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Cognitive Bias Modification in Obsessive Compulsive Disorder
Obsesif Kompulsif Bozuklukta Bilişsel Yanlılık Değişimi

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Abstract
Cognitive behavioral therapy, consisting of exposure and response prevention and cognitive restructring, is still one of the most effective treatments for obsessive compulsive disorder. However, some patients do not fully benefit from the treatment. This condition results in more search for novel approaches that can contribute to effectiveness of standard treatments. In this regard, the use of technology-based methods in recent researches is noteworthy. Cognitive bias modification is one of these current efforts of technology-based methods. Cognitive bias modification involves computerized tasks designed to modify some cognitive biases such as attention and interpretation associated with psychopathology, particularly anxiety disorders. Researches have generally demonstrated that cognitive bias modification can be effective way to alter cognitive biases and to reduce anxiety symptoms. In recent years, there have been also some studies to investigate the potential effects of cognitive bias modification for obsessive compulsive disorder. Although more researches with larger clinical samples are warranted, there is emerging evidence for efficacy of cognitive bias modification for obsessive compulsive disorder as well. Beside, some studies suggest that cognitive bias modification can be used as a supplementary technique to standart cognitive behavioral therapy for obsessive compulsive disorder. Accordingly, the aim of this article is to review the limited number of empirical studies, particularly focusing on the effects of cognitive bias modification on obsessive compulsive symptoms and mechanisms of action underlying these effects.
Keywords: Obsessive-compulsive disorder, cognitive aspects, computer-assisted therapy, cognitive bias modification

Öz
Maruz bırakma ve tepki önleme ile bilişsel yeniden yapılandırma uygulamalarından oluşan bilişsel davranışçı terapi günümüzde halen obsesif kompulsif bozukluğa yönelik en etkili tedavi yöntemleri arasındadır. Yine de bazı hastalar bu tedaviden yeterince yarar görmemektedir. Bu durum standart tedavilerin etkisini arttırabilecek yeni yaklaşımlara yönelik arayışları gündeme getirmiştir. Bu bağlamda teknoloji temelli yöntemlerin güncel bilimsel çalışmalarda sıklıkla incelenmeye başlaması dikkat çekicidir. Bilişsel yanlılık değişimi teknoloji temelli yöntemlerin güncel örneklerinden biridir. Bilişse yanlılık değişimi, başta anksiyete bozuklukları olmak üzere psikopatoloji ile ilişkili dikkat ve yorumlama yanlılıkları gibi bazı bilişsel yanlılıkları değiştirmeyi hedefleyen ve bilgisayar ortamında uygulanan çeşitli görevleri içermektedir. Bilimsel araştırmalar genel olarak bilişsel yanlılık değişiminin bilişsel yanlılıkları değiştirmede ve anksiyete belirtilerini azaltmada etkili olabileceğini göstermektedir. Son yıllarda alanyazında bilişsel yanlılık değişiminin obsesif kompulsif bozukluk için de potansiyel etkilerini araştırmaya yönelik çalışmalar söz konusudur. Geniş klinik örneklemler ile yapılacak daha fazla sayıda araştırmaya ihtiyaç olmakla birlikte, bilişsel yanlılık değişiminin obsesif kompulsif bozuklukta da etkin olduğuna dair kanıtlar giderek artmaktadır. Ayrıca bazı çalışmalar obsesif kompulsif bozukluğun bilişsel davranışçı terapi ile tedavisinde bilişsel yanlılık değişiminin tamamlayıcı bir teknik olarak da kullanılabileceğini göstermektedir. Dolayısıyla, bu derleme makalesinin amacı, bilişsel yanlılık değişiminin özellikle obsesif kompulsif bozukluk belirtileri üzerindeki etkilerini inceleyen sınırlı sayıdaki görgül çalışmayı ve ortaya çıkardığı değişimlerin ardındaki etki mekanizmalarını gözden geçirmektir.
Anahtar sözcükler: Obsesif-kompulsif bozukluk, bilişsel yönler, bilgisayar yardımlı tedavi, bilişsel yanlılık değişimi

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OBSESSIVE COMPULSIVE DISORDER (OCD) can be defined as a heterogeneous disorder with recurrent obsessions and compulsions that leads to significant distress and negatively affects individual's functionality, and genetic and environmental factors play a role in the development of the disorder (Mataix-Cols et al. 2005, Markarian et al. 2010). Cognitive behavioral therapy (CBT) is one of the psychotherapy methods that has been shown to be efficacious in the treatment of OCD (Ponniah et al. 2013). CBT for OCD involves a combination of cognitive techniques such as cognitive restructring and traditional behavioral techniques such as Exposure and Response Prevention (ERP) (Clark 2004). Foe xexample, results from Öst and his colleagues' comprehensive meta analysis (2015) suggested that CBT is an effective in reducing OCD symptoms in both individual and group settings. Beside, it is stated that the combination of CBT and medication provides a more effective treatment for severe OCD (Skapinakis et al. 2016).

