals are able to control and coordinate their thoughts and behaviors by the help of *executive function*. Executive functions are composed of planning, cognitive flexibility, abstract thinking, rule acquisition, action, decision making, working memory skills and inhibition inappropriate actions, etc... Several behavioral studies proved that performance of adolescents continue to develop on tasks for executive functions during adolescence (Blackmore, 2006). Moshman (1997) puts three higher-order thought processes which are inference, thinking, and reasoning into different places. He remarks that these processes improve during adolescence (Rice & Dolgin, 2008).

2.2.1. Information Processing

Cognitive performance and skills such as problem solving, reasoning, and planning develop in adolescence period (Welsh et al., 1991; Demetriou et al., 2002; Keating, 2004; Rice & Dolgin, 2008). With varying distinct developmental time courses; processing speed, working memory, and problem solving/planning skills depict separable abilities. Luna and colleagues (2004) showed that adult-typical processing speeds emerged around 15 years of age while adult-typical performance on working memory tasks emerged around 19 years of age.

Information Processing

Siegler's study (1995) points out importance of progressive steps, actions and operations in information processing approach to cognition taking place when adolescents gain, cultivate and utilize the information. Hale (1990) claims adolescents have different speeds of processing information that improves during early adolescence period. For instance, 15 year-old teenagers normally have more fast-paced rate of processing information than that of 10-year-old children. They can perform processing of information as fast as adults do (Rice & Dolgin, 2008).

When an adolescent interacts with a piece of information, he or she receives it; then evaluates, organizes, and transforms to different information to inquire issues, come up with solutions and make decisions. Figure 2 indicates information flow between the time when a stimulus is received and an action related to this stimulus is taken. It is observed that the direction of the flow is usually in forward direction although there might be several backward moves (Rice & Dolgin, 2008).

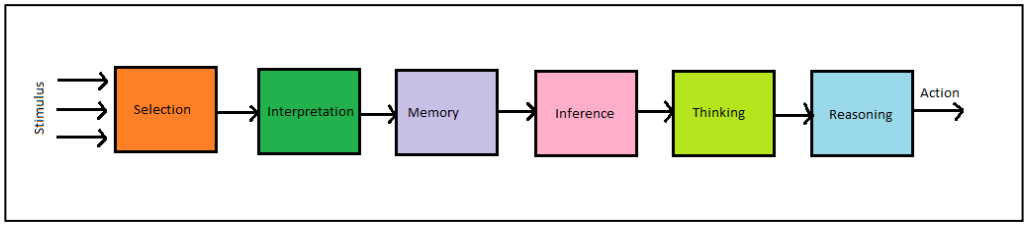

Figure 2 Steps in information processing (Rice & Dolgin, 2008).

Processing Speed

Mental processing speed accounts for age related changes in attention span and memory. Perception and utilization pace of information by brain is referred as mental processing speed. It has influence on responsiveness to characteristics of a stimulus and conception of this stimulus. Kail (1991) has important findings on the variation of mental processing speed between adolescents and adults. 12-13 year-old adolescents are slower in performing processing speed tasks, mental addition, mental rotation, memory search, and performance of simple motor skills compared to adults (Rice & Dolgin, 2008). This large difference is mostly attributed to neural development and myelinization (Kail, 2000; Rice & Dolgin, 2008). Improvement in short-term memory, in turn, leads to increase in capabilities of problem solving, reasoning and intelligence (Demetriou, Chistou; Spanoudis, and Platsidou, 2002; Rice & Dolgin, 2008). Fry and Hale (1996) name this series of enhancements as "developmental cascade." The information processing approach guides us in elaborating on why and how adolescents show more advanced ways of thinking compared to children. For instance, problem solving can be counted as one of the useful results of information processing. Accountable part of differences between

adolescents and children in problem solving ability can stem from the nature of information processing of adolescents (Rice & Dolgin, 2008).

Decision Making

Kuhn (2006) states that adolescents appear to be ahead of children in memorizing information, building possible relations, utilizing their logic, generating new variables and evaluating them to find prosperous solutions before decision-making and taking course of actions. Intelligent and mature people are expected to show the characteristics of making wise decisions. Some decisions that affect great portion of life are choosing a spouse, education, career, drug use, medical care and health habits (Rice & Dolgin, 2008). Adolescence period mean to lead a way to changes and challenges in which adolescents could make decisions that could be critical for the rest of their life and these decisions could be under the influence of deliberate and unconscious behaviors (Mann, Harmani, and Power; 1989; Rice & Dolgin, 2008).

Mann and his colleagues (1989) listed nine elements of decision making as follows: choice, comprehension, creativity, compromise, consequentially, correctness, credibility, consistency, and commitment. These are briefly discussed in the following (Rice & Dolgin, 2008).

Choice: Willingness to choose is a vital prerequisite for adolescents to confidently make choices and decisions (Brown and Mann, 1991; Rice & Dolgin, 2008). The locus of control in older adolescents (15 to 17 years old) is rather more internal: the decision making authority is individual centric. Instead, earlier adolescents (12 to 14 years old) tend to show more externality showing dependence on the surrounding outside (Mann, Harmoni, Power, & Beswick, 1986; Rice & Dolgin, 2008).

Comprehension: It is the understanding of decision making as a cognitive process. Closely related to comprehension, metacognition, is the ability to elaborate and grasp on one's own thinking and learning. Enhancement in meta-cognition is key element to cognitive advance during adolescence period according to many researchers

(Keating, 2004; Rice & Dolgin, 2008). Klaczynski (2005) suggests that adolescents become more analytical and tend to be more based on reasoning when they think. They can actively shape their own sense under deliberation instead of giving reflexive responses (Rice & Dolgin, 2008).

Creativity: Finding unusual and wise solutions that fit best to the problems rather than coming up with cut-and-dry solutions is an indication of creativity in adolescence.

Compromise: In a decision making process, imposing your solution no matter what is on the table as an alternative might be a wise approach due to possibility of chaos and contradiction. However, in a situation where compromise is favored, there is willingness to approach positively to mutually acceptable solutions if there are conflicts and discussion with family or friends.

Consequentiality: It is being aware of potential outcomes of actions performed. Older adolescents tend to predict and be aware of consequences of actions better than young adolescents do according to the study of Halpern-Felsher and Cauffman (2001) (Rice & Dolgin, 2008).

Correctness: Klayman (1985) counts correctness as one of the main indicators of decision making. Due to higher reliance on heuristics and rules of thumb, even adults cannot stand on the best solutions (Rice & Dolgin, 2008).

Credibility: It refers to the ability to be convinced in authenticating the information when making choices among different options.

Consistency: Another significant characteristic of competent decision making is making selections among given options in a consistent and stable way.

Commitment: It shows dependence or loyalty to decisions made. Older adolescents show higher commitment than younger ones (Mann, Harmoni, & Power, 1989; Rice & Dolgin, 2008).

As a result, many adolescents tend to follow steps of systematic decision making and have potential to solve problems in creative ways. Research has shown that adolescents in older ages are more competent than younger ones in decision making. Adolescents having age of 15 years old or more, have achieved significant level of competency in decision making (Rice & Dolgin, 2008).

2.2.2. Inhibition

There are several arguments about the age that inhibitory control matures. From childhood to adolescence, development of the inhibitory control component of executive functions in charge of suppressing all internal or external information that could interfere with the action at hand is an important concentration point. Whether inhibitory control development endures until the end of adolescence, or ends before adolescence is arguable (Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004). Welsh et al. (1991) discovered that the age of 9 or 10 years is the time at which inhibition reaches adult levels of maturation. Nevertheless, other studies (e.g., Becker et al., 1987; Passler et al., 1985) demonstrate that duration of inhibition development is at least from 6 to 12 years, and others (Levin et al., 1991) argue that until age 12 impulse control does not attain maturity (Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004).

A study conducted on a wide number of adolescents (275 participants aged between 6 and 81 year-old) aimed to examine the development of inhibitory control with stop-signal procedure (Williams, Ponesse, Schachar, Logan and Tannock, 1999). The procedure is based on a visual choice reaction time (go) task and inhibition of their responses upon hearing a stop signal. Performance of inhibition and response execution are evaluated by tabulating reaction times to the stop and go signals, respectively. The go task is a choice reaction time task in discrimination between two phenomena while stop task is random and involves inhibition of a planned response to go task. Sex differences has no significant effect on developmental change on stop-signal tasks as a result of Factorial ANOVA analysis while age is a significant factor affecting stop-signal reaction times as a result of One-way ANOVAs. As

shown in figure 3, older children (9-12 years) were faster in stopping than young children (6-8 years), and the group of elderly (60-81 years) was slower than young adults (18-29 years). On the other hand, sex differences has a significant effect on developmental change on go-signal tasks as a result of Factorial ANOVA analysis and age also is a significant factor affecting go-signal reaction times as a result of One-way ANOVAs. The youngest children (6-8 years) were slower in go-signal reaction time than the older children (9-12 years), and the young adults (18-29 years) were faster than the group of elderly (60-81 years) (Figure 3). The study led to the following result: Age is a significant factor in explaining inhibition responses especially in younger children and older adults (Williams et al., 1999). However, when we look at the figure 3, we can conclude that the results of adolescence (13-17 years) and young adulthood (18-29 years) look alike in both stop-signal reaction time and go-signal reaction time. There is no considerable difference between adolescence (13-17 years) and young adulthood (18-29 years).

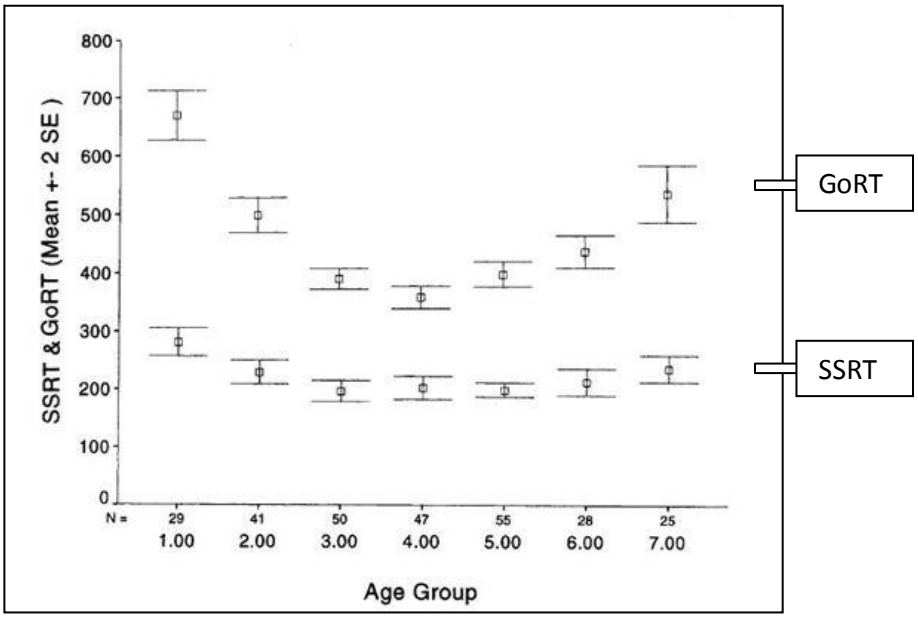

Figure 3 Group means (inner symbol) and standard errors of the mean (outer bars) for reaction times of SSRT (stop-signal reaction time) and GoRT (go-signal reaction time) for each age group (age group 1: 6-8, early childhood; **age group 2: 9-12**, midchildhood; **age group 3: 13-17**, adolescence; **age group 4: 18-29**, young adulthood; age group 5: 30-44, midadulthood; age group 6: 45-59, older adulthood; age group 7: 60-81, elderly. Reaction time means of SSRT: age group 1: 274; **age group 2: 223; age group 3: 197.7**; **age group 4: 208.6**; age group 5: 209.7; age group 6: 212.6 ; age group 7: 230.1, Reaction time means of GoRT: age group 1: 674.8; **age group 2: 503.7; age group 3: 393.7**; **age group 4: 361.8**; age group 5: 401; age group 6: 439.3; age group 7: 537.7) (Williams et al., 1999).

On another front, in a study using oculo-motor tasks cognitive maturation through adolescence is investigated (Luna, Garver, Urban, Lazar, and Sweeney, 2004). Processing speed, voluntary response suppression, and spatial working memory were measured by participation of 245 healthy volunteers with ages ranging from 8 to 30 year-old. Although processing speed, voluntary response inhibition and working memory have separate roles from each other, they work integrated in cognitive control of behavior. Oculomotor tasks have superior qualities over traditional psychological testing since it is more suitable for evaluating the maturation of cognitive processes in different age ranges. This study aimed to characterize the maturation of cognition into adulthood and elaborate on how it is linked to brain maturation by studying the development of three cognitive processes: processing speed, inhibitory control, and spatial working memory. Development in these performance criteria reaches stable levels in adolescence after steep initial improvement at earlier ages. According to this study, processing speed, response inhibition, suppression and working memory start performing at adult-level in different ages: processing speed at approximately 15, response inhibition at approximately 14 or suppression and working memory at approximately 19.

Results of the measurement of three cognitive processes highlighted on this study reveal continuous development of cognitive control of behavior through adolescence. Processing speed is slow throughout childhood, even on exogenous tasks, maturing in middle adolescence. Previous studies related to developmental oculomotor studies (Fischer et al., 1997; Fukushima, Hatta, & Fukushima, 2000; Klein & Foerster, 2001; Ross, Radant, Young, & Hommer, 1994; Luna et al., 2004) and developmental studies of simple manual reaction time (Elliott, 1970; Fry & Hale, 1996; Guttentag, 1985; Kail, 1991b; Luna et al., 2004) also confirm these findings. While initiating a response to a visual target, latency matures independent from cognitive demands, starting at about age 15 (Figure 4). As a result of changepoint analyses response suppression starts to mature at about age 14, supporting the results of previous studies regarding developmental studies of antisaccades (Fischer et al., 1997; Munoz et al., 1998; Luna et al., 2004).

