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A Review on Face / Emotion Recognition Performances and Levels of Emotial Stimulation in Schizotypals

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Abstract

Socialization is very important for a healthy life. Achieving socialization in the right sense is closely related to individuals' face and emotion recognition performance and competence in social life. Otherwise, individuals are likely to encounter social exclusion. Studies indicate that the face and emotion recognition performances of individuals with schizophrenia are inadequate. In particular, there are opinions that volumetric differences in the amygdala and related parts of the brain (which can be counted as the amygdala, superior temporal gyrus and fusiform gyrus) affect performance in this direction. For schizotypal personality disorder, which is defined as one of the Schizophrenia Spectrum Disorders, the results of studies in this direction are contradictory. It is aimed to compare the results of experimental studies on face and emotion recognition performances in individuals with schizotypal personality disorder and to identify some gaps and deficiencies in this subject with the studies we have done in the literature.

Keywords

Schizophrenia, Schizotypy, Schizotypal, Face-emotion recognition performances.

INTRODUCTION

Schizotypy and Schizotypal Definition

''The term schizotypy was first defined by Sandor Rado as a non-phenotypic form of schizophrenia and a personality organization that occurs on the basis of a genetic predisposition [1]. ''After Rado, Paul Meehl [2] brought a new dimension and neurodevelopmental A model has emerged. This model paved the way for the spread of schizotypy. ''In this model, Meehl highlighted a personality formation that arises due to a deterioration in dissociation, where schizotypy is defined as schizotaxia, and emerges with the addition of the social and activity of a heritable schizophrenic phenotype [1]. Faraone et al. [3], on the other hand, put forward a model contrary to Meehl's theory and claimed that schizotaxia is a stable syndrome and that it does not progress to schizotypal personality disorder or schizophrenia in most cases.

Lewandowski et al. [4], on the other hand, revealed that schizotypic individuals have lifelong sensory-motor disorders, discontinuity in associations, excessive fear in human relationships, and impairment in maintaining attention, but never develop symptoms of mental illness [4]. "The concept of schizophrenia spectrum was first defined by Kety and his colleagues [5], and schizophrenia spectrum disorders cover a group of disorders, including schizophrenia, that are similar to schizophrenia but may show milder symptoms than schizophrenia [1]." 'These disorders share some common clinical elements. Schizoaffective disorder, schizotypal personality disorder, paranoid personality disorder and schizoid personality disorder are disorders in this spectrum [6]. Recently, schizotaxia and schizotypy have also been included in the schizophrenia spectrum disorders [6] and schizotypy has been accepted as the prototype of schizophrenia spectrum disorders [7]. Schizotypal personality disorder is a diagnosis that was previously included in the axis II disorders classification of DSM-IV-TR (Diagnostic and Statistical Manual of Mental Disorders, IV. Edition-Text Revised). Although it shows similarities to schizophrenia in terms of clinical symptoms and cognitive abilities, the severity of the symptoms is lower. The common point in all definitions is that schizotypy refers to a condition that has a genetic link with schizophrenia, but its conceptual use varies. In some studies, it has been observed that the term schizotypy is used instead of the definitions schizotypal personality, a multidimensional personality trait that indicates a tendency to psychosis [8], or schizotypal personality disorder. Schizotypy is similar to schizophrenia in terms of its dimensional structure and neurocognitive features [9]. However, unlike schizophrenia, the symptoms are less severe and neurocognitive disorders cover less area. Today, schizotypy is defined as a concept that refers to schizophrenia-like symptoms that are included in the schizophrenia spectrum disorders and do not reach the clinical level [1].

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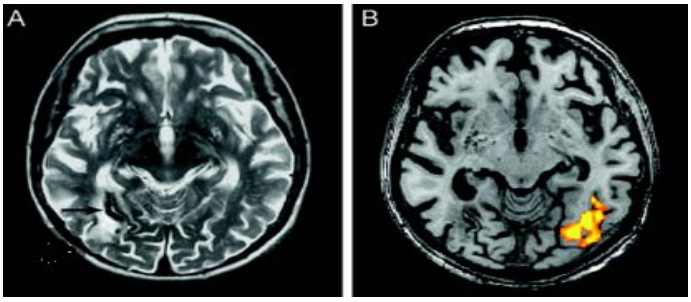
Face and Emotion Recognition Area