One of the goals of cognitive techniques using in CBT for OCD is to identify and change unrealistic beliefs and faulty interpretations related to involuntary experiences which have an important role in the maintenance of the disorder. In parallel with this, ERP aims to expose individiuals to all situations that they try to avoid, and thus to decrease distress and anxiety. Although it is recommended that these techniques be used together in the treatment of OCD, they can be applied alone. Moreover, ERP is more frequently used technique in clinical practice (Gava et al. 2007). On the other hand, cognitive techniques seem to be more acceptable to individuals diagnosed with OCD than ERP due to the more limited inclusion of exposure to the situations that they have been trying to avoid. Accordingly, the combination cognitive and behavioral techniques is recommended in order to increase treatment utilization rates in OCD (Daflos and Whittal 2012, McKay et al. 2015).

Although traditional CBT techniques have been shown to be effective in individuals with OCD, only 25% of the patients show complete resolution of symptoms (Fisher and Wells 2005). Besides, drop-out rates for CBT for OCD are generally high (Abramowitz 2006).

Such issues have prompted clinicians and researchers to find new approaches in the treatment of OCD that may help increase the effect of traditional CBT. Among these new approaches, prominent efforts are improving the effectiveness of ERP, involving the relatives of patients in the treatment process, acceptance-based approaches and finally technology use (Abramowitz et al. 2018). Particularly, the reflection of technological innovations in the field of mental health allowed for the structuring of cost-effective and more accessible interventions despite some issues and limitations (Andersson and Titov 2014). On the other hand, individuals with OCD generally live with the condition for 10-15 years before seeking professional help (Veale 2004). Factors such as shame about the symptoms (i.e., shame about the content of obsessions), not having enough information about the right resources for treatment and economic insufficiencies are associated with delay in treatment-seeking (Garcia-Soriano et al. 2014). When considered from this point of view, the use of internet and computer-based approaches in treatment will be able to provide access to patients. In recent years, the use of smartphone, internet and computer-based approaches in the treatment of a range of psychopathologies including OCD have become widespread and the number of researches has been gradually increasing (Andersson and Hedman 2013, Akgün et al. 2019). The majority of internet and computer-based approaches involves traditional CBT methods. (Andersson 2009).

There are several studies reporting the similar effect sizes to traditional face-to-face CBT in the treatmet of anxiety and mood disorders (Andersson et al. 2019). Accordingly, fidnings in this field point out that internet-based CBT is highly effective for reducing OCD symptoms and contributes to the long-term maintenance of treatment gains (Pozza et al. 2016).

Another current effort in which technology finds its place in psychological intervention programs is Cognitive Bias Modification (CBM) approach. CBM is a new computer-based approach to modifying cognitive biases such as attentional and interpretation biases which are identified as important factors in the development and maintenance of anxiety disorders. Experimental studies in this field have been aiming for reducing biased interpretations with various methods in computer environment. These studies have demonstrated that CBM can be effective for reducing such biases. In this review, by examining studies on the effect of CBM on OCD symtopms it is aimed to inform the professionals working with OCD patients in Turkey about this novel method as a supplementary technique besides traditional methods. To sum up, in this review, firstly, cognitive biases specific to OCD will be discussed in general, and then the limited number of empirical studies, particularly focusing on the effects of CBM on OCD symptoms and mechanisms of action underlying these effects will be reviewed.

OCD and cognitive biases

Cognitive models of anxiety disorders emphasize the central role of biased information processing in the development and maintenance of these disorders (Beck et al. 1985, Beck and Clark 1997, Williams et al. 1997, Mogg and Bradley 1998, Wells and Mathews 2014). These biases in information processing are comprised of cogntive biases such as selective attentional biases to anxiety provoking stimuli, threat-oriented and faulty interpretation biases about ambiguous stimuli or memory biases (Mathews and McLeod 2005).

The majority of studies examining cognitive biases in OCD have focused on the role of faulty and biased interpretations about obsessions in the development and maintenance of the disorder (Hezel and McNally 2016). Some other researches also postulated that OCD symptoms result from selective attentional biases to anxiety provoking and threatening stimuli associated with obsessions and compulsions (Tallis 1997). To test this hypothesis, many research conducted experimental studies using threatening stimuli associated with OCD symptoms (Muller ve Roberts 2005); still, there are some inconsistencies between results (Amir et al. 2009). Some possible accounts for this inconsistency will be presented later in this article.

Despite the growing knowledge of the critical role of cognitive biases in many anxiety disorders including OCD, it is important to note that there is limited number of studies to prove the causality between cognitive biases and psychopathologies (Macleod et al. 2004). In this regard, interest in experimental psychopathology studies, which are thought to make important contributions to the treatment of OCD and anxiety disorders, has increased in recent years (Williams and Grisham 2013). CBM is also the current example of this increasing interest and studies examining whether CBM can be a supplementary tool in enhancing the effect of traditional treatment methods have focused mainly on attentional and interpretation biases. Therefore, in this review, especially the concepts related to attentional and interpretation biases are discussed in detail.

