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Relationship Between Visual Integration, Social Cognition, and Symptoms in Schizophrenia: An Eye-Tracking Study

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ABSTRACT

Objective: This study investigates the associations between eye movement patterns, visual contour integration, social cognitive abilities, and symptom severity in individuals diagnosed with schizophrenia.

Method: The study included 40 clinically stable patients with schizophrenia. Eye movements were recorded using an eye-tracking system during a free-viewing paradigm. Visual integration was evaluated with the Jittered Orientation Visual Integration (JOVI) task, while social cognition was assessed using the Reading the Mind in the Eyes Test and the Hinting Task. Symptom severity was measured with the PANSS. Data were analyzed using Pearson correlation coefficients and repeated measures analysis of variance.

Results: Positive symptom severity was positively correlated with increased fixation counts and faster path velocity in social contexts. Conversely, social cognition was negatively correlated with fixation duration and saccadic velocity during face exploration. Participants exhibited significantly lower fixation counts when viewing socially relevant images. Additionally, shorter saccade length and slower path velocity were observed during face viewing. However, no significant relationship was found between eye movements and contour integration.

Conclusion: This study demonstrates that eye movement characteristics in schizophrenia may be significantly associated with social cognition and symptom severity. Although causal inferences cannot be drawn due to the cross-sectional design, the findings help clarify inconsistencies in the literature and partially address gaps regarding eye movement research. Furthermore, the study provides valuable insights for the development of eye movement–based assessment and intervention approaches in clinical practice.

Keywords: Eye tracking, schizophrenia, social cognition, visual integration

INTRODUCTION

Schizophrenia is one of the most complex and debilitating disorders in the field of mental health (McCutcheon et al. 2020). This disorder profoundly affects individuals' thoughts, feelings, and behaviors, imparing daily activities (Owen et al. 2016). Symptoms such as hallucinations and delusions impair individuals' ability to interact with their environment, and moreover, impairments in social cognition lead to greater difficulties in maintaining relationships (Torio et al. 2014). In addition to social cognitive deficits, neurocognitive deficits in areas such as attention, memory, and information processing further complicate the experiences of individuals with schizophrenia (Lepage et al. 2014). Research has indicated that these deficits may stem from fundamental cognitive errors and impairments associated with the visual processing system (Burton et al. 2016).

Eye-tracking technologies, together with advances in image analysis, have opened new avenues for understanding how visual processing anomalies contribute to the cognitive and symptomatic landscape of schizophrenia. Compared to healthy controls, various abnormalities, including a decrease in smooth pursuit gain (Morita et al. 2019), increased errors and delays in antisaccade tasks (Wolf et al. 2021), changes in fixation parameters, and a reduction in scanning path length (Kojima et al. 2001; Egaña et al. 2013) have been reported in schizophrenia. Furthermore, analysis of eye movements reveals the capacity of individuals with schizophrenia to interpret

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social situations and respond appropriately (Matsumoto et al. 2015). Various stimuli, including geometric shapes, images, moral databases, computer-generated faces, real faces, and natural food pictures, have been used to study eye behaviors (Bestelmeyer et al. 2006; Kacur et al. 2020). Several studies have shown that individuals with schizophrenia display reduced fixations on socially salient facial regions such as the eyes and mouth when viewing emotional expressions, which is associated with poorer emotion recognition and theory of mind performance (Loughland et al. 2002, Tso et al. 2012). For instance, Tso et al. (2012) found that diminished attention to the eye region correlated with lower performance on social cognitive tasks. Similarly, Loughland et al. (2002) demonstrated that schizophrenia patients had fewer fixations and shorter gaze durations on key facial features during face perception tasks, indicating reduced information sampling from socially relevant cues.

Building on the evidence that atypical visual attention patterns in schizophrenia are linked to social cognitive impairments, it is also important to consider earlier stages of visual processing that may contribute to these difficulties. One such mechanism is contour integration (CI), which plays a fundamental role in constructing coherent visual perceptions by enabling the visual system to link spatially separated elements into unified shapes and object boundaries (Jayakumar et al 2024). Deficits in this process may impair the ability to organize complex visual scenes, which in turn could influence higher-order functions such as interpreting social cues.

