EMOTIONAL CONFLICT RESOLUTION IN HEALTHY AND DEPRESSED POPULATIONS

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ABSTRACT

EMOTIONAL CONFLICT RESOLUTION IN HEALTHY AND DEPRESSED POPULATIONS

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Conflict resolution is essential for human cognitive system which renders adaptability to the environment, providing humans to fulfill daily activities. The main aim of this thesis is to create a task where the conflict activates emotional networks exclusively, while investigating how the cognitive and emotional conflicts are monitored and then resolved in the brain. After creating the appropriate material composed of controlled words in terms of emotional dimensions and concreteness values, a new Word-face Stroop Task is designed using Turkish words. Firstly subjects participated in a classical Stroop task to measure cognitive conflict and then

in the Word-face Stroop task, the conflict between “emotional” words and “emotional” faces is investigated. The same Stroop tasks are then administered to depression patients. The results of the classical Stroop replicated the previous findings: (1) Healthy population was slower in responding to incongruent cases than congruent cases (2) Depressed patients were significantly slower than healthy population. The Word-face Stroop, conducted on healthy population also replicated the earlier findings: (1) People were slower in reacting to incongruent stimuli than congruent stimuli (2) People reacted faster to positive words than negative ones. Same Stroop tasks conducted on depressed patients however revealed interesting results, novel to the literature: (1) Congruency scores were significantly different when healthy population and Depressive Disorder patients with Hamilton scores higher than 20 were compared (2) Patients with Hamilton scores higher than 20 and lower than 20 significantly differed in congruency scores (3) Patients showed a tendency to react faster to incongruent stimuli rather than congruent stimuli, contrary to normal population (4) Normal population showed greater congruency effect in positively valenced abstract words, whereas depression patients showed greater congruency effect in negatively valenced concrete words.

Keywords: Conflict resolution, emotional conflict resolution, Stroop Task, Major Depressive Disorder, Anterior Cingulate Cortex

ÖZ

SAĞLIKLI VE DEPRESİF POPÜLASYONLARDA DUYGUSAL ÇELİŞKİ ÇÖZÜMLEME

Başgöze, Zeynep
Yüksek Lisans, Bilişsel Bilimler Bölümü
Tez Yöneticisi: Yrd. Doç. Dr. Didem Gökçay

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Çelişki çözümleme, çevreye uyumu ve böylelikle günlük aktiviteleri sürdürebilmeyi sağladığından, insan bilişsel sisteminin çok önemli bir parçasıdır. Bu tezde asıl amaç, bir yandan bilişsel ve duygusal çelişkinin beyinde nasıl algılandığını ve çözüldüğünü araştırırken, bir yandan da çelişkinin beyinde özellikle duygusal sistemi aktive edebildiği bir düzenek hazırlamaktır. Bu amaç için oluşturulan Kelime-yüz Stroop deneyinde kullanılacak olan kelimeler sırasıyla duygusal değerliklerine ve somutluklarına göre elenerek seçilmiştir. Katılımcılar öncelikle bilişsel çelişki

çözümlemeyi ölçen klasik Stroop deneyine tabi tutulmuş, ardından da “duygusal” kelimeler ve “duygusal” yüzler arasında çelişki yaratılarak hazırlanan Kelime-yüz Stroop deneyine katılmışlardır. Daha sonra ise aynı deneyler depresyon hastalarına uygulanmıştır. Klasik Stroop deneyinin sonuçları önceki çalışmaların bulgularını yinelemiştir: (1) Sağlıklı bireyler uyumsuz durumlara uyumlu durumlara göre daha yavaş tepki verebilmişlerdir (2) Depresyon hastaları sağlıklılara göre belirgin şekilde daha yavaş tepki verebilmiştir. Sağlıklı insanlara uygulanan kelime-yüz deneyi de önceki çalışmaların sonuçlarını tekrarlamıştır: (1) Katılımcılar uyumsuz durumlara uyumlu durumlara göre belirgin şekilde daha yavaş tepki verebilmişlerdir (2) Denekler pozitif duygu yüklü kelimelere negatiflere gore daha çabuk tepki vermişlerdir. Depresyon hastalarına uygulanan bu Stroop deneyleri ise literatürde henüz görülmemiş ilginç sonuçlar ortaya çıkarmışlardır: (1) Sağlıklı denekler ve Hamilton değerleri 20’nin üstünde olan depresyon hastaları karşılaştırıldığında uyumluluk değerleri belirgin şekilde farklı çıkmıştır (2) Hamilton değeri 20’nin altında ve üstünde olan hastalar karşılaştırıldığında da belirgin fark görülmüştür (3) Hamilton skorları 20’nin üstünde olan hastalar normaller ve hafif depresyon hastalarının aksine uyumsuz durumlara daha çabuk tepki verme eğilimindedirler (4) Normaller pozitif duygu yüklü soyut kelimelerde daha büyük bir uyumsuzluk etkisi gösterirken, hastalar negatif duygu yüklü somut kelimelerde daha büyük bir uyumsuzluk etkisi göstermişlerdir.

Anahtar Sözcükler: Çelişki çözümleme, duygusal çelişki çözümleme, Stroop Deneyi, Majör Depresyon, Anterior Cingulate Cortex.

To My Unique Family

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beyond of this era with his great friendship, for their limitless support and endless love. And my profound thanks go to the greatest human being, who carries the other half of my heart, my dear sister Pınar Başgöze, for always being there for me.

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CHAPTER 1

INTRODUCTION

Humans are continuously subject to multimodal sensory stimuli during their lives. For survival, humans not only direct attention and monitor these stimuli, but also make decisions accordingly. When the information people get from their environment is task-irrelevant, this information can easily interfere with people's performance. Therefore, the human brain provides us with the ability to process the appropriate stimuli, making us ignore the irrelevant stimuli "via attentional biasing mechanisms" (Egner, Etkin, Gale, & Hirsch, 2008). This ability to resolve the conflicting cases is simply called **conflict resolution**.

It is accepted by most of the scientists that in the brain, conflict monitoring occurs in the caudal parts of the Anterior Cingulate Cortex (ACC) of the brain, whereas conflict resolution occurs in either rostral ACC or in Dorso-Lateral Prefrontal Cortex (DLPFC), depending on the type of the conflict (Haas, Omura, Constable, & Canli, 2006). While lateral prefrontal parts of the brain takes part in the resolution of cognitive conflicts, rostral & subgenual parts of the ACC together with the amygdala is active in the resolution of the emotional conflicts which affect human daily lives mostly (Bush, Luu, & Posner, 2000; Egner, et al., 2008).

The Stroop Task is a task designed to measure cognitive conflict resolution based on congruent and incongruent situations. In this task, subjects are expected to resolve the conflict between a word which is a color name and the color of the print that word is written in. In congruent cases, the word and the print color are the same (for

instance the word “red” is printed in red), a situation which facilitates subjects’ reading of these words. In incongruent cases, on the other hand, the word and the print color differ and the subject is expected to read the color of the word (e.g. the word “red” is printed in blue, subject should respond by saying “blue”). The congruency effect exposes itself in reaction times of the participants, which are always significantly slower for incongruent cases compared to congruent ones (MacLeod, 1991). In cases when subjects are asked to read only the name of the colors, but the words’ print color is not important or they are all printed in black, there is no facilitation effect.

However, conflicts in life do not always have a cognitive nature. Another type of conflict is emotional conflict. Currently, emotional conflict is measured indirectly by creating a conflict between emotional words and their color or emotional words and their number. However, these tasks fail to generate emotional conflict consistently, because they activate both cognitive and emotional parts of the system. Some other tasks using words and pictures have also been designed; but these either do not exactly create a pure emotional conflict, do not differentiate the emotional dimensions of the words (valence, arousal and dominance values) (Lang, 1980) or fail to control the basic properties of the words, such as frequency, length and concreteness values. In order to measure emotional conflict, it is necessary to create a task where the conflict activates emotional networks exclusively, controlling the stimuli used in the task carefully[1].

The main aim of this thesis is to develop a task capable of measuring emotional conflict consistently, designing trials which involve Turkish verbal stimuli. The neutral words will form a baseline and trials that create emotionally congruent, incongruent cases will be generated through the words’ emotional attributes.

The experiment design we use in this thesis is very much similar to Haas et al.’s Word-face Stroop task (2006) where the conflict is between “emotional” words and “emotional” faces. In congruent situations, words with positive valence are shown on positively affective faces, and words with negative valence are shown on negatively

[1] For example when words are used, attributes such as frequency, length and concreteness should be distributed evenly across the stimuli.

affective faces; whereas in incongruent situations positive words are shown on negatively affective faces and vice versa. The novelty of our task in this thesis is due to the use of a brand-new Turkish affective word list and evaluation of valence as well as concreteness of the words in emotional conflict resolution.

In order to prepare affective verbal stimuli, first of all we had to form an affectively normed Turkish word list. Thus, subjects evaluated 198 words in terms of three dimensions of emotion separately: valence, arousal and dominance (Experiment 1). After choosing the appropriate words for our Word-face Stroop task, consisting of differently valenced words with neutral arousal values, another task is designed to measure the concreteness values of these selected words (Experiment 2), so that concreteness effects could be counterbalanced across trials. Once the essential conditions for the verbal stimuli (not only valence, arousal and concreteness, but also word frequencies and length were considered) are satisfied, Word-face Stroop task is prepared, using affective faces taken from "The Productive Aging Lab Face Database" (Minear & Park, 2004). Words were superimposed on these affective faces either as a congruent stimulus (e.g. negative word on a sad face) or an incongruent stimulus (e.g. negative word on a happy face) or a neutral stimulus which forms the baseline (neutral word on neutral face). Before participating in our Word-face Stroop task, subjects first participated in a classical Stroop task which measures the cognitive conflict (Experiment 3), and then they proceeded to the Word-face Stroop task to measure the emotional conflict, in which they were asked to evaluate the valence of the words which appeared on a background showing affective faces (Experiment 4).

Another aim of this thesis is to investigate the behavioral differences in conflict resolution and emotional conflict resolution between the healthy and depressive populations. After conducting all these experiments on a healthy population, the classical Stroop Task and the Word-face Stroop Task are also administered to a smaller group of depressive patients who were not yet exposed to any medication (Experiment 5).

What we hypothesized is that participants will show the interference effect both in classical Stroop and in Word-face Stroop between the congruent and incongruent situations. Thus, they should exhibit both response latency (slower reaction times) and less accuracy in incongruent cases compared to congruent cases. Moreover, when the valence is concerned, healthy subjects are expected to react faster to positive words compared to negative and neutral words, because previous studies using different kinds of behavioral tasks involving words' valence revealed that normal people are significantly faster in responding to positive stimuli rather than negative stimuli, since it is assumed that the networks processing positive and negative stimuli in the brain are detached (Bernat, Bunce, & Shevrin, 2001; Dahl, 2001; Inaba, Nomura, & Ohira, 2005; Kuchinke, et al., 2005). Even though it is not obvious how concreteness will show its effect on emotionally valenced words, for the neutral words it is anticipated that the typical concreteness effect will show up such that subjects will react significantly slower to abstract words than concrete ones.

As for the differences between the healthy and depressive populations, we hypothesize that we will see a general slowness in reaction times, both in classical Stroop and Word-face Stroop results of depressive group compared to normal subjects. Furthermore, in perspective with the previous studies, it can be assumed that the positive bias of the healthy group will be converted into an opposite one for the depression patients, as a negative bias. Hence, depressed group is expected to react faster to negative words than to positive words, contrary to the normal population's faster responses to the positive words.

On the other hand, as these patients stay in a continuous negative mood, it can also be presumed that they will not care much about the stimuli hence not showing any kind of difference between negative, neutral or positively affective words. It's also possible for the same reason that they will not show the congruency effect in Word-face Stroop task as they continuously think in a stably negative state.

The organization of this thesis is as follows: In Chapter 2, an overview of the literature on the emotional conflict resolution will be provided. Related concepts and the studies about conflict resolution will be explained briefly, explaining the

conducted tasks to measure conflict resolution both cognitively and emotionally, while at the same time trying to understand the links with the major depressive disorder. Chapter 3 will outline our behavioral experiments. In Chapter 4, the findings of the experiments will be discussed in accordance with the previous studies. Finally, in Chapter 5 brief conclusions regarding these studies will be drawn.

CHAPTER 2

BACKGROUND AND LITTERATURE REVIEW ON EMOTIONAL CONFLICT RESOLUTION

There are many facets of conflict resolution: conflict between cognitive and emotional states are presumably resolved through separate but interacting networks. When one of the subcomponents of these networks malfunctions, like in Major Depressive Disorder, the conflict resolution process is disturbed. In order to develop a thorough understanding of these issues, several different aspects such as emotional conflict resolution, the tasks which try to measure cognitive and emotional conflict resolutions, the networks in the brain which are shown to be responsible for any kind of conflict resolution and some other theories, concerning valence and concreteness values of stimuli used in mentioned tasks which are thought to influence conflict resolution, need to be discussed.

2.1. Conflict Resolution

Conflict resolution is a process which provides human cognitive system its adaptability through “perceptual selection, response biasing and online maintenance of contextual information” (Botvinick, Braver, Barch, Carter, & Cohen, 2001).

Conflict resolution is vital for human beings because our environment constantly changes. Without our cognitive system we cannot adapt ourselves to new situations and therefore may simply not be able to survive. Fast and appropriate decisions are indispensable for survival. We should be able to change our strategies, at the right time, according to the changing environment surrounding us. We should know where

and when to focus our attention from less relevant to more relevant situations. Therefore the brain resolves conflicts in order to monitor incessantly the distractors which cause incongruities with current tasks people face constantly, in their daily lives.

Conflict resolution is what needs to be done when there is a conflict between a previous and a current thought or response. Accordingly, we decide which action or thought we should consider/act with the help of this very important capability of our brain.

A few examples of situations in which conflict resolution is not achieved are given by (Jonides, 2004):

- A one-year old child is shown an attractive toy in location A and then the toy is moved to location B in plain view of the child. The child, wanting the toy, reaches for it…but in location A, not B (Diamond, 1988).
- A patient with a lesion to the lateral part of frontal cortex is confronted with a task in which he has to produce as many words as possible beginning with the letter "S." He begins the task successfully, but then he keeps on repeating the same words over and over rather than producing new ones (Banich, 1997).

As seen from here, in many situations, one has to resolve the conflict between a previous and a current situation (for the baby it's between the recent location and the current location of the toy, for the lesioned patient it's between very familiar words which he has just said and the words which he should newly produce).

In the brain, Anterior Cingulate Cortex is believed to have an important role for conflict resolution and especially for the conflict monitoring. There are lots of studies (using either PET or fMRI) which showed that ACC activation increases notably in conflicting situations. Among tasks, Stroop task is the one where ACC activation has been perceived most, especially in incongruent situations (first observed by (Pardo, Pardo, Janer, & Raichle, 1990), using PET).

2.2. Stroop Test

Stroop test is a task which measures inhibition. Subjects conducting this task cannot inhibit the effect of word meaning over words' colors. In the classical Stroop task, one tries to read out as rapid as possible the color of the printed word which can be

either X's (or colored bars) or color names. When the print color and the name of the color are the same, it is called "congruent" (For example "red" is written in red). When the print color and the name of the color are different it's called "incongruent" (For example "red" is written in green) (Figure 1). During the conductance of this task, subjects' ACC activity increases especially while they try to perform the incongruent task in which they face a strong conflict between the word (e.g. red) and the print color (e.g. green) (Pardo, et al., 1990). Further studies show that ACC is actually where the conflict is evaluated (conflict detection), and that is how Dorso-lateral Prefrontal Cortex (DLPFC) is alerted, which in turn begins to try to reduce the conflict (conflict adaptation). So, ACC may play an important role in evaluating the conflict, but it is not exactly where the conflict adaptation occurs (Egner & Hirsch, 2005). It is not very well known at which level of processing the conflict, causing the interference effect that is seen in Stroop tasks, occurs. This conflict can occur while responding or it can occur while semantic or conceptual encoding. On the other hand, there are lots of studies that showed both levels contribute to the Stroop effect without a significant difference between them (van Veen & Carter, 2005).

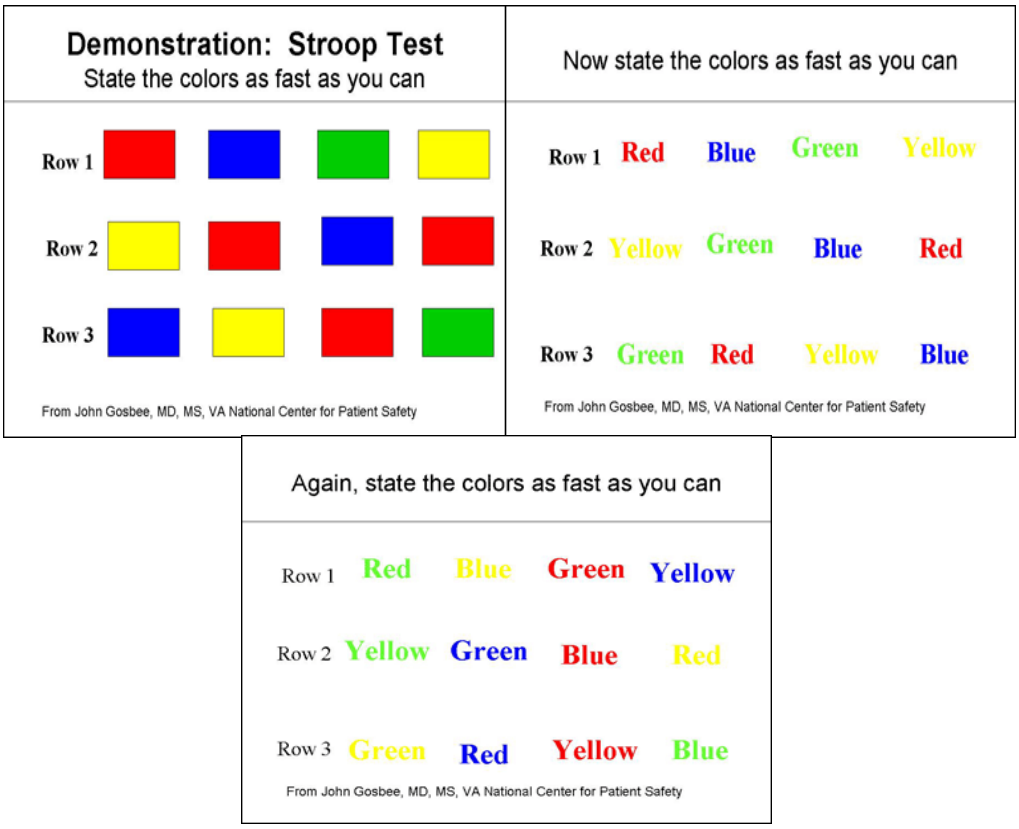

Figure 1 Classical Stroop Task
(http://patientsafetyed.duhs.duke.edu/module_e/stroop_test.html)

Conflict resolution is always tried to be measured by different kinds of Stroop Tasks, since the classical Stroop is not always accepted as the best instrument to measure and understand the interference effect. To be able to understand this effect, conducting a Stroop task, one should be able to reveal which cognitive processing patterns occur and hence what are the neural correlates of this effect; and at which level and where in the brain the conflict occurs and gets resolved.

The classical Stroop task is criticized since it fails to reveal the facts above; words may interfere with color naming, however color's effect on word naming is actually too little, moreover color names cannot be classified on a continuum (Tang, Critchley, Glaser, Dolan, & Butterworth, 2006).

2.3. Emotional Conflict

In order to understand emotional conflict, firstly one should know more about emotion. It is largely accepted that emotions have three orthogonal dimensions: valence, arousal and dominance. Valence is the dimension which ranges from pleasant to unpleasant (e.g. “peace” is mostly regarded as pleasant, while “cancer” is regarded as unpleasant). Arousal is the dimension which is related to the intensity of the excitement (e.g. “peace” has a very low arousal value, whereas “cancer” creates a great deal of excitement and has a high arousal value). Dominance, on the other hand, ranges from strong to weak feelings (e.g. people may feel themselves strong in the face of the word “peace”, whereas they may feel weak for the word “cancer”, since they would have big trouble in trying to cope with this fatal illness) (Bradley & Lang, 1999).

As for emotional conflict, it happens when the conflicts explained in the previous section occur in an emotional level and these are the ones which actually complicate our lives. Especially emotionally salient stimuli can interfere with current cognitive processes. On the other hand, the neural system which monitors and resolves emotional conflict is not very well known (Etkin, Egner, Peraza, Kandel, & Hirsch, 2006). Thereby, it is hard to understand exactly what emotional conflict means. The emotional conflict which is mentioned in this study cannot be completely created between humans’ conflicting “feelings”, since it would be so hard, if not impossible, to succeed in measuring “feelings” quantitatively. This study (and previous studies) tried to create emotional conflicts in a measurable way, by trying to put emotions in a measurable environment, using cognition. Hence actually we use cognition to mirror the effects of emotion and what is called emotional conflict is actually emotional “interference”, because these tasks measure the interference effect of two conflicting emotional situations which can be perceived in a cognitive level. Therefore while classical Stroop task measures cognitive conflict resolution, revealing the inhibitory effect of word meaning over word color, the emotional conflict resolution is measured by tasks revealing the inhibitory effect of an affective stimulus over another emotional stimulus.

Different versions of Stroop tests are used to measure emotional conflict. A very common of this kind of emotional Stroop is where emotionally valenced words are

used such as “murder”. It is perceived that subjects were slower in naming the colors of these emotional words, especially when anxiety disorder-related words are used in the task (Whalen, et al., 1998).