Interpretation bias in OCD

In this section, the role of common interpretation biases in the mechanisms relevant to the development and maintenance of OCD will be discussed. Cognitive theories emphasize the importance of dysfunctional thoughts and interpretation biases in explaining these mechanisms (Salkovskis 1999, Rachman 2003, Clark 2004). Although which cognitive structure plays a more critical role in the development and maintenance of OCD symptoms differs from theory to theory, it is possible to mention some common views adopted by different theories (Clark 2004): in fact involuntary thoughts, images and urges similar to obsessions are common as normal cognitive activities in many people who are not diagnosed with OCD. However, these involuntary experiences are misinterpreted by individuals diagnosed with OCD as an extremely unusual, revealing a hidden aspect of personality, specific to that person and this fact leads to anxiety and distress. In order to reduce anxiety or distress, obsessions are tried to be controlled and suppressed by various methods; when these attempts fail, ritualistic behaviors are exhibited. In the short term, these attempts can be effective; however, in the long term, these may lead to a relative increase in thought recurrence and contribute to the maintenance of OCD symptoms (Clark 2004).

Rachman (1997) has argued that "catastrophic misinterpretations" of the personal significance of intrusive thoughts are the main cause of the development and maintenance of obsessions. Accordingly, OCD patients tend to qualify themselves as a sinner, dangerous and/or an immoral because of having thoughts, images and/or urges which contain disturbing content such as sexuality, aggression and swearing to sacred values. This concept is named as Thought-Action Fusion (TAF) (Shafran and Rachman 2004). TAF is composed of two components, namely: TAF-Morality and TAF-Likelihood. TAF-Morality refers to the belief that having immoral thoughts is as unacceptable as actually engaging in immoral behaviour (e.g. “Having violent thoughts is almost as unacceptable as violent acts”). TAF-Likelihood refers to the belief that even thinking about an unpleasant situation increases the likelihood that this situation will actually occur (e.g. “If I think of myself being in a car accident, this increases the risk that I will have a car accident”). It is stated that TAF in any form is an important variable to predict the severity of OCD symptoms (Shafran et al. 1996, Rassin et al. 2001).

On the other hand, according to Clark (2004), the main cause of the development and maintenance of obsessions is disfunctional appraisals of failure in thought control. When one misinterprets the inability to achieve complete control over the unwanted intrusive thought and thought recurrence as a highly significant failure that could result in catasrtophic consequences, the frequency of the unwanted thought increases and becomes an obsession. In the absence of this line of misinterpretation, the impact of the unwanted thought may decrease. Acording to the model by Salkovskis (1999), unwanted intrusive thoughts turn into obsessions because of appraisal on inflated personal responsibility for having such thoughts and thus on reason for harm to oneself or others. Besides, it is considered that memory bias which is the type of cognitive bias results in the recurrency of neutralizing acts, particularly checking (Salkovskis 1999). In other words, these attempts produce adverse effects that turn the checking rituals into a self-perpetuating mechanism: checking causes more checking and thereby leads to memory distrust (Rachman 2002). It is suggested that this counterproductive strategy has even effect of reducing memory vividness and memory detail, therefore memory confidence

decreases and causes more repeated chaceking (van den Hout and Kindt 2003, Toffolo et al. 2015). To illustrate, Radomsky and his colleagues (2001) found that compulsive checkers diagnosed with OCD had significantly less confidence in their memory for checking actions that were carried out under high responsibility than under conditions of low responsibility. These results are confirmed by some other studies using different experimental methods (Bocshen and Vuksanovic 2007, Cougle et al. 2007).

Based on clinical observations and implementations, Obsessive Compulsive Cognitions Working Group (OCCWG) including more than 40 members from different countries identified six main belief/bias domains that can be relatively specific to OCD: inflated responsibility (i.e., the belief that one has pivotal power to prevent subjectively crucial negative outcomes), overimportance of thought (i.e., the beliefs that reflect TAF), overestimation of threat (i.e., an exaggeration of the probability or severity of harm), control of thoughts (i.e., an excessive concern about the importance of controlling one's thoughts), intolerance of uncertainty (i.e., beliefs about the necessity for being certain and difficulty tolerating uncertainty) and perfectionism (i.e., the tendency to try to do something perfectly and the belief that even minor mistakes will have serious consequences) (OCCWG 1997). Subsequently, three dominant merged factors emerged, namely: responsibility/threat estimation, intolerance of uncertainty/perfectionism and importance/control of thoughts, and the questionnaire that measures specifically those domains was developed (OCCWG 2005).

When literature is reviewed, there are many studies investigating the relationship between these belief domains and OCD symptoms. For instance, Taylor and colleagues (2002) found that there are both high correlation between these domains and OCD symptoms. Moreover, they concluded that intolerance of uncertainty, overestimation of threat and perfectionism are not specific to OCD and that they are common beliefs in other anxiety disorders. In another study (Tolin et al. 2006), it was reported that OCD patients differed from patients diagnosed with various types of anxiety disorder on beliefs about perfectionism and certainty and about importance and control of thoughts, but not on beliefs about threat estimation and inflated responsibility. It was stated that these belief domains are also important and valid cognitive concepts in Turkish clinical sample and OCD patients have more faulty beliefs particularly in the domain of inflated responsibility, overestimation of threat and perfectionism (Yorulmaz et al. 2013).