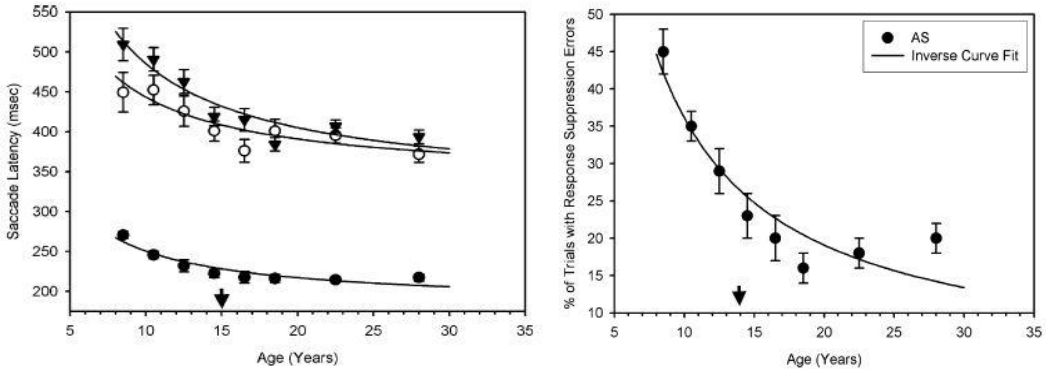

Figure 4 Mean + standard error of the mean (SEM) of the latency to initiate a saccade in each task (right graph) and mean with standard error of the mean (SEM) for the percentage of trials with a response-suppression failure in the antisaccade (AS) task for each age group (left graph). In the right graph, solid circles: the latency to initiate a saccade to a visual stimulus during the visually guided saccade (VGS) task; open circles: the latency to initiate an eye movement to the opposite location of a visual target in the antisaccade (AS) task; solid triangles: the latency to initiate an eye movement to a remembered location in the oculomotor delayed response (ODR) task; thick lines: the inverse curve fit on the mean latency to initiate an eye movement response in milliseconds by age in years; **arrows: the ages at which changepoint analyses indicate adult levels of performance were reached (15 years old)**. In the left graph, solid circles depict the mean + standard error of the mean (SEM) for the percentage of trials with a response-suppression failure in the antisaccade (AS) task; thick lines: the inverse curve fit on the response-suppression failures by age in years; **the arrow: the age at which changepoint analyses indicate adult level of performance were reached (14 years old)** (Luna et al., 2004).

Attention control similarly improves in mid-adolescence developmentally. In a visual-motor task called "antisaccade" task, individuals fixating on a central stimulus are regularly confronted with a target in their right or left visual field and urged to respond to the target quickly by deviating their stare to the opposite side of visual field instead of looking to target. On this task, improvements are observed until about 14 years of age (Luna et al., 2004). Improvements of inhibitory control, processing speed, working memory and decision making abilities were observed by various scientists during adolescence (Blackmore, 2006). In figure 5, several examples of executive functions are shown across ages. After 10-years old children exhibit a significant difference in many executive abilities (Paus, 2005).

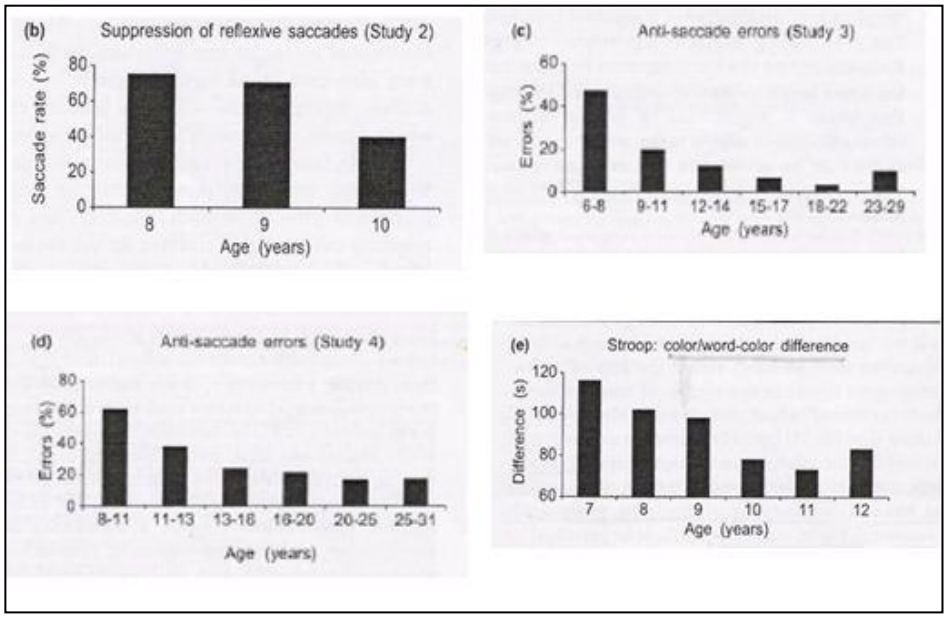

Figure 5 Age related changes in executive function performance (Paus, 2005).

2.2.3. Conflict Resolution

In order to complete a task, people need relevant information and stimuli. Therefore, people tend to focus on and select appropriate information while ignoring irrelevant ones. This ability enables people to resolve conflicts they encounter (Egner, Etkin, Gale & Hirsch, 2008). Conflict resolution is a cognitive ability which helps people process contextual information. Perceptual selection, response biasing and online maintenance are important components of conflict resolution (Botvinick, Braver, Barch, Carter, & Cohen, 2001).

2.2.3.1. Stroop Task in Adults

The most extensively used experiment for analyzing conflict resolution is the Stroop task (Stroop, 1935; Puccioni & Vallesi, 2012). In this task, participants try to identify the color of a word while disregarding its meaning. The classic version of the Stroop task has three conditions. 1:reading color words printed in black; 2: identifying color

patches; 3:identifying the color of the ink of color words, when the semantic meaning of the word is not congruent with the color of the word (e.g. the word "blue" printed in the color yellow) (Stroop,1935). It is observed that in third condition performance is slower than the first and second condition, in terms of response time and / or accuracy; which is refered as "the Stroop effect". The third condition involve inhibitory processing which urges people to suppress the more automatized response related to the meaning of the word (see MacLeod, 1991 for review; Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004).

In research applying the Stroop Test, it is found that response time to the color of a word when its name and color are incongruent is slower than when they are congruent. Response time (RT) and accuracy differences between incongruent and congruent conditions in the Stroop task are the basic measures of conflict resolution (Puccioni & Vallesi, 2012). The Stroop test is extensively used for measurement of inhibition in clinical assessment and experimental studies (Stuss et al., 2001; Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004). Evaluating the developmental pattern of inhibitory control with the Stroop test have a high correlation with theoretical and clinical implications (Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004).

The cognitive processes utilized in Stroop task such as response inhibition, interference resolution and behavioral conflict resolution are regarded as executive processes controlled by the frontal lobe (Adlemen, Menon, Blasey, White, Warsofsky, Glover & Reiss, 2002). The Stroop Color-Word task has been used to measure frontal lobe function since 1935 (MacLeod, 1991; Adlemen et al., 2002). Variations in interference resolution relates to age as emphasized by the reviewed evidence. It is thought that this interference is caused by the time interval to suppress task irrelevant but automatic processes (i.e. word reading in the Stroop task) (Lezak, 1995; Puccioni & Vallesi, 2012). Many researches imply that Stroop interference effect increases with aging (Andres, Guerrini, Phillips & Perfect, 2008; Belleville, Rouleau & Van der Linden,2006; Davidson, Zacks & Williams, 2003; Hartley, 1993; Mayas, Fuentes & Ballesteros, 2011; Rush, Barch & Braver, 2006; Schelstraete & Hupet, 2002; West & Allian, 2000; West & Bell, 1997; but see Ludwig, Borella,

Tettemanti & Ribaupierre, 2010; Uttl & Graf, 1997; Verhaeghen & De Meersman, 1998 as cited in Puccioni & Vallesi, 2012). An increase in interference with the Stroop test in older people (between 20 and 80 years) have been reported by several researchers (Houx et al.,1993; Wecker et al., 2000; West, 1999; Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004). In contrast to Kieley and Hartley (1997) and Shiling et al. (2002), reporting that such effect has not been observed in older people between 62 and 86 (Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004).

2.2.3.2 Stroop Test in Adolescents

Proponents of the early maturation of inhibition control component claim that adult level is acquired around the age of 10-12. However, classical data coming from the Stroop test and other inhibition studies connotes that there exists a linear decrease in RT to process interference with age until age 16. More specifically, Welsh et al. (1991), argues that the maturation of inhibition occurs between 10-12 years of age, in contrast, Comalli et al. (1962) implies that the increase in inhibition control continues until age of 16-18 years (Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004).

Analyzing errors and response times in the interference condition by researching nonlinear relations rooting from the measure, response times, and errors it is found that first an increase occurs in interference effect that goes from 6 to 8 or 10 years, but after this period a decrease is observed until age 17 years. Nevertheless, the non-linear relationship is interceded by reading skills. Unless reading variables are blocked, linear relationship between age and Stroop performance is not observed. This linear relationship implies a linear increase of inhibition control with age. (Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004) (Figure 6 and Figure 7).

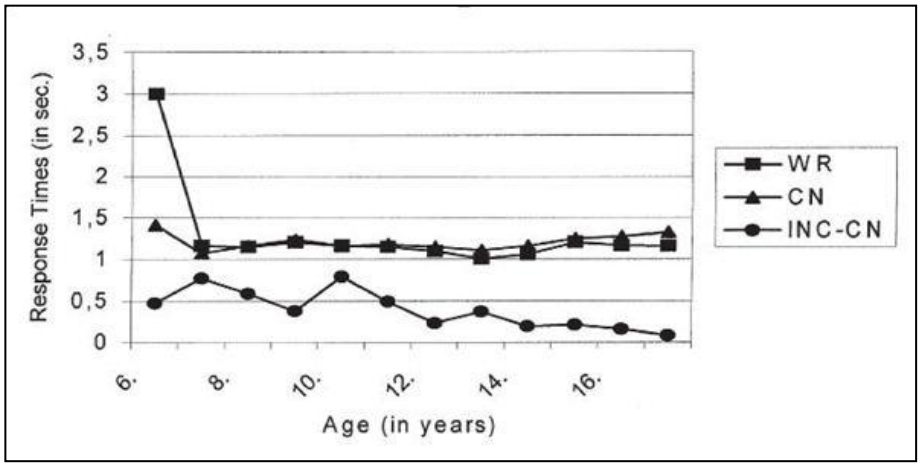

Figure 6 Stroop Test Accuracy (WR: word reading CN: color naming INC-CN: incongruent task color naming) (Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004).

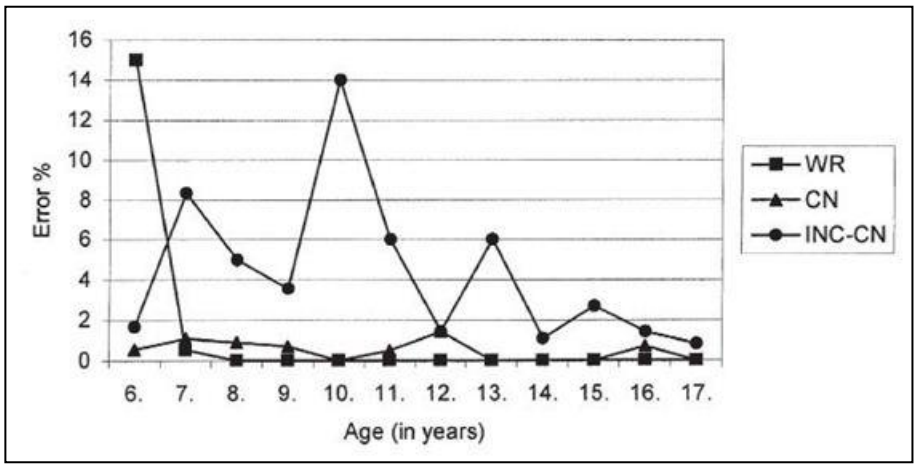

Figure 7 Performance in Stroop Test by age (WR: word reading CN: color naming INC-CN: incongruent task color naming) (Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004).

In another study (Adlemen et al., 2002), developmental changes in brain activation during a Stroop color-word interference task has been analyzed by using fMRI with participation of 30 people from different age ranges. It was observed that there was a positive correlation between age and Stroop related activation in the left lateral prefrontal cortex, the left anterior cingulate, and the left parietal and parieto-occipital cortices. No regions are found showing negative correlation between age and activation. The study also investigated if there is any difference in brain activation

among different age groups. There were basically three age groups specified: children (ages 7-11), adolescents (ages 12-16), and young adults (ages 18-22). Brain activation increases with age in specific regions of the brain which are supposedly significant in performance of the Stroop task. Particularly, activity in the left lateral prefrontal cortex and the anterior cingulate escalates proportionally with age, implying an increase in focal resource recruitment during maturation of individuals. This increase in activation is related to age and connected with better behavioral performance on findings of the Stroop task (Adlemen et al., 2002).

Considering the Turkish adolescent population, when Stroop effect is investigated, compatible results are found with Comali's findings (1962). A reduction in destructive effect is indicated from 7 years to 18 years old (Comali et al., 1962; MacLeod, 1991; Yalçın & Karakaş, 2008). Overall, the following conclusions can be drawn (Yalçın & Karakaş, 2008):

- Children's perseverative (repetitive) response and the number of repetitive errors decreases,
- The usual pattern of behavior is suppressed while gaining the ability to make unusual behavior,
- Efficiency in executive functions is increased.

2.2.3.3 Emotional Conflict Resolution and Word-Face Stroop Task

Classical Stroop task studies the relationship between words and colors to measure cognitive conflict resolution. On the other hand, the emotional conflict resolution investigates conflicts between affective stimuli (Başgöze, 2008).

> "*In psychology, the **emotional Stroop task** is used as an information-processing approach to assessing emotions. Related to the standard Stroop effect, the emotional Stroop test works by examining the response time of the participant to name colors of negative emotional words. For example, depressed participants will be slower to say the color of depressing words rather than non-depressing words. Non-clinical subjects have also been shown to name the color of an emotional word (e.g., "war", "cancer",*

"kill") slower than naming the color of a neutral word (e.g., "clock", "lift", "windy")" (Gotlib et al., 1984) *" Both the classic and the emotional Stroop tests, however, involve the need to suppress responses to distracting word information, while selectively maintaining attention on the color of the word to complete the task"* (Rebecca et al., 2003). (http://en.wikipedia.org/wiki/Emotional_Stroop_test)

The Word-face Stroop Task developed by Haas and colleagues (2006) is another test measuring emotional conflict resolution. Emotional saliency of the faces in the background creates congruent and incongruent conditions as follows. Affective words are written on affective faces. In the congruent condition, affective words and faces carry the same emotional pleasantness information, but in the incongruent condition, emotional pleasantness of faces and words are in disagreement. As a result, researchers found significant difference in RT's of subjects between emotionally incongruent (EI) condition, emotionally congruent (EC) condition and neutral (N) condition (Figure 8). The response times are shorter for EC than EI due to processes related to inhibition of interference in the EI condition.

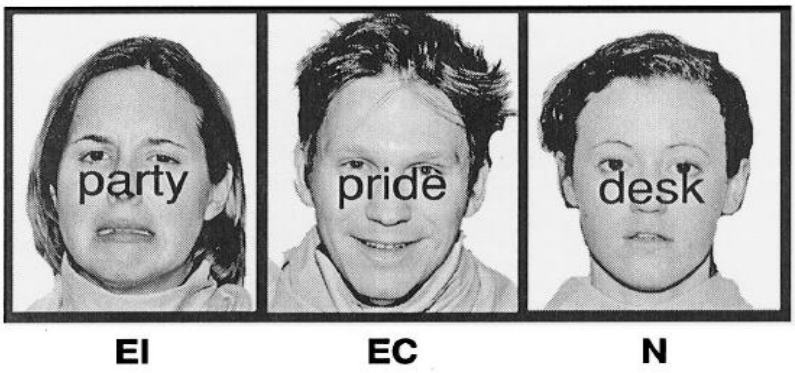

Figure 8 Examples of the stimulus in the Word-face Stroop Task (Haas, et al., 2006).