Some studies have investigated brain regions and processes related to face/emotion recognition. Among these areas, the amygdala is associated with both face and emotion recognition, while the fusiform gyrus is associated with face recognition and the superior temporal gyrus with emotion recognition. However, it has been stated that the dorsolateral prefrontal cortex, the part of the amygdala related to working memory, has a functional indirect connection and this connection is provided through the ventromedial prefrontal cortex."Disorders in facial and emotion recognition processes are thought to cause symptoms such as social withdrawal and delusions in schizophrenia and to be related to cognitive processes" [10]. Studies show that individuals with schizophrenia respond slower to emotional stimuli than control groups, and it has also been found that they identify negative faces faster than positive ones and remember stimuli with high emotional content more easily than neutral stimuli. When we look at the literature, there are studies on face and emotion recognition for schizophrenia and schizophrenia spectrum disorders. At this point, many studies point to impairments in face and emotion recognition processes in schizophrenia, and there seems to be almost a consensus on this issue in the literature. The results of studies conducted on people diagnosed with schizotypy are contradictory.

Inability to Recognize Faces

Prosopagnosia

Individuals cannot see faces fully due to a cognitive disorder called prosopagnosia, also known as face blindness. Prosopagnosia is a neurological disorder in which the area of the person's brain responsible for recognizing faces is underdeveloped or subsequently damaged. The term prosopagnosia is derived from the Greek words "prosopo" and "agnosia", meaning "face" and "lack of knowledge". It can also be expressed literally as "face blindness". Contrary to popular belief, prosopagnosia is not associated with memory loss, visual impairment or learning disabilities. These features were not affected in individuals. However, recent studies show that the rate of prosopagnosia is high in patients with autism and Asperger Syndrome. The disorder is thought to occur primarily as a result of damage and/or abnormalities in the fusiform gyrus (the region of the brain that controls face perception and related memory). However, it has also been reported to occur in inferior occipital and anterior temporal cortex injuries. The fusiform gyrus in question is also known as the lateral occipitotemporal gyrus. It is located in the 37th Brodmann area at the intersection of the temporal and occipital regions. Depending on the degree of damage caused, people may experience prosopagnosia in different ways. On the other hand, dyslexia (reading/learning disorder) and synesthesia (sensory confusion) can also be seen in fusiform gyrus damage. Therefore, do not think that only one complication is seen. Coming back to the topic, under conditions where damage is minimal, a person may experience the inability to recognize the faces of people with whom he or she is not closely related. Much rarer etiologies (causes) may include tumor compression in this area, damage due to carbon monoxide poisoning, surgical complications, encephalitis (brain inflammation) and Alzheimer's disease. In cases of moderate damage, the person may have difficulty recognizing people with whom he or she is in close contact (for example, the family circle). At advanced levels, the person may have problems not being able to recognize his or her own face in the mirror or even being unable to distinguish faces from objects. If acquired prosopagnosia occurs as a result of damage in early childhood, the child may grow up without fully developing the ability to recognize faces, without realizing that he or she cannot recognize faces. Acquired prosopagnosia, which occurs as a result of subsequent damage and abnormalities, is rare. The majority of cases indicate congenital prosopagnosia.



Figüre 1: Transient Prosopagnosia after İschemic Stroke [11].

It can be said that congenital prosopagnosia occurs as a result of genetic mutation and gene deletion. There is no specific treatment for prosopagnosia. However, it is thought that therapeutic strategies to help recognize human faces or techniques that attempt to restore normal face processing mechanisms may work for patients with both developmental and acquired prosopagnosia [12,13].

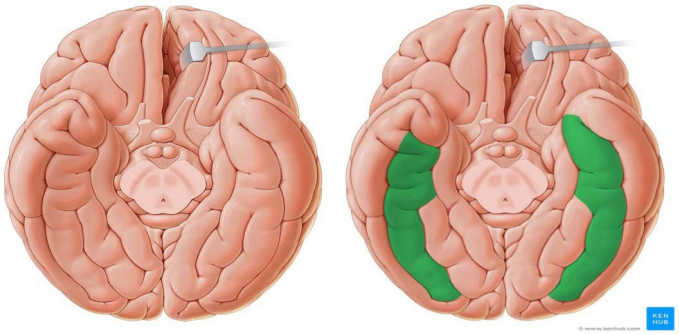


Figure 2: Anatomical Location of the Fusiform Gyrus at the Base of the Brain, Shown in Green [14].