Contour integration is commonly assessed using tasks that require individuals to detect contours formed by aligned elements among distractors, with the JOVI (Jittered Orientation Visual Integration) task being one of the most widely used paradigms in schizophrenia research (Silverstein et al. 2012, Butler et al. 2013, Keane et al. 2014). These studies have shown that individuals with schizophrenia often exhibit reduced CI performance, which has been linked to disorganized symptoms and impairments in social perception (Uhlhaas et al. 2005). Thus, although visual attention and visual integration are distinct processes, both may contribute to social cognitive dysfunction through different but interacting pathways. Further research is needed to explore how impairments at multiple levels of the visual processing hierarchy influence social functioning in schizophrenia.

The aim of this study is to examine how visual processing deficits, reflected in eye-tracking metrics, relate to contour integration abilities, specific schizophrenia symptoms and social cognition. We hypothesize that deficits in eye movements will lead to difficulties in contour integration and influence the interpretation of social stimuli. Specifically, we expect that individuals with schizophrenia will exhibit greater difficulty with eye-tracking measures and that this will correlate with negative symptoms, such as social withdrawal and flattened affect. To test these hypotheses, we will use a validated free-viewing eye-tracking task (Bestelmeyer et al 2006), alongside symptom evaluations, social cognitive tasks, and a contour integration test (JOVI). This approach allows for a comprehensive assessment of the relationship between visual processing deficits, symptom severity, and social cognition in schizophrenia.

METHODS

Design

In this study, we recorded fundamental eye movement metrics, specifically saccades and fixations, in 40 patients diagnosed with schizophrenia using a free viewing task (Bestelmeyer et al. 2006). The recordings were obtained with a Gazepoint GP3 eye tracker and analyzed using the Open Gaze and Mouse Analyzer (OGAMA) software.

Following the eye tracking session, participants underwent the JOVI task, a social cognition assessment, and a symptomatic evaluation. The study received ethical approval from the Uskudar University Ethics Committee (decision number 2022-50), confirming its compliance with established ethical standards.

Participants

The study included 40 patients diagnosed with schizophrenia who were receiving follow-up care at the Fatih Community Mental Health Center of Haseki Training and Research Hospital. Participants were between 18 and 55 years of age and met the ICD-10 diagnostic criteria for schizophrenia, as documented in their outpatient clinical records (ICD-10, World Health Organization, 1992). Patients who had not been hospitalized for psychiatric reasons within the past six months and who had been in regular follow-up for at least three months were considered clinically stable. Only individuals who had been monitored by the same center for more than one year were included to ensure consistency of clinical evaluation. Although structured diagnostic interviews were not conducted, diagnoses were based on retrospective chart reviews and repeated clinical assessments by psychiatrists during routine follow-ups. At the time of the study, all patients were undergoing antipsychotic treatment, and at least one second-generation antipsychotic had been prescribed in each case. To account for medication exposure, antipsychotic dosages were converted to chlorpromazine equivalents based on established reference scales (Rijcken et al., 2003; Kroken et al., 2009). Individuals with known intellectual disability, neurological conditions (e.g., epilepsy), significant visual impairments (e.g., cataract, strabismus), or a history of substance abuse were excluded from the sample.

Eye Tracking

Eye movements of the participants were recorded during a free-viewing task adapted from the study by Bestelmeyer et al. (2006). In addition to the four original stimulus categories (faces, landscapes, pink noise, and fractals), a fifth category—socially themed images—was included in the present study. During the task, participants were instructed to look freely at each image presented on the screen. A total of 35 stimuli were shown, with 7 images from each category. All stimuli were displayed for 5000 milliseconds, with an interstimulus interval of 500 milliseconds. To minimize potential order effects, the presentation sequence was arranged in a pseudo-random manner. The socially themed images depicted scenes containing social cues such as facial expressions, body language, and interpersonal distance. These images were selected based on criteria that aimed to activate social-cognitive processes, reflect everyday life scenarios, and present a clear social context. Written informed consent was obtained from all participants whose faces were visible in the face and socially themed images.