Hypotheses:

In an earlier study (Başgöze, 2008), healthy adults' reaction times for emotional conflict resolution were measured by using of Turkish words manipulated along the

valence axis. According to these results, the response times for the congruent situations (e.g. negative word on a sad face) were significantly less than the response times for the incongruent situations (e.g. positive word on a sad face). Also, the number of correct responses was higher in congruent situations than the incongruent ones.

By considering the Luna and colleagues' researches (2004), development in processing speed, voluntary response suppression, and spatial working memory performance criteria has reached some stable level in adolescence after steep initial improvement at earlier ages. Moreover, when the speed of information processing (Hale, 1990; Siegler, 1995; Rice & Dolgin, 2008) is taken into consideration, it is said that the adolescents are fast as adults. In this context, our hypothesis is that adolescents between 14-16 years-old (middle adolescent) will be able to achieve resolving emotional conflicts. On the other hand, whether there are any differences in terms of averages of the reaction times and correct responses between adolescents and adults population is questionable.

CHAPTER 3

BEHAVIORAL EXPERIMENTS

Recent research suggested that Stroop-task-related functional development occurred in the parietal lobe. It started to arise in adolescence. However, the Stroop-interference-task activity which occurs in the prefrontal cortex continues to develop into adulthood. Based on the existence of other executive function and physiological differences in the adolescent population, we would like to investigate whether the behavioral reactions to emotionally conflicting stimuli are different in adolescent versus healthy adult populations. For this purpose, we measured whether adolescents' reaction times differ with respect to adults' in response to emotional stimuli manipulated along the arousal axis.

In this research, The Classical Stroop Task and The Word-Face Stroop Task are administered to measure cognitive and emotional conflict resolution respectively. Both adolescent and adult populations are recruited to find out the differences and similarities of behavioral results in conflict resolution.

3.1 Screening Test for Selection of Healthy Adolescents

Adolescents were administered K-SADS-PL (Schedule for affective disorders and schizophrenia for school age children-present and life time version) by a licensed

psychologist[1]. According to the result of interviews, those adolescents who did not have a diagnosis were admitted to the experiment phase. All participants' families signed informed consent attached in Appendix E.

Participants

25 participants (11 Female, 14 male) with mean age 14.96 (*SD* = 0.78) years, participated in this study. 7 adolescents were 16 years old, 10 adolescents were 15 years old and 8 adolescents were 14 years old. All of the participants were native Turkish speakers. They had no psychological problem history according to all accounts of their families.

Materials

K-SADS-PL (Schedule for affective disorders and schizophrenia for school age children-present and life time version) was redeveloped by Joan Kaufman, Ph.D., Boris Birmaher, M.D., David Brent, M.D., Uma Rao, M.D., and Neal Ryan, M.D. The K-SADS-PL is designed for school aged children between 6 and 18 years old. It is a semi-structured diagnostic interview. DSM-III-R and DSM-IV criteria are used to determine current or past episodes of psychopathology in this age group. The Standardization study of K-SADS-PL for Turkish was carried out in The Child and Adolescent Psychiatry Department at Hacettepe University and Schedule for Affective Disorders and Schizophrenia for School Age Children-Present and Lifetime Version-Turkish Version (K-SADS-PL-T) was developed (Gökler, Ünal, Pehlivantürk, Kültür, Akdemir & Taner, 2004).

K-SADS-PL includes the assessment of the following major diagnoses: Major Depression, Dysthymia, Mania, Hypomania, Cyclothymia, Bipolar Disorders, Schizoaffective Disorders, Schizophrenia, Schizophreniform Disorder, Brief

[1] We would like to express our gratitude to Zeynep Tüzün for her help in test administration.

Reactive Psychosis, Panic Disorder, Agoraphobia, Separation Anxiety Disorder, Avoidant Disorder of Childhood and Adolescence, Simple Phobia, Social Phobia, Overanxious Disorder, Generalized Anxiety, Obsessive Compulsive Disorder, Attention Deficit Hyperactivity Disorder, Conduct Disorder, Oppositional Defiant Disorder, Enuresis, Encopresis, Anorexia Nervosa, Bulimia, Transient Tic Disorder, Tourette's Disorder, Chronic Motor or Vocal Tic Disorder, Alcohol Abuse, Substance Abuse, Post-Traumatic Stress Disorder, and Adjustment Disorders (Kaufman et al, 1997).

Procedure

Schedule for Affective Disorders and Schizophrenia for School Age Children-Present and Lifetime Version-Turkish Version (K-SADS-PL-T) is composed of three parts. First part is called **Unstructured Introductory Interview**. In this section, the information about the child's demographic, health, presenting complaint, prior psychiatric treatments and also school functioning, hobbies, and peer and family relations is collected (Gökler et al, 2004). Second part is called **Screen Interview**. In this section, children are asked to find the primary symptoms of major diagnoses in the K-SADS-PL. To be able to find the symptoms, there is a specific scoring type for K-SADS-PL. *0-3 point rating scale* is used to determine whether any symptoms of the diagnosis are available or not. If no information is available, the score is 0; if the symptom is not present, the score is 1; if there are sub-threshold levels of symptomatology, the score is 2 and if threshold criteria are available, the score is 3. To select healthy adolescent population, adolescents' scoring should be under the scores of 3 in all diagnoses. If any symptoms are available for specific diagnosis, to confirm the diagnosis, additional scoring is made for five Diagnostic Supplements which are Affective Disorders, Psychotic Disorders, Anxiety Disorders, Behavioral Disorders and Substance Abuse and Other Disorders. This part is named as **Supplement Completion Checklist**. There is a list of symptoms, probes, criteria for each supplement. Diagnosis criteria according to DSM-III-R (APA1987) ve DSM-IV (APA 1994) are presented. **Children's Global Assessment Scales** is the third part of

the The K-SADS-PL. Every child's current level of functioning is determined by the help of this scale.

All interviews take 45-120 minutes for each child. The K-SADS-PL is required to interview with both adolescents and parents, since The K-SADS-PL aims to collect as possible all information about the child. If the participants are pre-adolescents, the rater should first meet with parents. However, while working with adolescents, first adolescents are interviewed. If the collected information is inconsistent with each other, the rater's clinical judgment is accepted.

Results

After the participants were interviewed, all adolescents qualified to participate in the experiments.

3.2. EXPERIMENT 1: Classical Stroop Task

Classic Stroop task is a basic test which is used to measure the time difference between spelling words and naming the colors. The participants are first required to read the written words and then to name the colors of the words.

In this task, participants are required to name the color of a word which expresses the name of a color. The task is easy when the color and the meaning of the word is congruent (e.g., the word "green" in green letters), but when the color in the print and the word's content are not congruent (e.g., the word "red" in green letters), people get confused. It is thought that, people get confused, since reading words is an automatic skill and practiced more than naming the colors. In order to prevent the tendency to respond the word instead of color, attentional control is required (MacLeod, 1991).

3.2.1 Method:

Participants

20 healthy right handed adolescents (10 female, 10 male; between ages 14-16) with a mean age of 14.95 (SD = 0.82) years participated voluntarily in this experiment. Participants have an average of 8.95 (SD = 0.82) years of education and they were all native Turkish speakers. None of them had a history of any diseases, psychological problems and difficulty in identifying the colors. In another group, 20 healthy right handed adults (11 female, 9 male; between ages 24-30) with a mean age of 26.5 (SD = 1.67) years participated voluntarily in this experiment. All of the participants were native Turkish speakers. They had no psychological problem history according to all accounts of their families.

Materials

Istanbul University Medical School, Neurology Department's Neuropsychology Lab developed the Stroop task which is used in this experiment. There are colored words and colored rectangles on the paper for the task. And another paper with the correct answers is used for scoring. Wrong answers, spontaneous corrections and reaction times are noted on this sheet. By the help of the chronometer, reaction times are measured. To measure reaction times, a command is issued to start like "you can start" and terminated when the subject stopped answering for the whole part.

Procedure

There are three parts in this task. First, colorful (red, blue, green) little rectangles were presented to the participants and they were asked to name the colors of the rectangles quickly and correctly. They were also informed that if they did wrong, they could correct themselves. Secondly, a list of words (kırmızı: red, mavi: blue,

yeşil: green) are shown to the participants written in incongruent ink colors (e.g., "kırmızı: red" printed in red). Participants first required reading the colorful words and they just read the words (congruent). At the last section, they named the colors of the colorful words (incongruent: "kırmızı: red, printed in blue). For each part: reaction times in milliseconds, number of correct answer and number of spontaneous corrections were saved and each part was scored independently.

3.2.2 Results

For Adolescents:

Reaction times (RT)

A repeated measures ANOVA is conducted which revealed a significant main effect, $F(2,38) = 46.488$ $p<.000$ for the difference between reaction times in three levels: rectangle color reading, word reading and color naming (Figure 9). Participants consumed more time while naming the colors of the colorful words than both naming the color of rectangles color and reading just words.

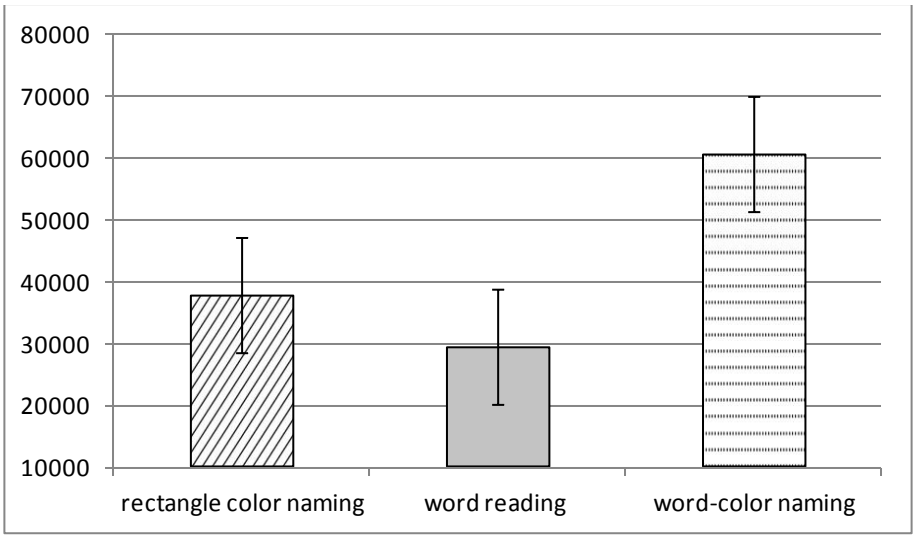

Figure 9 Reaction time means of classical Stroop for adolescent

Wrong Answer

A repeated measures ANOVA is conducted on the wrong answer numbers. It revealed a significant effect, $F(2,38) = 10.449$ $p<.000$. That is, they made more mistakes while saying colors of words than naming colors of rectangles and reading words. In addition, again the word reading task is the easiest one.

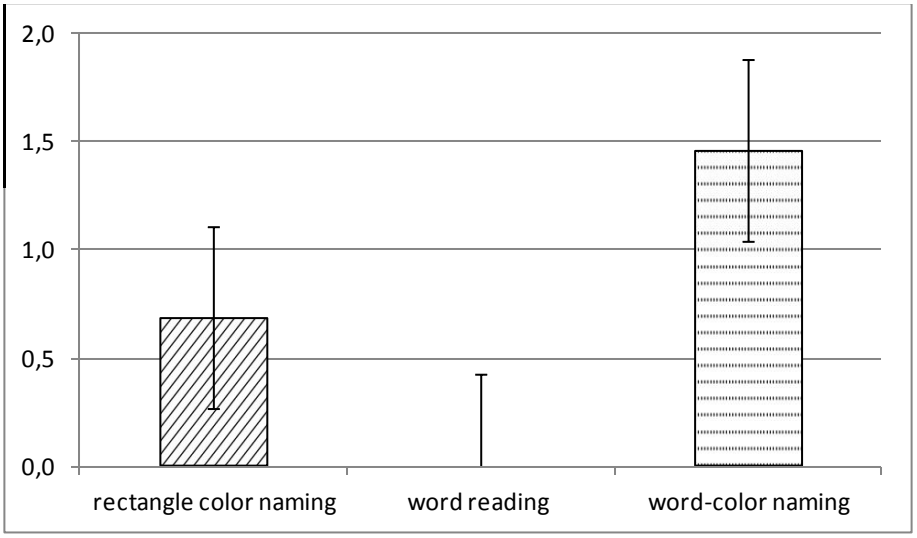

Figure 10 Wrong answer means of classical Stroop for adolescents

Spontaneous Correction

Again repeated measures ANOVA is conducted which revealed a significant effect on spontaneous corrections, $F(2,38) = 8.363$ $p<.05$ Hence, participants made corrections at most in incongruent situation (word-color naming).

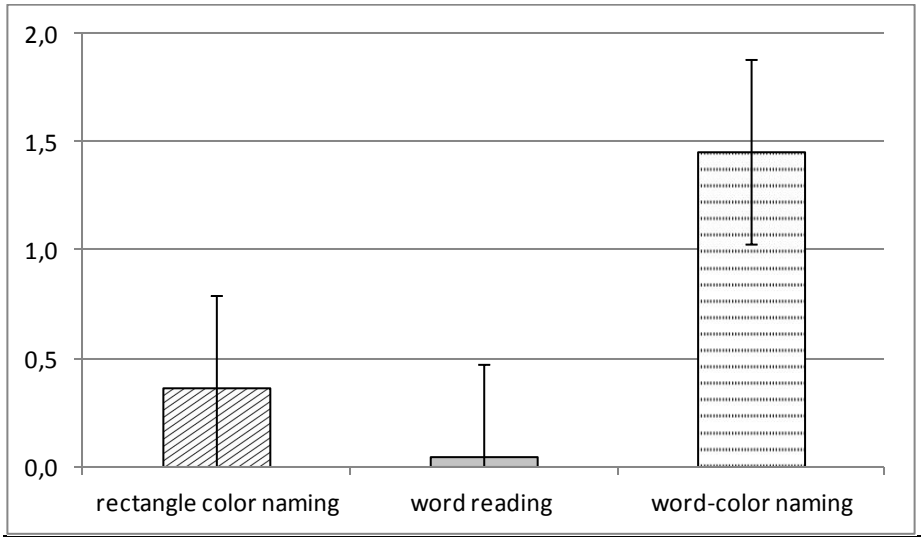

Figure 11 Spontaneous correction means of classical Stroop for adolescents

For Adults:

Reaction times (RT)

A repeated measures ANOVA is conducted which revealed a significant main effect, $F(2,38) = 148.351$ $p<.000$ to measure the difference between reaction times in three levels (rectangle color reading, word reading and color naming) (Figure 12). Participants consumed more time while naming the colors of the colorful words than both naming the color of rectangles color and reading just words.