Preliminary Studies

Some studies in this field seem to have revealed that there is a disorder in face and emotion recognition processes [15]. In studies examining the relationship between the severity of schizotypy and face and emotion recognition, it has been shown that facial emotion recognition is weaker in people with high schizotypy than in controls, and the weakness is mostly in recognizing the emotions of happiness and surprise [16]. Mikhailova et al. [16] investigated facial and emotion identification processes in depressive, schizotypal and healthy groups. In the group with schizotypals, performances in face and emotion recognition processes were found to be significantly lower in general, especially low performances in sad and happy facial expressions stood out. This situation underlines the investigation of neurophysiological differences in schizotypals. In a study conducted by Toomey, Rosemary and David Schuldberg [17], schizophrenia spectrum disorders were investigated. The study focused on the possibility that deficiencies in decoding emotional codes may occur late in life, but no significant differences between groups were found [18].

Other studies on schizotypy and emotion recognition are also growing, with Waldeck and Miller [19] showing that in schizotypy, there are more difficulties in the warmth of positive emotions such as happiness and surprise, at this point, relationships are seen especially between positive schizotypal traits and the recognition of negative developments [19,20]. A study by Gur et al. [21] revealed that, while there was a decrease in bilateral hippocampal and left amygdala activity in schizophrenic patients in recovery tasks by separating

positive emotion from negativity, an increase in exactly the same activity was observed in control groups [21].

Current Studies

Our review of the literature on the relevant subject led us to another study by C. Dickey et al. [22]. This study is about fusiform gyrus volume and face/emotion recognition performances in schizophrenia and schizotypal patients. According to the results of this study, the results are abnormal in schizophrenia, and no significant differences were found for schizotypals. In this study, fusiform gyrus volume in particular was associated with magical thinking and illusions, and further research was emphasized [22]. However, while it has been shown that positive schizotypy is associated with the impairment in recognizing negative emotions such as fear, sadness and anger [23], studies by Williams et al. [24] indicate that negative schizotypy is associated with the impairment in recognizing negative facial expressions. Their findings that it is are open to evaluation [24]. In a study conducted by Jahshan and Sergi [25], high schizotypy (n= 52) and low schizotypy (n= 40) groups; It has been investigated in terms of secondary memory, executive function, and two elements of social cognition (emotion perception and theory of mind). No significant differences were found in theory of mind, emotion perception, secondary memory and executive functions in individuals with high schizotypy compared to low individuals [25]. In another study, no significant differences were found in face and emotion recognition performances between schizotypals and control groups [24]. It has been shown that there are structural and functional abnormalities in these brain regions in schizophrenia spectrum disorders [26,27]. However, in a functional imaging study by Yoon et al. [28]; While functional abnormalities were found in the amygdala and superior temporal gyrus during face and emotion recognition processes, no abnormalities were detected in the fusiform gyrus, the brain region involved in face recognition [28]. Williams et al. [24] found that there is a relationship between the severity of schizotypal features and poorer emotion recognition, especially positive emotions. In the relevant study using the Benton Face Recognition Test, significant differences were found in the face recognition performances of individuals with low and high schizotypy, and the performances of individuals with high schizotypy were found to be significantly lower [24]. J. Schmid et al. [29] conducted a similar study with Frontotemporal Dementia patients using facial expressions developed by Paul Ekman, and significant differences were observed in face recognition performances in this group of patients compared to the control groups. Dementia patients showed lower performance than control groups [29]. In another study conducted in the same year, emotion recognition performances in schizotypals were found to be significantly lower than in control groups, and this is significant for the healthy maintenance of social cognition and responding [30]. In another study, Suslow and colleagues [31] investigated amygdala activation in face and emotion recognition processes. Increased amygdala activation has been found in the perception of emotional faces in patients with depression [31]. Henry et al. [32] observed the suppression of affect and emotions in high-level schizotypals. This study linked negative schizotypy with blunted affect. According to the study, blunted affect is associated with increased suppression, and blunted affect should be investigated in this regard in schizophrenia and similar disorders [32]. In another study conducted by Phillips, L. K, and Seidman [33], it was underlined that impairments in emotional processing processes occur prominently in schizophrenia, but the tendency is lower in schizophrenic disorders, and in this sense, psychophysiological factors should be further investigated [33]. Another skill in which Autism Spectrum Disorder and Schizophrenia Spectrum Disorders have been investigated [34] is to underline the fact that the impairments that begin in childhood lead to impairments in social cognition with the display of schizotypal and autistic features in later periods. It is also underlined that these impairments will increase schizotypal behaviors in children with autism. Attention has not been paid to the amount of growth memory load involved in face and emotion recognition in schizotypy, but a contribution to memory capacity has been included in schizophrenia [35]. So, what are the perspectives on the difference compared to control in schizophrenia and schizophrenia spectrum disorders? At this point, naturally, making an evaluation without looking at brain efficiency and the differences between them will be quite insufficient. First of all, the examinations identified areas related to face and emotion recognition. According to the results of these studies, the areas in the brain where face and emotion recognition can be transmitted are the amygdala, superior temporal gyrus and fusiform gyrus.