Eye movements were recorded using the Gazepoint GP3 eye-tracking device, a research-grade system with a sampling rate of 60 Hz (Iskander et al. 2018, Meng et al. 2018, Seha et al. 2019, Zhu et al. 2019). Prior to the experiment, a nine-point calibration was performed using a visual angle of 0.5–1°, and only calibrations that met the accuracy criteria of the device were accepted. A separate drift check was not conducted manually, as drift correction is inherently integrated into the OGAMA software. Stimuli were presented on a 14-inch monitor with adjustable tilt, which was set according to each participant's eye level. Participants were seated approximately 60 cm away from the screen, and this distance was kept constant throughout the experiment. All images had dimensions of 1600 × 2000 pixels and were presented at a uniform size. The experimental setting was arranged under dim and stable lighting conditions, avoiding direct sunlight or artificial light sources.

The presentation and analysis of the data were carried out using OGAMA. Analysis parameters were set according to the default settings of the program (Vosskühler et al. 2008, Ujbányi 2018). Key parameters such as the minimum fixation duration and dispersion threshold were based on previous eye-tracking research and the software's recommended default configurations. Gaze data falling outside the display area were automatically identified and excluded from the analysis by the OGAMA software. As a result, only fixations occurring within the visible screen area were included in the statistical evaluations. The recorded data were exported in appropriate formats for subsequent statistical analysis.

Clinical and Neuropsychological Measures

Psychopathology

Psychopathology, which encompasses the variety and intensity of psychiatric symptoms, was evaluated using the Positive and Negative Syndrome Scale (Kay et al. 1988, Kostakoğlu et al. 1999). This widely recognized scale allows clinicians to quantify symptoms related to conditions such as schizophrenia, offering a standardized approach for clinical assessment and treatment monitoring.

Social cognition

Social cognition, essential for effective interpersonal relationships and adaptive behavior, was investigated using tasks that focused on emotion recognition and Theory of Mind (ToM). The Hinting Task (Corcoran et al. 1995) and the Revised Reading the Mind in the Eyes Test (Baron-Cohen et al. 1997, Yildirim et al. 2011) were utilized to assess individuals' abilities to understand others' mental states and emotions, engaging both the social-cognitive and social-perceptual aspects of ToM.

Contour integration

Contour integration, a process involved in perceiving coherent shapes and objects from fragmented visual input, was assessed using the JOVI task. This task challenges participants to detect the direction of a hidden oval target amidst distractors, thereby probing their ability to integrate local elements into a global perceptual whole (Silverstein et al. 2012).

Data Analysis

The data analysis in this study was conducted to examine the relationships between visual perception, social cognition, symptom severity, and eye movement parameters in individuals with schizophrenia. Initially, the linear relationships among visual perception, social cognition, symptom severity (positive, negative, and general symptoms measured using PANSS), and eye movement parameters in the schizophrenia group were analyzed using Pearson correlation analysis. This analysis was employed to identify the associations between the variables and determine which parameters were significantly related. Correlation coefficients were tested for significance at the α=0.05 level, and 95% confidence intervals were calculated for each correlation. Due to the exploratory nature of the study, Bonferroni correction is not applied.

The Repeated Measures Analysis of Variance (ANOVA) was applied to compare the different types of visual stimuli used in the free viewing task. This analysis allowed for the comparison of participants' eye movement performance for each type of visual stimulus and controlled for within-group variance. All data analyses were conducted using the IBM Statistical Package for Social Sciences (SPSS) program version 26.0.

RESULTS

Demographics

The demographic characteristics of the schizophrenia patients are presented in Table 1. The study sample consisted

Table 1. Demographic and medical characteristics of schizophrenia patients

		X	SD	N	%
Age (years)		34.70	9.30		
Gender	Male			29	72.50%
	Female			11	27.50%
Education (years)		8.65	3.75		
Num. of psychiatric hospitalizations		1.53	1.34		
Chlorpromazine-equivalent dose		494.48	276.32		
PANSS Positive		26.95	5.49		
PANSS Negative		19.72	4.83		
PANSS General		52.35	10.82		
Hinting task		10.85	4.26		
Eyes test		18.33	4.59		
0jit		22.70	6.98		
7jit		19.23	6.08		
9jit		16.37	5.55		
11jit		15.10	4.98		
13jit		12.37	4.20		