On the other hand, emotional Stroop cannot actually measure the emotional conflict as successful as the classical Stroop measures the cognitive conflict. Moreover, even though the interference effect can be perceived in patients, emotional Stroop cannot achieve to show this effect for healthy population (Etkin, et al., 2006).That’s why scientists searched for different kinds of Stroop to be able to create an emotional conflict which “arises from the incompatibility between the task-relevant and task-irrelevant emotional dimensions of a stimulus” (Etkin, et al., 2006).

Another reason to develop different kinds of Stroop was to explore the neural correlates of conflict resolution. For this reason, scientists designed fMRI studies where they can see which parts of the brain get activated during a Stroop task; but artifacts due to head movement deducing from speech presented prohibiting factors. This lead to creation of another kind of Stroop called counting Stroop —or cStroop and the emotional version of it: emotional counting Stroop—or ecStroop (Bush, et al., 1998). The cStroop creates the conflict between the number of the words and the written number-words. For instance, subjects react slower in responding correctly (pushing the second button as an answer for “two”) to the words “three” written two times compared to a neutral word such as “bird” presented similarly.

In the counting emotional Stroop task, on the other hand, emotionally valenced words (actually only neutral and negative words in this task) are used instead of numerical words. As a neutral condition, subjects see the word “cushion” written three times on the screen, and hence should push the third of four buttons (for an answer of “three”). As a negative condition on the other hand, subject for instance see the word “murder” written four times and hence should push the fourth button. Therefore, subjects are expected to react slower in negative conditions compared to neutral conditions, which created the emotional interference effect (Figure 2) (Whalen, et al., 1998).

These tasks really showed the interference effect in patient groups; on the other hand, they lack the positively valenced words, hence we cannot know if this effect occurs solely in negative words.

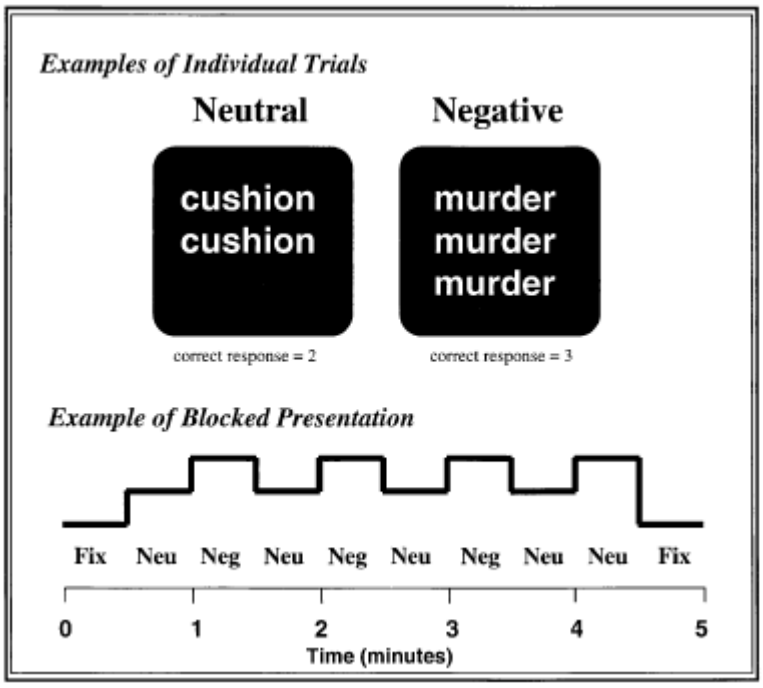

Figure 2 Stimulus presentation of ecStroop to be used in fMRI study (from Whalen et al., 1998)

The earliest task which seemed to be successful at constructing emotional conflict is the one Stenberg, Wiking and Dahl developed in 1998 (Stenberg, Wiking, & Dahl, 1998). They used affective facial expressions with words on the foreground and subjects evaluated these words in terms of being good or bad, ignoring the happy, angry and neutral facial expressions behind. The results were as expected: Participants were faster responding to the congruent stimuli. Moreover, they showed RT latencies in evaluating negative words.

This task is successful, however, instead of sad faces, angry faces are used in correspondence to “bad” and it is unclear whether anger can be paired with a word (“sad”) that surely refers to sadness.

Another kind of Stroop using words and faces is the one of Anes and Kruer (2003). In this experiment distracting stimuli are not the faces, but the words; hence subjects evaluated the facial expressions as being happy or angry with distracting words “happy” “angry” and “blank” appearing in the foreground. The interference effect is again seen significantly in this study. Moreover, RT’s for angry facial expressions

were longer than happy facial expressions, and consequently, the accuracy was better in angry faces.

The problem with this task, as the writers agree with, is that anger should be processed differently than other negative emotions. Moreover, the opposite of "happy" must be "sad", rather than "angry" (Anes & Kruer, 2004).

Etkin et al., also developed a similar task again asking subjects to evaluate the emotional faces with word distractors, using only "fear" and "happy" as words, superimposed on fearful and happy facial expressions; and therefore they created an emotional conflict between a task-relevant and a task-irrelevant stimuli and hence this task could represent a suitable emotional type of color-word Stroop task (Etkin, et al., 2006).

To sum up, classical emotional Stroop tasks fail to create the conflict in an emotional level, since when the conflict is between emotional valence and color, the latency effect can be seen even without color interference. This happens because the cognitive conflict and emotional conflict seem to activate different networks in the brain. Therefore, what is needed is "a Stroop-like task in which emotionally salient stimuli are presented that have two dimensions that are either in response conflict with each other (i.e., emotionally incongruent, EI) or not (emotionally congruent, EC)" (Haas, et al., 2006). Hence, Haas and colleagues developed the Word-face Stroop Task which balances emotional saliency in congruent and incongruent conditions, using again affective faces with affective words superimposed on them (Figure 3). Behaviorally they found significant difference in RT's of subjects to three different kinds of stimuli: emotionally incongruent (EI), emotionally congruent (EC) and neutral (N). Moreover, they conducted this experiment with fMRI and found greater caudal ACC (will be explained in detail in "Neural correlates of conflict resolution" section) activation in the brain during emotionally incongruent trials, which is consistent with the model proposing that caudal ACC is where the "conflict monitoring" occurs (Haas, et al., 2006).

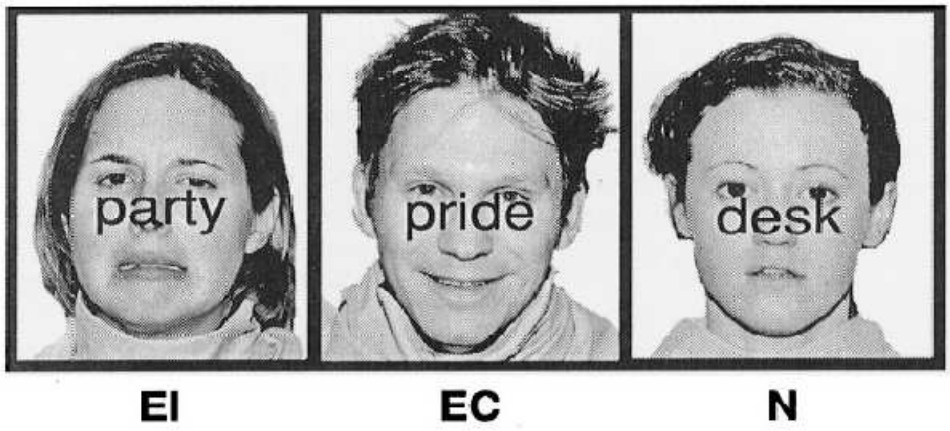

Figure 3 Examples of three types of stimuli which Haas et al. used in their Word-face Stroop Task.

2.4. Positive-Negative Asymmetry Hypothesis

As shown in lots of studies, when valence is processed in tasks, subjects tend to have longer response latencies in negatively valenced words than the positive ones (Dahl, 2001).

Studies conducting different kinds of tasks (subsequent detection, word recognition, lexical decision etc.) show that subjects are slower in responding to negative words than positive ones. Especially in one of them (subsequent detection task done by Dahl in 2001) it's revealed that this asymmetry is seen when an affective orienting task is used, not in a non-affective orienting task.

According to the researchers, who found the same advantage for positive words in response latencies and accuracy data, this asymmetry might have occurred because of the different organization of the emotional material in memory. It's claimed that the networks activating for negative and positive stimuli should be differently structured. From these experiments it's well understood that

> …positive material is better elaborated and interconnected in the cognitive emotional system than negative material (Ashby et al., 1999; Isen, 1985; Ruiz-Caballero and Gonzalez, 1994), while broader positive schemata should be **more readily cued** when the network activation increases.

(Kuchinke, et al., 2005).

Another claim is that "the emotional intensity of negative items is greater than for positive items", which is exposed using ERP data: "The greater positivity[2] for negative targets may produce the greater recognition memory for negative compared to positive and neutral targets" (Inaba, et al., 2005), which leads subjects to stuck more on negatively valenced stimuli rather than positively valenced stimuli, and hence results with latencies for negatively valenced targets.

2.5. Word concreteness effect

There is quite large amount of research demonstrating that abstract words are more difficult to process compared to concrete words in tasks such as visual lexical decision or word naming (Fiebach & Friederici, 2004). On the other hand it is not very well known whether the concreteness effect appears when the words used in a task are emotionally valenced.

An ERP study, conducting a visual word processing task, showed that "concrete negative" words such as "wound" or "bomb" differ from neutral and positive words as a function of mental imagery" (Kanske & Kotz, 2007).

Another study based on an immediate serial recall task with emotional words exposed that the typical word concreteness effect (i.e. it's easier to recall concrete words than abstract ones) is perceived only for positive words, not for negative words (Tse & Altarriba, 2008).

There is not much information and adequate evidence about word concreteness effect on emotionally valenced words, especially regarding the congruency effect.

2.6. Neural Correlates of Conflict Resolution

Anterior Cingulate Cortex is a part of the limbic lobe. Its functions can be grouped into categories according to its anatomical structure: anterior part is thought to be responsible for execution, posterior part for evaluation, dorsal part (BA[3] 24b´-c´, 32) for cognition and ventral part (BA 25, 33) for emotions (Bush, et al., 2000) (Figure 4). It's also demonstrated by (Hirayasu, et al., 1999) that subgenual ACC is associated with emotions, while dorsal ACC with attention-related processes.

[2] Positivity here refers to the jump in signal.
[3] BA: Broadmann Area

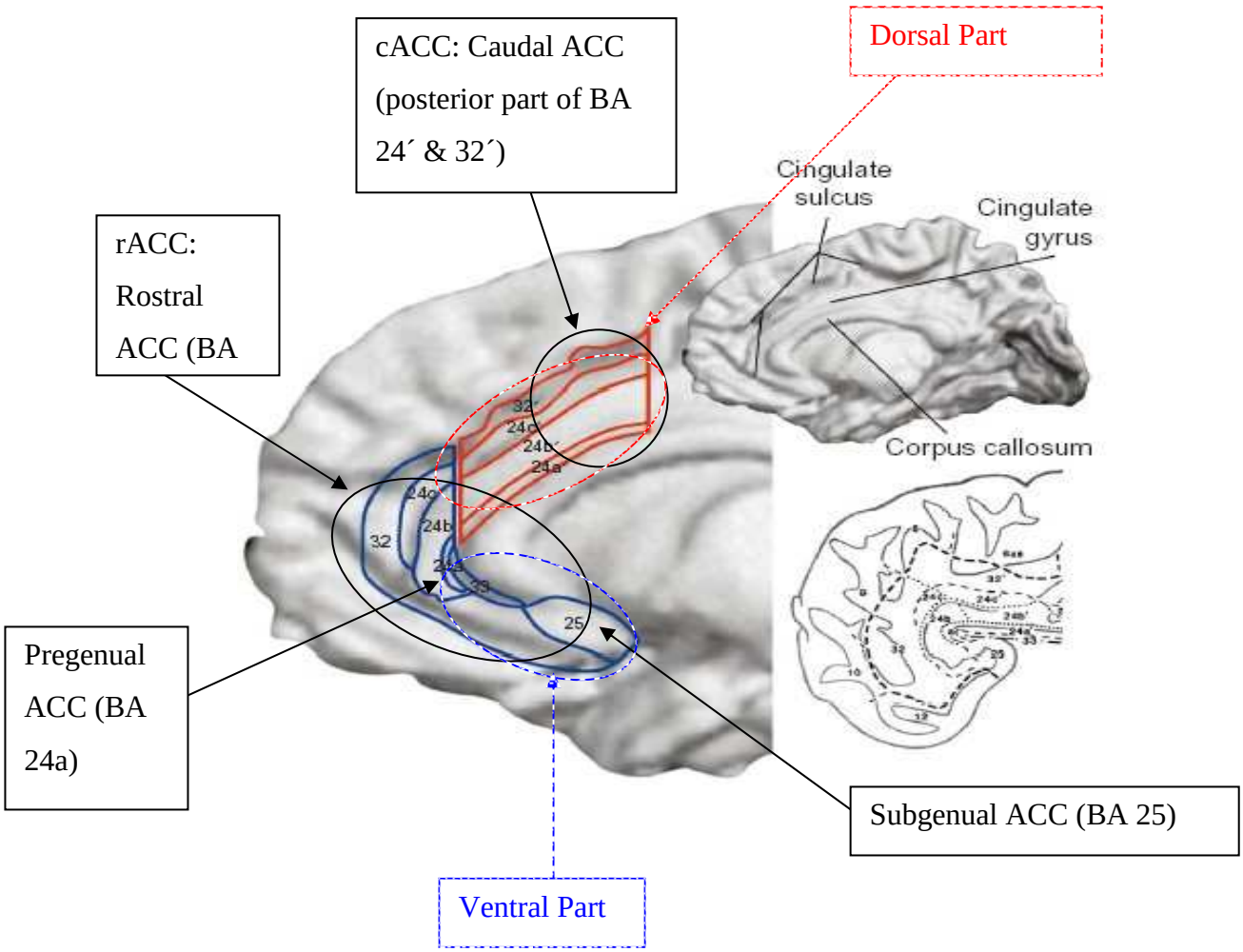

Figure 4 Anterior Cingulate Cortex (basic figure taken from Bush et al., 2001)

In lesion studies it is seen that when ACC is lesioned (in humans & in cats), attention and kinetic states are impaired (Cohen, Kaplan, Moser, Jenkins, & Wilkinson, 1999). In imaging studies it is found that the cognitive part of ACC (dorsal) has mostly a role on attention, which also has reciprocal interconnections between Lateral Prefrontal Cortex (LPFC), parietal cortex, premotor and supplementary motor areas. On the other hand, emotion part (rostral-ventral (BA 24 a-c, 32, 25)) has connections with amygdala, periaqueductal gray, nucleus accumbens, hypothalamus, anterior insula, hippocampus and orbito-frontal cortex (Devinsky, Morrell, & Vogt, 1995). So

it can be said that the cognitive part has access to sensory association cortices, while the emotion part of ACC has access to limbic structures.

Interestingly it has been shown that the emotion processing and cognitive regions in ACC counteract. Bush et al. (2001) found that during the emotional Stroop task[4], ACC's emotion part's activation decreases during cognitive information processing, while it increases during display of emotionally valenced words. Another study done by Davis et al. (2005), which monitored the single cell activity in ACC neurons, showed that in cognitively demanding tasks, neurons in the cACC were responding to the highly conflicting tasks (inhibitory or exhibitory) only for the emotionally valenced words, but not for non-emotional words. According to (Davis, et al., 2005), it may not be the case that different parts of ACC functions differently, rather perhaps neurons respond to these conflicting tasks with an inhibitory effect and that may be why Bush et al (2001) thought that there was no activation in rACC. To sum up, it is also possible that what Bush et al. (2001) saw was not a deactivation but an inhibitory effect of those neurons.

Moreover, pregenual ACC is also claimed to be the facilitator of the connection between frontal and limbic pathways. Trying to find out the connection between negative mood states and a leading slowness of cognition (e.g. "the fleeting sadness one feels on hearing a tragic news event or the more sustained feelings of melancholia and impaired concentration that accompany intense grief", (Mayberg, et al., 1999)), Mayberg constructed a model which can explain how emotion and cognition interact (Figure 5). So, there seems to be a functional reciprocal relationship between cortical and limbic pathways and this leads to the fact that these pathways do not work independently. This situation, then, can explain why negative mood (emotion) can significantly influence attention (cognition).

[4] In the emotional version of the Stroop task, people are asked to read out the color of the words which have emotional content such as murder, love etc., in the incongruent situation and words which have neutral content such as dog, tree etc., in the congruent situation. On the other hand, the kind of Emotional StroopTask Bush et al. (2001) used is the "counting" emotional Stroop where people are asked to say the number of the emotionally valenced words in the incongruent task, while they are asked for the number of neutral words in the neutral task.

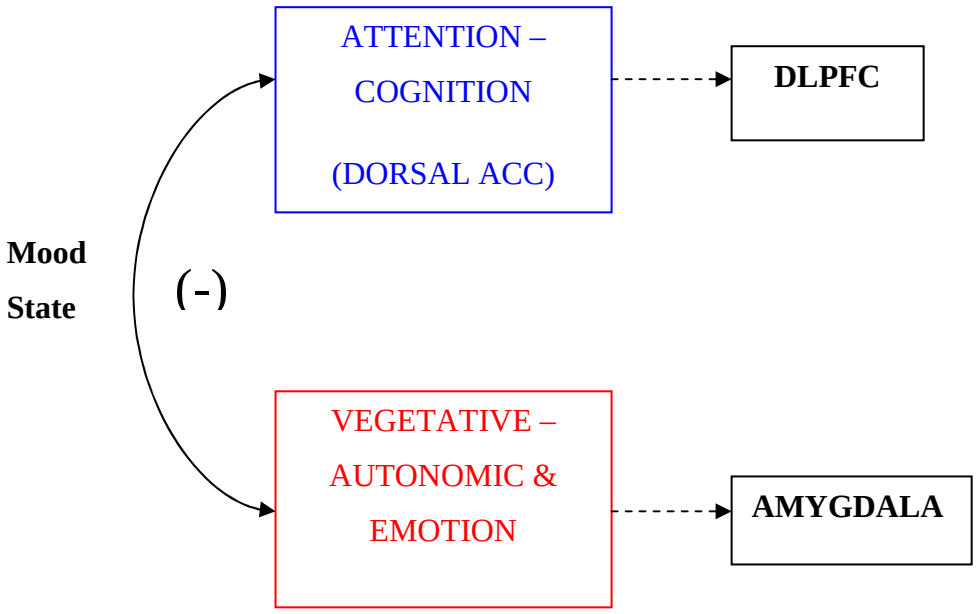

Figure 5 Simplified model of emotion-cognition interaction from Mayberg (1999, p. 680).

Returning to the functionality of ACC, it can be postulated that ACC decides which part of the brain should be alerted to be able to respond to the situation. Both dACC[5] and rACC contribute to the error responses' evaluation (Polli, et al., 2005), through the connectivity proposed by Mayberg in Figure 5. Observations of error related negativity (ERN), a component of event related potential, which is uniquely generated on ACC when errors occur, showed that ACC is responsible for error "detection" which leads to error correction with ACC's connections to other (esp. frontal) areas of the brain (Bush, et al., 2000). This has also been claimed by Botvinick et al. (2001).

While ACC is mostly involved in error-detection and also modulation of emotional responses, it is also speculated to subserve learning and behavior. For example, in animal studies, it's understood that ACC has an important role in early learning (Bussey, Muir, Everitt, & Robbins, 1996). As Posner and Rothbart (1998) claimed ACC may be in charge of maturation of our behaviors and self-regulation while growing up. This is facilitated by the migration of spindle neurons into ACC in early childhood. Additionally, the interaction between amygdala and ACC helps infants to

[5] dACC: dorsal ACC (BA 24b´-c´, 32).

learn how to control their emotions providing a kind of early self-regulation in infants (Posner & Rothbart, 1998). As for behavior, ACC seems to be involved in modulating self-confidence, a capability of human beings which is highly corrupted in Major Depressive Disorder patients.

2.7. Major Depressive Disorder

Major Depressive Disorder (MDD) is also known as clinical depression or unipolar[6] depression. The mood symptoms of MDD can be: abnormal depressed mood (sadness persisting at least two weeks, hopelessness, feeling the self "empty"), abnormal loss of interest (also lack of motivation) or abnormal irritability (seen especially on children and adolescents). MDD affects people both physically and psychologically. Physically, abnormal appetite (eating too much or not eating at all), abnormal sleep (insomnia or hypersomnia), fatigue, loss of energy, slowing of speech, movement and thinking, or agitation can be seen in patients; while psychologically, depressed people feel worthless and extremely guilty; they lose interest generally, but especially for things that they formerly were interested in. In addition, their self-esteem is lowered and they become extremely pessimist. They frequently think of death and there is a huge risk of suicide for MDD patients.

According to World Health Organization[7];

Depression is the leading cause of disability as measured by YLDs [years lived with disability] and the 4th leading contributor to the global burden of disease (DALYs [disability adjusted life years]) in 2000. By the year 2020, depression was projected to reach 2nd place of the ranking of DALYs calculated for all ages, both sexes. However today, depression is already the 2nd cause of DALYs in the age category 15-44 years for both sexes combined.

Statistics on MDD patients indicate that:

- Depression is common, affecting about 121 million people worldwide.
- Depression is among the leading causes of disability worldwide.
- Depression can be reliably diagnosed and treated in primary care.
- Fewer than 25 % of those affected have access to effective treatments.