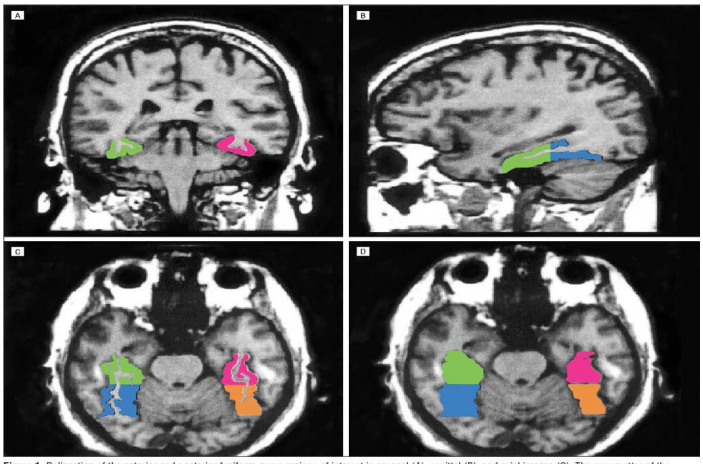


Figure 3. Delineation of the anterior and posterior fusiform gyrus regions of interest in coronal (A), sagittal (B), and axial images (C). The gray matter of the anterior fusiform gyrus is shown in red (subject left) and green (subject right). The gray matter of the posterior fusiform gyrus is shown in orange (subject left) and blue (subject right). D, A 3-dimensional reconstruction of the fusiform gyrus [36].

There are also studies in the literature suggesting that there are some differences in the ability to recognize emotions in relation to schizotypy dimensions [37]. A thesis study prepared by L.Brown [38] highlighted face/emotion recognition deficits in schizophrenia and also revealed that the schizotypy group exhibited lower performance in locating face labels compared to controls, but no general impairment was detected in neurocognitive measurements. In this study, disorganized symptoms and low quality of life were associated with negative interpretation of statements. This situation pointed out social-cognitive biases in schizotypy. Germine et al. [39] draw attention to the relationship between susceptibility to psychosis and face/emotion recognition ability in a study they conducted. However, there are no differences between genders. The results regarding schizotypals were found to be related to individual differences [39]. Performance in face recognition abilities was investigated in another study on the basis of schizophrenia and heredity [40]. In the relevant research, comparisons were made between individuals with schizophrenia, their first-degree relatives and healthy control groups, and the effect of heredity was pointed out. According to the results of another study, the increase in working memory tasks and memory load in the brain causes the amygdala to take part through this connection [41]. There are also studies supporting that impairment in face and emotion recognition, which is the main cause of problems in social communication in schizophrenia, is associated with amygdala volume decrease and amygdala damage. Yann Quide et al. [42] evaluated schizotypal, bipolar and healthy groups within the scope