X: Mean; SD: Standard Deviation; N: Number of Participants; %: Percentage ; PANSS: Positive and Negative Syndrome Scale; jit: Abbreviation denoting the degree of random orientation deviation in visual stimuli.

of 40 individuals aged between 25 and 44 years. Among them, 29 participants (72.5%) were male. Additionally, all participants had an educational background ranging from 4 to 12 years. The mean daily chlorpromazine-equivalent dose was 494.48±276.32 mg. Correlational analyses between antipsychotic dosage and all other study variables revealed no statistically significant associations (p>0.05). Further characteristics of the schizophrenia patients included in the study are detailed in Table 1.

Exploring visual scanning eye movements associated with visual integration, social cognition and symptoms in schizophrenia

Our results reveal distinct associations between eye-tracking measures and both clinical and cognitive variables in schizophrenia. Since visual tracking has been explored using both social and non-social stimuli in schizophrenia (Bestelmeyer et al. 2006, Huang et al. 2021), we investigated how face, social, and landscape scanning relate to visual integration, social cognition, and symptomatology.

For face scanning (Table 2), higher fixation counts and increased path velocity were positively associated with greater positive symptom severity (r=0.43, p <0.001 and r=0.36., p=0.02 respectively). Conversely, shorter fixation duration and reduced saccade velocity were negatively correlated with hinting ability (r=-0.36, p=0.02 and r=-0.34, p=0.02 respectively). Similarly, in social context scanning (Table 3), fixation counts and path velocity were positively related to positive symptoms (r=0.41, p<0.001 and r=0.36, p=0.02), while fixation duration showed a negative relationship with hinting ability (r=0.35, p=0.02). In landscape scanning (Table 4). fixation counts were significantly positively correlated with positive symptoms (r=0.46, p<0.001) while fixation duration showed a negative relationship with hinting ability (r=0.35, p=0.02).

Exploring visual scanning variables

Figure 1 shows representative visual scan paths for each type of stimulus in a participant with schizophrenia. When the social images were compared with the others, significantly fewer fixations counts (F=8.21, df=3.65, p <0.001, pη2=0.19) were observed. For face images, participants showed shorter saccade lengths compared to landscape, pink noise, and social (F=9.63, df=3.29, p <0.001, pη2=0.17). Additionally, path velocity for face images was slower compared to ones for fractal, landscape, and pink noise images (F=4.90, df=3.17, p=0.002, pη2=0.11).

Table 2. Correlation between face scanning and visual integration. social cognition. and symptoms in schizophrenia (n = 40).

	Fixation counts r(p)	Fixation Duration Mean(ms) r(p)	Saccade Length(px) r(p)	Saccade Velocity(px/s) r(p)	Path Velocity(px/s) r(p)
PANSS Positive	0.43* (0.00)	-0.21 (0.19)	0.03 (0.83)	-0.00 (0.98)	0.36* (0.02)
PANSS Negative	0.15 (0.34)	-0.14 (0.37)	0.073 (0.65)	0.03 (0.83)	0.10 (0.52)
PANSS General	0.22 (0.16)	-0.20 (0.21)	-0.04 (0.80)	-0.23 (0.13)	0.11 (0.47)
Hinting task	-0.09 (0.57)	-0.36* (0.02)	0.03 (0.84)	-0.34* (0.02)	-0.16 (0.31)
Eyes test	-0.29 (0.06)	0.03 (0.81)	-0.05 (0.75)	-0.15 (0.34)	-0.25 (0.12)
0jit	-0.15 (0.32)	0.20 (0.20)	-0.20 (0.20)	-0.12 (0.42)	-0.20 (0.20)
7jit	-0.00 (0.96)	0.07 (0.63)	-0.14 (0.36)	-0.16 (0.30)	-0.05 (0.73)
9jit	0.02 (0.90)	0.08 (0.60)	-0.16 (0.30)	-0.10 (0.52)	0.01 (0.93)
11jit	0.00 (0.97)	0.09 (0.56)	-0.05 (0.73)	-0.08 (0.60)	0.08 (0.61)
13jit	0.03 (0.83)	0.12 (0.44)	-0.10 (0.53)	0.03 (0.81)	0.10 (0.53)

r = Pearson correlation coefficient; p = Statistical significance level (p-value); *p<0.05 indicates statistical significance; PANSS: Positive and Negative Syndrome Scale; jit: Abbreviation denoting the degree of random orientation deviation in visual stimuli.