[6] Unipolar means one pole, patient is always depressed, while bipolar (two poles) patient is sometimes depressed and sometimes euphoric.
[7] http://www.who.int/mental_health/management/depression/definition/en/

At this point it is important to consider the effects of MDD on human cognition. MDD patients have poor concentration and cannot decide easily. They become mentally fatigued when they are asked to read, study or solve complex problems. Memory losses, which may even lead to dementia, occur.

Several different tests for finding out how much depression affects cognition lead to a common conclusion as follows: Depression impairs more or less every kind of cognition. Particularly, MDD seems to impair attentional set shifting regardless of the age (young or old), or the period of depression they experience. It can be said that, depression affects the performance for a wide spectrum of cognitive processes involving intelligence, problem solving, learning and speed (Christensen, Griffiths, Mackinnon, & Jacomb, 1997). Memory, attention, visuomotor speed and language stand out as the most affected cognitive functions in MDD (Ravnkilde, et al., 2002).

2.8. Conflict Resolution and MDD

MDD patients cannot overcome interference. In MDD patients, conflict resolution is impaired just like all the other cognitive processes. PET imaging studies show that depressed patients have blunted activation—compared with controls—of the anterior cingulate gyrus during performance of the incongruent Stroop test which provides the measurement of how fast one can overcome interference (George, et al., 1997). It can be said that depression severely impairs our "conflict resolution" capability.

An example for conflict resolution is provided by Jonides:

> Many depressed or dysphoric patients engage in rumination about negative self-referenced thoughts such that this rumination becomes a "habit of thought" (Hertel, 2004). Rumination is sufficiently powerful that it impairs the ability to engage in many tasks of daily life because of its consuming nature.
>
> (Jonides, 2004).

Hence, for these patients conflict is between their constant negative thoughts and the thoughts which they have to think to pursue their daily activities.

Conflict resolution constitutes a real problem for MDD patients as they cannot successfully fulfill their daily activities. In tasks eliciting conflict or error based responses, such as the Stroop Task, MDD patients show "decreased post-error and

post-conflict performance, emerging mainly within the context of emotionally negative feedback relating to task performance" (Holmes & Pizzagalli, 2007).

Erickson, et al., (2005), conducting a series of experiments on depressive patients (rapid visual information, pattern recognition memory test, spatial working memory test and affective Go/No-Go task), showed that depressed patients made more omission errors when responding to happy than to sad words. Moreover they responded more quickly to sad targets than to happy targets whereas healthy subjects showed the opposite pattern for both error and response time variables. Therefore, even if the normative state is characterized by a positive bias in healthy population, it's not the case for depressed population. Another interesting claim they made is that unmedicated depression patients show attention deficits rather than cognitive impairments, which can cause their mood-congruent bias (being faster to sad targets than happy targets) (Erickson, et al., 2005).

An fMRI study, where affective facial processing in depressive patients is inquired, (Frodl, et al., 2007) demonstrated deactivations in ACC, right DLPFC and right superior frontal cortex in healthy subjects, whereas MDD patients failed to show this deactivation in these areas. This could occur because of the use of different neuronal strategies in face recognition or because of the problem to stop activation in these areas during emotional tasks. Thus, "In order to complete the tasks, depressive patients have to activate certain brain regions to a greater extent than control subjects, or that they pay more attention to the sad stimuli" (Frodl, et al., 2007).

2.9. MDD's relation to ACC functions

At this point, we will inquire how MDD is related to ACC functions to understand how exactly ACC impairments can lead to MDD. In MDD patients, ACC volume seems to be reduced. Bilateral grey matter deficit is seen in ACC, especially for elder depressed patients (Ballmaier, et al., 2004). Additionally, neuronal somal size in PFC (& ACC) is also decreased which means that neuronal activity is 9% diminished in 5^{th} layer of ACC (Chana, Landau, Beasley, Everall, & Cotter, 2003). Another claim is that glia cells are also reduced in this area in MDD patients. A portion of the cingulate cortex contains the highest density of 5HTT terminals (serotonin) in a

region where ACC gets dense projections from Amygdala (Pezawas, et al., 2005). Functional connectivity analyses also proved that "amygdala and pACC[8] are significantly 'functionally connected'" (Pezawas et al.2005, p.4). In literature amygdala is generally associated with fear conditioning (& fear memory) and negatively charged emotions (LeDoux, 2000). ACC and amygdala function together in a feedback loop, and rACC inhibits these negative emotions of amygdala (by inhibiting amygdala activity)[9] (Pezawas, et al., 2005). In depression, rACC activation decreases, while sadness (of patients) increases. This effect is observed probably because of decreased activity; because rACC can no longer inhibit amygdala's negativity. This connection between amygdala and ACC is very crucial in MDD patients; because if ACC volume is really low in MDD patients and the neuronal activity of ACC is also low, this may cause the amygdala-ACC connection to weaken, which in turn will diminish ACC's inhibition of amygdala's negativity. Because of this chain, the patient may become dysphoric. The fronto-limbic circuitry which has been discussed before is also important in MDD, because the connection between ACC and DLPFC may form the connection between mood and attention (as in Mayberg's model). When this connection is somehow impaired, then the person cannot focus on something, probably this is the reason why he/she cannot evaluate his/her feelings, and gets depressed. It is also shown by (Kennedy, et al., 2001)—looking at the changes in brain glucose metabolism after a paroxetine[10] therapy—that in depressed patients there exists a problem in cortical-limbic circuitry which is compensated by paroxetine intake.

Finally, there is adequate evidence that genetics is very much involved in this illness. (Hirayasu, et al., 1999) showed that when MDD patients have a family history of affective disorder, their left subgenual ACC volume are % 24 smaller in comparison to the MDD patients who do not have a family history. Moreover Pezawaset al. demonstrated that 5HTTLPR (Serotonin Transporter Gene Promoter Region Polymorphism) has direct effects on the connectivity of amygdala and rACC.

[8] pACC: pregenual ACC.
[9] Perilimbic PFC and MPFC neurons contribute to the inhibition of amygdala (Pezawas et al.2005).
[10] Paroxetine is an antidepressant of the selective serotonin reuptake inhibitor (SSRI) type (Wikipedia).

In conclusion, it can be said that the ACC performs error detection and alerts prefrontal or limbic circuits depending on the nature of the conflict. Cognitive conflicts require involvement of prefrontal circuits and emotional conflicts require the involvement of limbic circuits, which are both known to be affected in MDD.

CHAPTER 3

BEHAVIORAL EXPERIMENTS

Previous chapter showed that emotional conflict can be measured by different kinds of Stroop tasks and to be able to construct a strong emotional conflict, Word-face Stroop seems to be the best option, especially if we want to compare healthy and MDD population both in terms of interference effect and in terms of valence and concreteness effects on their capacity to resolve emotional conflicts. Therefore, in these experiments we tried to investigate emotional conflict with a Word-face Stroop Task, replicating the interference effect which is clearly shown in classical Stroop tasks (MacLeod, 1991). On the other hand, as we did not have an adequate Turkish word list to conduct this experiment, we first had to form a Turkish word list in order to use in our Word-face Stroop Task. Moreover, before conducting the Word-face Stroop, subjects first participated in a classical Stroop Task which worked as a baseline and which helped us to see if there is any difference in interference effects between Word-face Stroop and Classical Stroop behaviorally, while comparing the results for healthy subjects and MDD patients.

3.1. EXPERIMENT 1: METU TURKISH EMOTIONAL WORDS

According to the dimensional view of emotions, two dimensions which primarily account for the changes in emotion evaluation are valence (ranging from unpleasant to pleasant) and arousal (ranging from calm to excited). A third one which is less related is called dominance (ranging from controlled to in-control) (Osgood, Suci, & Tannenbaum, 1957).

In ANEW, the Self-Assessment Manikin (SAM) was developed to symbolize these three dimensions (Lang, 1980). SAM consisted of figures representing each dimension. Participants rated the words in a 9-point scale for each dimension. Over 1000 words are normatively rated in ANEW which consisted of both nouns and adjectives.

In this experiment, Turkish words are rated in terms of these three basic dimensions of emotion: valence, arousal and dominance, to be able to document the emotional information they carry. We used the Manikin of Emotional Rating (MERT) developed by Anıl Ilgaz (Appendix A). Using these figures and a 9-point scale, participants rated 198 Turkish words and then mean ratings of valence, arousal and dominance are calculated for each word.

3.1.1 Method:

Participants

45 participants in three age groups, balanced in gender, participated in this study. 20 young adults (20-35) with a mean age of 28.6 (*SD* = 3.96) years, 18 middle-age adults (41-58) with a mean age of 49.6 (*SD* = 5.76) and 7 old adults (60-72) with a mean of 62.71 (*SD* = 4.42) voluntarily participated. All of the participants were native Turkish speakers.

Materials

Some of the words used in this study are translations of a subset of words taken from ANEW and some of them are chosen from a Turkish publication (Tekcan & Göz, 2005). These words are chosen carefully according to their frequency (15-444) with a mean of 81.7 (*SD* = 85.8) and length (3-12 letters). The words are restricted to be nouns.

MERT is an affective rating system which consists of graphical illustrations of a face sketch, symbolizing the three emotional dimensions. These figures are bipolar scales with 5 figures representing the values of the scale (Appendix A). For valence, faces range from a happy face to an unhappy face, for arousal they range from excited face to a calm face and for dominance a large face (in-control) to a small face (dominated)

figure. In order to indicate their evaluations, participants marked one of the 9 squares right under or in-between these figures.

Procedure

Experiments were run individually. Participants rated 198 Turkish words in terms of valence, arousal and dominance using three MERT booklets, one for each emotional dimension. Every booklet had same words with different figures displayed on the rating scale. Therefore subjects rated all 198 words three times in terms of different emotional dimensions: first for valence, then for arousal and finally for dominance.

3.1.2 Results and Discussion

After the participants rated the words, a database in MS Access is formed and the mean values of valence, arousal and dominance are calculated. In Appendix B, 198 words with their mean values of valence, arousal and dominance and their standard deviations can be found.

From Figure 6, one can realize that valence ratings are distributed in a balanced fashion for negative, neutral and positive categories. For the arousal dimension the words are mostly neutral or high arousing. There is only one word which is both negative and low arousing (the word “tembellik”, meaning laziness). From all these words, we have chosen a subset with neutral arousal and varying valence along positive, neutral and negative values for use in the Word Face Stroop Task.

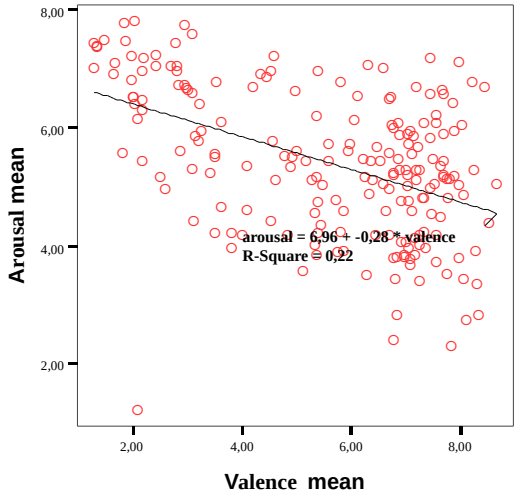

Figure 6 2-dimensional space (arousal-valence) of the emotional normative rating of 198 Turkish words

3.2 EXPERIMENT 2: CONCRETENESS

The words which will be used in Word-Stroop Task should also be distributed equally in terms of concreteness of the words, because a difference between abstract and concrete words can also be seen, since most of the studies shows that abstract words can be processed more difficultly than concrete words (Fiebach & Friederici, 2004). Therefore, not only the words' valence, but also the concreteness needs to be tested in case they have an effect on emotional conflict resolution. Hence, the words which are selected from the first experiment were then tested according to their concreteness values.

3.2.1 Method:

Participants

40 participants, balanced in gender, with a mean age of 24.85, voluntarily participated in this study. All of the participants were native Turkish speakers.

Materials

170 words are chosen from the above study (neutral arousing, differently valenced words). These words are presented to the subjects in an MS Excel sheet, and they decided how much these words are concrete or abstract using a 7-point scale. If a word is absolutely abstract, then they put an "X" under "1"; if the word is definitely concrete, then they put the "X" under 7; but if they cannot decide whether the word is concrete or abstract clearly, they marked the one (2-6) to which they think the word's concreteness value seems to be close (Appendix C).

Procedure

Experiments were run individually. Participants rated 170 Turkish words in terms of their concreteness. Whenever an "X" is entered into a cell, in another Excel sheet, the value of that box (1-7) showed up automatically and then using those values a database is formed for each subject and finally the means for each word are calculated using MS Excel (Appendix C).

3.2.2 Results and Discussion

The mean concreteness values of each word are calculated. 38 words were rated as completely abstract, with a mean of 2.33 (*SD* = 0.4), 69 words were concrete with a mean of 6.54 (*SD* = 0.23) and other 63 words were showed to be neither strictly abstract nor strictly concrete, with a mean of 4.67 (*SD* = 0.93) (Appendix C).

71 (33 abstract, 38 concrete) of these words are chosen to be used in the Word-Stroop Task, according to their arousal and valence means. All of these words have neutral arousal means (varying between 4-6).

3.3. EXPERIMENT 3: CLASSICAL STROOP TASK

Stroop Task is a classical experimental design which creates interference between word reading and color naming (i.e. Stroop interference effect). The quantification of this interference is measured according to the difference between the reaction times of congruent (e.g. “red” printed in red) versus incongruent (e.g. “red” printed in blue) situations. Subjects conducting this experiment tend to react significantly longer in incongruent situations compared with the congruent situations.

3.3.1 Method:

Participants

33 healthy right handed subjects (16 female, 17 male; between ages 20-33) with a mean age of 25.24 (*SD* = 3.5) years participated voluntarily in this experiment. Participants had an average of 17.27 (*SD* = 1.09) years of education and they were all native Turkish speakers. None of them had a history of brain injury, and were not on any mood-altering medication. Only two of them had used anti-depressants more than 4 years ago. None of them had a problem distinguishing the colors. Same participants conducted both Classical Stroop and Word-face Stroop successively.

Materials

Subjects completed the Stroop Task which is developed in Istanbul University Medical School, Neurology Department’s Neuropsychology Lab. The task is conducted with a paper with colorful rectangles and colorful words on it. The scoring is done manually on another sheet where the correct answers are printed for each

part. Subjects' wrong answers are scratched, whereas spontaneous corrections are circumscribed. Reaction times are measured with a chronometer, starting with a "start" command and terminated when the subject stopped answering for the whole part.

Procedure

This task consisted of three parts. First, participants were presented with colorful (red, blue and green) little rectangles and were asked to name the color of these rectangles as quickly and correctly as possible, and they were also told that if they realized that they did wrong, they might correct themselves spontaneously. Then, they were shown a list of the words (kırmızı:red, mavi:blue, yeşil:green) printed in incongruent ink colors (e.g. "kırmızı:red" printed in blue). Subjects were first asked to read these colorful words, hence they just read the printed word (congruent), and after a very short break they were instructed to name the colors of those colorful words (incongruent). Each of these parts is scored independently as reaction times in milliseconds, number of correct answer and number of spontaneous corrections.

3.3.2 Results and Discussion

Reaction times (RT)

To measure the difference between RT means of three levels (rectangle color reading, word reading and color naming) (Table 1), a repeated measures ANOVA is conducted which revealed a significant main effect, $F(2,64) = 265.901$ $p<.000$. Contrasts reveal that color naming tend to be more time consuming (conflicting) than both rectangle color naming and words reading. Moreover word reading tends to be the easiest—since there is no conflict—, whereas rectangle color reading is not that easy even if there seem to be no conflict. This is because reading is a process which occurs more automatically and more easily than trying to find out the color of the rectangle and than naming that color (MacLeod, 1991).

Table 1 RT means of three levels of classical Stroop task

RT	Mean	Std_dev
rectangle color naming	3332,12	467,358
word reading	2493,33	371,876
word-color naming	5654,85	1054,96

Wrong Answers

Again a repeated measures ANOVA is conducted on the correct answer numbers for rectangle color reading, word reading and color naming (Table 2). The main effect of wrong answer is again found to be significant $F(2,64) = 7.065$ $p<.01$. This again means that in incongruent situation (color naming) subjects tend to make more mistakes than other tasks, and again easiest one was the word reading.

Table 2 Wrong Answer means for three levels of classical Stroop task

Wrong Answers	Mean	Std_dev
rectangle color naming	0,27273	0,57406
word reading	0	0
word-color naming	0,81818	1,42422

Spontaneous Correction

Repeated measures ANOVA, with three levels again (Table 3), revealed a significant effect of spontaneous correction $F(2,64) = 9.244$ $p<.001$. This also means that in incongruent situation subjects made more corrections than rectangle color naming and word reading, and least correction is seen in the word reading task.

Table 3 Spontaneous correction means for three levels of classical Stroop

Spontaneous Corrections	Mean	Std_dev
rectangle color naming	0,66667	0,95743
word reading	0,09091	0,29194
word-color naming	1,45455	2,23734

3.4. EXPERIMENT 4: WORD-FACE STROOP TASK

In the literature, as summarized in Chapter 2, emotional conflict is being measured by creating a conflict between emotional words and their color or emotional words (Emotional Stroop, (Gotlib & McCann, 1984) and their number of occurrence (Emotional Counting Stroop, (Whalen, et al., 1998). However, these tasks fail to generate emotional conflict consistently, because they activate both cognitive and emotional parts of the system. To be able to measure emotional conflict, one needs to create a task where the conflict activates emotional networks exclusively. The Word-face Stroop (Haas, et al., 2006), which we conducted in this study, is such a task where the conflict is between "emotional" words and "emotional" faces. The subjects are asked to tell the emotional state of the given word (positive, neutral, negative) while the words are displayed on emotionally affective faces. In congruent situations, positive words are shown on positively affective faces, negative words are shown on negatively affective faces; whereas in incongruent situations positive words are shown on negatively affective faces and vice versa. The novelty of our task in this study is due to the use of a brand-new Turkish affective word list and manipulation of valence as well as concreteness of the words.

Hypotheses:

The first hypothesis predicts the fact that people slow down when they face a conflicting situation regardless of the nature of the conflict, be it emotional or not. Hence, the response times for the incongruent situations (e.g. negative word on a happy face) should be significantly higher than the response times for the congruent situations (e.g. positive word on a happy face) and the number of correct response should be less in incongruent situations than the congruent ones, as showed in the previous studies (Haas, et al., 2006).

The second hypothesis is that positively valenced words will be advantageous in response latencies and data accuracy, since positively valenced stimuli generally and automatically facilitate word recognition. This situation may occur because positive schemata are **more readily cued** when the network activation increases (Kuchinke, et al., 2005). It can be understood that the normative state is characterized by a **positive bias** (Erickson, et al., 2005). Moreover, this may be the case since

participants are typically more distracted by negative stimuli as compared to neutral or positive stimuli (van Hooff, Dietz, Sharma, & Bowman, 2008).

The third hypothesis is about the concreteness effect. We expect to see the typical word concreteness effect for the neutral data (since this effect is not very well understood for emotionally valenced words), which means that subjects are expected to show more response latency to the abstract neutral words than to the concrete neutral words. On the other hand, as it is not very clear in the literature that how concreteness effect occurs in emotionally valenced words, we cannot have a lucid idea whether this effect will show itself in our task or not.

3.4.1 Method:

Participants

33 healthy right handed subjects (16 female, 17 male; between ages 20-33) with a mean age of 25.24 (*SD* = 3.5) years participated voluntarily in this experiment. Participants have an average of 17.27 (*SD* = 1.09) years of education and they were all native Turkish speakers. None of them had a history of brain injury, and were not on any mood-altering medication. Only two of them had used anti-depressants more than 4 years ago.

Design

To show the basic congruency effect, initially a paired samples t-test is done. Then, to measure the difference between congruent, incongruent and neutral cases, repeated measures ANOVA with one factor and three levels is conducted. At the end, the whole data is analyzed with a 2 (congruency: congruent, incongruent) X 2 (valence: positive, negative[11]) X 2 (concreteness: abstract, concrete) repeated measures design, to be able to see the effects of valence and concreteness with congruency. Moreover, to be able to inquire and understand more about the interactions between these factors, paired samples t-tests are conducted separately for different pairs of these categories.

[11] Neutral stimuli are thought to be a baseline case and they cannot be compared to others, since they have no incongruent case.

Materials

96 words (32 neutral, 32 negative and 32 positive) are used in this experiment. 71 of them were extracted from Experiments 1 & 2 and 25 of them are taken from a database of Turkish Affective Word Norms with SAM formed by Mark Ashton Smith in Bilkent University, Department of Psychology. All of these words' frequencies, lengths and emotional dimension values were controlled. Their frequencies have a mean of 97.4 (*SD* = 80.3); their length have a mean of 5.41 (*SD* = 1.4). 48 of these words are abstract (*M* = 2.28, *SD* = 0.47) and 48 words are concrete (*M* = 6.58, *SD* = 0.29). The emotional valence scores are as follows for positive words: *M* = 7.29, *SD* = 0.49, for negative words: *M* = 2.89, *SD* = 0.79 and for neutral words: *M* = 5.57, *SD* = 0.62. The valence levels differed significantly from each other *F* (2, 93) = 369,690, *MSe*= 157.528. The arousal levels for 16 positive abstract (*M* =5.34, *SD* = 0.62), 16 positive concrete (*M* = 5.39, *SD* = 0.29), 16 negative abstract (*M* =5.5, *SD* = 0.73), 16 negative concrete (*M* =5.57, *SD* = 0.49), 16 neutral abstract (*M* =5.28, *SD* = 0.41) and 16 neutral concrete words (*M* =5.01, *SD* = 0.5) did not differ significantly *F*(5, 90) = 2,2, *MSe* = 0.62. Hence the words are manipulated on the valence axis, but were neutral and not manipulated on the arousal axis.