of childhood trauma.Those who experienced childhood trauma in all groups; showed lower performance in skepticism and social cognitive abilities. Evaluations were made in the areas of face recognition, working memory, attention, immediate and delayed memory [42]. According to another study conducted by Brown and Cohen [37] on schizotypals, a different result was found. Research findings showed that the schizotypy group had significant differences (lower performance) in the recognition performance of only neutral expressions compared to the controls, that both groups had low performance in recognizing negative expressions, and that there was no difference in terms of correct response times in face / emotion recognition processes [37]. Castro and Pearson [43] completed their research on schizotypy with a dichotic listening task. Accordingly, there are striking disturbances in language and emotional prosody in schizophrenia. Schizotypal personality traits are expressed subclinically. In this study, high-level schizotypals showed lower sensitivity in the dichotic listening task. This condition was not found to be associated with atypical lateralization of language and emotion in schizotypy, but was associated with lower emotion recognition performance [43]. In the same year, S. Van Rijin et al. [44] conducted a study on adolescents who were prone to psychosis and had a high tendency to schizotypy. Accordingly, the participants showed poor performance in identifying neutral faces and tended to describe neutral faces as angry. This situation drew attention to the relationship between misattributing social cues and susceptibility to psychosis [44]. According to the results of another study conducted by Canli et al. [1] within the scope of Kırıkkale University, the schizotypy group showed the lowest performance in the processes of recognizing the feeling of happiness, but other than that, no significant difference was detected between the groups. It was observed that this finding was explained by the fact that the decrease in emotion recognition performance in the schizotypy group was due to the effect of working memory [1]. Premkumar et al. [45] conducted a study on the fear of rejection in schizotypals. According to this study, fear of rejection leads to greater perceptions of insecurity and stress in close relationships. This activates the dorsal anterior cingulate. Unusual perceptual experiences and strange beliefs characterized by schizotypals increase susceptibility to rejection [45]. Roddy et al. [46] conducted their research on 793 children with psychotic tendencies (schizophrenia). Accordingly, there are significant differences in face recognition performances compared to controls, especially their performance in recognizing sad faces is quite low [46]. Another study is on alexithymia and schizotypy using the Oxford Liverpool Emotion Inventory [47]. In this study, similarly low performances were achieved in face and emotion recognition processes. Luis H. R. et al. [48] conducted a study on schizotypals using the Empathic Accuracy Paradigm and Mind Reading Test in the Eyes. According to the study results, schizotypals showed empathic dysfunction, and this was associated with the lack of social support in schizophrenia spectrum disorders. In this context, there is a connection between avoidance, empathic dysfunction, and lack of social support [48]. In a study conducted using f-MRI, Jia Huang et al. [49] investigated the changing facial expressions in daily life between schizotypal and control groups. The study identified changes in the face of stimuli that increase happiness (praise) or decrease happiness (blame). More inactive periods were detected in the left posterior cingulate and right superior temporal gyrus in response to stimuli in schizotypals. This point to the neural basis of social interaction deficits in schizotypals [49]. Cohen AS et al. [50] investigated natural facial expressions on individuals with high schizotypy tendency (n=28). Facial expression changes were examined in the laboratory. Facial expression changes were found to be closely related to the measure of psychoticism. In the study; Measurements of depression, anxiety, paranoia and schizotypy were made. The study found significant differences between groups in facial expressions in response to stimuli [50]. In another study, the effect of marijuana and hemp use on face and emotion recognition performances in individuals with schizotypy was investigated [51]. According to the findings of this study using Nimstim photo sets, marijuana use negatively affects facial recognition performances, while hemp use has the opposite effect. The use of both substances together did not create a significant difference in individuals with schizotypy. Rahnel AB et al. [52] used the Oxford – Liverpool Emotions and Experiences Inventory in their study. Findings support neurophysiological deficits in high schizotypy [52]. Christian G. K and colleagues [53] investigated facial recognition performance among schizophrenia, genetic risk groups and control groups. Differences have been detected in genetically predisposed individuals, especially in the identification of facial expressions of happiness, anger and fear. The most obvious difference between the groups belongs to the fear facial expression [53]. Eduardo F. and his colleagues [54] investigated the mirror effect in their study. At this point, in the study based on the fact that individuals with schizophrenia show strange facial expressions when looking at their own faces in the mirror, evaluations were made on the point that this tendency creates desensitization over time. In a control group study using the Mirror Looking Test, it was determined that while a tendency towards positive and disorganized schizotypy was observed in adolescents with abnormal experiences, the results between the two groups differed considerably [54]. Shota Uono et al. [55], in their study conducted in the same year, emphasized the connection between understanding emotional facial expressions and social interaction. Impairments have been clearly identified in some psychiatric diseases. In this study, groups with autism and schizotypal tendencies were compared. Accordingly, in the results of the exaggerated dynamic facial expressions perception test, schizotypals tend to exaggerate emotional facial expressions. A positive relationship has been found between schizotypal features and the degree of dynamic and static facial expressions [55]. Cohen A.S. et al. [56] also investigated the diathesis-stress model on schizotypals in their research. Accordingly, there may be neurobiological and psychological foundations, relational drives, hedonic capacity, social cognition and stress response systems behind the problems in social cognitive abilities, especially in schizotypy [56]. Catalan A. et al. [57] compared facial recognition processes (FER) in first episode psychosis, borderline and control groups. While there was no significant difference in angry facial expressions between the groups, significant differences were observed in fear and happy facial expressions [57]. Ji Woon Jeong et al. [58] investigated multimodal emotion perception in schizotypy using EEG. In the study in which EEG recordings were taken with visual and auditory stimuli, over 98% accuracy in classification and zero false positive results were obtained [58]. Farsham A. and his colleagues [59] conducted a study on the facial recognition performances of borderlines and schizotypals. According to the findings of the research, there are significant differences between schizotypals, borderline personality disorder and control groups. Accordingly, there are differences in the recognition of borderline fear and curiosity in the schizotypal group. Significant differences regarding the feeling of disgust were detected in all three groups [59]. In another study conducted in the same year [60], autism spectrum disorder and schizotypal patients and control groups were compared in terms of social cognition. In this study, amygdala activations were investigated using MRI. Compared to autism, in the schizotypal group, an activation difference was observed in response to stimuli in the right posterior cerebellum, fusiform, inferior temporal gyrus, left posterior cerebellum, left intraparietal sulcus, and fusiform gyrus extending along the medial parts of the temporal gyrus. If we look at