Although there are differences between studies about the prominent belief domains in OCD, the general finding is that there is a strong relationship between these biases and OCD symptoms. Furthermore, Wheaton and colleagues (2010), in their study with large clinical sample, concluded that certain belief domains strongly predict certain OCD symptom dimensions (i.e., responsibility/threat estimation beliefs predicting contamination obsessions, perfectionism/certainty beliefs predicting symmetry obsessions, importance/control of thoughts beliefs predicting unacceptable thoughts and responsibility/threat estimation beliefs predicting symptoms related to being responsible for harm). Furthermore, which belief domain is more dominant among individuals with OCD can differ according to the symptom severity as well as differing according to symptom category. Kim and colleagues (2016) reported that inflated responsibility strongly predicted OCD symptoms, but only for those with the least severe symptoms, while the relationship between symptoms and importance and control of thoughts were relatively independent of symptom severity. To sum up, findings from studies on the subject support

the main idea of cognitive models that emphasize the central role of dysfunctional beliefs and interpretation biases in the development and maintenance of OCD symptoms.

Attentional bias in OCD

In the relevant literature, it is generally stated that individuals with anxiety disorders exhibit selective attentional biases to threatening stimuli that are equivalent or similar to the anxiety-provoking situation (Cisler and Koster 2010). It is argued that attentional biases play an important role in the development and maintenance due to their negative impact on information processing and interpretation (MacLeod et al. 2002). This is explained by the fact that anxious individuals are attentive to anxiety and threat-related stimuli, and they tend to ignore any other stimuli (Kuelz et al. 2004). Although OCD has been no longer classified as an anxiety disorder in DSM-5 any more (American Psychiatric Association [APA] 2013), individuals diagnosed with OCD really experience high levels of anxiety and exhibit anxiety-linked attentional biases as well (Muller and Roberts 2005). Numerous studies have indicated that individuals with OCD exhibit selective attentional bias particular to OCD-related stimuli (Bar-Haim et al. 2007). In compliance with the nature of OCD, attentional biases generally occur in the presence of anxiety-linked and threatening stimuli associated with intrsuvie experiences and/or compulsions.

Unlike studies investigating interpretation biases, experimental tasks and/or neuropsychological assessment methods based on measurement of response times to specific stimuli are mainly used in studies investigating attentional biases (McNally 2001). A similar attention biases in OCD patients has been empirically demonstrated using different experimental paradigms. Foa and McNally (1986) investigated attentional biases in OCD using dichotic listening task. This task requires the subject to shadow, or repeat aloud, a message presented to one ear while ignoring a message presented to the other ear. In a study using this task, Foa and McNally (1986) reported that OCD patients better recognized the threat words (e.g., urine, feces, cancer, rabies, etc.) in the text that they were asked not to pay attention to than the neutral words that they were asked not to pay attention to.

Another task used in studies to investigate attentional biases in OCD is a revised version of the standart Stroop task (Stroop 1935), called the emotional Stroop task. In the modified Stroop task, threat words associated with psychopathology in different colors are presented and the participant is asked to tell as quickly as possible what color it is written without paying attention to the meaning of the word. Delayed color-naming of threat words is termed "interference effect" and is considered as a criterion for attention bias. In a study using with Stroop task comprising semantic manipulation with threat words, OCD patients' performance on such words were found to be slower when compared to healthy controls' (Foa et al. 1993). Foa and colleagues (1993) also reported that OCD patients were more vigilant for contamination-related words. Although similar results were found in other studies using emotional Stroop task (Unoki et al. 1999, Moritz et al. 2004, Rao et al. 2010), it was also shown that there is an attentional bias for only OCD-relevant threat words, but not all threat words. Therefore, the researchers suggested that attention bias in OCD may be specific to symptom-relevant stimuli.

As mentioned before, individuals diagnosed with OCD tend to misinterpret the unwanted intrusive thought and the inability to achieve complete control over them as a

highly significant failure; and to believe that failure in thought control increases the danger (Clark 2004). In this respect, an inhibitory control, in other words an exclusion of unwanted intrusive thoughts that are considered as threatening from cognitive system, has a great importance to individuals with OCD. In the furtherance of this explanation about the deficits in inhibitory control in OCD, De Ruiter and Brosschot (1994) and Kyrios and Iob (1998) have proposed that the increased Stroop interference may result from an attempt to avoid processing the stimulus because it contains emotionally valenced information, and this effort needed to avoid cognitively processing threatening information increases response latencies. These explanations are consistent with Williams and colleagues'point of view (1996) and they have indicated that not only is Stroop interference related to information processing towards emotional input, but also biased information processing may be determinant. Due to the inability of Stroop task to rule out interpretation biases, the dot-probe task has become an alternative method of assessing attentonal bias (Amir et al. 2009).

The dot-probe task developed by Macleod and colleagues (1986) begins with with the presentation of a central fixation cross (e.g., "+") for 500 ms. The fixation cross is then replaced with two stimuli (e.g., words or faces) side by side on a computer screen. One of the stimuli is threat-related and one is threat-neutral. After 500 ms, both stimuli disappear and a probe (either "←"or "→")is shown in the location of one of the stimuli. Participants indicate as quickly as possible which probe was shown via using keyboard. Higher response rates when the probe is shown in the location of threat-related stimuli are considered as a criterion for attention bias. In order to measure attention bias in OCD, this task was first used by Tata and colleagues (1996). In their study using with dot-probe task comprising semantic manipulation with contamination-related words, OCD patients' response rates towards threat-related words were found to be higher than high trait anxious controls'. Similar results were also found in other studies using dot-probe task (Amir et al. 2009).