Table 3. Correlation between social scanning and visual integration. social cognition. and symptoms in schizophrenia (n = 40).

	Fixation counts r(p)	Fixation Duration Mean(ms) r(p)	Saccade Length(px) r(p)	Saccade Velocity(px/s) r(p)	Path Velocity(px/s) r(p)
PANSS Positive	0.41* (0.00)	-0.25 (0.11)	0.04 (0.78)	0.11 (0.48)	0.36*(0.02)
PANSS Negative	0.19 (0.22)	-0.11 (0.46)	0.05 (0.74)	0.12 (0.45)	0.13 (0.41)
PANSS General	0.21 (0.18)	-0.23 (0.15)	-0.03 (0.83)	-0.10 (0.52)	0.12 (0.43)
Hinting task	0.00 (0.97)	-0.35* (0.02)	0.16 (0.29)	-0.01 (0.92)	0.04 (0.79)
Eyes test	-0.23 (0.13)	0.09 (0.55)	-0.02 (0.87)	-0.08 (0.62)	-0.11 (0.46)
0jit	-0.09 (0.56)	0.16 (0.30)	-0.07 (0.64)	-0.05 (0.73)	-0.10 (0.51)
7jit	0.05 (0.73)	0.06 (0.68)	-0.12 (0.45)	0.02 (0.87)	0.03 (0.85)
9jit	0.01 (0.91)	0.07 (0.66)	-0.10 (0.53)	0.04 (0.77)	0.00 (0.96)
11jit	-0.00 (0.98)	0.06 (0.68)	0.01 (0.92)	0.05 (0.71)	0.07 (0.64)
13jit	-0.07 (0.63)	0.07 (0.64)	-0.17 (0.29)	0.00 (0.98)	-0.11 (0.46)

r = Pearson correlation coefficient; p = Statistical significance level (p-value); p <0.05 indicates statistical significance; Jit: Abbreviation denoting the degree of random orientation deviation in visual stimuli.

Table 4. Correlation between landscape scanning and visual integration. social cognition. and symptoms in schizophrenia (n = 40).

	Fixation counts r(p)	Fixation Duration Mean(ms) r(p)	Saccade Length(px) r(p)	Saccade Velocity(px/s) r(p)	Path Velocity(px/s) r(p)
PANSS Positive	0.46* (0.00)	-0.24 (0.13)	-0.03 (0.85)	0.08 (0.61)	0.27 (0.08)
PANSS Negative	0.23 (0.14)	-0.21 (0.17)	0.12 (0.43)	0.08 (0.60)	0.15 (0.35)
PANSS General	0.27 (0.08)	-0.23 (0.15)	-0.10 (0.51)	-0.10 (0.53)	0.05 (0.72)
Hinting task	-0.01 (0.92)	-0.34* (0.02)	0.16 (0.32)	-0.02 (0.88)	0.00 (0.96)
Eyes test	-0.23 (0.14)	0.05 (0.75)	0.09 (0.56)	-0.03 (0.82)	-0.08 (0.61)
0jit	-0.15 (0.34)	0.19 (0.22)	-0.23 (0.15)	-0.27 (0.08)	-0.21 (0.17)
7jit	-0.05 (0.76)	0.07 (0.63)	-0.19 (0.24)	-0.18 (0.25)	-0.14 (0.37)
9jit	-0.08 (0.60)	0.12 (0.43)	-0.16 (0.30)	-0.16 (0.30)	-0.11 (0.47)
11jit	-0.09 (0.55)	0.11 (0.48)	-0.02 (0.90)	-0.11 (0.46)	-0.05 (0.75)
13jit	-0.08 (0.60)	0.14 (0.38)	-0.22 (0.17)	-0.04 (0.78)	-0.11 (0.47)

r = Pearson correlation coefficient; p = Statistical significance level (p-value); p <0.05 indicates statistical significance; Jit: Abbreviation denoting the degree of random orientation deviation in visual stimuli.