the research on face and emotion recognition in recent years; Aghvinian M. et al. [61] conducted a large-scale study with individuals with high and low schizotypy. In this study, social, cognitive and emotional functioning in individuals with high schizotypy (n = 92) and low schizotypy (n = 22) was examined. According to research findings, individuals with high schizotypy failed tests related to working memory, empathy, and social functioning compared to those with low schizotypy. In particular, individuals with high schizotypy exhibit functional deficits, such as deficiencies in friendships, family relationships, interpersonal interactions, and recreational activities. According to research findings, individuals with schizotypy experience major problems in social functioning in addition to having weak cognitive and emotional skills [61]. Yi Mang et al. [62] conducted a study on high negative schizotypy (n= 64) and low negative schizotypy (n= 34). In this research, amygdala activation was monitored in response to facial expressions. Accordingly, the high NS group showed lower amygdala activation in fear and neutral facial expressions. Especially in the group with high NS, low activation was observed in the dorsal anterior cingulate cortex in the fearful situation [62]. Again, in the same year, Rössler J et al. [63] investigated the effect of dopamine in schizotypals using f-MRI. The effect of dopamine in schizophrenics is known, but in schizotypals the issue of dopaminergic involvement is unclear. According to research results, dopamine-induced striato-occipital dissociation may be related to schizotypalism, but more research is needed on this subject [63]. A study conducted in 2019 [64] calculated the effect of childhood trauma between high negative schizotypy (n=74) and low negative schizotypy (n=52) groups. In this research, research was conducted on 4 basic emotions and amplitudes were monitored in response to stimuli. The high NS group showed reduced P100 amplitude in all facial expressions. Larger N170 amplitudes emerged for angry and fearful expressions than for disgust and happiness. Happy expressions yielded shorter N170 latency than disgust. As a result, the high NS group appears to have greater impairments in basic visual processing compared to the low NS group. Yu Liang et al. [65] investigated happy - excited, angry - sad facial expressions in low NS and high NS. According to the findings of this research, the rate of affect reporting to stimuli is low in people with low NS, and this rate is much higher in those with high NS [65]. Smith ES et al. [66] conducted an interesting study. This study was developed on the attention and reactions of mothers with schizotypal tendencies and their 6-month-old babies. In the study, standardized positive and negative faces were shown to parents and their babies, and potential reactions to the event were evaluated. Accordingly, in 6-month-old babies, reaction and attention to stimuli are not affected by the mother's personality. Schizotypic mothers, on the other hand, showed greater amplitude for fearful facial expressions compared to happiness, unlike non-schizotypic mothers [66]. A study conducted by Eunchang et al. [67] was based on the claim that schizophrenia patients and individuals at ultra-high risk for psychosis have low facial and emotional expression recognition performance. The study regarding this claim was conducted among high-risk (n = 43) and healthy (n = 57) people. Accordingly, high-risk groups in terms of schizotypy and individuals prone to paranoia were compared. In tasks created with 60 photo sets, high-risk individuals showed lower performance in face recognition than healthy controls. This condition was found to be associated with a tendency to schizotypy, but not to paranoia [67]. Another study conducted in 2020 is a thesis study conducted by Ashley Cheyanne [68]. This study is a study on attention and focus in schizotypals. According to the study in question, there are claims that schizotypals show reduced fixation with unfamiliar eyes. According to the findings of this research, no significant difference was found in the time it took for schizotypals to focus on foreign eyes for neutral and happy faces [68]. Another study is by Dr. Julie Hall and Prof.Dr. It was conducted by Ruth Krebs between 2018 and 2020. According to the findings of the research, the presence of schizotypal features indicates negative processes in the processing of emotions and emotional evaluation. According to the results of the study, individuals with high schizotypy show slower performance in processing facial expressions, and this may be related to noradrenaline emotion processing processes. For this reason, there is a need to increase research on this subject [69]. In the same year, implicit emotion regulation was investigated in individuals with schizotpy by Delhii Hoid and colleagues [70]. In the relevant study, the differences between schizotypy (n = 30) and healthy controls (n = 30) were compared using EEG. Identity (PI) ERP paradigm was used in this study. The presence of deficits in the early and middle stages of the implicit process has been detected in individuals with schizotypy [70]. Nahal P et al. [71] conducted another study and compared the differences between autism and schizotypals with the Eye Mind Reading Test (RMET). According to RMET results, there are differences in optimal emotion recognition performances between underdeveloped imagination autism and overdeveloped schizotypy. Research findings support previous studies in this respect [71]. Shota Uono and colleagues [55] conducted a study on face recognition performance on people with schizophrenia and subclinical schizotypal features. In this research, emotional facial expressions are presented together with their opposites. Accordingly, expressions of anger and happiness in the relevant groups were detected faster and more accurately than their opposites. A negative correlation was found between the degree of schizotypy and the efficiency of detecting regular expressions compared to opposite expressions. Additionally, there is a negative correlation between the emotion recognition task and positive schizotypy. In summary, individuals with high schizotypy showed poor results in face recognition performance [72]. As a recent up-to-date study in the relevant field, a large-scale research was conducted by Laura Fusor [73] and a group of researchers. In the study conducted among individuals with schizophrenia (n=2039), their siblings (n=2141) and healthy controls (n=2049), facial emotion recognition (FER) performances in individuals with schizophrenia were investigated. In the relevant study, the participants were given the Degraded Face Affect Recognition Task (DFAR) and their performance was compared between groups. According to the results, DFAR total scores are lower in individuals with schizophrenia than in their siblings. DFAR scores are lower in siblings compared to healthy controls. At this point, research emphasizes the investigation of FER and genetic link [73].