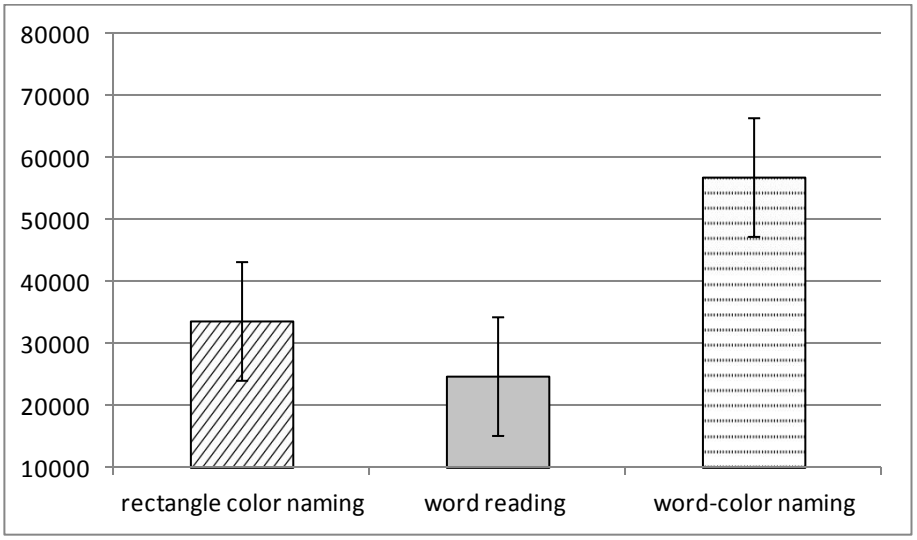

Figure 12 Reaction time means of classical Stroop for adults

Wrong Answer

Repeated measures ANOVA is conducted on the wrong answer numbers. It revealed a significant effect, $F(2,38) = 4.338$ $p<.05$. Therefore, participants made more mistakes in incongruent situations than in congruent situations. That is, they made more mistakes while saying colors of words than naming colors of rectangles and reading words.

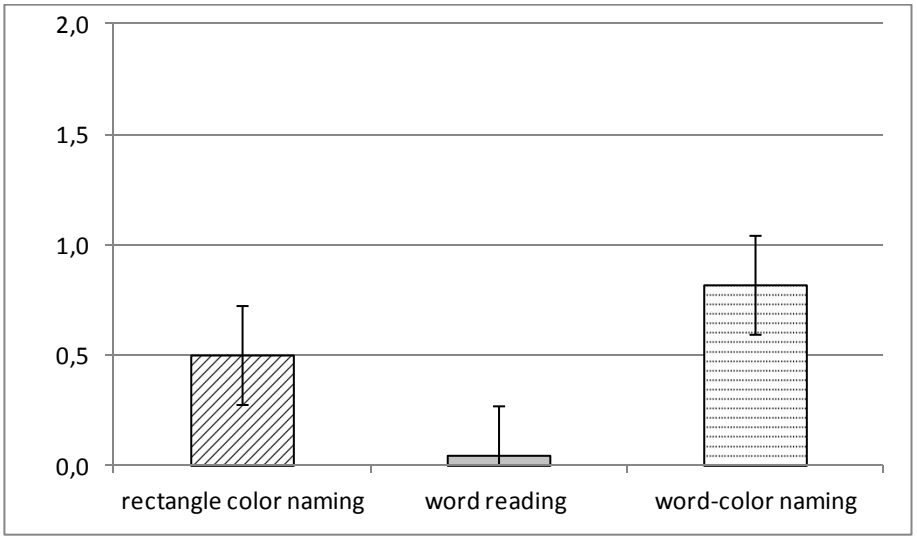

Figure 13 Wrong answer means of classical Stroop for adults

Spontaneous Correction

Again repeated measures ANOVA is conducted which revealed a significant effect on spontaneous corrections, $F(2,38) = 4.916$ $p<.05$. Hence, participants made corrections at most in incongruent situation (word-color naming).

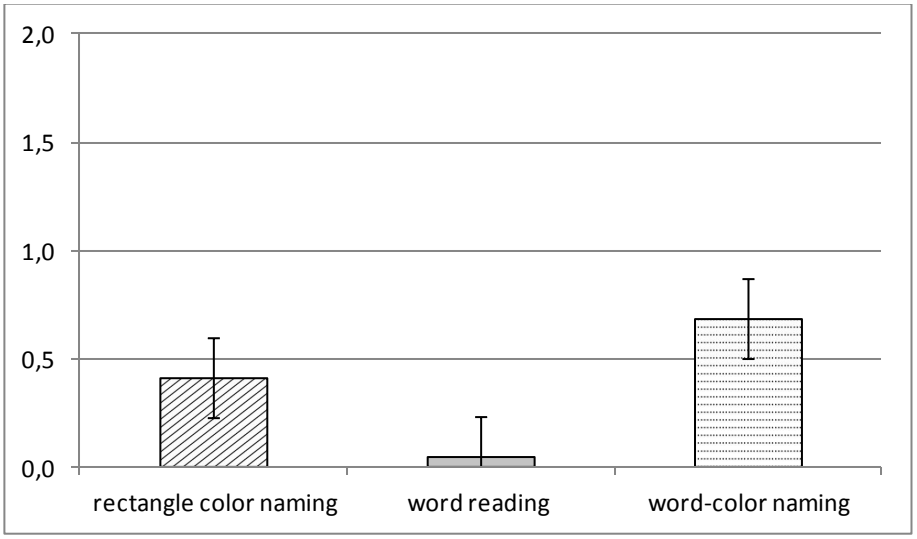

Figure 14 Spontaneous correction means of classical Stroop for adults

Comparing Results between Adolescents and Adults:

One way ANOVA is conducted which revealed no significant main effect, $F(1,39) = 1.946$ $p=0.171$ to measure the difference reaction times of rectangle color reading, also barely significant effect $F(1,39) = 3.349$ $p=0.075$ to measure the difference reaction times of word reading and $F(1,39) = .078$ $p = 0.782$ for word-color naming between adolescents and adults (Figure 15).

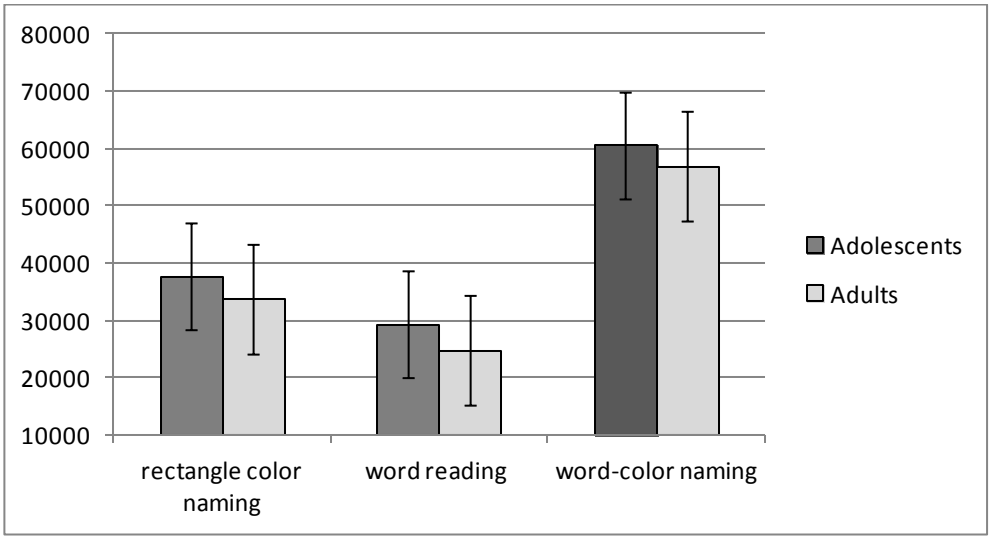

Figure 15 Reaction time means of classical Stroop for adolescents and adults

One way ANOVA is conducted which revealed no significant main effect in the number of wrong answers, $F(1,39) = 0.363$ $p = .550$ for rectangle color reading and $F(1,39) = 1.000$ $p = .324$ for word reading and $F(1,39) = 1.900$ $p = 0.176$ for word-color naming between adolescents and adults (Figure 16).

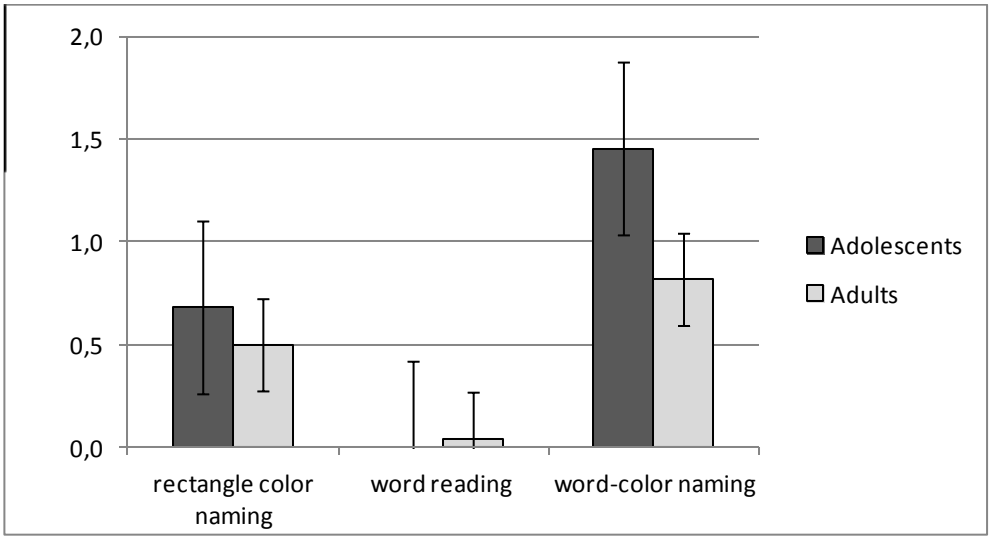

Figure 16 Wrong answer means of classical Stroop for adolescents and adults

One way ANOVA is conducted which revealed no significant main effect in the number of spontaneous corrections, $F(1,39) = 0.081$ $p = .778$ for rectangle color reading and $F(1,39) = 1.000$ $p = 0.324$ for word reading and $F(1,39) = 1.195$ $p = .281$ for word-color naming between adolescents and adults (Figure 17).

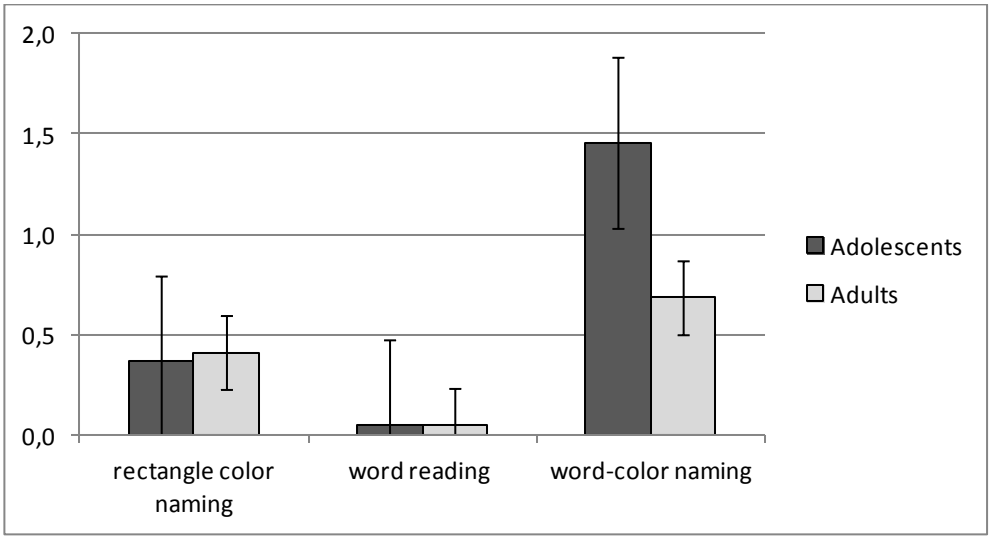

Figure 17 Spontaneous correction means of classical Stroop for adolescents and adults.

3.3. EXPERIMENT 2: Word-Face Stroop Task

The "Word-face Stroop" experiment, which measures conflicts between emotional words and emotional facial expressions, is a task which exclusively creates emotionally congruent and incongruent situations (Başgöze, 2008). In this task, the conflict is between "emotional" words and "emotional" faces. In the study, the words are shown on emotionally affective faces and the participants are required to mention the emotional state of the given word (positive, neutral and negative). In congruent situations, both the words and the faces are same that's positive words are presented on positively affective faces and negative words are presented on negatively affective words. In incongruent situations, negative words are shown on positively affective faces and vice versa.

In this thesis, word selection was conducted by manipulations on the arousal axis instead of the valence axis.

The novelty of this study is using the brand-new Turkish affective word list and manipulation of words based on the arousal values.

3.3.1 Method:

Participants

20 healthy right handed adolescents (10 female, 10 male) with a mean age of 14.95 (SD = 0.82) years participated voluntarily in this experiment. Participants have an average of 8.95 (SD = 0.82) years of education and they were all native Turkish speakers. None of them had a history of any diseases, psychological problems and difficulty in identifying the colors. In another group, 20 healthy right handed adults (11 female, 9 male; between ages 24-30) with a mean age of 26.5 (SD = 1.67) years participated voluntarily in this experiment. All of the participants were native Turkish speakers. They had no psychological problem history according to all accounts of their families.

Materials

Emotionally normed words were selected from TUDADEN database (Gökçay & Smith, 2011). In this experiment, 48 words (16 positive, 16 negative and 16 neutral) are used (Appendix B). Lengths and emotional dimension values of all words were controlled. Their length have a mean of 5.54 (SD =1.0). The emotional arousal and valence scores are as follows:

1. Words with positive arousal and negative valence: Arousal: M = 7.07, SD = 0.48, Valence: M = 1.85, SD = 0.51.
2. Words with positive arousal and positive valence: Arousal: M =6.82, SD = 0.49, Valence: M = 7.90, SD = 0.47.
3. Words with neutral arousal and neutral valence: Arousal: M = 4.89, SD = 0.35, Valence: M = 5.16, SD = 0.40.