To sum up, the results from different studies using different experimental tasks have demonstrated that OCD patients exhibit attentional bias to disorder-specifi stimuli. On the other hand, some studies have shown that OCD patients do not differ from healthy controls (Van den Heuvel et al. 2005, Moritz and von Mühlenen 2008, Harkness et al. 2009).

Among possible accounts for this inconsistency in results, there are differences between the characteristics of the tasks (Bradley et al. 2016) and the stimuli used in those tasks are not sensitive enough to evoke attentional bias in OCD (Moritz et al. 2008). Recently, in order to increase the reliability of dot-probe task, which is one of the most widely used experimental paradigms to measure attentional biases, there are several studies aiming at developing effective methods, and many focused particularly on the development of specific methods for the analysis of data on variables such as the response duration to stimuli used dot-probe task, and testing of different models related to the type and presentation of stimuli (Staugaard 2009, Evans and Britton 2018, Aday and Carlson 2019). There were also some attempts to develop methods in order to increase the reliability of emotional Stroop task (Dresler et al. 2012, Ben-Haim et al. 2016).

Cognitive bias modification

CBM can be seen as an experimental method using a set of stimuli based on information

processing bias (Williams and Grisham 2013). CBM studies were firstly conducted to reveal the biased information processing style in anxiety disorders (MacLeod and Mathews 2012). In these early studies aiming to modify the interpretation bias, ambiguous stimuli were presented to the participants on the computer screen (e.g., word fragment completion task). Then, the participants were provided with a training that would enable them to make more positive or negative inferences by resolving ambiguity. The results of the studies (Mathews and Mackintosh 2000, MacLeod et al. 2002) indicated that it is possible to induce both negative and positive interpretation biases in healthy individuals. A similar effect was obtained in clinical sample and it was observed that the training provided in this way could reduce fear reactions (Teachman and Addison 2008). The fact that these early studies yielded effective results that could modify interpretation biases led researchers and clinicians to investigate the feasibility of CBM as an intervention.

There are two main approaches including interventions aimed at providing a change on cognitive biases: Cognitive Bias Modification-Attention (CBM-A) and Cognitive Bias Modification-Interpretation (CBM-I). In CBM-A studies, revised versions of the standart attention tasks which measure the attentional bias have been used.

In these studies, a training package is provided to shift the attention of the person to non-threatening stimuli (e.g., conditions, words or faces) through various manipulations on the computer screen. On the other hand, in CBM-I studies, ambiguous stimuli are presented to the participants on the computer screen (e.g., word fragment completion task). Individuals are received training focusing on making more positive inferences by resolving ambiguity. As a result of the review of 12 meta-analysis studies conducted in this field (Jones and Sharp 2017), it was found that CBM is effective in reducing anxiety and depression symptoms as well as bias; and it has small effects on reducing symptoms of eating disorders, alcohol abuse and smoking. Moreover, it was reported that CBM-I is more effective in reducing anxiety, while CBM-A is more effective in reducing stress.

In addition to the different examples of CBM studies carried out in the form of computer-based intervention in the internet or laboratory environment, there are also some other paradigms that have been implemented via applications on smartphones. For instance, Enock and colleagues (2014) applied CBM-A program in a manner that is compatible with smartphone technology (i.e., as a form of intervention program via smartphone) in adults with high social anxiety and they achieved promising results. In recent years, gamification method also has been remarkable in terms of increasing the motivation of the participant in the completion of a series of experimental tasks presented in the CBM-A intervention as well (Boendermaker et al. 2015). In that sense, gamification is actually defined as the use of game design in non-game context (Deterding et al. 2011),and these games are described as "serious games" designed primarily for non-entertainment fields such as education and health (Lau et al. 2016). For instance, Dennis and O'Toole (2014) gamified CBM-A for adults with high anxiety using angry-neutral facial expressions of a cartoon character instead of word or face pairs. In contrast to the standart CBM-A interventions, the researches used game graphics in this training. There has been growing interest in this method not only in the field of CBM but also in mental health field to evaluate its effects on reducing symptoms related to psychopathology. Zhang and colleagues'review (2018) demonstrated that there are 8 smartphone applications which had been evaluated scientifically for the delivery of CBM for social anxiety, anxiety and stress, alcohol and tobacco use and insomnia.

To sum up, the adventure of CBM studies that has begun with anxiety disorders is still in a relatively early stage of development for OCD. Nevertheless, there are also methodological limitations which makes comparison between studies difficult (Jones and Sharp 2017). Several of the studies examining the effects of CBM on OCD symptoms have focused on the effects of CBM-I training. However, the number of the studies focusing on the the effects of CBM-A training is limited.