Affective Faces

Faces in the background were chosen from "The Productive Aging Lab Face Database" (Minear & Park, 2004). 4 happy, 4 sad and 4 neutral faces, each having 2 male and 2 female samples, are selected. These pictures are resized to be compatible with E-Prime and their color values are rearranged to make sure that they do not attract attention needlessly (Appendix D).

Procedure

The subjects were asked to judge the emotional valence of the words (positive, negative or neutral) which appeared on a background showing the affective faces (happy, sad or neutral). Each subject responded to three types of trials: congruent cases, incongruent cases and neutral cases. In congruent situations positive words are shown on positively affective faces, negative words are shown on negatively

affective faces; whereas in incongruent situations positive words are shown on negatively affective faces or negative words are shown on positively affective faces.

Subjects saw 32 neutral (neutral word on neutral face), 64 congruent (32 positive word on positive face, 32 negative words on negative face), 64 incongruent (32 positive words on negative face, 32 negative words on positive face). They saw each word twice either in congruent or incongruent settings (e.g. the word “melek” - “angel” - shows up both on a positive face as congruent and later on a negative face as incongruent). Hence they answered to 160 slides consisting of words on faces.

The stimuli were shown on a gray background at the center on a personal laptop. The software program E-Prime was used to design the experiment.

At the beginning participants were instructed that when they see a fixation point they need to focus on that point. When they see a Word-face, they were supposed to answer using the keyboard indicating their judgment of the word’s valence. It was emphasized that they should answer according to the words’ valence not the faces’ valence (see Appendix E). The flow of an experiment session is summarized in Figure 7.

Moreover, to be able to provide the most efficient conflict between the words and the faces, the words were printed in gray, and the subjects were seated approximately 60 cm away from the computer screen.

Participants first saw 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 words as fast and as correctly as possible. Slides—consisting of words on faces—remained on the screen during 2000 ms until the subjects indicated their response. They responded to the trials using the marked keys on the keyboard using yellow sticks with a plus sign, minus sign and an empty one (L for positive, S for negative and Y for neutral, respectively). All participants have been instructed that they should use their right hand’s index finger and were warned carefully that they should not lean their hand against the keyboard in order to prevent faster responses because of their hands’ closeness to the keys. Before they begin to the experiment they first practiced the task with the experimenter being

careful for all these instructions; and then they are left alone to complete the 10 minute task. After the participants completed the task they were given a debriefing.

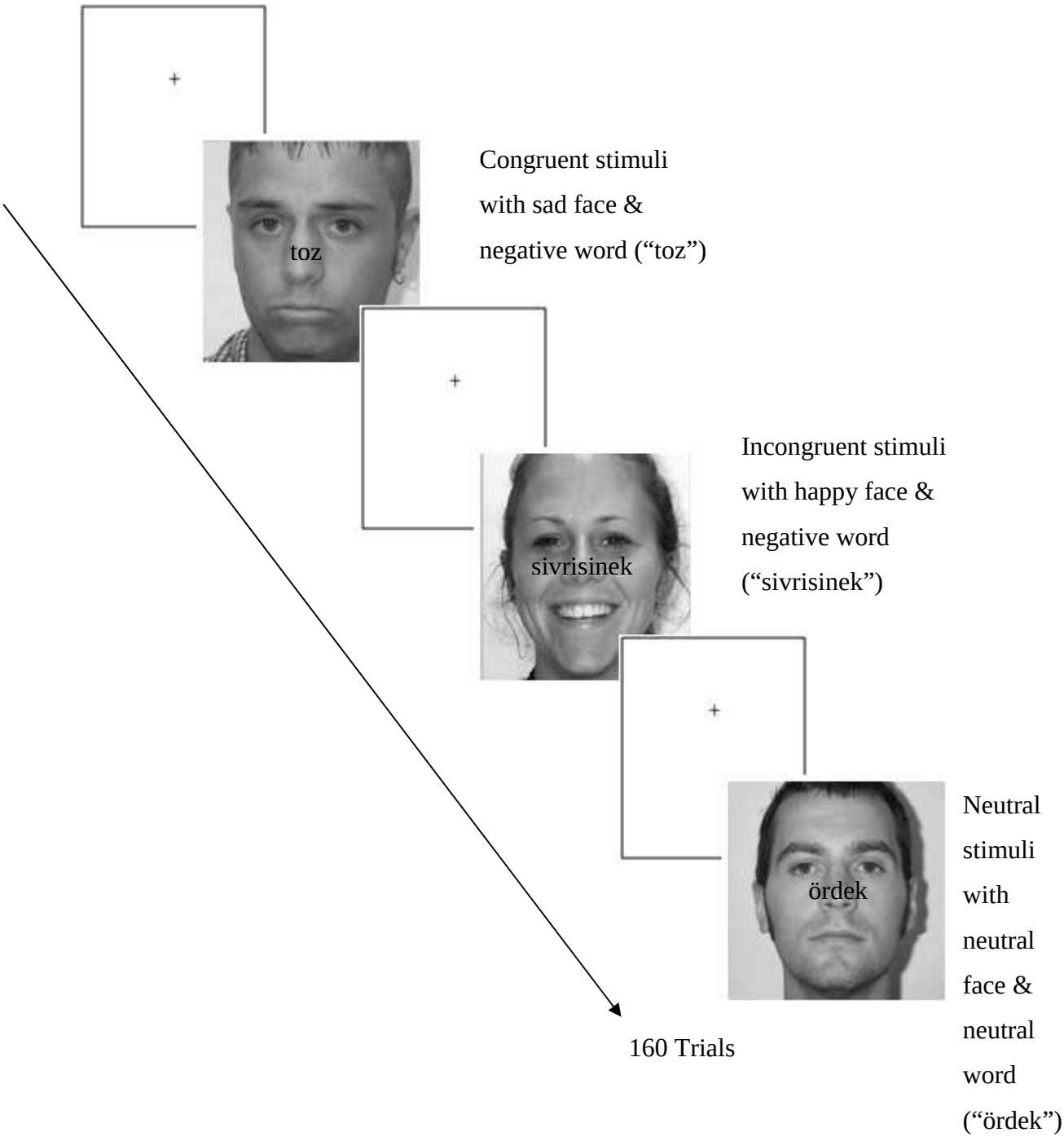

Figure 7 The flow of an experiment session

3.4.2 Results and Discussion

Congruency Effect

Reaction Times

First of all, to show the classical interference effect displayed by all kinds of Stroop, a paired samples t-test is conducted comparing the means of congruent and incongruent cases, which revealed clearly this effect t (1, 32) = -4.232 p<.001 (Figure 8). This result exposes that congruent stimuli caused subjects to response significantly later compared to congruent stimuli, as expected.

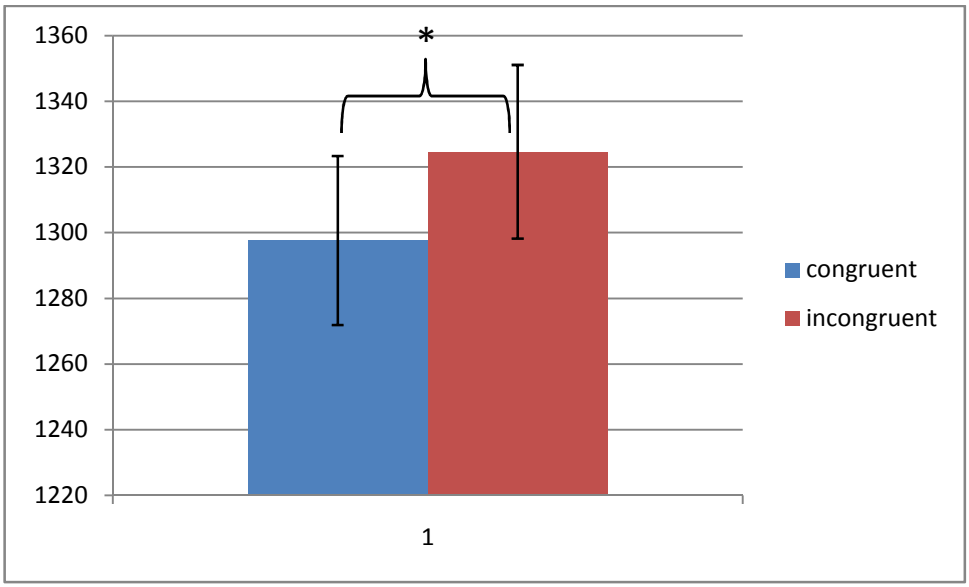

Figure 8 Reaction Times for congruent and incongruent stimuli

Correct Response

A paired samples t-test, to measure the difference between correct responses for congruent and incongruent situations, revealed that participants made more mistakes in responding to incongruent situations, therefore correct response rates are higher for congruent cases t (1, 32) = 2.824 p<.01 (Figure 9).

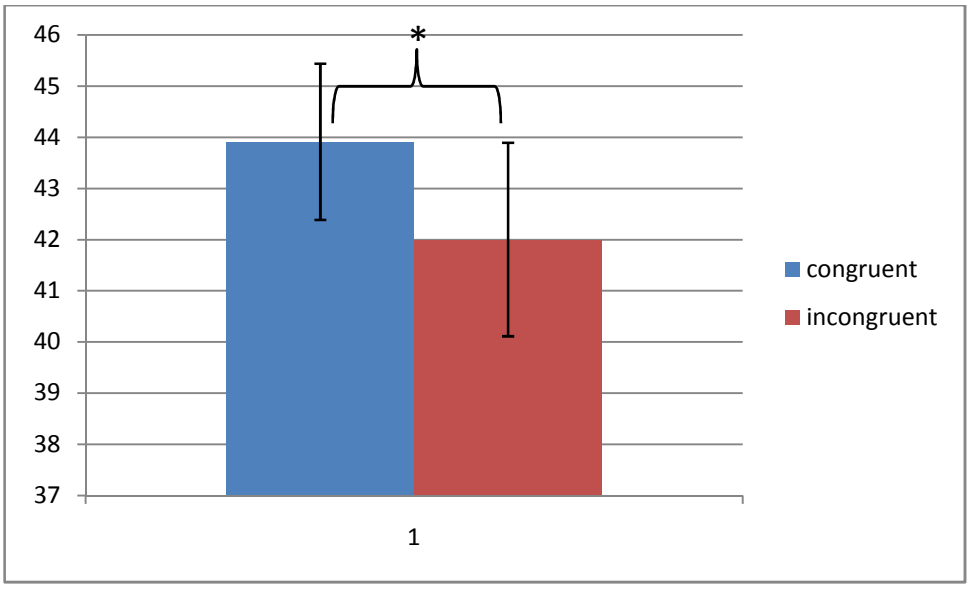

Figure 9 Effect of congruency (Correct Response rates for congruent and incongruent situations)

Congruent-Incongruent-Neutral

To be able to see the difference between the means of congruent, incongruent and neutral stimuli, repeated measures ANOVA (one factor: congruency) with three levels (congruent, incongruent and neutral) is conducted. ANOVA revealed a significant main effect of congruency F (2, 64) = 30.355 η^2 = .487 p<.001 (Figure 10). Pairwise comparisons showed that all three levels differed significantly from each other. Interestingly, for the neutral stimuli, participants were much slower than both congruent and incongruent, contrary to other Stroop tasks. This should be because of the fact that they have trouble in placing the neutral word on a negative-positive scale, in their minds.

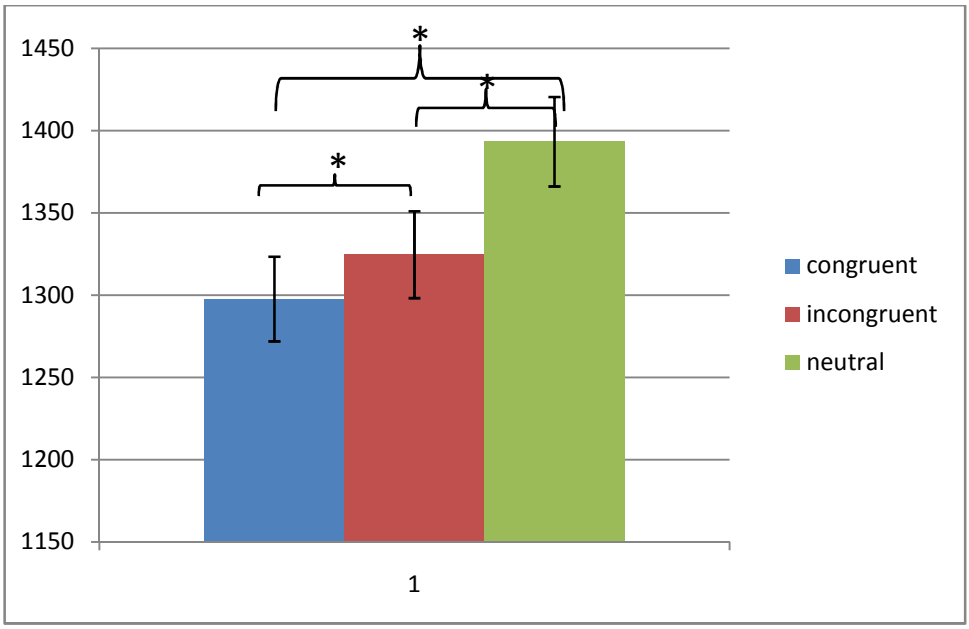

Figure 10 Effect of congruency (Reaction times for neutral, congruent and incongruent situations)

Congruency-Valence-Concreteness

A repeated measures ANOVA with RT's of congruency (congruent/incongruent), valence (negative/positive), and concreteness (abstract/concrete) factors is conducted to measure the mean differences, which revealed a significant main effect of congruency F (1, 32) = 17.853 η^2 = 0.358 p<.001 and valence F (1, 32) = 9.341 η^2 = 0.226 p<.01 (Figure 11), but no significant main effect of concreteness F (1, 32) = 1.193 η^2 = 0.036 p = 0.283. Hence, subjects were slower in reacting to incongruent words than congruent words (as also shown for general data above). Moreover, they were quicker while responding to positive words rather than negative words which can be explained with the fact that positive words have an advantage in recognition as shown in previous studies (Kuchinke, et al., 2005).

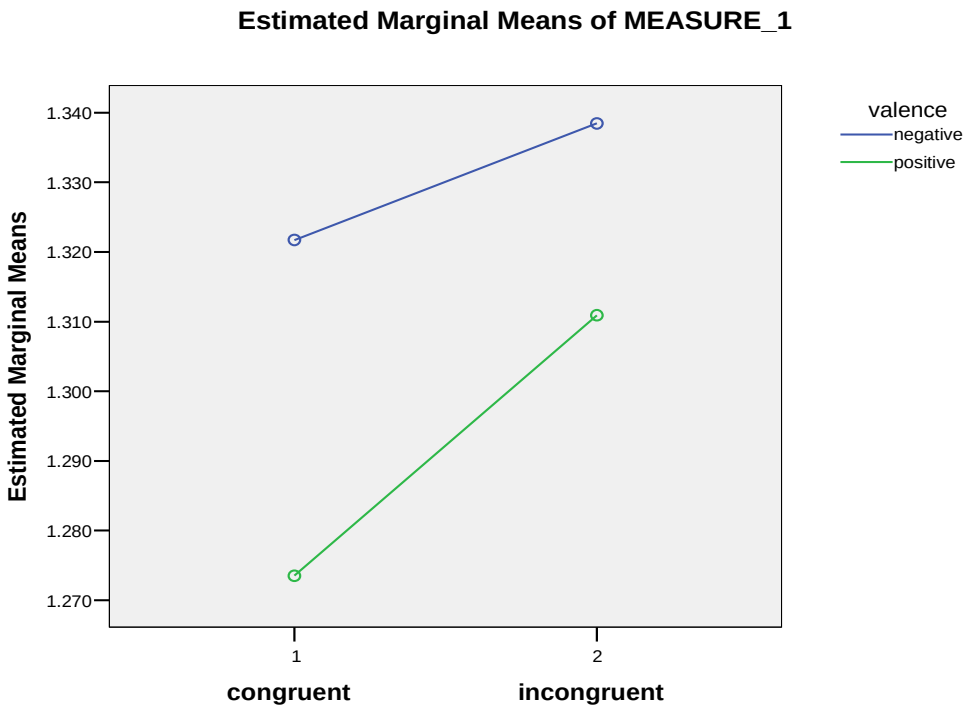

Figure 11 Congruency vs. Valence

Concreteness effect proved to be significant only when a paired samples t-test is conducted on RT's of neutral words (on neutral faces), t (1, 32) = 6.818 p<.001. This fact revealed that subjects were significantly slower while responding to abstract neutral words compared to concrete neutral words; on the other hand this was NOT the case for negatively or positively valenced words (Figure 12).

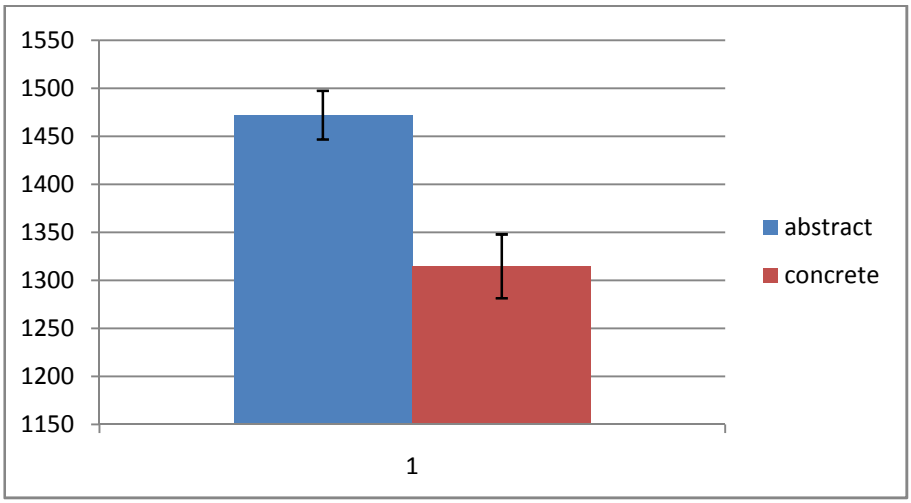

Figure 12 Effect of concreteness for only neutral words

Interaction between congruency valence and concreteness

Even if there seem to be no interaction between these three factors, when repeated measures ANOVA is conducted separately for abstract and concrete stimuli, interaction between congruency and valence seem to be so close to be significant for abstract stimuli, but not for concrete stimuli (cong*val interaction for abstract: F (1, 32) = 3.538 p=.069; for concrete: F (1, 32) = .033 p= .857). This non-significant interaction between congruency and valence for abstract words can also be clearly seen from Figure 13, since when a paired samples t-test is conducted just between negative abstract congruent and negative abstract incongruent stimuli, there is no significant effect t (1, 32) = -.344 p<.001; whereas when this test is conducted for positive abstract congruent and positive abstract incongruent this effect is significant t (1, 32) = -3.379 p<.01. All these facts reveal that the congruency effect is particularly significant for positive abstract words; hence subjects tend to be significantly quicker for the congruent stimuli especially when the words have a positive valence, compared with the positive abstract incongruent cases. One should not forget that this case is only valid for abstract words. When the words are concrete, there is no sign of this kind of interaction as can be seen from Figure 14.

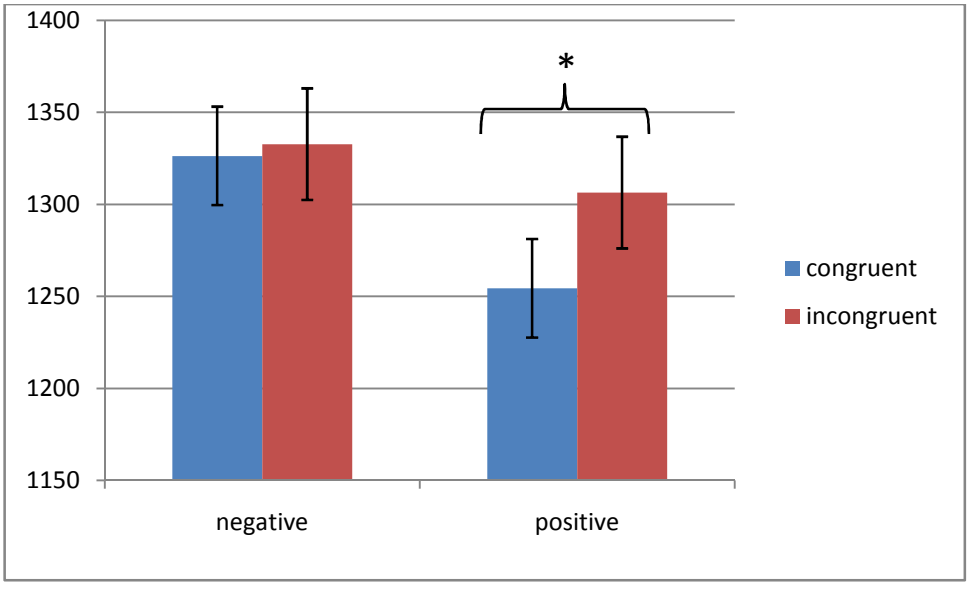

Figure 13 Reaction times for congruent and incongruent cases for **abstract** negative and **abstract** positive words

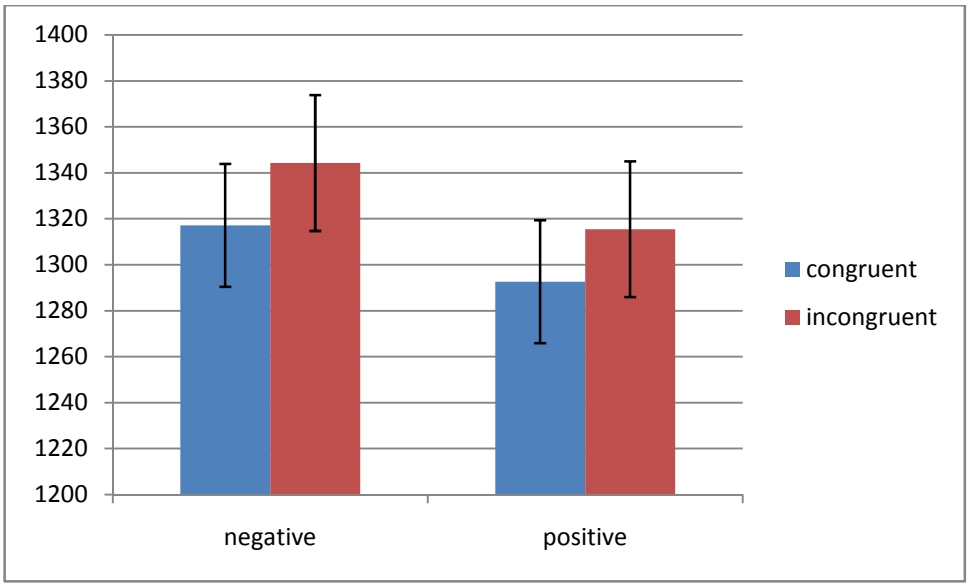

Figure 14 Reaction times for congruent and incongruent cases for **concrete** negative and **concrete** positive words

3.5. EXPERIMENT 5: CLASSICAL STROOP & WORD-FACE STROOP ON DEPRESSIVE PATIENTS

In the previous chapter it is emphasized that depression patients have trouble in resolving not only cognitive conflicts but also (and especially) emotional conflicts. To be able to see the difference between the behavioral results of healthy subjects and of depressive patients on conflict resolution, we conducted both of the Stroop Tasks (classical Stroop and Word-face Stroop for measuring cognitive and emotional conflict resolution, respectively) mentioned above to depression patients who are not yet medicated.