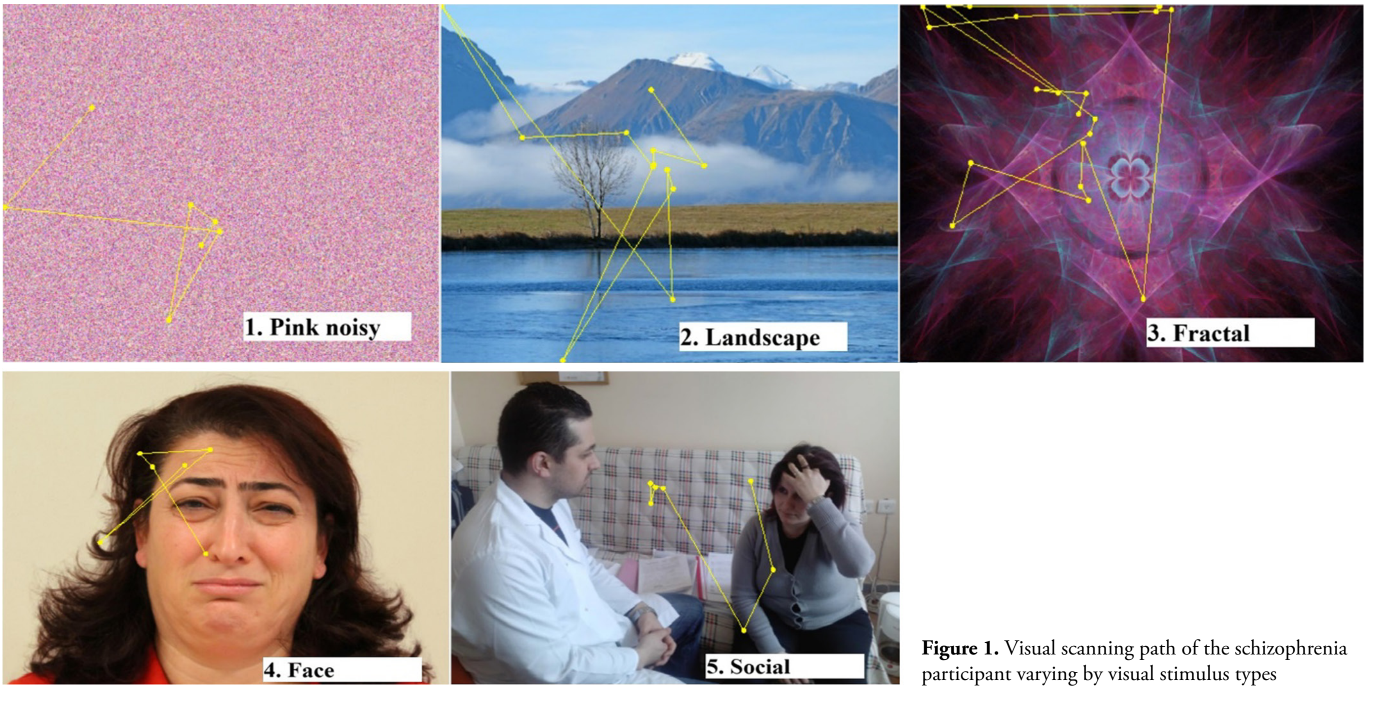

Figure 1. Visual scanning path of the schizophrenia participant varying by visual stimulus types

DISCUSSION

This study explored the relationships between positive symptoms, social cognition, and eye movement patterns in individuals with schizophrenia, revealing significant associations that shed light on the interplay between symptomatology, cognitive processing, and visual attention mechanisms. Specifically, we found that increased positive symptoms were linked to higher fixation counts across all visual stimuli and increased path velocity in social contexts. Additionally, better social cognition, as measured by higher hinting task scores, was associated with shorter fixation durations across all stimuli and reduced saccade velocity when viewing faces. These findings contribute to our understanding of how schizophrenia affects visual attention and social functioning, with potential implications for targeted interventions.