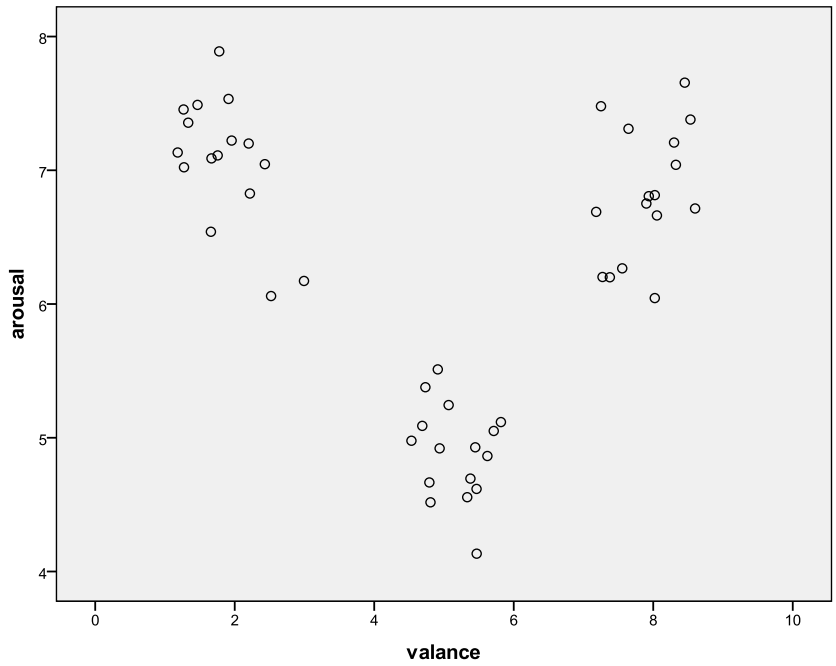

Figure 18 2-dimensional space (arousal-valence) of the emotional normative rating of 48 Turkish words.

Affective Faces

"The Productive Aging Lab Face Database" (Minear & Park, 2004) was used in the experiment as a background. 12 faces were chosen. 4 happy, 4 sad and 4 neutral faces were used, and each group had 2 female and 2 male pictures (Appendix C).

Procedure

The participants were asked to assess the emotional valence of the words (positive, negative or neutral) with the affective faces (happy, sad or neutral) in the background. There are three situations in the experiment. First one is congruent situations, positive words are shown on positively affective faces; negative words are shown on negatively affective faces. Second one is incongruent situations, positive words are shown on negatively affective faces and vice versa. In addition, there is another situation as a baseline. In this situation, neutral words are shown on neutral faces. Each subject is expected to decide the valence (positive, negative or neutral) of the emotional words by pressing 3 different keys among the 48 concrete words (16 positive, 16 negative, 16 neutral). Positive and negative words appeared under both a congruent and an incongruent situation. Neutral words had no incongruent situation, serving as a baseline. The neutral words were shown only one time. Overall, participants judged 32 congruent (16 positive word on positive face, 16 negative words on negative face), 32 incongruent (16 positive words on negative face, 16 negative words on positive face) and 16 neutral (neutral word on neutral face). In total they answered to 80 trials. To design the experiment, the software program E-Prime was used.

Before starting experiment, the experimenter requests from the participants to fill up "Participant Information Form" to obtain participant characteristics such as age, gender, usage of left or right hand and usage frequency of computer (Appendix E). After collecting the characteristics, the experimenter starts to give instructions about experiment to be conducted.

The stimuli to be presented to the participant were located at the center of the computer screen. Before the experiment starts, the participants were given the instruction that they should focus on a fixation point whenever they see it on the center of the screen. Next, they will be shown certain number of word and face pairs consecutively in which a meaningful word is put on the middle of the face. Whenever they see each of these word-face pairs, they were supposed to show their response via hitting of the pre-specified keys on the keyboard. Each of this response is recorded as judgment of the participant on the valence of the word. It is emphasized that they should only focus on the valence of the word not that of the face they are viewing (Appendix D). The processes of experiment implementation are summarized in Figure 19.

The words are printed in gray color on each face and the human subjects were seated approximately 60 cm away from the computer screen in order to cause desirable conflict between the words and the faces. Participants first were shown a fixation point during 1500 ms, and then observed the stimuli during 2000 ms (congruent, incongruent or neutral, showing up randomly). They tried to evaluate the valence of the word on each stimuli as fast and correctly as possible.

Each slide including word-face pair was subject to the participant at most 2000 ms until they reflect response via keys. The response was given by hitting one of three keys which have yellow sticks with plus sign, minus sign and zero one (i.e. L for a positive response, S for a negative response and Y for neutral cases). Participants are told that they should use their right hand while hitting the keys and not lean their hands on the keyboard to prevent sudden and faster responses due to little distance between the hands and the keys. To provide healthy results, the participants are first subject to sample trial of the experiment under the inspection of the experimenter. Then, they are given to complete a similar task on their own lasting 5 minutes. After the completion of the task, the participants are given debriefing information about the experiment.

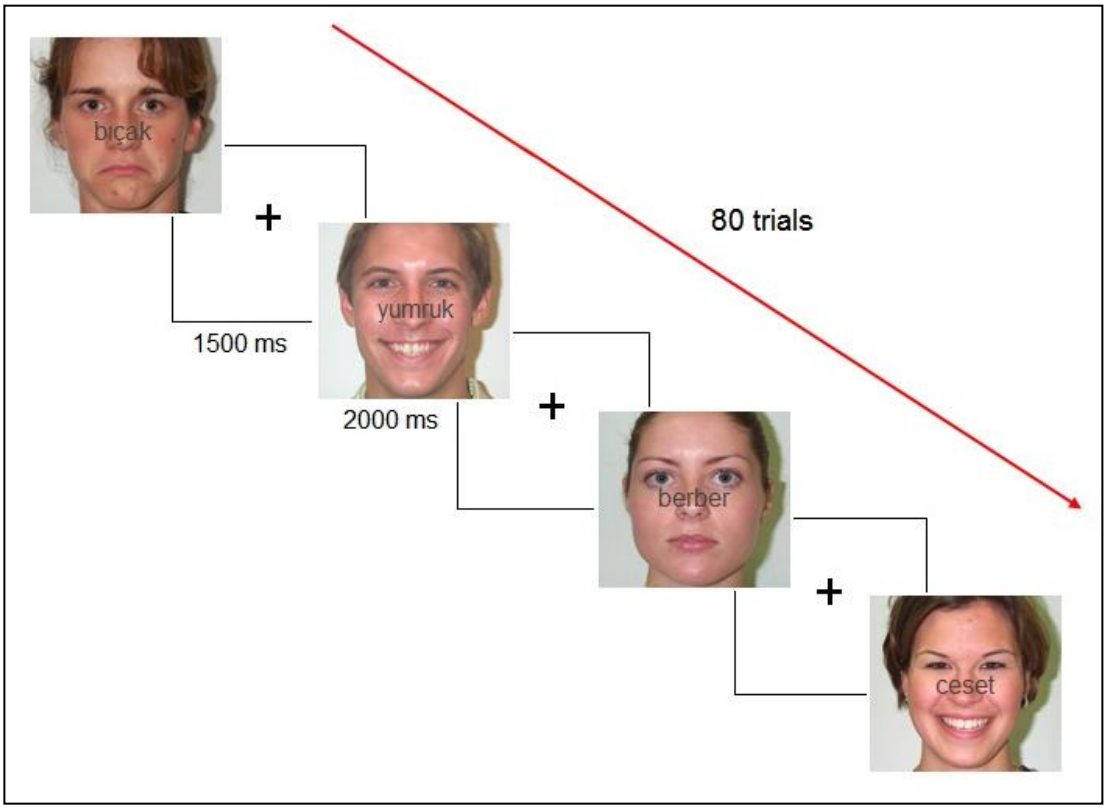

Figure 19 Example of the experiment session

3.3.2 Results

For Adolescents:

Congruency Effect: Reaction Times

First, a repeated measures ANOVA is conducted to measure the difference between reaction times in three levels (congruent, incongruent and neutral) (Figure 20) which revealed a significant main effect, $F(2,38) = 19.539$ $p<.05$.

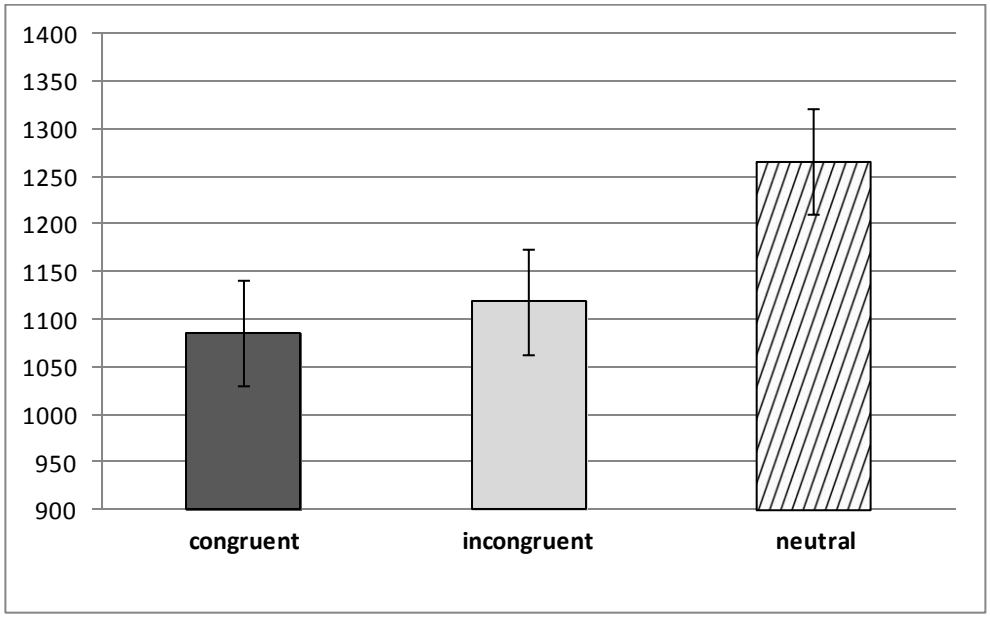

Figure 20 Reaction time for congruent, incongruent and neutral stimuli

Second, a paired samples t-test is done to demonstrate the basic congruency effect: $t(1,19) = -2.064$ $p=.053$, which revealed a significant effect of congruency. On average, participants responded more quickly to congruent situations than to incongruent situations.

Congruency Effect: Correct Response

Besides, a repeated measures ANOVA is conducted on the correct responses. It revealed a significant effect, $F(2,38) = 87.294$ $p<.05$. (Figure 21).

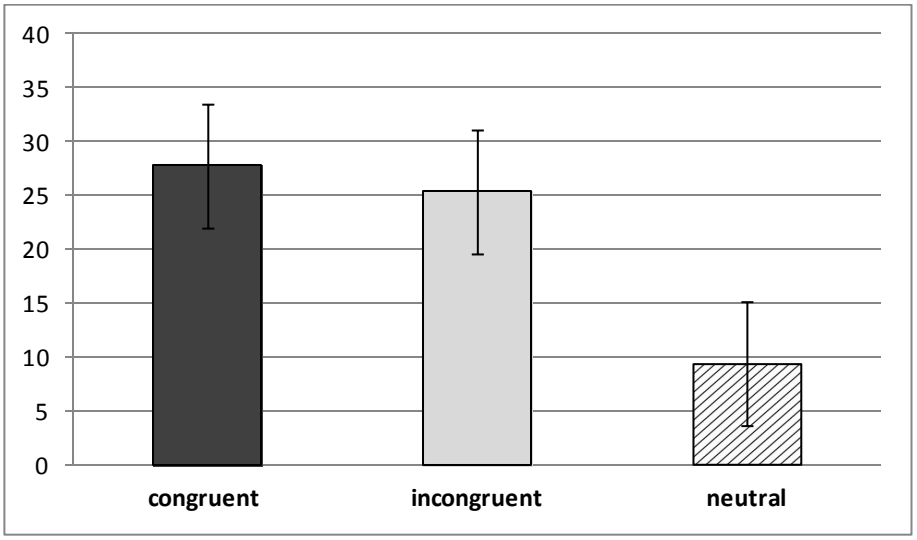

Figure 21 Correct response rates for congruent, incongruent and neutral situations

Then, a paired samples t-test is conducted to compare the means of congruent and incongruent cases for correct responses. Participants made less mistakes in responding to congruent situations when it is compared to incongruent situations $t(1,19) = 2.239$ $p<.05$.

Congruency – Valence: Reaction Times

A repeated measure ANOVA with two factors and two levels is conducted to measure the difference between RT's of congruency (congruent, incongruent) and valence (positive, negative).

A significant main effect of congruency $F(1, 19) = 5.080$ $\eta^2 = 0.211$ $p<.05$ and non significant effect of valence $F(1, 19) = 0.140$ $\eta^2 = 0.007$ $p=.712$ is found. Interaction between congruency and valence is insignificant $F(1, 19) = 0.189$ $\eta^2 = 0.010$ $p=.669$) (Figure 22). Subjects were significantly quicker in reacting to congruent words than incongruent words.

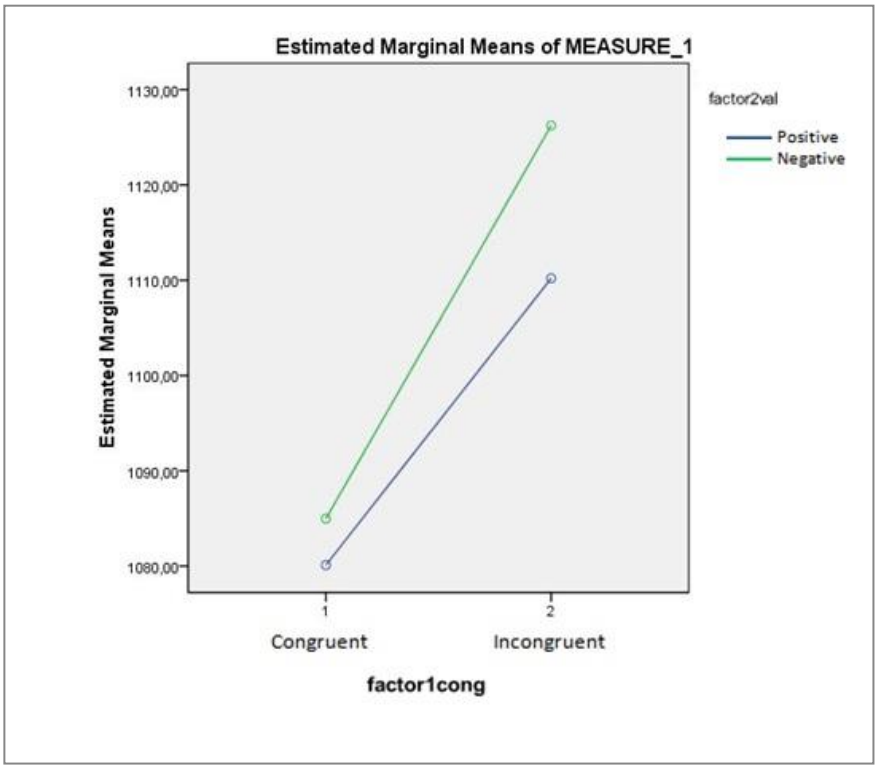

Figure 22 Congruency versus Valence for reaction time

Congruency – Valence: Correct Response

Repeated measures ANOVA with two factors and two levels is conducted to measure the difference between CR's. The data is analyzed with a 2 (congruency: congruent, incongruent) X 2 (valence: positive, negative) repeated measures design, which revealed a significant main effect of congruency $F(1, 19) = 5.011$ $\eta^2 = 0.209$ $p<.05$ and non significant effect of valence $F(1, 19) = 2.184$ $\eta^2 = 0.103$ $p=.156$. Interaction between congruency and valence is insignificant $F(1, 19) = 0.119$ $\eta^2 = 0.006$ $p=.733$) (Figure 23). Therefore, subjects made less mistakes in responding to congruent situations when it is compared to incongruent situations.