Hypotheses:

As it is explained in the previous chapter; since MDD patients have a problematic interaction of cortical and limbic pathways in their brain, their ACC does not seem to inhibit amygdala's negativity adequately, and thus, these patients experience constant negative thoughts which affect their cognitive speed, even in neutral situations.

Therefore, in the classical Stroop, we expect to see a general slowness in MDD patients compared to healthy population, when we compare the interference effect (interference effect = RT's of incongruent – RT's of congruent trials) means. As for

the congruency effect, which is expected to be seen in the Word-face Stroop task, we may not be able to see the significant difference between the congruent and incongruent stimuli in patients as we did in healthy population, since patients cannot even have an awareness of the fact that same words appear once as a congruent and then as an incongruent stimuli; rather they just evaluate the words influenced by their constant negative state without realizing that they see a word twice. This interpretation comes from the fact that during debriefing, normal population always reported that a word appeared more than once, however, except two of them (two "medicated" MDD patients), depressed patients did not mention such a thing probably because they did not realize this fact.

Moreover, the effect of positively or negatively valenced emotional words in MDD patients and the concreteness effect of these stimuli will be different when compared to healthy population. For instance, based on an affective go/no-go task to depressed patients conducted by (Erickson, et al., 2005), we may expect to see that depressive patients react quicker to negative stimuli compared to positive stimuli, which is the exact opposite of what is found in Experiment 4 above for the healthy population. Hence it is also expected that for patients with MDD, the positive bias seen in normal subjects is not expected, rather the patients will be in a continuous negative mood, and therefore their state could be characterized by a negative bias rather than positive. Or it is also possible that they do not even show any difference between positive and negative words, exactly because of the same reason (i.e. continuous negative thoughts).

3.5.1 Method:

Participants

18 depressive patients with a mean age of 31.5 (*SD* = 9.67), Hamilton Score[12] of 20.8 (two missing scores and one medicated service patient) and years of education of 9.6 (*SD* = 3.9) participated in the classical Stroop Task.

[12] "**Hamilton Depression Rating Scale** (**HDRS**) or **HAM-D**, is a 21-question multiple choice questionnaire that clinicians may use to rate the severity of a patient's major depression. The questionnaire rates the severity of symptoms observed in depression such as low mood, insomnia,

20 depressive patients with a mean age of 30.4 (*SD* = 8.5), Hamilton Score of 20.5 (two missing scores and two medicated service patient) and years of education of 10.1 (*SD* = 3.56) participated in the Word-face Stroop task.

These patients were all newly diagnosed as depression hence were unmedicated, except the two who were staying at hospital's psychiatry service. One of them does not respond to medication, and is going to have deep brain stimulation as cure; and the other one is severely suicidal.

Since Hamilton scores were showing that half of the patients were not in a major depression—since their scores were lower than 20— , 20 depressive subjects, who participated in Word-face Stroop task, are split into two subgroups as minor depressives and major depressives.

Depressive patients, with Hamilton scores lower than 20 (we called them as minor depressives in this study), were 10 persons, with a mean age of 31.6 (*SD* =8.59), Hamilton Score of 15.37 (two missing scores) and years of education of 10.7 (*SD* = 3.65).

Depressive patients, with Hamilton scores higher than 20 (major depressives), were again 10 persons, with a mean age of 29.2 (*SD* = 8.79), Hamilton Score of 25.62 (except two medicated service patients) and years of education of 9.5 (*SD* = 3.57).

Design

First of all, without comparing the results to normal population, same statistics for both classical Stroop and Word-face Stroop were also conducted for depressed patients, as was done for healthy population. These statistics were conducted on 20 patients, without regarding their level of depression.

Subsequently, in order to show the general slowness effect, the congruency score is calculated by subtracting the mean RT of congruent cases from mean RT of incongruent cases for each subject (both healthy and depressive patients). This time,

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agitation, anxiety and weight loss. The questionnaire is presently one of the most commonly used scales for rating depression in medical research." http://en.wikipedia.org/wiki/Hamilton_Score()()() The one which is used in this study was 17-question face-to-face questionnaire, in Turkish.

patients' level of depression was regarded and hence the patient group was split into two, to conduct the statistics. Then, paired samples t-test is conducted to measure the difference between the means of normal population's congruency scores and depressive patients' scores. These paired samples t-tests are conducted for the following pairs: 20 depressive patients – 20 healthy people, 10 major depressive patients – 10 minor depressive patients, 10 major depressive patients – 10 healthy people, 10 minor depressive patients – 10 healthy people[13].

Materials

Exactly the same materials as in Experiment 4, for the classical Stroop and the Word-face Stroop, are used in these experiments. The only difference was the conduction of Hamilton Rating Scale for Depression.

Procedure

Again the same procedure, as in Experiment 4, is run for these experiments; however, before participating in both Stroop tasks, patients had to answer Hamilton questions in order to understand their level of depression.

3.5.2 Results and Discussion

The Classical Stroop

Reaction times (RT)

Repeated measures ANOVA is conducted to measure the difference between RT means of rectangle color reading, word reading and color naming. ANOVA revealed a significant main effect, F (2,34) = 201.030 $p<.001$. The results reveal that patients, as healthy population, are slower in color naming than both rectangle color naming and word reading. Moreover word reading tends to be the easiest, as there is no conflict; whereas rectangle color reading is not that easy even if there seem to be no conflict.

[13] These 10 heatlhy people are the first 10 of 33 healthy people who participated in Experiment 4.

Table 4 Reaction time means for three levels of classical Stroop for depressive patients

RT's	Mean	Std_dev
rectangle color naming	4191,11	695,869
word reading	3375	629,988
word-color naming	7516,67	1323,02

Wrong Answer

Again a repeated measures ANOVA is conducted on the wrong answer numbers for rectangle color reading, word reading and color naming. The main effect of wrong answer is again found to be significant $F(2,34) = 15.341$ $p<.001$. This again means that in incongruent situation (color naming) subjects tend to make more mistakes than other tasks, and again easiest one was the word reading.

Table 5 Wrong Answer means for three levels of classical Stroop for depressive patients

Wrong Answers	Mean	Std_dev
rectangle color naming	0,22222	0,54832
word reading	0,11111	0,32338
word-color naming	1,33333	1,13759

Spontaneous Correction

Repeated measures ANOVA, with three levels again, revealed a significant effect on spontaneous correction $F(2,34) = 15.125$ $p<.001$. This also means that in incongruent situation subjects made more corrections than rectangle color naming and word reading, and least correction is seen in the word reading task.

Table 6 Spontaneous correction means for three levels of classical Stroop for depressive patients

Spontaneous corrections	Mean	Std_dev
rectangle color naming	1,11111	1,60473
word reading	0,16667	0,38348
word-color naming	2,5	1,46528

General Slowness

The general slowness is obviously seen in the classical Stroop task, as expected. Depression patients (major or minor) were significantly slower compared to healthy population in all of the categories: rectangle color naming, word reading and color naming t (1, 17) = 3.9 p<.01; t (1, 17) = 4.037 p<.01; t (1, 17) = 3.5 p<.01, respectively.

No significant effect is seen when a t-test is conducted between healthy and depression population's wrong answers and corrected answers.

The Word-face Stroop

Congruency Effect

Reaction Times

In order to see if the classical interference effect exists in the patient group, a paired samples t-test is conducted comparing the means of congruent and incongruent cases, which did NOT reveal this effect t (1, 19) = -.785 p = .442 (Figure 17). Even if there seem to be a tendency towards responding later to incongruent stimuli, this difference is not significant.

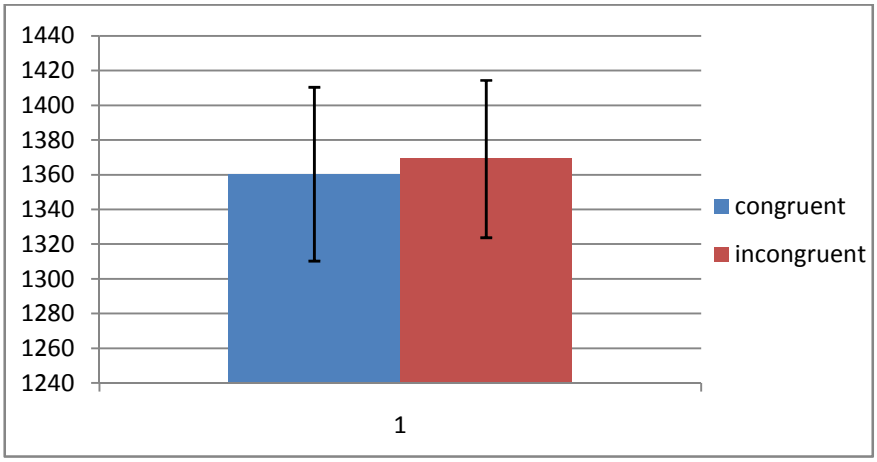

Figure 15 Insignificant congruency effect on depression patients.

Correct Response

A paired samples t-test, to measure the difference between correct responses for congruent and incongruent situations, revealed no significant difference t (1, 19) = 1.731 p = .1 (Figure 18).

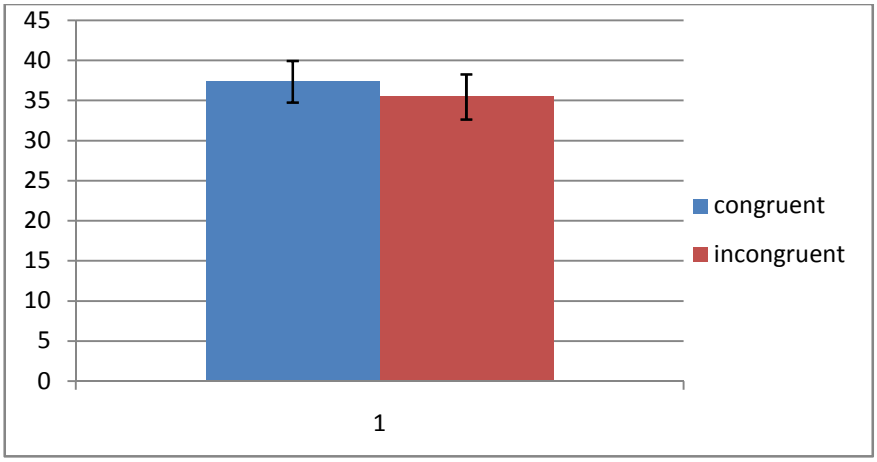

Figure 16 Correct response rates for congruent and incongruent stimuli for depressed patients.

General slowness

The paired samples t-test conducted between 10 major depressive patients & 10 minor depressive patients and between 10 major depressive patients&10 healthy people revealed a significant mean difference (t (1, 9) = -2.543 $p<.05$, t (1, 9) = -2.406 $p<.05$ respectively); whereas the differences between 10 minor depressive patients&10 healthy people and 20 depressive patients&20 healthy people were not significant.

Interestingly these significant differences are not because major depressive disorder patients were slower in incongruent cases than minor depression or than healthy population. The difference was that the congruency effect seen in healthy population (they were faster in responding to congruent cases than incongruent cases) turned out to be exactly the opposite for major depression patients, i.e. MDD patients responded faster to incongruent stimuli than congruent ones. That's why the mean congruency score (incongruent RT's – congruent RT's) for MDD patients was – 20.566, whereas this score was + 26.445 for healthy population. This same effect is seen between minor and major depressive disorder patients, minors' mean congruency score was +

38.05. This is a brand new result, which was not seen in any of the previous studies, because it is the first time this kind of Stroop is conducted to depression patients.

Congruency-Valence-Concreteness

When a repeated measures ANOVA is conducted on 20 depression patients (minor & major together), only valence seems to have a significant effect F (1, 19) = 6.226 η^2 = 0.247 p<.05. This effect has no difference when compared to healthy population, since depression patients too seem to respond faster to positively valenced words than negatively valenced words. Congruency and concreteness, however, did not exhibit any significant effect (F (1, 19) = .617 η^2 = 0.031 p = .442); F (1, 19) = .323 η^2 = 0.017 p = .576, respectively).

On the other hand, when the repeated measures ANOVA is conducted on 10 major depression patients[14], with Hamilton Scores more than 20, none of these effects mentioned above were significant. (Valence: F (1, 9) = 1.129 η^2 = 0.111 p = .316); concreteness: F (1, 9) = .153 η^2 = 0.017 p = .705; congruency: F (1, 9) = 2.339 η^2 = *0.206* p = .161. 10 subjects may not reveal a significant effect on any of these categories, but at least the tendencies can be perceived. MDD patients tended to be faster in incongruent stimuli than congruent stimuli, which is the opposite of the healthy population as mentioned above. It seems that the congruency effect could be significant if more MDD patients could have been participated in this study.

Interactions

Repeated measures ANOVA conducted on 20 depression patients exhibit no significant interactions between three factors (congruency, valence or concreteness). However, when the same statistics is conducted on 10 major depression patients there seem to be an interaction even if it is not significant. It seems that if the number of the participants would be higher, concreteness would have been in an interaction with congruency and valence (valence-concreteness interaction: F (1, 9) = 2.269 η^2 = 0.201 p = .166; congruency-concreteness interaction: F (1, 9) = 2.295 η^2 = 0.203 p = .164).

[14] In ANOVA's done with the subsets of depressives patients (10 major, 10 minor) Bonferroni corrections were applied.

Interestingly, while in normal subjects the interactions seem to exist for abstract words, for depressed patients the situation is again the opposite: MDD patients show the interactions in concrete words. When a paired samples t-test is done between congruent-negative stimuli and incongruent negative stimuli (both for concrete words), the result is too close to be significant: t (1, 9) = 2.164 p = .059. This means that MDD patients are slower when they face concrete negative words when these appear on congruent stimuli compared to concrete negative words appearing on incongruent stimuli (Figure 19). This interaction is not seen for abstract words.

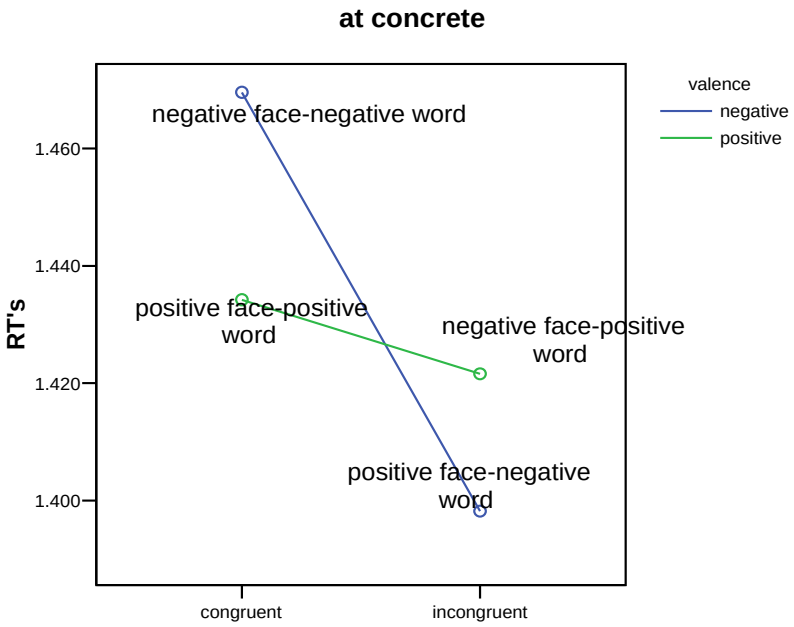

Figure 17 The interaction between congruency and valence on concrete words.

CHAPTER 4

GENERAL DISCUSSION

In the classical Stroop task and the Word-face Stroop task, presumably dissociable levels of conflict resolution was measured—cognitive and emotional, respectively. The classical Stroop task worked as a baseline and displayed the congruency effect clearly, since congruent stimuli was significantly different from the incongruent stimuli. The Word-face Stoop we have developed also proved to be a good measurement of emotional conflict as it could show the congruency effect significantly just as the classical Stroop, but in an emotional level. Besides showing that normal population was slower in responding to incongruent stimuli compared to congruent stimuli, our Word-face Stroop also showed that people were reacting faster to positive words rather than the negative or neutral ones. Even though the words' concreteness features did not show a significant effect on the evaluation of emotionally valenced words, this typical effect was seen in responding to neutral words, as expected. When the Word-face Stroop is conducted to depressive participants, however, the congruency effect was not significant, and moreover when the depressive group is split into two, as minor and major depressives, major depressive disorder patients showed an opposite tendency towards responding faster to incongruent stimuli. The positive bias for emotionally valenced words seen in normal population is also seen in depressed patients when the level of depression was disregarded; on the other hand, when the level of depression is regarded (when the statistics are done for 10 MDD patients), MDD patients did neither show a positive bias, nor a negative bias for emotionally valenced words.

4.1. Congruency Effect of cognitive and emotional Stroop tasks on normal population

Both in classical Stroop (cognitive conflicts) and in the Word-face Stroop (emotional conflicts) a significant effect of congruency was found comparing the mean differences of reaction times and of correct responses, as expected.

In the classical Stroop, people were slower in responding to incongruent stimuli than to congruent stimuli as well as the baseline case, where they named the colors of the rectangles. Rectangle color naming was more time consuming for subjects than reading the color names, and "This is because, in the *case* of words and letters, the association between the idea and name has taken place so often that the process has become automatic, whereas in the case of colors and pictures we must by a voluntary effort choose the name", as McLeod quotes James McKeen Cattell in his review paper (1991). Hence we replicated the earlier findings concerning the Stroop (or interference) effect.

Considering the emotional Stroop, even though it was hard to create a pure emotional conflict, this design, where the conflict is between emotionally valenced words and affective faces, proved to be a good instrument for measuring the emotional conflict resolution. Hence our first hypothesis is confirmed, which stated that the RT's and the correct responses of congruent compared to incongruent stimuli would display a significant difference.

When we compared the RT means of congruent incongruent and neutral stimuli however, we interestingly found that people were significantly slower in reacting to neutral stimuli (neutral word on neutral face) than to congruent and incongruent stimuli. This could be because it was hard to make a decision about the valence of a neutral word, and this hard decision making process must have caused the revealed latency. Another interpretation might be brought forward due to an assumption we made: In our Word-face Stroop, neutral words always appeared on neutral faces, we assumed that subjects would realize this fact and respond faster just evaluating the face. However, while debriefing, none of the participants reported that this case facilitated the detection that a word is neutral. They were not even aware of it.

Yet on another front, this effect may also be explained by facilitation. In congruent cases there was obviously a facilitation brought by the affect of the faces, providing an emotional backdrop. Even in the incongruent situations, affective faces must have had an effect which somehow facilitated evaluation of the superimposed words when compared to neutral faces which did not evoke any emotion. Hence, when the faces are neutral, it is very probable that there was no sign of facilitation and therefore response latencies occurred.

4.2. Positive-Negative Asymmetry Hypothesis & Concreteness Effect

Our second hypothesis, stating that the positive stimuli would be more advantageous than negative and neutral ones, is also confirmed; since subjects responded significantly quicker to the positive words than the negative words.

On the other hand, concreteness effect was not significant when the words are emotionally valenced. However neutral words showed this typical effect, as participants significantly slowed down while responding to abstract neutral words compared to concrete neutral words. Thus, this is a replication of the previous studies regarding the concreteness effect.

4.3. Interactions

As for the interactions between congruency, valence and concreteness, even though we did not find a significant interaction between these three factors, or a significant effect of concreteness, when analyses were done separately for concrete and abstract words, we showed that there could be something ANOVA could have missed. What ANOVA missed was the interaction between concreteness, valence and congruency which is only significant for the positively valenced abstract words. Hence, concreteness has an effect on congruency only for positively valenced words, since participants, as expected, responded faster to positive and abstract words appearing on positively affected faces (congruent) compared to positive and abstract words appearing on negatively affected faces; however they did not show this significant congruency effect on negatively valenced abstract words, neither for any emotionally valenced (positive or negative) concrete words.