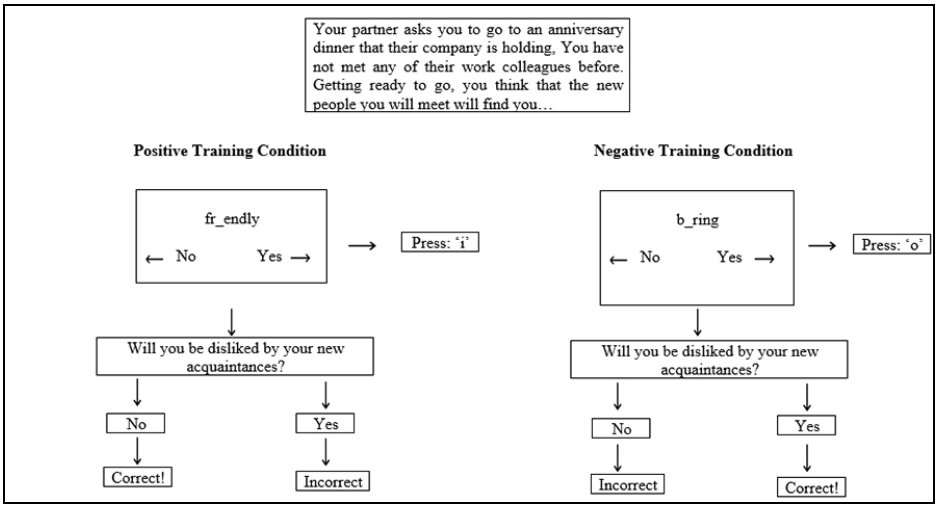

Figure 1. The example of positive and negative CBM-I training

OCD and interpretation bias modification

An experimental task consisting of anxiety-provoking and threatening scenarios developed by Mathews and Mackintosh (2000), has been widely used to modify interpretation biases. This task involves a decision-making process (e.g., word fragment completion task) after an ambiguous stimulus (e.g., words with a missing letter). In this decision-making process, the participants is provided with a training aiming to enable them to interpret ambiguous information in a positive or negative manner. An example requiring a participant to resolve the ambiguity of a scenario by selecting the missing letter to complete the sentence is: "Your partner asks you to go to an anniversary dinner that their company is holding, You have not met any of their work colleagues before. Getting ready to go, you think that the new people you will meet will find you b_ring/fr_endly." Each description is displayed at a time, until just before participants reach the final word. In this phase, a word fragment is presented that matched one of the designated final words (requiring the participant to enter the letter "i" to form the word "friendly" in the positive condition or to enter the letter "o" to form the word "boring"in the negative condition). When the fragment is correctly solved, a comprehension question to ensure the participant has processed the meaning of the sentence "Will you be disliked by your new acquaintances?" (Yes/No). Answers are followed by feedback ("correct" or "incorrect" message) depending on the condition. For example, in the positive condition, after presentation of the fragment corresponding to "friendly", the required answer is "Yes" whereas after the fragment corresponding to "boring", it is "No". In the negative condi-

tion, after presentation of the fragment corresponding to "boring", the required answer is "Yes" whereas after the fragment corresponding to "friendly", it is "No" (see Figure 1). In order to reduce interpretation biases, scenarios are always presented in the positive condition. In other words, a positive meaning emerges when the word fragment is correctly solved. For example, in the scenario previously shown, the positive condition is designed to strengthen the relationship between a social situation and the positive outcomes that may be associated with this situation. In this way, a contingency learning with stimulus-response proportion (Schmidt et al. 2007) is established between the ambiguous start of the scenario and a positive resolution in order to create a new learning. It is expected to increase individual's tendency to make more positive inferences about the associated consequences of similar situations in real life, thereby learning such contingency via repeatedly presenting a set of different scenarios in the computer environment (Williams and Grisham 2013).

This experimental task developed by Mathews and Mackintosh (2000) has been widely used in the CBM-I studies of OCD. Because OCD is a heterogeneous disorder, Clerkin and Teachman (2011) designed the scenarios in the task based on the domains outlined by the OCCWG (2003, 2005). In relevant studies, every training scenario presented to each participant in experimental group ends with a positive meaning when the word fragment is correctly solved. In control group, half the scenarios have a positive resolution while the remaining scenarios have a negative resolution. In a study with a nonclinical sample of students high in OCD symptoms, Clerkin and Teachman (2011) reported that participants in positive CBM-I condition endorsed healthier OCD-relevant interpretations and beliefs following training compared to participants in control condition. Williams and Grisham (2013) replicated the the study of Clerkin and Teachman (2011) and they reported similar findings. In addition, the researches reported that severity of OCD symptoms did not moderate the effects of positive CBM-I training; in other words, CBM-I was effective in reducing interpretation biases regardless of the symptom severity. Beadel and colleagues (2014) also revealed a similar effect of CBM-I on OCD belief domains.

In some studies, the effect of CBM-I had been tested specifically for certain belief domains associated with OCD. To illustrate, Grisham and colleagues (2014) found a decrease in the beliefs of participants with high levels of inflated responsibility following CBM-I which consists of scenarios particularly aimed at reducing such beliefs. Clerkin and colleagues (2014) reported that CBM-I which was designed to modify beliefs about importance and need to control thoughts was effective in reducing such beliefs. Stech and Grisham (2017) tested the effect of CBM-I which was designed to modify same belief domain via adding a online session to a laboratory session and they reported similar findings.

In another study with non-clinical sample of students, Siwiec (2015) examined whether CBM-I can impact TAF strength and OCD symptoms via adding two online sessions to a laboratory session. There were actually no differences between experimental and control groups in the study, while there were decreases in TAF and anxiety scores in both groups. After a while, Siwiec and colleagues (2017) further tested the CBM-I including only a laboratory session in non-clinical sample of students. The results of the study indicated that participants in the positive CBM-I condition designed to decrease obsessional thoughts associated with TAF exhibited significantly greater reduction in the

severity of total TAF and TAF-Morality than the participants in the control condition while reductions on TAF-Likelihood did not differ by group.