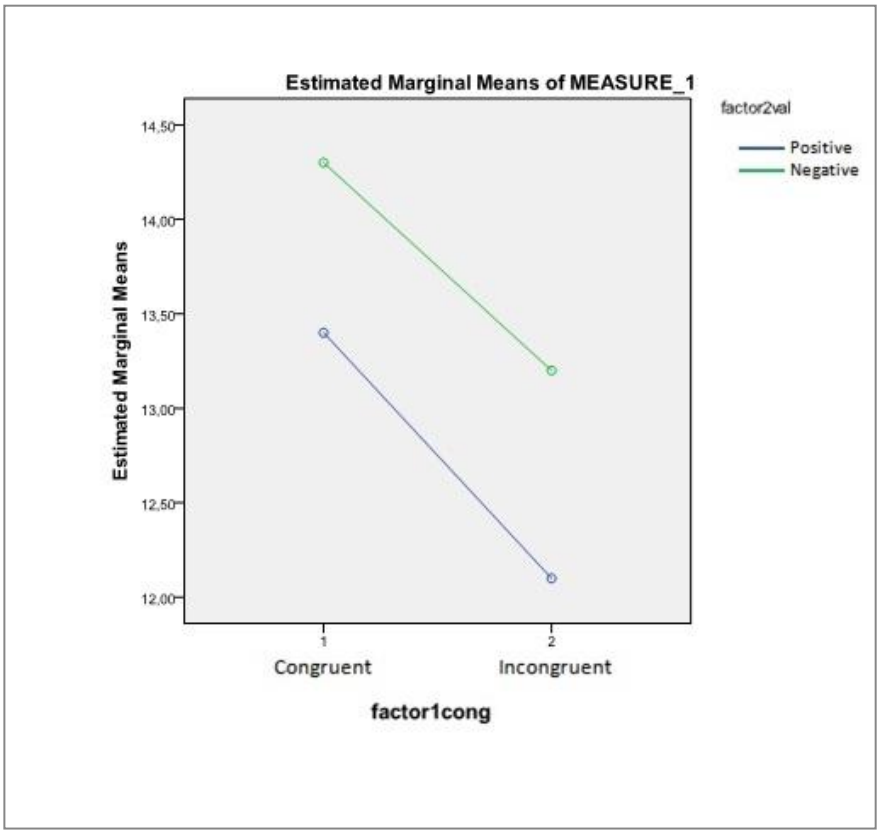

Figure 23 Congruency versus Valence for correct responses

For Adults:

Congruency Effect: Reaction Times

First of all, a repeated measures ANOVA is conducted which revealed a significant main effect, $F(2,38) = 12.956$ $p<.05$ between reaction times in three levels (congruent, incongruent and neutral) (Figure 24).

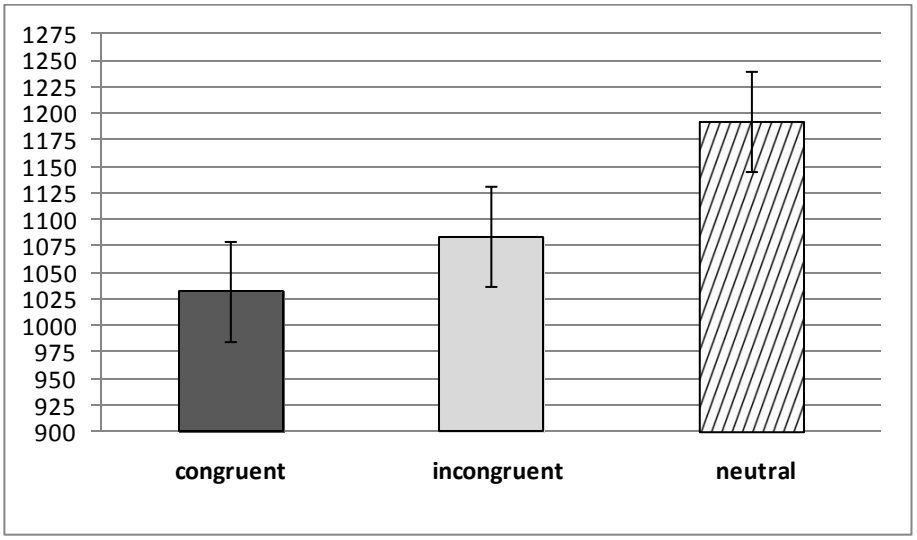

Figure 24 Reaction time for congruent, incongruent and neutral stimuli for adults

Second, a paired samples t-test is done to show the basic congruency effect. Accordingly, to compare the means of congruent and incongruent cases for reaction times a paired samples t-test is conducted. The result is significant: $t(1, 19) = -3.012$ $p<.05$. On average, participants reacted significantly more quickly to congruent situations than to incongruent situations.

Congruency Effect: Correct Response

In addition, a repeated measures ANOVA is conducted on the correct responses. It revealed a significant effect, $F(2,38) = 99.647$ $p<.05$ (Figure 25).

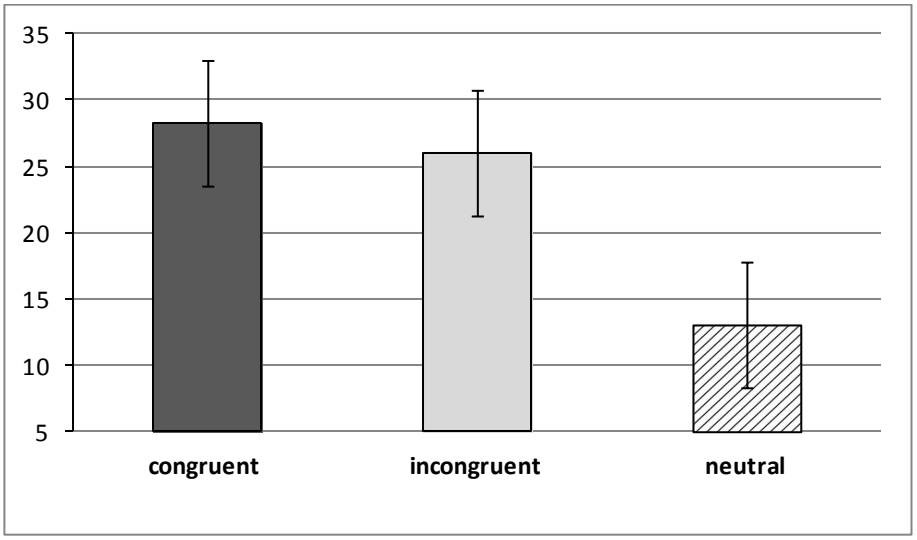

Figure 25 Correct response rates for congruent, incongruent and neutral situations

Besides, a paired samples t-test is conducted to compare the means of congruent and incongruent cases for correct responses. Participants made significantly less mistakes in responding to congruent situations when it is compared to incongruent situations: $t(1, 19) = 2.151$ $p=.045$.

Congruency – Valence: Reaction Times

A repeated measures ANOVA with two factors and two levels is conducted to measure the difference between RT's of congruency (congruent, incongruent) and valence (positive, negative), which revealed a significant main effect of congruency $F(1, 19) = 9.072$ $\eta^2 = 0.323$ $p<.05$ and non significant effect of valence $F(1, 19) = 3.431$ $\eta^2 = 0.153$ $p=.080$. Interaction between congruency and valence is insignificant $F(1, 19) = 0.001$ $\eta^2 = 0.000$ $p=.973$) (Figure 26). Subjects were quicker in reacting to congruent words than incongruent words. In addition, they were quicker while responding to positive words rather than negative words in both congruent and incongruent situations, but this difference was not significant.

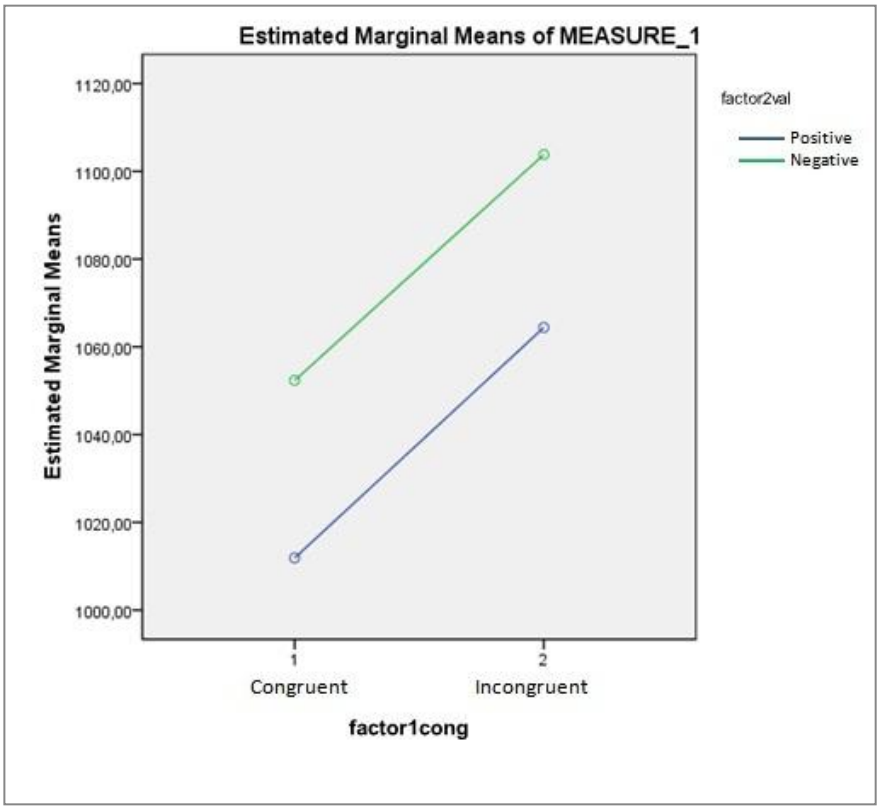

Figure 26 Congruency versus Valence for reaction time

Congruency – Valence: Correct Response

A repeated measures ANOVA with two factors and two levels is conducted to measure the difference between CR's of congruency (congruent, incongruent) and valence (positive, negative) which revealed a significant effect in congruency $F(1, 19) = 4.627$ $\eta^2 = 0.196$ $p<.05$ and significant effect in valence $F(1, 19) = 5.777$ $\eta^2 = 0.233$ $p<.05$. Interaction between congruency and valence is insignificant $F(1, 19) = 0.862$ $\eta^2 = 0.043$ $p=.365$) (Figure 27). Therefore, subjects made less mistakes in responding to positive words than negative words in both congruent and incongruent situations. In addition, they made less mistakes in responding to congruent situations when it is compared to incongruent situations.

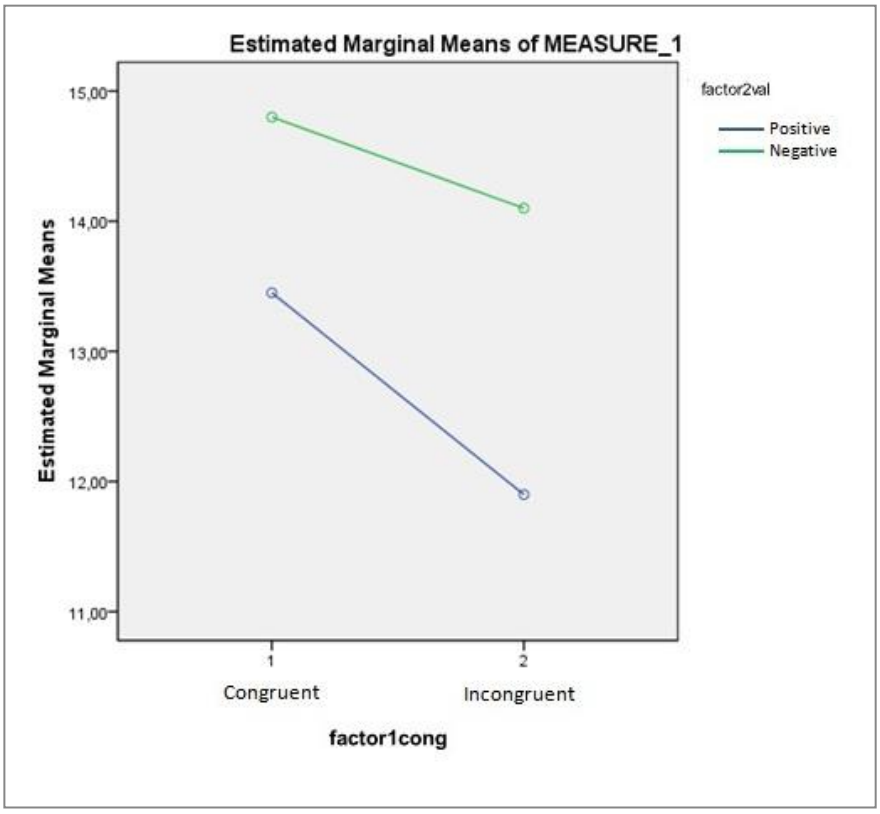

Figure 27 Congruency versus Valence for Correct Responses

Comparing Results between Adolescents and Adults: Reaction times:

A mixed ANOVA is conducted to measure the difference between RT's of adolescents and adults. The data is analyzed with a 2 (group: adolescents, adults) X 3 (congruency: congruent, incongruent and neutral) repeated measures design, which revealed no significant main effects between groups $F(1, 38) = 2.429$ $\eta^2 = 86503.44$ $p = .127$ (Figure 28).