This effect of concreteness appearing only for positively valenced words, could be because of the faster processing of positive words compared to negative words as discussed in Chapter 2 (Kuchinke, et al., 2005). And perhaps that is why concreteness effect can only be seen when the words are positively valenced (Tse & Altarriba, 2008).

On the other hand, the fact that this effect was only seen for abstract words, but not for concrete words can be explained by stating that the subjects recall better the concrete words than the abstract words (Fiebach & Friederici, 2004), therefore the difference between congruent and incongruent cases become larger since abstract words need more attention and subjects face a bigger conflict as they resolve more difficultly the conflicts involving abstract words.

4.4. Performance of the Unmedicated Depression Patients

The classical Stroop Task

Depression patients, without regarding their level of depression, showed a significant difference between the RT's, wrong answers and corrected answers for three different categories (rectangle color reading, word reading and color naming), just as in normal population.

Moreover, patients were also significantly slower in reacting to these categories compared to normal population, as expected. However, this difference was not seen in wrong and corrected answers.

Therefore, the general slowness effect which was hypothesized is confirmed.

The Word-face Stroop Task

Depressed patients did not show any significant difference in RT's of congruent and incongruent cases, nor in correct response rates. Only valence showed a significant effect. Despite the fact that there was no significant effect of congruency or concreteness, the patients were faster in responding to positively valenced words, similar to the normal population. This latest result was not expected. However, when the same statistics were conducted on major depressive disorder patients, with Hamilton scores higher than 20, there was no significant effect of valence.

It is clearly understood that the level of depression is a major confound in conducting these kinds of experiments; because when the depressed group is split into two subgroups as minor depressives and major depressives, the differences between the congruency scores between these subgroups were significantly different. What is more, MDD patients' congruency scores were also significantly different than normal population, whereas minor depressive patients did not show any difference when compared to the normal population.

MDD patients were interestingly faster in responding to incongruent stimuli contrary to normal population who were faster in responding to congruent stimuli, although this difference was not significant. However, minor depressive patients also showed a tendency to be faster in responding to congruent stimuli like healthy subjects. On the other hand the tendency leads to the speculation that if the number of MDD patients participated in this study could be higher, these statistics could have turned out to be significant. This finding may be interpreted such that, the 'conflict' effect created by our task is absent in the MDD population. The question that 'Why the MDD population does not respond to the emotional conflict?' brings out important issues beyond the scope of this thesis. Still, we feel that the task created through this study is strong enough to capture emotional differences between healthy and diseased populations.

We hypothesized that patients would show an insignificant effect of congruency since they were in a continuous negative mood and hence they would not even be aware of the fact that they see a word twice—once in a congruent and once in an incongruent case. MDD patients showed an insignificant congruency effect, according to this hypothesis; however we did not expect their tendency towards being faster to incongruent stimuli. Another reason of this result may be the fact that unmedicated depression patients display an attention deficit which leads to a mood-congruent attentional bias (Erickson, et al., 2005). This actually means that as MDD patients are continuously in a negative mood, hence the congruent mood for them is negative. They may be slow to incongruent stimuli because they have an internal conflict with positive stimuli and their own internal negative state.

Another explanation for this opposite result may be due to the observation that healthy people and MDD patients show opposite pattern of neuronal activities in ACC and DLPFC (Frodl, et al., 2007), but this is impossible to verify through our observations which were done only behaviorally.

On another front, opposite results in interactions between congruency, valence and concreteness have also been attained across the healthy and MDD populations in our study. In MDD patients, the concreteness effect appeared on concrete negative words, while for the healthy population this appeared on abstract positive words. This result could be interpreted as a signal of negative bias in MDD patients contrary to positive bias in healthy people (Erickson, et al., 2005). Perhaps this result is seen because negative concrete words "differ from neutral or positive words as a function of mental imagery" as shown in a lexical decision task, recording ERP (Kanske & Kotz, 2007).

4.5. Limitations of the Study

One major limitation is that in the word face Stroop task, the words were always appearing on the same faces (e.g. the word "toz" ("dust") always appeared on the "2nd sad man" face, as a congruent case) although the whole stimuli's appearance was random. Although unlikely, this might have caused some affective faces to draw more attention and create differences in reaction times.

Another limitation is the difficulty of finding unmedicated depressed patients in such a short period of time. The 20 patients participating in our study are not all major depressive disorder patients which significantly affected the results of our experiments.

Moreover, it would have been better to administer a mood test before normal subjects take both kinds of Stroop tasks, since they may temporarily be in a euphoric or dysphoric mood.

In order to understand how MDD patients actually perceive the words, same words, evaluated by normal population in Experiment 1, should also be evaluated by depressive patients, preferably right after the Stroop tests. Therefore, it would be

more satisfactory to correlate and interpret the correct response rates of the patient group according to their own word evaluation results.

CHAPTER 5

CONCLUSION

In this study we investigated how conflict resolution occurs both cognitively and emotionally in healthy and depressed populations. The main aim of this thesis was to construct a task to successfully quantify emotional conflict resolution, while manipulating the valence and the concreteness of the words and controlling arousal, word frequency and word length. After the task was successfully tested on a normal population, it is used to measure MDD patients' performance on resolving emotional conflicts, in order to understand and learn more about how they were impaired.

In Experiment 1, we constructed a Turkish word database in terms of three dimensions of emotions (valence, arousal and dominance). After we selected appropriate words (with neutral arousal, variable valence) for our 4th Experiment, Experiment 2 was conducted to determine these words' concreteness values.

In Experiment 3, a classical Stroop test was administered to normal population for measuring cognitive conflict resolution. The results were as expected. Subjects were significantly slower in incongruent cases when compared to congruent ones, moreover the error rates for incongruent stimuli were also significantly different from congruent stimuli, as all previous studies about conflict resolution and Stroop tasks showed.

Our newly designed Word-face Stroop task has proved to be very successful in creating an emotional conflict between congruent and incongruent cases, in Experiment 4. Participants were significantly slower in incongruent cases than

congruent cases, just as in the classical Stroop task, but this time in an emotional state. The significant differences not only emerged in reaction times but also in correct response rates, subjects made more mistakes in responding to incongruent situations compared to congruent ones.

What is more, Experiment 4 also showed that people reacted faster to positively valenced words rather than negatively valenced ones, as was hypothesized. On the other hand, the concreteness effect was not seen on emotionally valenced words, but was only seen for neutral stimuli. The interactions revealed interesting results, however. Healthy subjects showed a greater congruency effect on positively valenced abstract words than negatively valenced abstract or any concrete words. Therefore, even if the effect was not directly seen on ANOVA, when the statistics were done separately, concreteness seemed to have an effect on resolving emotional conflict.

Experiment 5 was composed of both the classical Stroop and the Word-face Stroop tasks, conducted on depression patients. The results of the classical Stroop task, were as expected: Patients were significantly slower in incongruent situations and moreover they were also significantly slower compared to healthy population but only in terms of reaction time, not with respect to wrong or corrected answer rates.

The results were astonishing in the Word-face Stroop task, because there was not only a significant difference between healthy and MDD populations, but there was also a significant difference between minor and major depressive disorder patients. Even if the results did not show any difference when the statistics were done on 20 depressed patients, disregarding their level of illness; when patients' level of depression was regarded, we observed that the congruency scores for MDD patients were significantly different compared to healthy and minor depressive populations. MDD patients showed an opposite pattern in reacting to the Word-face Stroop stimuli. Even though the difference was not yet significant (the number of MDD patients conducted this task was not adequate to show a significant result, but the tendency showed that it might be if the subject number was higher), they seem to

respond faster to incongruent stimuli rather than congruent ones. This result is not compatible with previous studies based on other types of emotional Stroops.

Another opposite and interesting result which was again newly seen in this area was the fact that MDD patients showed a greater congruency effect on negatively valenced concrete words compared to others, contrary to the greater congruency effect of healthy population on positively valenced abstract words.

On the whole, this thesis made us realize that emotional conflict resolution can be measured effectively with our Word-face Stroop. People get slower when they face an emotionally conflicting situation, just as when they face a cognitively conflicting case; but at the end they resolve this conflict as they are perfectly aware of these conflicting cases.

Moreover, again this task reveals significant differences between healthy and depressed populations. However, the level of depression should be seriously considered, since minor and major depressive patients differ significantly from each other. Perhaps, the opposite results (between healthy and depressed populations) show us that, MDD patients cannot be aware of the conflicts adequately as they cannot successfully resolve these emotional conflicts.

In the future, first of all, the same task should be conducted on a higher number of major depressive disorder patients, not on minor depressed ones. Secondly, to be able to explain these interesting results, a neuroimaging study with our Word-face Stroop could be conducted, in order to find out the differences in activities of different brain regions, involved in cognitive and emotional conflict resolution.

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APPENDICES

APPENDIX A: MANIKIN OF EMOTIONAL RATING

Valence (sample page)

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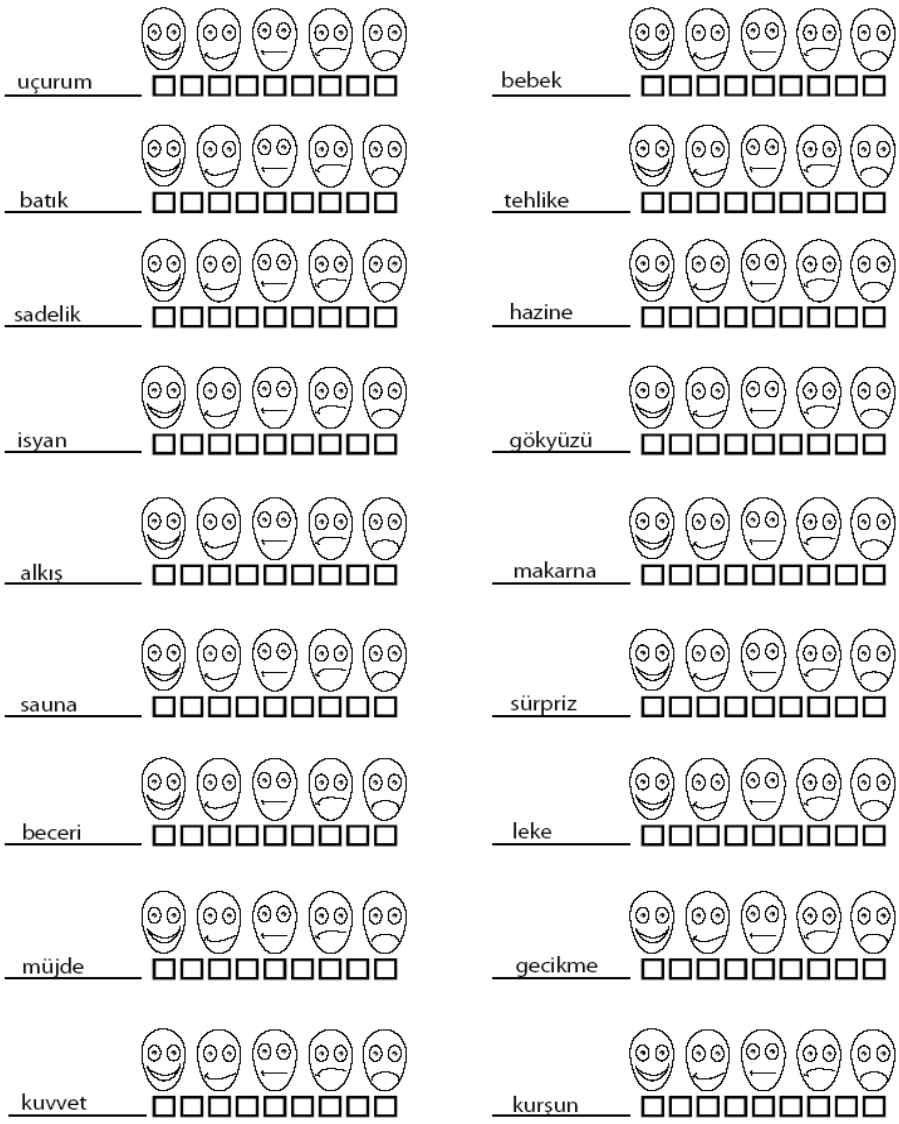

Arousal (Sample Page)

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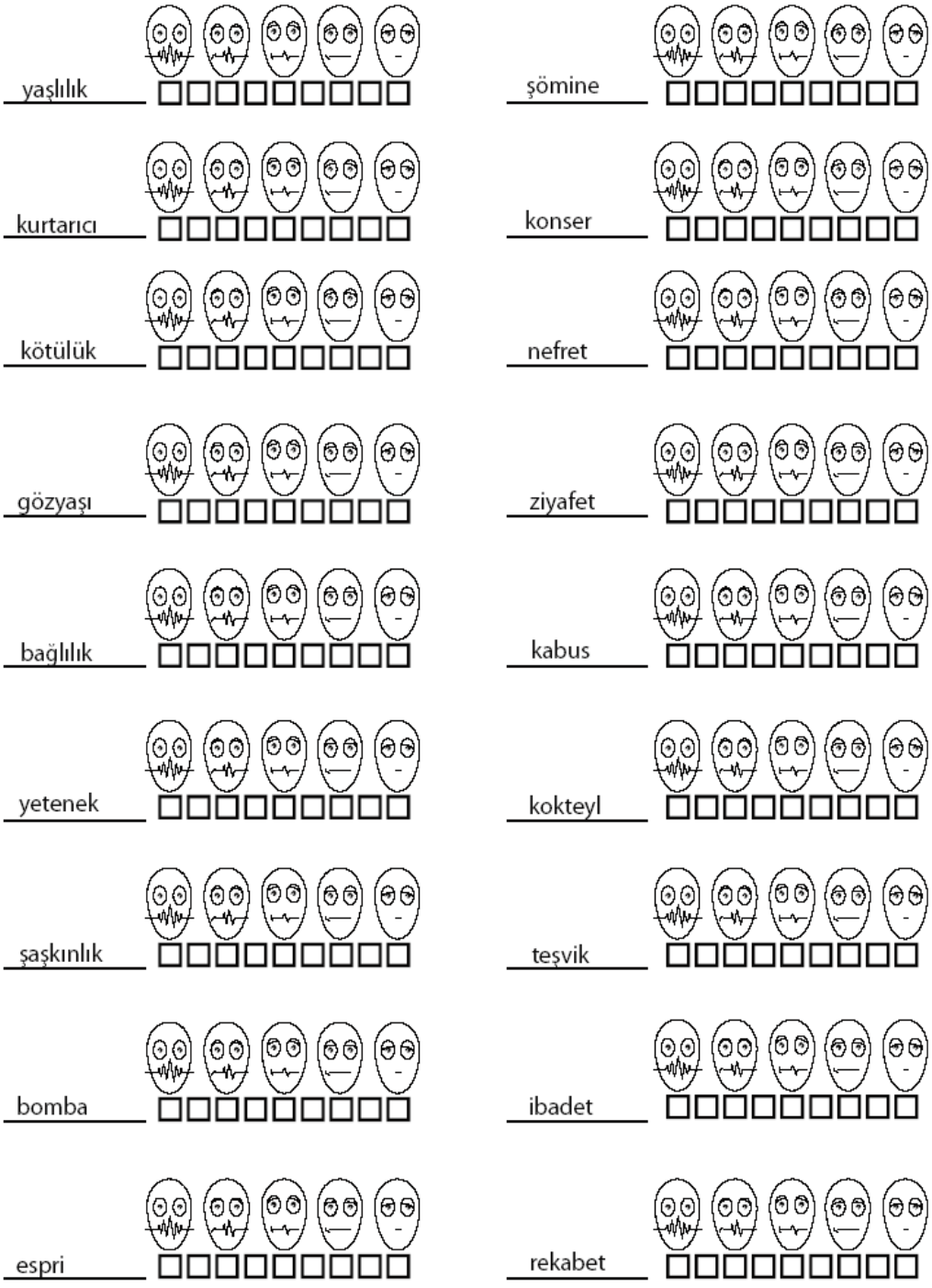

Dominance (Sample Page)

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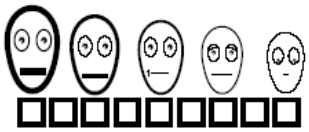
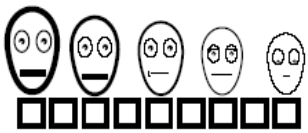
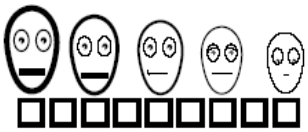
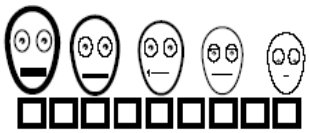
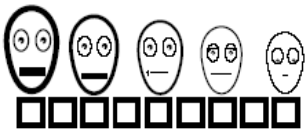
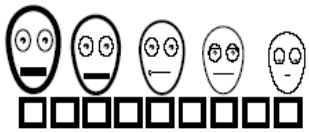
ahlak 

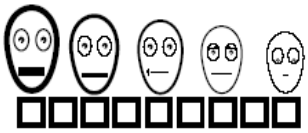
şarkı 

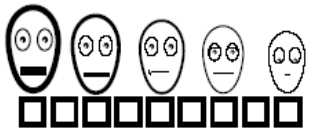
ipek 

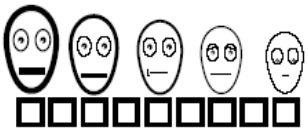
şöhret 

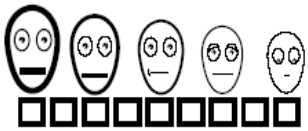
kuduz 

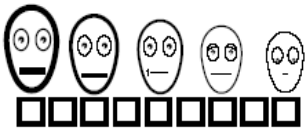
tecavüz 

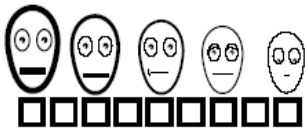
madalya 

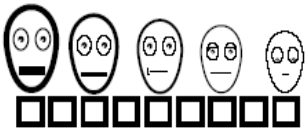
beslenme 

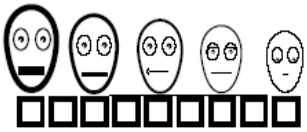
buhar 

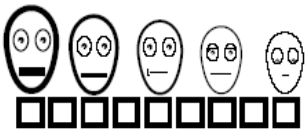
sualtı 

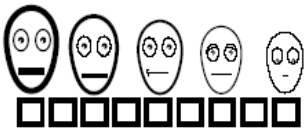
ceset 

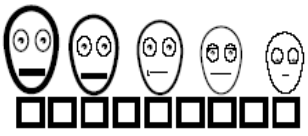
temizlik 

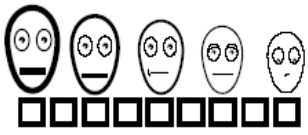
şeref 

dürtü 

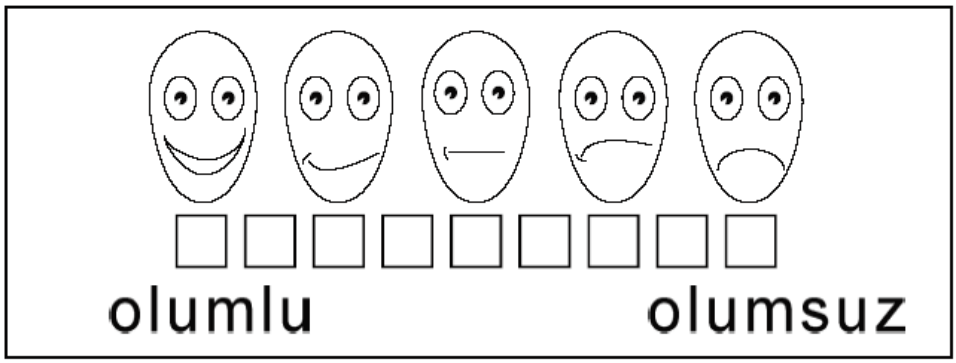
koku 

fikir 

okyanus 

yaprak 

Valence Instructions

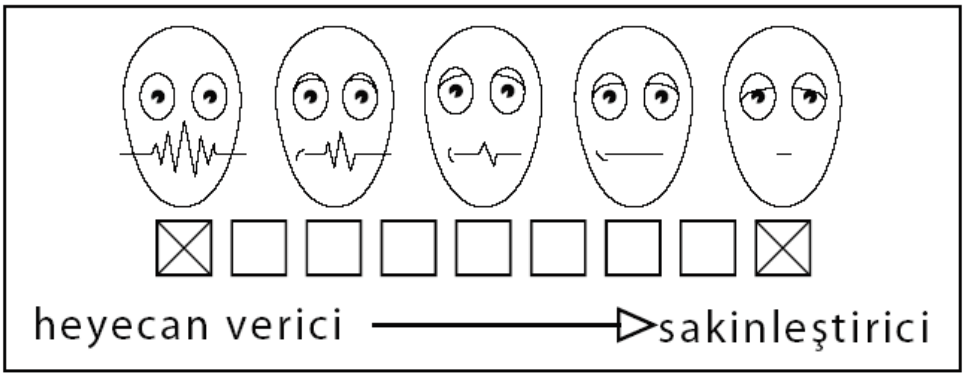


Deneye katıldığınız için teşekkürler. Bugün yapacağımız çalışma duygularla ilgili ve bu çalışmada insanların farklı tip kelimelere nasıl tepki verdiğiyle ilgileniyoruz. Önünüzde çeşitli figürler içeren kağıtlar var. Bu figürlere "Değerlendirme Yüzleri" diyoruz ve sizden istediğimiz bu figürleri kullanarak her bir kelimenin sizde uyandırdığı etkiyi derecelendirmek. Bu yüzler üç farklı duygu sınıfını ve bu sınıf içerisindeki dereceleri göstermekte.