Black and Grisham (2016) tested the effect of positive CBM-I training designed to decrease memory distrust and intolerance of uncertainty in a non-clinical sample. In this study, participants were given a written or auditory scenarios. Accordingly, the researches assigned each participant to four different contidions: auditory or verbal positive or control CBM-I training. The results of the study demonstrated that reductions on memory distrust and intolerance of uncertainty did not differ between auditory positive CBM-I training and verbal positive CBM-I groups. On the other hand, it was reported that participants in auditory positive CBM-I training condition exhibited more reduction in interpretation biases compared to participants in auditory control CBM-I training condition. These results indicated that CBM-I was effective in reducing interpretation biases independently of the type of stimulus presentation method (written or auditory) (Black and Grisham 2016). The researches conducted similar study with OCD patients (Black ve Grisham 2018) but this time they used scenarios associated with perfectionism as well. They tested the effect of CBM-I via adding a three online sessions to three laboratory sessions. It was reported that reductions on interpretation biases did not differ by group and participants in both conditions endorsed more adaptive OCD-relevant beliefs following training. The researches stated that the lack of differences between the groups may be related to the fact that OCD is a heterogeneous disorder and individual differences exist in terms of clinical features.

Words Sentence Association Paradigm (Beard and Amir 2009) that has been used previously to assess interpretation bias in social anxiety has been also used in CBM-I studies of OCD. The task begins with the presentation of a word/phrase representing either a threat interpretation (e.g., "dog-poop") or a benign interpretation (e.g., "twig") in the center of the computer screen. After 500 ms, stimulus disappears and an ambiguous sentence (e.g., "I stepped on something brown.") appears. This sentence remains on the screen until participants press the space bar indicating that they have finished reading the sentence. When participants finished the reading the sentence, a comprehension question to ensure the participant has processed the meaning of the sentence "Was the word related to the sentence?" (Agree/Disagree). Answers are followed by feedback ("correct" or "incorrect" message) depending on the condition. For example, in the positive condition, after presentation of the benign interpretation corresponding to "twig", the required answer is "Agree" whereas after the threat interpretation corresponding to "dog-poop", it is "Disagree". The results of CBM-I studies of OCD using this method (Amir et al. 2015, Najmi and Amir 2017) are consistent with the results of another studies using the method developed by Mathews and Mackintosh (2000).

Tos um up, relevant studies have demonstrated that CBM-I is effective method in increasing in OCD-specific adaptive interpretive biases. However, there are significant limitations of the studies. These limitations are common in studies of CBM-I in other disorders as well (Macleod 2012, Jones and Sharp 2017). One of the most important limitation in these studies is the the use of analogue samples. Neveretheless, as Abramowitz and colleagues (2014) reviewed empirical research on the epidemiology, etiology, phenomenology of OCD symptoms, and studies on developmental and maintenance factors in both clinical and analogue samples, they concluded that also research with analogue samples is highly relevant for understanding and making inferences for OCD; thus, it is very reasonable to include analogue samples in suh studies.

Another salient limitation here is that there are differences in methodological paradigms of these studies. CBM-I studies of OCD range from BYD-Y studies in OCD range from single session to two-to-three sessions that are given on consecutive days or with one-day intervals. There are differences between studies in terms of frequency of sessions as well as the duration. In addition, the environments in which the CBM-I studies are carried out differ in the form of laboratory, online or a combination of both. All these limitations make comparisons between studies difficult.

OCD and attentional bias modification

Originally introduced as a measurement tool to assess the attentional bias (MacLeod et al. 1986), a modified version of the dot-probe task has been used to alter attention bias (see Figure 2). The probe appears at the two locations with equal frequency (50%-50%) in standart dot-probe task while the probe appears in the location of the neutral stimulus in 80%-100% of trials in modified dot-probe task. Thus, it is aimed at reducing attention bias via using this approach in which task performance is facilitated by attending to neutral stimuli and away from threat-related stimuli. In other words, the modified dot-probe task links the appearance of the probe to the neutral stimulus by establishing a contingency between their locations.