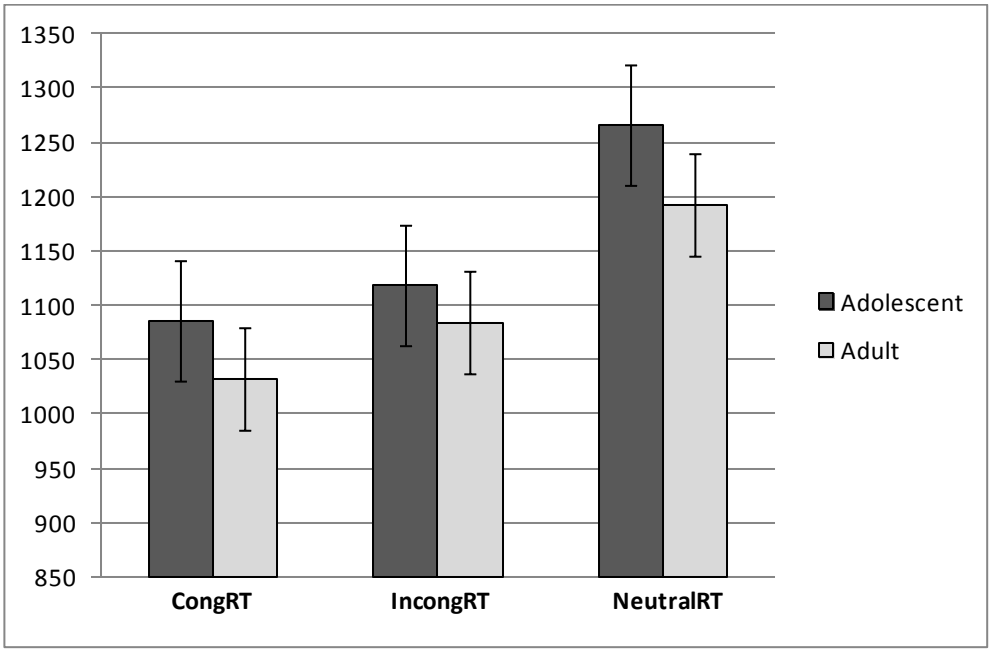

Figure 28 Reaction time means of congruent-incongruent-neutral for adolescents and adults

Comparing Results between Adolescents and Adults: Correct Response:

A mixed ANOVA is conducted to measure the difference between CR's of adolescents and adults. The data is analyzed with a 2 (group: adolescents, adults) X 3 (congruency: congruent, incongruent and neutral) repeated measures design, which revealed barely significant main effects between groups $F(1, 38) = 3.266$ $\eta^2 = 81.675$ $p = .079$ (Figure 29).

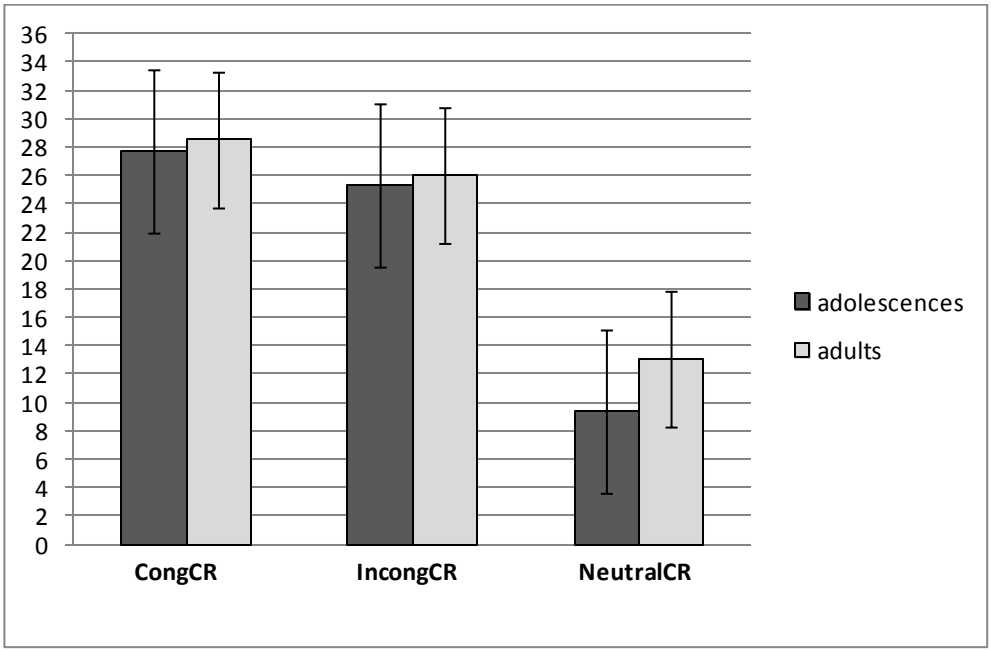

Figure 29 Correct response means of congruency for adolescents and adults

CHAPTER 4

GENERAL DISCUSSION AND CONCLUSION

To the best of our knowledge, there are no computerized tests conducted in the Turkish adolescent population regarding resolving emotional conflicts. The main aim of this study is to develop a task to measure emotional conflicts in adolescents and to investigate the behavioral differences between healthy adolescents and adult populations. For this aim, experiments with the Classical Stroop test and the Word-face Stroop test were conducted. Both Classical Stroop and the Word-face Stroop tasks are used to measure the inhibition of interference in conflict resolution. Cognitive conflicts are handled in the classical Stroop task, while emotional conflicts are handled in the Word-face Stroop task.

4.1 Discussion of The Classical Stroop Task's Results

Both adolescent and adult population subject to classical Stroop, are observed to respond to incongruent stimuli slower than to congruent stimuli while they are expected to state the ink color of the color words. As widely known (Puccioni & Vallesi, 2012) response to the color of a word while its name and color are incongruent is slower than the response while they are congruent. Thus, earlier findings related to the Stroop effect has been replicated in our study for both adolescents and adults.

In addition when we compare the adolescents and adults according to the results of the classical Stroop task, adolescents are slower than adults with respect to reaction times although this difference is not significant. In addition, the number of wrong answers significantly decreases in adults compared to adolescents in incongruent conditions. Already, many researches indicate that Stroop inhibition effect increase with aging. (Andres, Guerrini, Phillips & Perfect, 2008; Belleville, Rouleau & Van der Linden,2006; Davidson, Zacks & Williams, 2003; Hartley, 1993; Mayas, Fuentes & Ballesteros, 2011; Rush, Barch & Braver, 2006; Schelstraete & Hupet, 2002; West & Allian, 2000; West & Bell, 1997; but see Ludwig, Borella, Tettemanti & Ribaupierre, 2010; Uttl & Graf, 1997; Verhaeghen & De Meersman, 1998 as cited in Puccioni & Vallesi, 2012). According to our findings, the 14-16 year old adolescents handle the cognitive interference just as well as adults, both in terms of response time and correct responses.

4.2 Discussion of The Word-Face Stroop Task's Results

Emotional Stroop Task, in which there is a conflict between words having emotional valence and affective faces having emotional value, is a useful tool for measuring emotional conflict resolution.

The results in the adolescent population showed that there is a significant difference for both reaction time and correct response numbers with respect to congruency. In congruent situation, the responses were faster than from the incongruent situations. When the correct response numbers were analyzed, there were more correct responses in congruent situation than in incongruent situations. On the other hand, a significant difference in reaction time could not been observed between positive and negative words, although adolescents were faster in evaluating the negative words than the positive words in congruent situations.

If we look at the adults' behavioral Word-face Stroop results, there is a significant difference for reaction time and significant difference for correct response numbers

on congruency. That is, participants were faster and more correct in congruent situations.

When positive and negative situations were analyzed, there is a marginally significant difference for reaction time ($p=0.080$) and a significant difference for correct response numbers. Hence unlike adolescents, adults exhibited a tendency to resolve conflicts in for positive words much better than negative words.

Most importantly, when we compare the adolescents and adults according to the results of the Word-face Stroop task, a significant reaction time difference was not observed although adolescents are slower than adults in both congruent and incongruent situations. However, the difference between adolescents and adults was marginally significant for correct responses ($p=0.079$).

A major limitation of our study is the number of subjects admitted to the study. In the adult population, there were some marginally significant results (for ex. valence effect in the Word-face Stroop experiment). If we had twice the number of subjects some of the statistics between groups might have been significant.

Development in processing speed, voluntary response suppression, and spatial working memory performance criteria has reached some stable level in adolescence after steep initial improvement at earlier ages (Luna et al., 2004). Furthermore, processing speed, response inhibition or suppression and working memory start performing at adult-level in different ages: processing speed at approximately 15, response inhibition at approximately 14 or suppression and working memory at approximately 19.

Results of the measurement of processing speed indicated that it slows down throughout childhood, maturing in middle adolescence. Previous studies related to developmental oculomotor studies (Fischer et al., 1997; Fukushima et al, 2000; Klein & Foerster, 2001; Ross et al, 1994; Luna et al., 2004) and developmental studies of simple manual reaction time (Elliott, 1970; Fry & Hale, 1996; Guttentag, 1985; Kail, 1991b; Luna et al., 2004) also confirm these findings. The results of the study

indicated that maturing in the latency to initiate a response to a visual target, independent from cognitive demands, starts at about age 15.

Test researchers who study on 6-17 year old children applied the Stroop in order to explore the development of inhibitory control during childhood and adolescence. Earlier results obtained by applying other measures (e.g., inhibiting motor behaviors), shows that inhibitory control maturation is acquired at 12 years of age (Becker et al., 1987; Welsh et al., 1991; Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004). Other data implies that inhibitory control development continues until adolescence; for example, rare literature on the Stroop test shows the developmental changes exist until adolescence (Comalli et al., 1962; MacLeod, 1991; Leon-Carrion, Garcia-Orza & Perez-Santamaria, 2004).

Adolescents' age mean is 14.95 and adults' age mean is 26.5 in our study. Previous researches indicated that response inhibition reach to adult-level at approximately 14 years old. At this point, if we look at the number of correct responses for adolescents and adults, as well as response times, their results are almost the same with each other, supporting the literature.

However, although marginally significant, adults exhibited valence differences in conflict resolution, such that they processed positive words marginally significantly faster and responded significantly more correctly to positive words. This is consistent with the literature which indicates that positive information is facilitated. Interestingly, such a pattern favoring positive words was absent in the adolescent population. Although interaction in group comparison was not detected, if a larger sample size leads to important valence differences across these populations, it will not be surprising.

In conclusion, when the arousal dimension of the words are manipulated to create a conflict with affective faces on the background, adolescents behaved similarly to adults in terms of handling the congruency demands of the emotional conflict resolution task. This effect was similar for the classical Stroop task, such that there were no significant differences between the two subject groups for response times as well as correct response rates. Both adolescents and adults exhibited the traditional

slowing down behavior for incongruent cases while being faster for the congruent cases regardless of whether the conflict was created through the classical Stroop task of Word-face Stroop task.

In the future, this task can be tested with more healthy adolescents in order to strengthen the results.

Moreover, a new conflict resolution experiment with manipulated words on valence axis might shed some light on the marginally significant valence differences observed in the adolescent population.

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APPENDICES

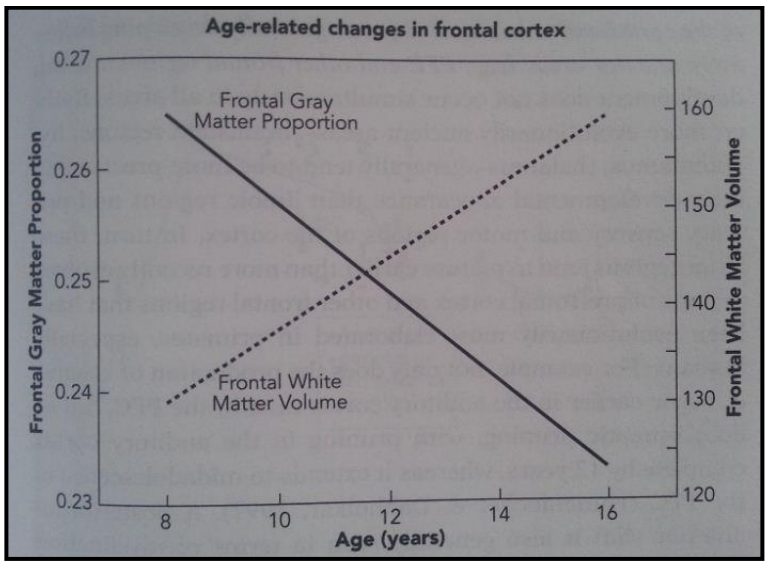
APPENDIX A: CHANGES IN BRAIN MORPHOLOGY IN ADOLESCENTS

Young adults have the full potential for brain development and cognitive abilities. During adolescence, physical growth, physiology, cognitive abilities and emotional skills are changed and continue to improve. Besides, there are lots of changes in the brain structure and in the brain functions during adolescence (Paus, 2005). Earlier, it was believed that development of brain was completed during early childhood (Straugh, 2003; Rice & Dolgin, 2008). Now, it is known that some of the key brain structures do not develop until people's twenties (Casey, Giedd and Thomas, 2000; Giedd et al., 1999a; Rice & Dolgin, 2008). Whereas human brain gains its maximum weight about 10-12 years, the brain is exposed to significant developmental change during adolescence. Following to reaching maximum volume for girls at 10.5 years and for boys at 14.5 years, there occur developmental declines in gray matter volume (Lenroot et al., 2007; Spear, 2010).

The cerebrum is composed from two hemispheres connected by corpus callosum which is a band consisting of nerve fibers to transmit information. There are four lobes in each hemisphere. These four lobes have different contributions to thinking. The development of three lobes which are parietal lobe, frontal lobe and temporal lobe, continue to adolescence. The connections among these lobes also continue to develop during adolescence in addition to their maturation. The parietal lobe becomes active while people are trying to solve problems on special reasoning (Kandel, Schwartz and Jessel, 1991; Rice & Dolgin, 2008). When individuals deal

with higher-order tasks such as planning, the frontal lobe is active. Language is the common function of the temporal lobe.

As seen in the figure below, throughout the adolescence period the balance between white matter and gray matter change due to progressive changes by increasing volume of white matter and regressive changes by decreasing volume of gray matter. In this period, especially in the frontal lobes, notable myelination of axons causes increase in the volume of the white matter (Sowell et al., 1999; Spear, 2010).



Age-related changes in gray and white matter volume of the frontal cortex (adapted from Sowell et al., 2002 as cited in Spear, 2010).

Giedd et al. (1999) stated that grey matter volume of the frontal and parietal lobes increase at the age of 10 and 12 years in both girls and boys. After this, grey matter volumes of these two lobes considerably decreases.

Sowell et al. (2001) also found similar results for age-related changes in the frontal and parietal lobes of 14 children between 7 and 11 years old and 11 adolescents between 12 and 16 years old. She found that dorsal and parietal lobes lose grey matter density between childhood and adolescence. However, grey matter density increases in the frontal cortex after adolescence (16 years old) until reaching adulthood.

At a lower level, brain structures maturate in two phases. First phase includes rapidly growing and proliferation of the cells. Interconnections which are the result of high rate growth are named as "Exuberant Synapses". Growth do not cease until age of 16. Following to this point the second phase begins. The number of cells reduces and interconnections are trimmed down. While several cells grow strongly, inactive cells disappear. The proportion of cells which die off in this period is stunning. In this period, around 7 to 10 percent of cells are lost, even in some areas this proportion can increase to 50 percent (Durston et al., 2001; Rice & Dolgin, 2008). Inhibition is related to maturity and the number of inhibitory synapses is much less than the number of excitatory synapses that are eliminated. Indeed the proportion of inhibitory to synapses to excitatory increases from 1/7 to 1/4 throughout adolescence.

On the other hand, in terms of brain function, according to Adleman (2002), there is a positive correlation between brain activation and age. In that study, young adults are between 18 and 22 years old, adolescents are between 12 and 16 years old and children between 7 and 11 years old are compared. Adleman (2002), found the following results:

- Young adults had significantly greater activation than children in the anterior cingulate, left parietal, parieto-occipital and left middle frontal gyrus.