Yukarıdaki ölçek gülümseyen adamdan mutsuz adama sıralanmış olumlu-olumsuz ölçeğidir. Bu ölçeğin sol ucu, kelimeyi değerlendirdiğinizde mutlu, hoşnut, tatmin olmuş ve umutlu hissettiğinizi gösterir. Kendinizi çok mutlu hissettiğinizde, bunu en soldaki kareyi işaretleyerek belirtiniz. Ölçeğin sağ ucu ise, kelimeyi değerlendirdiğinizde kendinizi mutsuz, kızgın, umutsuz, kederli ve sıkıntılı hissettiğinizi gösterir. Çok mutsuz hissettiğiniz durumu, en sağdaki kareyi işaretleyerek gösteriniz. Aradaki kareleri de daha az mutlu veya mutsuz hissettiğinizi belirtmek için kullanabilirsiniz. Eğer tamamıyla nötr hissediyorsanız, yani mutlu ya da mutsuz hissetmiyorsanız, en ortadaki kareyi işaretlemeniz gerekir. Ne kadar mutlu veya mutsuz hissettiğinizi en iyi şekilde belirtmek için toplam olası 9 kareden o kelimeye karşı hislerinizi gösteren en uygun kareyi işaretleyiniz.

Lütfen her kelime için çok fazla düşünmeden, değerlendirmeyi hızlı yapmaya çalışınız. Hatta değerlendirmelerinizi kelimeyi ilk görüşünüzdeki tepkinize dayanarak yapınız. Kelimeler arasında herhangi bir ilişki yoktur. Bu nedenle her kelimenin bağımsız olarak değerlendirilmesi gerekmektedir. Örneğin, tesadüfen peş peşe hep benzer kareyi işaretlediyseniz, sırf bu yüzden bundan sonraki işaretleyişlerinizi değiştirmeyin.
Teşekkürler.

Arousal Instructions

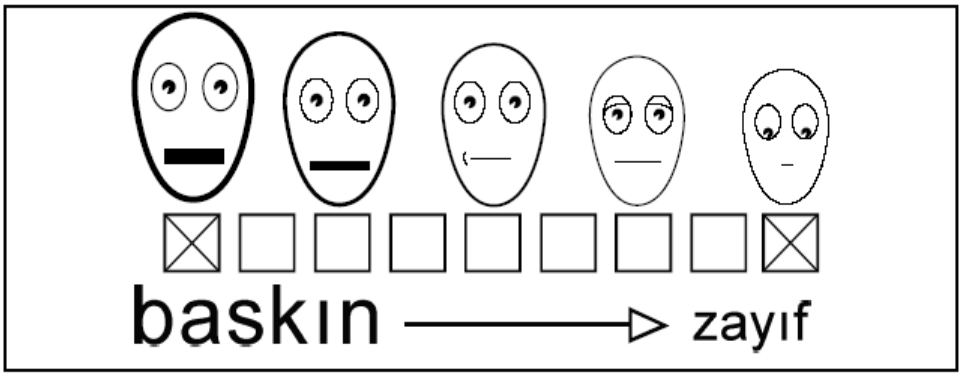


Deneye katıldığınız için teşekkürler. Bugün yapacağımız çalışma duygularla ilgili ve bu çalışmada insanların farklı tip kelimelere nasıl tepki verdiğiyle ilgileniyoruz. Önünüzde çeşitli figürler içeren kağıtlar var. Bu figürlere "Değerlendirme Yüzleri" diyoruz ve sizden istediğimiz bu figürleri kullanarak her bir kelimenin sizde uyandırdığı etkiyi derecelendirmek. Bu yüzler üç farklı duygu sınıfını ve bu sınıf içerisindeki dereceleri göstermekte.

Yukarıdaki ölçek heyecanlı adamdan sakin adama sıralanmış heyecan verici - sakinleştirici ölçeğidir. Bu ölçeğin sol ucu, kelimeyi değerlendirdiğinizde heyecanlı, coşkun, sinirli, tetikte veya canlı hissettiğinizi gösterir. Eğer heyecanlanmış hissediyorsanız, en soldaki kareyi işaretlemeniz gerekir. Bu ölçeğin sağ ucuna baktığınızda, tam tersi olan sakin yüz şeklini göreceksiniz. Kendinizi kelimeyi değerlendirirken tamamen rahatlamış, sakin, ağır, durgun hissettiğinizde en sağdaki kareyi işaretlemeniz gerekir. Heyecanlı ve sakin hisler arasındaki hislerinizi ortadaki karelerden birini işaretleyerek belirtebilirsiniz. Eğer tamamıyla nötr hissediyorsanız, yani heyecanlı ya da sakin hissetmiyorsanız, en ortadaki kareyi işaretleyiniz. Ne kadar heyecanlı veya sakin hissettiğinizi en iyi şekilde belirtmek için toplam 9 kareden o kelimeye karşı hislerinizi gösteren en uygun kareyi işaretleyiniz.

Lütfen her kelime için çok fazla düşünmeden, değerlendirmeyi hızlı yapmaya çalışınız. Hatta değerlendirmelerinizi kelimeyi ilk görüşünüzdeki tepkinize dayanarak yapınız. Kelimeler arasında herhangi bir ilişki yoktur. Bu nedenle her kelimenin bağımsız olarak değerlendirilmesi gerekmektedir. Örneğin, tesadüfen peş peşe hep benzer kareyi işaretlediyseniz, sırf bu yüzden bundan sonraki işaretleyişlerinizi değiştirmeyin.
Teşekkürler.

Dominance Instructions



Deneye katıldığınız için teşekkürler. Bugün yapacağımız çalışma duygularla ilgili ve bu çalışmada insanların farklı tip kelimelere nasıl tepki verdiğiyle ilgileniyoruz. Önünüzde çeşitli figürler içeren kağıtlar var. Bu figürlere "Değerlendirme Yüzleri" diyoruz ve sizden istediğimiz bu figürleri kullanarak her bir kelimenin sizde uyandırdığı etkiyi derecelendirmek. Bu yüzler üç farklı duygu sınıfından birinin içerisindeki dereceleri göstermekte.

Yukarıdaki ölçek kendinizi baskın-zayıf olarak değerlendireceğiniz ölçektir. Ölçekteki figürün büyük olması sizin kelimeyi değerlendirirken baskın hissetiğinizi, küçük olması da zayıf hissetiğinizi gösterir. Eğer kontrolün tamamen sizde olduğunu düsünüyorsanız, etkin, önemli, baskın, özerk veya kontrollü hissediyorsanız, en soldaki kareyi isaretleyiniz. Bu ölçeğin sağ ucu ise, kelimeyi değerlendirirken kendinizi tamamıyla kontrol edilen, etki altında, himaye altına alınmış, korkutulmuş, boyun eğmiş, baskı altına alınmış veya güçsüz hissettiğinizi gösterir. Aradaki kareleri de daha az baskın veya zayıf hissettiğinizi belirtmek için kullanabilirsiniz. Eğer tamamıyla nötr hissediyorsanız, yani baskın ya da güçsüz hissetmiyorsanız, en ortadaki kareyi işaretlemeniz gerekir. Kelimeye karşı hislerinizi en iyi şekilde belirtmek için toplam 9 kareden en uygun olanı işaretleyiniz.

Lütfen her kelime için çok fazla düşünmeden, değerlendirmeyi hızlı yapmaya çalışınız. Hatta değerlendirmelerinizi kelimeyi ilk görüşünüzdeki tepkinize dayanarak yapınız. Kelimeler arasında herhangi bir ilişki yoktur. Bu nedenle her kelimenin bağımsız olarak değerlendirilmesi gerekmektedir. Örneğin, tesadüfen peş peşe hep benzer kareyi isaretlediyseniz, sırf bu yüzden bundan sonraki işaretleyislerinizi değiştirmeyin.
Teşekkürler.

APPENDIX B : AFFECTIVE NORMS FOR TURKISH WORDS

WORD	VAL_MEAN	VAL_STDV	ARO_MEAN	ARO_STDV	DOM_MEAN	DOM_STDV
ağaç	8,04	1,21	3,44	2,56	6,51	1,79
ahlak	6,82	1,97	3,82	2,20	6,62	2,38
alev	4,44	2,51	6,87	1,98	5,02	2,51
alkış	8,02	1,39	6,04	2,22	6,91	1,77
ameliyat	2,80	1,74	6,98	2,11	4,49	2,74
arı	5,36	2,44	6,20	2,20	5,00	2,17
arzu	7,42	1,39	6,58	2,47	7,40	1,47
aslan	5,38	2,43	6,98	2,04	4,89	2,35
aşk	8,20	1,18	6,78	2,98	7,18	2,24
ata	7,02	1,99	5,22	2,56	5,96	2,29
ayar	5,44	1,53	4,36	1,54	5,91	1,67
ayin	4,00	2,08	4,18	2,00	4,62	2,11
ayrılık	2,00	1,35	6,51	2,14	4,56	2,47
bağlılık	6,76	2,15	3,80	2,42	6,80	1,94
batık	3,53	2,06	6,76	2,10	4,42	2,66
bebek	7,87	1,71	5,18	3,29	6,56	2,53
beceri	8,04	1,26	4,87	2,66	7,24	1,26
bekleme	2,87	1,44	5,60	2,20	4,78	2,03
beslenme	6,68	1,79	4,96	2,18	6,44	1,88
beste	6,96	1,64	3,82	2,41	5,67	2,02
bitki	7,53	1,31	3,73	2,34	6,29	1,60
bomba	1,84	1,41	7,78	1,82	3,44	2,67
borç	2,02	1,32	6,40	2,30	4,87	2,67
bozkır	4,84	2,26	4,18	1,92	5,47	1,78
bozukluk	3,18	1,45	5,78	1,82	5,09	2,26
buhar	5,33	1,45	4,02	1,83	5,29	1,58
cehennem	2,18	1,45	6,29	2,37	4,29	2,56
cesaret	7,53	1,56	6,07	2,22	7,22	1,65
ceset	1,67	1,17	7,09	2,41	3,33	2,50
coşku	7,69	1,10	6,58	2,25	7,07	1,47
çaba	7,13	1,75	5,84	2,11	6,87	1,73
davul	4,91	2,24	5,51	1,96	4,84	1,93
deprem	1,47	0,84	7,49	2,17	3,24	2,68
dikkat	6,84	1,38	5,49	2,15	7,09	1,58
dilek	7,24	1,76	5,29	2,60	6,71	2,08
dinlenme	8,09	1,20	2,76	2,29	7,20	1,78
dondurma	7,29	1,38	4,80	2,27	6,16	1,88

doyum	7,00	1,57	5,27	2,54	6,67	1,76
döviz	5,47	2,05	5,04	1,71	5,22	2,01
düğün	6,87	1,87	5,27	2,43	6,00	1,95
dürtü	5,57	1,44	5,73	1,80	6,20	1,62
efsane	6,73	1,79	6,04	2,04	5,67	2,29
eğlence	7,80	1,36	5,13	2,97	7,20	1,50
eksiklik	3,49	1,41	5,51	1,90	4,84	1,85
emniyet	7,07	1,86	3,67	2,33	6,75	1,88
endişe	3,22	1,40	6,40	1,99	5,11	2,31
enerji	7,87	1,53	5,95	2,29	6,67	1,88
esinti	6,91	1,53	4,07	2,54	5,73	1,86
espri	7,96	1,04	5,04	2,44	7,09	1,58
estetik	7,47	1,70	4,53	2,73	6,29	2,12
evren	7,07	1,70	5,96	2,60	5,82	2,60
fantezi	6,84	2,12	6,07	2,45	6,20	2,16
fikir	7,68	1,05	5,89	2,62	7,56	1,31
futbol	5,16	2,14	5,42	2,48	5,33	2,24
garanti	7,73	1,37	3,53	2,44	6,30	2,02
gecikme	3,07	1,40	6,60	1,66	4,71	2,29
gelişme	7,64	1,45	5,36	2,45	6,80	2,03
gerginlik	2,16	1,40	6,96	1,94	4,36	2,56
gevşeme	6,82	1,85	2,84	2,06	6,44	2,04
göğüs	6,33	1,83	4,89	1,99	5,64	1,75
gökyüzü	8,51	0,99	4,38	3,04	6,56	2,38
gönül	7,24	1,60	4,02	2,31	6,49	2,08
gözyaşı	3,62	1,81	4,67	2,58	4,69	2,34
gurbet	3,42	1,91	5,24	2,23	4,76	2,30
güçlük	4,20	1,69	6,69	1,46	5,33	2,14
günah	3,60	1,88	6,11	2,17	5,04	2,35
güneş	7,64	1,68	4,49	2,84	6,20	2,54
güven	8,29	0,97	3,36	2,66	7,20	1,97
güvercin	7,00	1,81	4,07	2,36	6,02	1,73
hafıza	7,18	1,74	5,11	2,24	6,18	2,50
hayal	7,11	1,68	4,60	2,62	6,80	1,78
hazine	7,18	1,74	6,69	2,23	6,18	2,18
heyecan	7,43	1,23	7,18	1,84	7,29	1,46
huzur	8,33	1,04	2,82	2,57	6,98	2,13
ibadet	5,11	2,57	3,56	2,06	5,47	2,63
ilham	7,69	1,43	5,42	2,68	6,53	1,98
indirim	7,18	1,68	5,27	2,13	5,84	2,07
intihar	1,64	1,19	6,91	2,38	4,36	3,18
intikam	2,93	2,22	6,71	2,36	4,38	2,82

ipek	7,16	1,48	3,84	2,35	6,44	1,63
isyan	4,34	2,32	6,93	1,71	4,98	2,75
itibar	7,44	1,18	4,98	2,38	6,98	1,63
kabus	1,96	1,36	6,82	2,08	4,04	2,61
kader	4,53	2,15	4,42	2,18	4,33	2,57
kanepe	6,80	1,58	3,44	2,27	6,58	1,66
kanser	1,27	0,75	7,45	2,04	2,89	2,57
kaos	2,80	2,11	7,04	2,02	4,27	2,67
kargaşa	3,00	1,60	6,64	1,84	4,45	2,29
karmaşa	2,98	1,48	6,67	2,01	4,11	2,29
kayak	6,36	2,15	5,44	2,62	5,44	2,17
kedi	5,84	2,42	4,60	2,52	6,02	2,34
keyif	8,27	0,96	3,93	2,85	7,27	1,57
kırık	3,07	1,47	5,31	1,82	4,53	1,84
kısmet	6,38	2,15	5,11	2,22	5,36	2,25
kira	3,25	1,81	5,96	1,93	4,60	2,02
kirlilik	2,18	0,96	5,44	1,99	4,40	2,17
kokteyl	7,02	1,36	5,02	2,14	6,33	1,82
koku	5,36	1,94	5,16	2,15	5,76	1,71
konser	7,69	1,38	5,16	2,61	6,76	1,80
koşu	6,69	1,61	5,58	2,32	6,84	1,65
kötülük	2,00	1,31	6,51	1,95	4,14	2,72
kudret	6,89	1,77	5,87	2,44	6,49	2,00
kuduz	1,96	1,30	7,22	2,11	3,31	2,50
kulübe	5,73	1,81	3,89	1,97	5,58	1,67
kumar	2,18	1,72	6,47	2,26	4,87	2,67
kurban	3,13	2,19	5,84	2,31	4,24	2,36
kurşun	2,04	1,48	7,82	1,79	3,47	2,62
kurtarıcı	6,51	1,87	5,44	2,48	6,24	2,11
kuvvet	7,53	1,59	6,22	2,21	7,13	1,85
leke	3,51	1,82	5,56	1,59	4,71	1,93
lider	6,76	2,05	6,00	2,43	6,42	2,17
macera	6,56	1,94	7,02	1,88	6,31	2,01
madalya	7,02	1,53	5,89	2,35	5,98	1,97
makarna	6,91	1,95	4,76	2,13	6,36	2,00
manyak	2,84	1,97	6,73	2,09	4,89	2,39
manzara	7,96	1,19	3,80	2,93	6,67	2,08
masaj	7,53	1,41	4,18	2,96	6,60	1,83
masal	6,96	1,77	3,84	2,62	6,16	2,34
merak	6,69	2,10	6,49	1,65	6,73	1,75
merhamet	7,04	1,89	3,98	2,15	6,73	2,07
merhum	2,58	1,67	4,96	2,24	3,82	2,15

muayene	4,78	2,21	5,53	1,87	5,13	2,11
mücadele	6,71	1,94	6,51	1,83	7,02	1,62
müjde	8,44	1,06	6,69	2,49	7,07	1,92
nasihat	5,36	2,08	3,84	1,98	5,87	2,27
nefret	2,09	1,41	6,16	2,02	5,09	2,82
nem	4,07	1,71	4,62	1,28	4,58	1,70
nur	5,84	2,54	3,93	2,27	5,56	1,96
okyanus	7,31	1,93	4,80	3,23	5,40	2,74
ödeme	4,60	2,14	5,11	2,01	5,64	2,29
ödev	4,89	2,24	5,33	1,94	5,84	2,28
öfke	2,69	1,55	7,04	2,02	5,31	2,44
ördek	6,69	1,83	4,20	2,08	5,80	1,73
park	7,07	1,51	3,78	2,23	6,13	1,63
parti	6,09	2,36	6,55	2,18	6,24	1,75
perde	5,38	1,40	4,22	1,46	5,87	1,62
pijama	7,24	1,71	3,40	2,16	6,20	1,94
pizza	6,24	1,99	5,16	2,07	5,73	1,83
posta	6,56	1,59	5,07	2,25	5,93	1,90
reform	7,04	1,78	5,73	2,54	6,58	1,50
rekabet	4,96	2,02	6,62	2,01	5,89	2,13
ritm	7,11	1,64	5,56	2,42	6,60	1,80
ruh	5,38	1,91	4,73	2,32	5,27	2,22
rüya	6,76	1,79	5,22	2,39	5,80	2,34
sadelik	7,82	1,19	2,31	1,77	6,87	2,17
sakatlık	1,80	1,10	5,58	2,35	3,29	2,42
sauna	6,27	2,26	3,49	2,30	5,96	2,02
savaş	1,87	1,44	7,47	2,20	3,82	2,89
sepet	5,80	1,46	4,24	1,40	5,44	1,52
sessizlik	6,78	1,69	2,40	1,79	6,20	1,98
sevda	7,42	1,91	5,82	2,75	6,42	2,34
sevgi	8,66	0,71	5,07	3,31	7,82	1,63
silah	2,42	1,82	7,23	2,18	4,09	2,73
sis	4,09	2,15	5,36	2,26	4,36	2,17
soygun	2,20	1,60	7,20	2,15	3,47	2,43
spor	7,49	1,63	5,49	2,71	6,89	1,57
sualtı	5,95	2,65	5,73	2,66	5,18	2,33
surat	5,71	1,77	4,78	1,51	5,40	1,25
sürat	4,53	2,06	6,96	1,58	5,89	2,18
sürpriz	7,95	1,38	7,11	1,91	6,67	1,97
süsleme	6,78	1,78	5,24	2,42	6,53	1,71
şaka	6,47	1,78	5,67	2,09	5,91	1,84
şans	7,31	1,58	6,07	2,43	5,60	2,28

şarkı	7,77	1,54	4,82	2,80	6,69	1,53
şaşkınlık	5,00	1,49	5,60	1,92	5,49	1,91
şehir	5,93	2,08	5,60	2,16	5,71	1,90
şehit	2,43	2,60	7,05	2,35	3,95	2,95
şehvet	6,29	1,94	7,07	1,91	6,38	2,27
şeref	7,51	1,65	5,07	2,50	7,09	1,61
şimşek	4,58	2,18	7,22	1,55	4,58	2,40
şişe	5,33	1,71	4,56	1,27	5,71	1,62
şişmanlık	2,51	1,73	5,16	2,40	4,56	2,75
şöhret	6,05	1,93	6,13	2,21	6,44	1,83
şömine	7,24	1,26	4,18	2,56	6,27	1,62
tadilat	4,56	1,97	5,78	1,83	5,22	2,04
tatil	8,24	1,28	5,27	3,10	7,36	1,57
tecavüz	1,27	0,66	7,02	2,37	3,89	2,65
tehlike	2,93	1,74	7,73	1,83	4,73	2,44
tembellik	3,80	2,02	3,96	2,09	5,16	2,31
temizlik	7,16	1,84	4,13	2,43	7,09	1,73
terör	1,33	0,90	7,36	2,19	3,87	2,87
teşvik	7,04	1,36	4,76	2,31	6,64	1,73
tören	6,22	1,81	5,47	2,02	6,00	1,69
uçurum	2,78	2,27	7,44	1,85	5,38	2,85
vadi	6,64	1,81	4,60	2,39	6,00	2,15
vahşet	1,33	0,67	7,40	2,15	4,00	2,99
yalnızlık	3,80	2,44	4,22	2,56	4,96	2,53
yankı	5,27	1,21	5,11	1,75	5,91	1,84
yaprak	7,36	1,53	3,98	2,39	6,51	1,83
yarışma	5,80	2,18	6,78	1,87	6,44	1,60
yaşlılık	3,11	1,76	4,41	2,64	3,84	2,59
yatak	7,33	1,57	4,24	2,86	6,67	1,88
yetenek	7,73	1,21	5,13	2,64	7,24	1,67
yılan	3,09	2,07	7,58	1,64	3,93	2,26
yolculuk	7,20	1,97	5,69	2,62	6,89	1,94
zafer	7,84	1,41	6,42	2,73	7,27	1,79
ziyafet	7,69	1,20	5,20	2,33	6,96	1,46