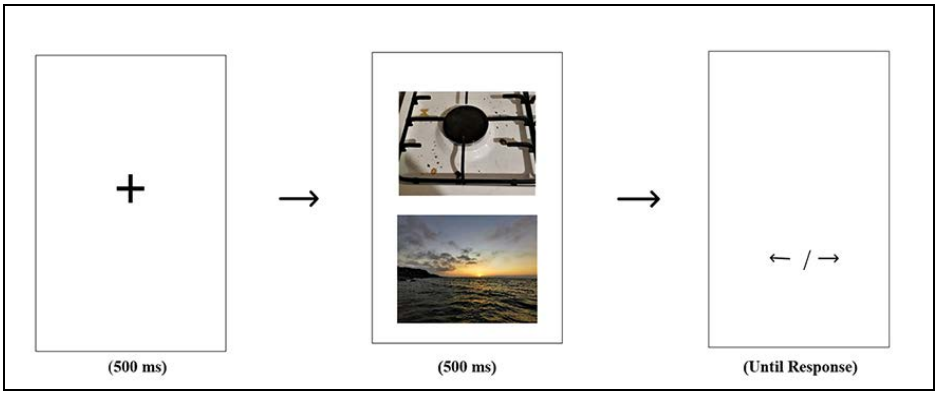

Figure 2. A modified dot-probe task using in CBM-A

In CBM-A studies of OCD, participants in experimental group are given the modified dot-probe task as attention training and so that the probe is presented in the location of the neutral stimulus in 100% of trials. The dot-probe task is not modified in control condition, so that the probe is presented at the two locations with equal frequence (50%-50%). In study using with a modified dot-probe task with contamination and checking-related pictures, Habedank and colleagues (2017) examined the effect of an online, eight-session CBM-A training in non-clinical sample of individuals high in OCD symptoms. It was reported that participants receiving CBM-A showed a significant reduction in attention bias compared to participants in control group. However, participants who were received CBM-A did not differ from participants in control group with regard to symptom reduction and the reduction in OCD symptoms was found in both groups. The results of 1-month follow-up study have demonstrated that the reduction of symptoms remained stable at in both both groups. Najmi and Amir (2010) ap-

plied the CBM-A for subclinical washers by integrating contamination-related words in the task. The researches indicated that participants receiving CBM-A showed a significant reduction in attention bias to contamination-related stimuli compared to participants in control group. More importantly, the facilitating effect of CBM-A during ERP was also reported. Participants receiving CBM-A completed more steps in ERP compared to participants in control group. Similar results were reported by similarly conducted studies (Amir et al. 2015, Najmi and Amir 2017).

In another study, Rouel and Smith (2018) used a modified spatial cuing task instead of a modified dot-probe task. The standart spatial cuing task (Posner 1980), which is originally introduced as a measurement tool to assess the attentional bias, begins with the presentation of a central fixation cross (e.g., "+") for 500 ms with two white rectangles presented on either side on a computer screen. One white rectangle is then replaced by threat-related picture presented for either 100 or 500 ms. Then both the white rectangle and the picture disappear and a probe (either "X" or "/") is shown in the location of either the picture or the rectangle Participants indicate as quickly as possible which probe was shown via using keyboard. Higher response rates when the probe is shown in the location of threat-related stimuli are considered as a criterion for attention bias. The probe appears at the two locations with equal frequency (50%-50%) in standart spatial cuing task. On the other hand, Rouel and Smith (2018) modified the task as attention training and so that the probe is presented in the location of the neutral stimulus in 100% of trials in the task in their study. Thus, they aimed at reducing attention bias via using this approach. The results of the study with non-clinical sample of individuals high in contamination-related OCD symptoms have demonstrated that participants receiving CBM-A training exhibited a significant reduction in attention bias to contamination-related stimuli compared to participants in control group.

To sum up, empirical studies have showed that CBM-A is effective in reducing attention bias in OCD. However, CBM-A may not produce effects that are strong enough to generalize to all cases. Despite the results that showed CBM-A training provides a reduction in attentional bias to symptom-related and threatening stimuli in OCD and thereby increase the effect of ERP, it has not found to be entirely effective in reducing OCD symptoms in some studies (Najmi and Amir 2010). It is suggested that such an effect occurs more often in the case of CBM-A training given in more than one session (Amir et al. 2015, Najmi and Amir 2017). In this respect, as in CBM-I, increasing the number of sessions in CBM-A training would provide a more effective approach on OCD symptoms.

Conclusion

The use of technology in the field of mental health has been increasing day by day. It is seen that the number of scientific studies on the subject has increased as well. One of the new methods is CBM, which can be defined as experimental tasks that focus on changing biased information processing associated with psychopathology with healthier information processing. Also, in Turkey, there is a study examining the effect of CBM-A training in non-clinical sample of students high in anxiety symptoms (Booth et al. 2014). Although the effects of CBM have started to investigate in anxiety disorders so far, it is possible to see current examples in OCD as well. There are a limited number of studies in OCD where this method is tested using different experimental research designs. The

results of these studies have shown that CBM is an effective and promising method in reducing cognitive biases in OCD. In addition, there are promising results that show the use of CBM as an adjunct techniques to the standart CBT enhances treatment effects.

In cognitive models, it is often suggested that there is a mutual interaction between different biases in the development and maintenance of psychopathologies. However, many research have focused mainly on only one of these biases (Hirsch et al. 2006). This condition is actually similar in the field of CBM studies. Nonetheless, recently, in line with the views on the common effect of bias, there are a couple of studies to test the effect of combined Cognitive Bias Modification programs (Beard et al. 2011, Brosan et al. 2011, Everaert et al. 2013), which is combination of both CBM-A and CBM-I in intervention programs. The results of these studies are generally very positive. Although only one bias is targeted in CBM studies of OCD, the potential of the implementation of combined techniques is a matter of curiosity. In Turkey, such a preliminary study including combined intervention in a non-clinical sample of students with high levels of social anxiety reported positive results (e.g., Koç 2016). More importantly, there is first attempt on testing efficacy of combined modification programs for OCD in Turkey as well (Derin 2019). All in all, considering that technological tools occupy our daily life significantly, it can be foreseen that such tools will find their place in the field of mental health as supportive intervention tools in the near future.

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