- Young adults had significantly greater activation than adolescents in the left middle frontal gyrus.

- Both young adults and adolescents had greater activation than children in the parietal cortex.

When the temporal lobe is deeply investigated, it is realized that the two structures, the hippocampus and the amygdala mature during adolescence. The functions of hippocampus are learning, memory and motivation while the amygdala involves in interpretation of sensory information and make people respond to this information in primal or emotional ways. It is also related with the emotional memory. The limbic system supports several functions such as the processing of emotions and emotion based behaviour, in addition it makes learning easier and helps formation of

memories .The most important structures of the limbic systems can be considered as hippocampus, septal area, amygdala. The ‘extended amygdala’, such as the bed nucleus of the stria terminalis (BNST) and, importantly, the shell portion of the nucleus accumbens consist of associated structures. While the hippocampus, interrelating with other limbic and non-limbic areas, have a crucial responsibility in learning and formation of memories , the amygdala includes different several sub regions, interrelating with other limbic and non-limbic areas, stimulating for emotional and affective response.

To summarize, experiments proved that brain structure and functions show differences with improvement from childhood to adolescence and from adolescence to adulthood. Overall, these structural changes in the brain manifest the functional activations and in turn the behavioral response of the maturing adolescent individual.

APPENDIX B: AFFECTIVE NORMS FOR TURKISH WORDS

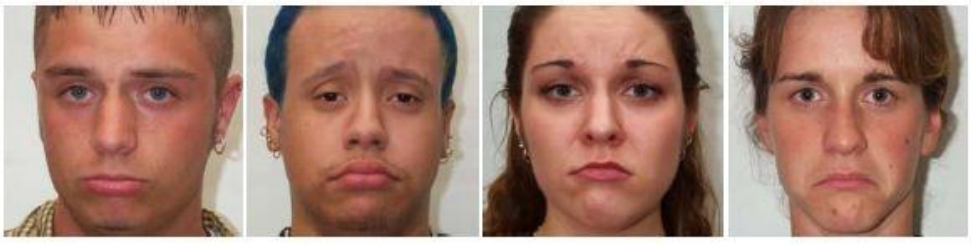
Word	length	Arousal Mean	Valence Mean
KATLİAM	7	7,132970393	1,182031311
KANSER	6	7,454545455	1,266666667
DEPREM	6	7,488888889	1,466666667
ŞEHİT	5	7,0455	2,4318
EROİN	5	7,1111	1,7556
ŞİDDET	6	6,540312629	1,658315178
CESET	5	7,088888889	1,666666667
KAZA	4	7,888888889	1,777777778
İDAM	4	7,533333333	1,911111111
SOYGUN	6	7,2000	2,2000
TERÖR	5	7,3556	1,3333
BIÇAK	5	6,826086957	2,217391304
TECAVÜZ	7	7,0222	1,2727
KARAKOL	7	6,059606481	2,521175987
KUDUZ	5	7,2222	1,9556
YUMRUK	6	6,172433679	2,993072594
HAZİNE	6	6,6889	7,1818
SEYAHAT	7	7,0408	8,3246
UÇAK	4	7,4788	7,2509
MEKTUP	6	6,202020202	7,272727273
SEVGİLİ	7	7,2072	8,2983

ARABA	5	7,310344828	7,64516129
ÖDÜL	4	6,2667	7,5556
ŞELALE	6	6,2000	7,3778
BAYRAK	6	6,806294086	7,935973956
PARA	4	6,814144737	8,021990741
DENİZ	5	7,3793	8,5333
SİNEMA	6	6,751272954	7,900982615
GENÇLİK	7	6,6622	8,0526
ARKADAŞ	7	7,655172414	8,451612903
KELEBEK	7	6,714285714	8,6
ALKIŞ	5	6,0444	8,0222
DELİK	5	4,517241	4,806452
ŞİŞE	4	4,555556	5,333333
ŞALTER	6	4,920707455	4,937462977
DÜĞÜM	5	5,088889	4,688889
KAYA	4	5,244444	5,066667
ÇEKİÇ	5	5,377778	4,733333
İLAÇ	4	4,977778	4,533333
HEYKEL	6	4,694737	5,378947
MASKE	5	4,665765	4,790480
HARİTA	6	5,117290	5,815979
KORİDOR	7	4,133333	5,468750
MALZEME	7	4,863636	5,622222
DAVUL	5	5,511111	4,911111
CADDE	5	5,050716	5,713259
BERBER	6	4,928571	5,448276
DEMİR	5	4,617504	5,466830

APPENDIX C: AFFECTIVE FACES

Neutral Faces

Happy Faces



Sad Faces

APPENDIX D: INSTRUCTIONS FOR WORD-FACE STROOP TASK

Sizden istenen şudur:

1. Ekranda (+) işareti gördüğünüz takdirde sürekli buna bakın.

2. Ekranda resim gördüğünüz takdirde yüzlerin üzerindeki kelimeleri değerlendirin.

3. Kelime
olumlu ise "+"
olumsuz ise "-"
nötr ise "0" tuşuna basın.

(Kelimeyi değerlendirirken tüm resme bakın)

DENEME BÖLÜMÜNE BAŞLAMAK İÇİN SPACE TUŞUNA BASINIZ!

APPENDIX E: SAMPLE INFORMED CONSENT FORMS

Consent Form I for Word-Face Stroop Task

Bu çalışma, Orta Doğu Teknik Üniversitesi Enformatik Enstitüsüne bağlı olan Bilişsel Bilimler Ana Bilim Dalında yükek lisans öğrencisi M. Arzu Aruntaş'ın yüksek lisans tezi için bilgi toplamak amacıyla yapılacaktır. Çalışmanın amacı, sağlıklı ergenlerin duygusal çelişki çözümlemeyle nasıl başa çıktıklarını bulmaktır. Çalışmaya katılım tamamıyle gönüllülük temelindedir. Cevaplarınız gizli tutulacak ve sadece araştırmacılar tarafından değerlendirilecektir; elde edilecek bilgiler bilimsel yayımlarda isminiz olmaksızın kullanılacaktır.

Deney, kişisel rahatsızlık verecek soruları içermemektedir. Ancak, katılım sırasında herhangi bir nedenle kendinizi rahatsız hissederseniz cevaplama işini yarıda bırakıp çıkmakta serbestsiniz. Böyle bir durumda deneyi uygulayan kişiye, deneyi tamamlamadığınızı söylemek yeterli olacaktır. Deney sonunda, bu çalışmayla ilgili sorularınız cevaplanacaktır. Bu çalışmaya katıldığınız için şimdiden teşekkür ederiz. Çalışma hakkında daha fazla bilgi almak için ODTÜ Enformatik Enstitüsü Tıp Bilişimi öğretim üyelerinden Yrd. Doç. Dr. Didem Gökçay (Tel: 210 3750; E-posta: didem@ii.metu.edu.tr) ya da M. Arzu Aruntaş (Tel: 05422272245; E-posta: aruntas@metu.edu.tr) ile iletişim kurabilirsiniz.

Bu çalışmaya tamamen gönüllü olarak katılıyorum ve istediğim zaman yarıda kesip çıkabileceğimi biliyorum. Verdiğim bilgilerin bilimsel amaçlı yayımlarda kullanılmasını kabul ediyorum. (Formu doldurup imzaladıktan sonra uygulayıcıya geri veriniz).

İsim Soyad Tarih İmza

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Consent Form II for Word-Face Stroop Task

Gönüllü Katılımcı Formu:

Kişisel Bilgiler:

Adı Soyadı:

Cinsiyet: ☐ Kız ☐ Erkek

Doğum Tarihi:

Yaşı:

Okulu:

Sınıfı:

Yazı yazarken, yemek yerken, diş fırçalarken, kavanoz açarken, makas kullarırken hangi elinizi kullanıyorsunuz?: ☐ Sağ ☐ Sol ☐ İkisi eşit

Düzenli olarak herhangi bir ilaç kullanıyor musnuz? ☐ Evet (……..) ☐ Hayır

Bilgisayar Kullanım Sıklığı:

Bilgisayar kullanıyor musunuz? ☐ Evet ☐ Hayır

Kullanıyorsanız;

Bilgisayarı kullanma amaçlarınız nelerdir?

☐ Ödev

☐ Oyun

☐ İnternette vakit geçirmek

Diğer: ……

Günde ortalama kaç saat kullanıyorsunuz:……..

Haftada ortalama kaç saat kullanıyorsunuz:……..

Denek Kodu:.....

Aşağıda farklı duygusal durumları niteleyen sözcükler bulunmaktadır. Lütfen, herhangi bir sözcüğü okuyarak, aşağıdaki ölçekte anlamları tanımlanmış sayılardan uygun gördüğünüz birini yanındaki boş kutuya yazınız. Şu anda kendinizi nasıl hissettiğinizi, diğer bir deyişle, her bir duyguyu ne ölçüde yaşadığınızı düşünün ve değerlendirmenizi buna göre yapın.

1	2	3	4	5
Çok Az	Biraz	Orta Düzeyde	Oldukça Fazla	Aşırı Derecede

1. Hevesli		11. Huzuruz-tetikte	
2. Sıkıntılı		12. Canlı	
3. Heyecan dolu		13. Kendinden utanan	
4. Üzgün		14. Şevkli	
5. Güçlü		15. Gergin	
6. Suçlu		16. Kararlı-azimli	
7. Ürkek		17. İlgili	
8. Kızgın		18. Sinirli	
9. Coşkulu		19. Aktif	
10. Onurlu		20. Korkmuş	

Daha önce herhangi bir nörolojik ya da psikiyatrik ilaç kullandınız mı?

(.....) Evet (.....) Hayır

Hala kullanıyor musunuz?

(.....) Evet (.....) Hayır

Consent Form for Parents

Sayın Veliler, Sevgili Anne-Babalar,

Günlük hayatta pek çok olay karşısında karar vermek durumunda kalıyoruz. Duygusal çelişki içeren durumlarda, karar verme sürecimiz acaba nasıl etkilenmektedir? Örneğin bir ayakkabıyı çok beğenmiş olabiliriz. Günlük ihtiyacımızı karşılamayacak denli abiye ve rahatsız bir ayakkabıyı sırf çok güzel göründüğü için almalı mıyız? Yoksa bunun yerine günlük ihtiyacımız için kullanabileceğimiz, ayağımızı rahat ettiren, ancak pek de beğenmediğimiz bir ayakkabıyı mı tercih etmeliyiz? Hayatımız tercihlerle doludur. Ergenlik süreci de bu tercihlerin şekillendiği ilk zamandır.

ODTÜ Enformatik Enstitüsü Bilişsel Bilimler Ana Bilim Dalı'nda halen devam etmekte olduğum yüksek lisans tezimde Sağlıklı Ergen Popülasyonunda Duygusal Çelişki Çözümleme konusunu araştırıyorum. Bu araştırmada, İlköğretim 8. sınıf, Lise 1 ve 2. sınıf öğrencileri ile 20'şer dakika süren bilgisayar testi ve anket çalışması yapmaktayız. Çalışmamın amacı, sağlıklı ergenlerin duygusal çelişki çözümlemeyle nasıl başa çıktıklarını bulmaktır.

İki aşama sürecek bu araştırmanın birinci aşamasında bilgisayar testi yapılacaktır. Bilgisayar testinde, sağlıklı ergenlerin duygusal çelişki çözümlemeyle nasıl başa çıktıklarını bulmak için kelime ve yüz içeren ekranlar kullanılmaktadır. Bu deneyde duygusal kelimelerle-duygusal yüz ifadeleri arasındaki çelişkiye verilen cevabı ölçüyoruz. Deney süresi yaklaşık 20 dakikadır. İkinci aşamada ise ergenlerin psikolojik durumunun değerlendirildiği bir anket yapılacaktır. Anket, Hacettepe Universitesinden Uzm. Dr. Zeynep Tüzün tarafından gerçekleştirilecektir ve görüşme süresi yaklaşık 20 dakikadır. Ergenlik zaten psikolojik açıdan hassas bir zamandır. Çocuğunuzun psikolojik sağlığını ölçen bu anket* sonrasında eğer üzerine eğilmeniz gereken bir durum saptanırsa, size ayrıca bilgi verilecektir. Deney ve anket ODTU yerleşkesinde, Enformatik Enstitüsü binasında yapılacak olup ulaşımınız için gerekli planlama, sizinle iletişime geçerek tarafımızdan sağlanacaktır.

Çocuğunuzun cevaplayacağı soruların onun psikolojik gelişimine olumsuz etkisi olmayacağından emin olabilirsiniz. Uyguladığımız deney ve anket, Orta Doğu Teknik Universitesi Etik Kurulu tarafından incelenmiş ve uygun bulunarak onaylanmıştır. Çocuğunuzun deney süresince verdiği cevaplar kesinlikle gizli tutulacak ve bu cevaplar sadece bilimsel araştırma amacıyla isimlerini belirtmeksizin kullanılacaktır. Bu formu imzaladıktan sonra çocuğunuz katılımcılıktan ayrılma hakkına sahiptir.

Deneyleri tamamlayan ergen katılımcılara teşekkürümüzü belirtebilmek için bir adet 4GB Flash bellek verilecek, ayrıca size deney sonucunu bildiren kısa bir özet iletilecektir.

Deneyimize katılarak bize sağlayacağınız bilgiler ergenlerin duygusal çelişki çözümleme ile nasıl başa çıktıkları konusunda önemli bir katkı sağlayacaktır. Araştırmayla ilgili sorularınızı aşağıdaki e-posta adresini veya telefon numarasını kullanarak bize yöneltebilirsiniz.

Saygılarımızla,

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Şimdi lütfen bu araştırmaya çocuğunuzun katılması konusunda izniniz olduğunu aşağıdaki gerekli yerleri doldurarak belirtiniz.

Bu araştırmada tamamen gönüllü olarak çocuğum ……'nın katılımcı olmasına izin veriyorum. Çalışmayı çocuğumun istediği zaman yarıda kesip bırakabileceğini biliyorum ve verdiği bilgilerin bilimsel amaçlı olarak kullanılmasını kabul ediyorum.

Velisinin Adı-Soyadı:……
İmza ……
Tarih……

Veli iletişim bilgileri:
E-mail adresi:……
Cep telefonu:……
Ev telefonu:……

Çalışmaya katılabileceğiniz uygun günü ve saati belirtir misiniz?:

5 Mayıs Cumartesi: ☐	12 Mayıs Cumartesi: ☐
Saat:	Saat:

Öğrencinin Adı, Soyadı:

Katılım Tarihi:

Sonuç:

- ☐ Testleri tamamlamıştır, flash bellek verilmiştir
- ☐ Testleri tamamlamamıştır

- ☐ Duygu durum testi (DSM IV) normaldir
- ☐ Duygu durum testi sonucu size iletilecektir

APPENDIX F: THE CLASSICAL STROOP TASK

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