CONCLUSION AND RECOMMENDATIONS

When we look at the literature, there are studies on face and emotion recognition for schizophrenia and schizophrenia spectrum disorders. The results of studies conducted on people diagnosed with schizotypy are contradictory. Some studies in this field seem to have revealed that there is a disorder in face and emotion recognition processes [15,16,19,24,74]. In some studies, no significant differences were found in face and emotion recognition performances between schizotypals and control groups [17,23,25]. Williams et al. [24] found that there was a relationship between the severity of schizotypal features and poorer emotion recognition, especially positive emotions being more difficult to recognize [24]. It is known that face and emotion recognition processes are an important part of social interaction. It is thought that the disorders observed in these processes cause symptoms such as social withdrawal and delusions in schizophrenia and are related to cognitive processes [10]. It has been shown that schizophrenia patients have slower emotion recognition response speeds than normal controls, can recognize negative faces faster than positive faces, and remember emotionally

charged stimuli more easily than neutral stimuli. It is thought that there are differences between schizotypy dimensions in terms of the ability to recognize emotions [37]. It has been shown that positive schizotypy is associated with the recognition of negative emotions such as fear, anger and sadness [23,33] and in the study conducted by Williams et al. [24], negative schizotypy had worse emotion recognition performance. They found that it was associated with impairment in recognizing negative facial expressions [24]. In studies examining the relationship between the severity of schizotypy and facial and emotion recognition, it has been shown that facial emotion recognition is weaker in people with high schizotypy than in controls, and the weakness is mostly in recognizing the emotions of happiness and surprise [16,19]. It is noteworthy in the literature that studies on face and emotion recognition in schizotypy were conducted without memory load. However, it was observed that a study on face and emotion recognition in schizophrenia was conducted with the effect of memory load [35]. Brain regions related to face and emotion recognition include the amygdala, superior temporal gyrus and fusiform gyrus. Among these brain regions, the amygdala is involved in both face and emotion recognition, while the superior temporal gyrus is more involved in emotion recognition and the fusiform gyrus is more involved in face recognition [75]. It has also been stated that the amygdala has a functional indirect connection with the dorsolateral prefrontal cortex, the brain region related to working memory, and that this connection is provided through the ventromedial prefrontal cortex [26]. It has been shown that the amygdala is also involved through this connection as the memory load increases during working memory tasks [41]. It has been supported by studies that impairment in face and emotion recognition, which is the main cause of problems in social communication in schizophrenia, is associated with amygdala volume deficiency and amygdala damage. In a study conducted by Gur et al. [21], a decrease in the activity of the left amygdala and bilateral hippocampus was observed in patients with schizophrenia in distinguishing negative from positive emotions, while an opposite increase in activity was observed in the healthy control group [21]. It has been shown that there are structural and functional abnormalities in these brain regions in schizophrenia spectrum disorders [3,7]. However, in a functional imaging study by Yoon et al. [71]; While functional abnormalities were found in the amygdala and superior temporal gyrus during face and emotion recognition processes, no abnormalities were detected in the fusiform gyrus, the brain region involved in face recognition [71]. One of the important issues that draws attention in experimental studies on face and emotion recognition performances in Schizophrenia Spectrum Disorders is that; In many experimental studies conducted in this field, photo sets or similar sets describing Paul Ekman's facial expressions were used [44]. However, in our social lives, we do not only manage facial and emotion recognition processes according to the facial expressions of individuals, but these processes are also accompanied by the tone of voice, gestures, facial expressions, energy, etc. of the person in front of us. Therefore, having individuals participating in the experiment identify faces