VAL_MEAN: Valence mean

VAL_STDV: Valence standard deviation

ARO_MEAN: Arousal mean

ARO_STDV: Arousal standard deviation

DOM_MEAN: Dominance mean

DOM_STDV: Dominance standard deviation

APPENDIX C: CONCRETENESS SURVEY

Sample from a subject

	soyut	1	2	3	4	5	6	7	somut
kumar					x				
merhum							x		
tatlı							x		
dürtü			x						
cehennem		x							
arı								x	
sanayi						x			
ilham				x					
ıslık								x	
yankı							x		
beslenme					x				
demir								x	
boya								x	
gelenek			x						
şaşkınlık				x					
fikir					x				
estetik					x				
fırın								x	
mantar								x	
eğlence				x					
kampüs								x	

tören						x	
ziyafet						x	
ata					x		
pizza							x
karanlık				x			
içerik			x				
koşu						x	
bebek							x
bozkır						x	
bozukluk		x					
malzeme							x
yaşlılık						x	
gelişme				x			
ray							x
nefret			x				
şarkı							x
temizlik						x	
cadde							x
yetenek					x		
kumaş							x
şişe							x
ayrılık			x				
karayolu							x
güvercin							x
alkış							x
spor							x

sakatlık				x			
gurbet					x		
kucak						x	
iltihap							x
şişmanlık							x
neşe		x					
nem							x
sivrisinek							x
sinema						x	
surat							x
okyanus							x
şaka			x				
uyum	x						
şarap							x
kurban					x		
asansör							x
ayar		x					
şapka							x
kira		x					
hayal	x						
kısmet	x						
alet							x
kedi							x
tütün							x
depo						x	
ritm					x		

eksiklik			x				
itibar		x					
yatak							x
bekleme		x					
cesaret		x					
gönül	x						
hafıza		x					
gemi							x
yalnızlık		x					
şans	x						
korunma	x						
futbol							x
reform						x	
dilek		x					
kayak							x
çamur							x
sevgi	x						
güzellik							x
idrar							x
güneş							x
sıkıntı	x						
ilgi		x					
savunma			x				
enerji							x
ayin						x	
tasarruf		x					

hasar						x	
evren							x
kötülük	x						
tatil				x			
ödül					x		
konser							x
espri						x	
maç							x
madalya							x
melek	x						
perde							x
döviz							x
şömine							x
dert		x					
sepet							x
ruh	x						
göğüs							x
şeref		x					
kaya							x
koku						x	
harf							x
şehir							x
gecikme		x					
yazar							x
gözyaşı							x
pislik					x		

sualtı							x
sis						x	
gübre							x
yara						x	
ciddiyet		x					
dostluk			x				
endişe		x					
sevda		x					
buhar							x
mezar							x
teori						x	
posta							x
beceri		x					
ofis							x
ördek							x
vadi							x
cinsiyet				x			
doyum		x					
zafer		x					
çaba		x					
kurtarıcı					x		
kuvvet					x		
bilek							x
gökyüzü							x
yıldız							x
masaj					x		

leke						x	
zevk		x					
kokteyl							x
şöhret		x					
borç		x					
tarz		x					
indirim			x				
ödev					x		
üzüntü	x						
kırık						x	
çöplük							x
kuşku		x					
davul							x
dondurma							x
yolculuk			x				
doğa							x
kirlilik					x		
teşvik		x					
yatırım			x				

Calculation Sheet (from above subject)

	soyut	1	2	3	4	5	6	7	somut	deger
kumar		0	0	0	4	0	0	0		4
merhum		0	0	0	0	0	6	0		6
tatlı		0	0	0	0	0	6	0		6
dürtü		0	2	0	0	0	0	0		2
cehennem		1	0	0	0	0	0	0		1
arı		0	0	0	0	0	0	7		7
sanayi		0	0	0	0	5	0	0		5
ilham		0	0	3	0	0	0	0		3
ıslık		0	0	0	0	0	0	7		7
yankı		0	0	0	0	0	6	0		6
beslenme		0	0	0	4	0	0	0		4
demir		0	0	0	0	0	0	7		7
boya		0	0	0	0	0	0	7		7
gelenek		0	2	0	0	0	0	0		2
şaşkınlık		0	0	3	0	0	0	0		3
fikir		0	0	0	4	0	0	0		4
estetik		0	0	0	4	0	0	0		4
fırın		0	0	0	0	0	0	7		7
mantar		0	0	0	0	0	0	7		7
eğlence		0	0	3	0	0	0	0		3
kampüs		0	0	0	0	0	0	7		7
tören		0	0	0	0	0	6	0		6
ziyafet		0	0	0	0	0	6	0		6
ata		0	0	0	0	5	0	0		5
pizza		0	0	0	0	0	0	7		7
karanlık		0	0	0	4	0	0	0		4
içerik		0	0	3	0	0	0	0		3
koşu		0	0	0	0	0	6	0		6
bebek		0	0	0	0	0	0	7		7
bozkır		0	0	0	0	0	6	0		6
bozukluk		0	2	0	0	0	0	0		2
malzeme		0	0	0	0	0	0	7		7
yaşlılık		0	0	0	0	0	6	0		6
gelişme		0	0	0	4	0	0	0		4
ray		0	0	0	0	0	0	7		7
nefret		0	0	3	0	0	0	0		3
şarkı		0	0	0	0	0	0	7		7
temizlik		0	0	0	0	0	6	0		6
cadde		0	0	0	0	0	0	7		7
yetenek		0	0	0	0	5	0	0		5
kumaş		0	0	0	0	0	0	7		7
şişe		0	0	0	0	0	0	7		7

ayrılık	0	0	3	0	0	0	0	3
karayolu	0	0	0	0	0	0	7	7
güvercin	0	0	0	0	0	0	7	7
alkış	0	0	0	0	0	0	7	7
spor	0	0	0	0	0	0	7	7
sakatlık	0	0	0	4	0	0	0	4
gurbet	0	0	0	0	5	0	0	5
kucak	0	0	0	0	0	6	0	6
iltihap	0	0	0	0	0	0	7	7
şişmanlık	0	0	0	0	0	0	7	7
neşe	0	2	0	0	0	0	0	2
nem	0	0	0	0	0	0	7	7
sivrisinek	0	0	0	0	0	0	7	7
sinema	0	0	0	0	0	6	0	6
surat	0	0	0	0	0	0	7	7
okyanus	0	0	0	0	0	0	7	7
şaka	0	0	3	0	0	0	0	3
uyum	1	0	0	0	0	0	0	1
şarap	0	0	0	0	0	0	7	7
kurban	0	0	0	0	5	0	0	5
asansör	0	0	0	0	0	0	7	7
ayar	0	2	0	0	0	0	0	2
şapka	0	0	0	0	0	0	7	7
kira	0	2	0	0	0	0	0	2
hayal	1	0	0	0	0	0	0	1
kısmet	1	0	0	0	0	0	0	1
alet	0	0	0	0	0	0	7	7
kedi	0	0	0	0	0	0	7	7
tütün	0	0	0	0	0	0	7	7
depo	0	0	0	0	0	6	0	6
ritm	0	0	0	0	5	0	0	5
eksiklik	0	0	3	0	0	0	0	3
itibar	0	2	0	0	0	0	0	2
yatak	0	0	0	0	0	0	7	7
bekleme	0	2	0	0	0	0	0	2
cesaret	0	2	0	0	0	0	0	2
gönül	1	0	0	0	0	0	0	1
hafıza	0	2	0	0	0	0	0	2
gemi	0	0	0	0	0	0	7	7
yalnızlık	0	2	0	0	0	0	0	2
şans	1	0	0	0	0	0	0	1
korunma	1	0	0	0	0	0	0	1
futbol	0	0	0	0	0	0	7	7
reform	0	0	0	0	0	6	0	6
dilek	0	2	0	0	0	0	0	2
kayak	0	0	0	0	0	0	7	7
çamur	0	0	0	0	0	0	7	7
sevgi	1	0	0	0	0	0	0	1
güzellik	0	0	0	0	0	0	7	7
idrar	0	0	0	0	0	0	7	7

güneş	0	0	0	0	0	0	7	7
sıkıntı	1	0	0	0	0	0	0	1
ilgi	0	2	0	0	0	0	0	2
savunma	0	0	3	0	0	0	0	3
enerji	0	0	0	0	0	0	7	7
ayin	0	0	0	0	0	6	0	6
tasarruf	0	2	0	0	0	0	0	2
hasar	0	0	0	0	0	6	0	6
evren	0	0	0	0	0	0	7	7
kötülük	1	0	0	0	0	0	0	1
tatil	0	0	0	4	0	0	0	4
ödül	0	0	0	0	5	0	0	5
konser	0	0	0	0	0	0	7	7
espri	0	0	0	0	0	6	0	6
maç	0	0	0	0	0	0	7	7
madalya	0	0	0	0	0	0	7	7
melek	1	0	0	0	0	0	0	1
perde	0	0	0	0	0	0	7	7
döviz	0	0	0	0	0	0	7	7
şömine	0	0	0	0	0	0	7	7
dert	0	2	0	0	0	0	0	2
sepet	0	0	0	0	0	0	7	7
ruh	1	0	0	0	0	0	0	1
göğüs	0	0	0	0	0	0	7	7
şeref	0	2	0	0	0	0	0	2
kaya	0	0	0	0	0	0	7	7
koku	0	0	0	0	0	6	0	6
harf	0	0	0	0	0	0	7	7
şehir	0	0	0	0	0	0	7	7
gecikme	0	2	0	0	0	0	0	2
yazar	0	0	0	0	0	0	7	7
gözyaşı	0	0	0	0	0	0	7	7
pislik	0	0	0	0	5	0	0	5
sualtı	0	0	0	0	0	0	7	7
sis	0	0	0	0	0	6	0	6
gübre	0	0	0	0	0	0	7	7
yara	0	0	0	0	0	6	0	6
ciddiyet	0	2	0	0	0	0	0	2
dostluk	0	0	3	0	0	0	0	3
endişe	0	2	0	0	0	0	0	2
sevda	0	2	0	0	0	0	0	2
buhar	0	0	0	0	0	0	7	7
mezar	0	0	0	0	0	0	7	7
teori	0	0	0	0	0	6	0	6
posta	0	0	0	0	0	0	7	7
beceri	0	2	0	0	0	0	0	2
ofis	0	0	0	0	0	0	7	7
ördek	0	0	0	0	0	0	7	7
vadi	0	0	0	0	0	0	7	7
cinsiyet	0	0	0	4	0	0	0	4

doyum	0	2	0	0	0	0	0	2
zafer	0	2	0	0	0	0	0	2
çaba	0	2	0	0	0	0	0	2
kurtarıcı	0	0	0	0	5	0	0	5
kuvvet	0	0	0	0	5	0	0	5
bilek	0	0	0	0	0	0	7	7
gökyüzü	0	0	0	0	0	0	7	7
yıldız	0	0	0	0	0	0	7	7
masaj	0	0	0	0	5	0	0	5
leke	0	0	0	0	0	6	0	6
zevk	0	2	0	0	0	0	0	2
kokteyl	0	0	0	0	0	0	7	7
şöhret	0	2	0	0	0	0	0	2
borç	0	2	0	0	0	0	0	2
tarz	0	2	0	0	0	0	0	2
indirim	0	0	3	0	0	0	0	3
ödev	0	0	0	0	5	0	0	5
üzüntü	1	0	0	0	0	0	0	1
kırık	0	0	0	0	0	6	0	6
çöplük	0	0	0	0	0	0	7	7
kuşku	0	2	0	0	0	0	0	2
davul	0	0	0	0	0	0	7	7
dondurma	0	0	0	0	0	0	7	7
yolculuk	0	0	3	0	0	0	0	3
doğa	0	0	0	0	0	0	7	7
kirlilik	0	0	0	0	5	0	0	5
teşvik	0	2	0	0	0	0	0	2
yatırım	0	0	3	0	0	0	0	3

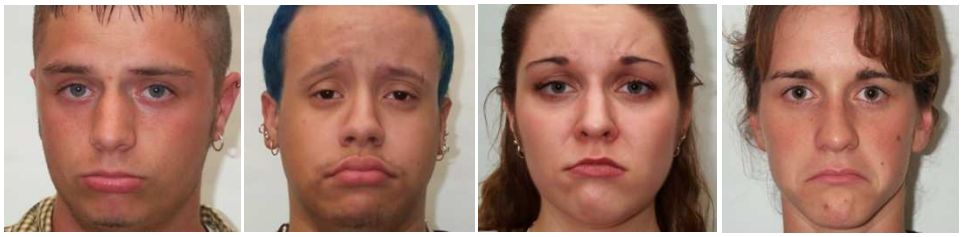
Concreteness Survey Results

WORD	CONCR. MEAN	WORD	CONCR. MEAN	WORD	CONCR. MEAN	WORD	CONCR. MEAN
alet	6,625	eğlence	3,1	karayolu	6,7	ördek	6,875
alkış	5,85	eksiklik	3,325	kaya	6,825	perde	6,725
arı	6,75	endişe	2,275	kayak	6,425	pislik	5,65
asansör	6,8	enerji	4,125	kedi	6,875	pizza	6,825
ata	5,125	espri	4,025	kırık	5,675	posta	6,225
ayar	4,15	estetik	3,35	kısmet	1,775	ray	6,775
ayin	4,625	evren	5,4	kira	5,675	reform	3,925
ayrılık	3,025	fırın	6,675	kirlilik	5,525	ritm	4,35
bebek	6,775	fikir	2,125	kokteyl	6,025	ruh	1,325
beceri	2,975	futbol	6,475	koku	4,6	sakatlık	5,575
bekleme	3,725	gecikme	3,925	konser	6,475	sanayi	5,925
beslenme	5,775	gelenek	2,35	korunma	3,125	savunma	3,35
bilek	6,675	gelişme	3,925	koşu	6,025	sepet	6,525
borç	5,2	gemi	6,85	kötülük	2,15	sevda	2,225
boya	6,525	göğüs	6,6	kucak	4,8	sevgi	2,175
bozkır	6,4	gökyüzü	6,475	kumar	4,675	sıkıntı	2,275
bozukluk	4,375	gönül	1,75	kumaş	6,875	sinema	6,3
buhar	6,325	gözyaşı	6,475	kurban	5	sis	6,4
cadde	6,775	gurbet	3,225	kurtarıcı	4,95	sivrisinek	6,5
cehennem	2,05	gübre	6,85	kuşku	2,4	spor	5,625
cesaret	2,2	güneş	6,425	kuvvet	4,375	sualtı	6,325
ciddiyet	2,825	güvercin	6,75	leke	6,4	surat	6,225
cinsiyet	5,95	güzellik	2,925	maç	6,325	şaka	3,45
çaba	2,9	hafıza	3,225	madalya	6,375	şans	2
çamur	6,7	harf	6,225	malzeme	6,45	şapka	6,775
çöplük	6,25	hasar	5,1	mantar	6,65	şarap	6,575
davul	6,775	hayal	1,65	masaj	6,275	şarkı	5,775
demir	6,775	ıslık	6,175	melek	1,725	şaşkınlık	2,525
depo	6,6	içerik	4,4	merhum	4,775	şehir	6,2
dert	2,35	idrar	6,875	mezar	6,525	şeref	2,3
dilek	2,15	ilgi	2,3	nefret	2,35	şişe	6,675
doğa	5,75	ilham	1,925	nem	5,475	şişmanlık	5,8
dondurma	6,75	iltihap	6,325	neşe	2,9	şöhret	3,075
dostluk	2,35	indirim	4,9	ofis	6,65	şömine	6,675
doyum	2,9	itibar	2,425	okyanus	6,375	tarz	3,35
döviz	6,275	kampüs	6,2	ödev	5,95	tasarruf	3,95
dürtü	2,65	karanlık	4,35	ödül	5,4	tatil	5,475

WORD	CONCR. MEAN	WORD	CONCR. MEAN	WORD	CONCR. MEAN
tatlı	5,2	vadi	6,775	yetenek	2,725
temizlik	4,8	yalnızlık	2,225	yıldız	6,5
teori	3,55	yankı	5,8	yolculuk	5,225
teşvik	3,4	yara	6,425	zafer	3
tören	5,8	yaşlılık	4,775	zevk	2,625
tütün	6,725	yatak	6,775	ziyafet	5,475
uyum	2,475	yatırım	5,05		
üzüntü	2,125	yazar	6,375		

APPENDIX D : AFFECTIVE FACES

Sad Faces



Neutral Faces

Happy Faces

APPENDIX E: INSTRUCTIONS FOR WORD-FACE STROOP TASK

“Sizden istenen, öncelikle ekranda göreceğiniz artı işaretine odaklanmanız, sonra da ekranda belirecek olan YÜZLER üzerindeki KELİMELERin sizde uyandırdığı etkinin olumlu mu, olumsuz mu, nötr mü olduğuna karar vermeniz, ve buna göre kararınız
olumlu ise "+"
olumsuz ise "-"
nötr ise "O"
tuşuna basmanızdır.

Tüm bunları mümkün olduğunca hızlı ve doğru bir şekilde yapmalısınız!

DENEME BÖLÜMÜNE BAŞLAMAK İÇİN SPACE TUŞUNA BASINIZ!”

APPENDIX F: SAMPLE INFORMED CONSENT FORMS

Consent Form for Classical Stroop Task

Kişisel Bilgiler

Ad Soyad: _____ Kod: _____

Adres: _____

Telefon: _____

Eğitim Durumu: _____

Yaş: _____ Cinsiyet: ☐ Kadın ☐ Erkek

Herhangi bir beyin ameliyatı geçirdiniz mi ya da psikiyatrik ilaç kullandınız mı?
☐ Evet ☐ Hayır Belirtiniz:

Renk görmeyle ilgili bir probleminiz var mı?
☐ Evet ☐ Hayır Belirtiniz:

Gönüllü Katılım

Ben _____, Ortadoğu Teknik Üniversitesi Enformatik Enstitüsüne bağlı olan Bilişsel Bilimler Ana Bilim Dalında yüksek lisans öğrencisi Zeynep Başgöze'nin denetimindeki kelime ve renk okuma ile ilgili bu deneye gönüllü olarak katılmayı kabul ediyorum.

Bu çalışmada kağıt üzerinde bazı renkli kelimeler ve renkli kutucuklar göreceğimin farkındayım. Kelime isimlerini veya kelime renklerini veya kutucukları bu gördüklerime göre okuyacağımın farkındayım.
Çalışma sonuçlarında ismimin kullanılmayacağını ve ismimin benden toplanan verilerle direkt ilişkilendirilmeyeceğini biliyorum. Beni belirleyecek bir bilgi olmaksızın verilerin herhangi bir araştırma dergisinde yayınlanmasına izin veriyorum.

Çalışmada toplam 3 birim olduğunun, çalışmanın bir biriminin ortalama 2 dakika süreceğinin, ve çalışmayı istediğim zaman bırakabileceğimin farkındayım.

Çalışmaya gönüllü olarak, hiçbir etki altında kalmadan katılıyorum.

İmza _____ Tarih_____

Teyit

Verilerinizin gizliliğinin korunacağını temin ediyorum. Bu çalışmanın sonuçları isminizi veya katılımcıları belirleyecek herhangi bir bilgi içermeyecektir. Bu veriler üçüncü kişilere verilmeyecek ve sadece araştırma amaçlı kullanılacaktır.

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Consent Form for Word-face Stroop Task

Kişisel Bilgiler

Ad Soyad: Kod:

Adres: _____

Telefon: _____

Eğitim Durumu: _____

Yaş: _____ Cinsiyet: ☐ Kadın ☐ Erkek

Herhangi bir beyin ameliyatı geçirdiniz mi?
☐ Evet ☐ Hayır Belirtiniz:

Herhangi bir psikoloji rahatsızlığınız var mı ya da hiç psikiyatrik ilaç kullandınız mı?
☐ Evet ☐ Hayır Belirtiniz:

Gönüllü Katılım

Ben _____, Ortadoğu Teknik Üniversitesi Enformatik Enstitüsüne bağlı olan Bilişsel Bilimler Ana Bilim Dalında yuksek lisans öğrencisi Zeynep Başgöze'nin denetimindeki duygusal çelişki çözümleme ile ilgili bu deneye gönüllü olarak katılmayı kabul ediyorum.

Bu çalışmada bilgisayar ortamında birtakım yüz resimleri üzerinde kelimeler göreceğimi biliyorum. Gördüğüm kelimeleri olumlu-olumsuz-nötr kriterlerine göre değerlendireceğimin farkındayım.

Çalışma sonuçlarında ismimin kullanılmayacağını ve ismimin benden toplanan verilerle direkt ilişkilendirilmeyeceğini biliyorum. Beni belirleyecek bir bilgi olmaksızın verilerin herhangi bir araştırma dergisinde yayınlanmasına izin veriyorum.

Çalışmanın ortalama 15 dakika süreceğinin, ve çalışmayı istediğim zaman bırakabileceğimin farkındayım.

Çalışmaya gönüllü olarak, hiçbir etki altında kalmadan katılıyorum.

İmza _____ Tarih_____

Teyit

Verilerinizin gizliliğinin korunacağını temin ediyorum. Bu çalışmanın sonuçları isminizi veya katılımcıları belirleyecek herhangi bir bilgi içermeyecektir. Bu veriler üçüncü kişilere verilmeyecek ve sadece araştırma amaçlı kullanılacaktır.

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