and emotions through photographs is a very limited situation in terms of displaying correct performances. Another shortcoming of the studies conducted in this field is that the photo sets are required to be identified within a period of time (4 - 10 seconds). When describing faces and emotions in our social life, we make great use of elements such as the background and history of our relationships with individuals, our previous relationships with individuals and the results of these relationships, and knowing the temperaments of individuals. For example, we may feel that someone we know very well is actually criticizing us while smiling, and we can interpret it correctly. Photo sets cannot provide this information to the participants, and the tasks given randomly in a very short period of time may be misidentified due to the excitement factor. Another limited aspect of experimental studies on face and emotion recognition is that such studies are tested in laboratory environments. In such cases, individuals will have some laboratory devices such as eye trachers. This may affect the research findings by affecting the emotional state of the participants. Another limited aspect of the studies is that in such experimental designs, photographs are presented consecutively in a randomized manner. Since the time between given tasks is limited to seconds, participants' perceptions may become fatigued and their facial and emotion recognition performances may decrease. However, in our daily lives, the states of people around us such as anxiety, disgust, sadness and happiness do not change in seconds, we have long time intervals such as minutes and even hours to interpret these emotions and facial expressions correctly, and for this reason, there is often no time limit for us to make the correct definition. Another critical point we can bring to this issue is about cultural differences. Even though Ekman has proven a common definition and perception of emotions and facial expressions with his studies, it should not be forgotten that there may be differences in facial and emotion recognition processes among communities in all geographies of the world. For example, in some societies, such as the Far East, there are some social and traditional obstacles to individuals expressing their emotions. Therefore, since individuals in such societies may be insufficient to reflect their emotions as "facial expressions", individuals participating in a research design conducted in the relevant society may be less successful than those in a European society. The problem here is not that the face and emotion cannot be identified correctly by the participants, but that in the relevant culture, the facial and emotion description is displayed through a different expression rather than a "facial expression". Therefore, an experimental study designed with a set of photographs developed for a European or American society may be inadequate or meaningless in the process of identifying faces and emotions for participants in the Far Eastern society. Another striking aspect of the studies is that the relevant experiments were conducted and completed in a short period of time, such as one day. However, an interpretation limited to the day the participants participated in the experiment (perception, emotional state, attention elements, etc. on that day may affect face and emotion recognition performances) may not fully reflect the reality. Therefore, in such experiments, testing participants with the same tasks again in a different time period may yield healthier and more realistic results. Face and emotion recognition performances can be suggested as a suggestion for daily patterns; The internal and external validity of facial and reading emotion packages should be realized under more surveillance and in a more widespread way of monitoring general daily life, not limited to photographic units, and more three-dimensional systems (including voice, facial expressions and gestures). The use of patterns, the constant purchase of photo books and others, bringing daily life closer and adding it to a time period where they can make healthy decisions and definitions in this sense, preserving the different connections of societies and cultures in reflecting facial care or expressing emotions, designing different culture-specific paradigms, working Monitoring whether there are any special conditions regarding the day the experiments were taken, designing the experiments in at least two rooms (such as retesting the studies after 15 days) is a strong point in terms of making these computers more organized.

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