Our results indicate that individuals with more severe positive symptoms such as hallucinations and delusions exhibit a higher number of fixation counts when viewing various visual stimuli. This suggests a broader, less focused scanning pattern, potentially reflecting difficulties in filtering irrelevant information, a common challenge in schizophrenia. Notably, in social contexts (e.g., images involving interactions), these individuals demonstrated increased path velocity, indicating faster overall eye movement paths. Given that path velocity likely reflects the average speed across fixations and saccades, this finding may suggest rapid, possibly less adaptive scanning in social settings, which could exacerbate difficulties in processing complex social information.

Previous studies present conflicting findings on fixation counts in schizophrenia. For instance, oughland et al. (2002) and Huang et al. (2021) L reported higher fixation counts compared to healthy controls, aligning with our results, whereas Sprenger et al. (2013) observed fewer fixations. This discrepancy may stem from differences in symptom profiles across samples, as our study is the first to specifically link higher fixation counts to increased positive symptoms. Patients with milder positive symptoms might exhibit fewer fixations, contributing to the variability in prior research. In contrast to earlier work focusing on negative symptoms, we found no significant association between negative symptoms and eye movement patterns. highlighting the specificity of positive symptoms in driving these effects.

Regarding path velocity, prior research on smooth pursuit tasks often reports reduced velocities in schizophrenia (Nagel et al. 2012, Suzuki et al. 2012). However, our free-viewing task revealed the opposite increased path velocity with higher positive symptoms. This task-specific difference suggests that free exploration may capture symptom-driven, rapid scanning rather than the controlled tracking assessed in pursuit tasks, warranting further investigation into the functional implications of these patterns.

Higher hinting task scores, reflecting stronger social cognition, were associated with shorter fixation durations across all visual stimuli, indicating efficient processing. Specifically for faces, these individuals exhibited reduced saccade velocity, suggesting a more deliberate and controlled approach to examining facial features critical for interpreting social cues like emotions and intentions. This contrasts with Matsumoto et al. (2015), who found that longer fixation durations were linked to better performance in a biological motion perception task. The divergent findings may reflect differences in task demands: hinting ability requires rapid inference from subtle cues, potentially favoring shorter, well-directed fixations, whereas biological motion perception might benefit from prolonged attention.

Previous research often notes prolonged fixation durations in schizophrenia, linked to attentional disengagement and distractibility (Benson et al. 2012, Sprenger et al. 2013). Our finding of shorter durations with better social cognition suggests that effective social inference may depend on maintaining optimal fixation lengths, avoiding both excessive dwell time and overly rapid shifts. The reduced saccade velocity for faces further supports this, indicating a focused strategy that could enhance social understanding. However, no significant relationship emerged between eye movement measures and the "Revised Reading the Mind in the Eyes Test" possibly due to its focus on the eye region, which may increase attentional complexity and distraction in schizophrenia.

Our study found fewer fixation counts on social content compared to control content, challenging Bestelmeyer et al. (2006), who suggested lower fixation counts are not specific to social stimuli. This specificity strengthens the hypothesis that abnormal eye movement patterns contribute to social cognitive deficits in schizophrenia, potentially due to reduced attentional allocation to socially relevant information (Wolf et al. 2021). Additionally, we observed shorter saccade lengths and slower path velocity for facial stimuli, consistent with literature noting restricted scan paths in schizophrenia when viewing faces (Loughland et al. 2002, Bestelmeyer et al. 2006). These patterns may hinder the ability to gather sufficient information from dynamic facial expressions, contributing to emotion recognition difficulties.

Unlike Morita et al. (2019), who linked abnormal eye movements to perceptual organization deficits using non-social stimuli, we found no significant association between eye movements and contour integration, a key aspect of perceptual organization. This suggests that contour integration impairments in schizophrenia (Keane et al. 2014) may not primarily result from gaze abnormalities, pointing to other underlying mechanisms that require further exploration.

Several limitations of this study should be acknowledged. First, the absence of a healthy control group limits the ability to determine whether the observed findings are specific to schizophrenia. Additionally, the lack of a clinical comparison group restricts the understanding of whether these eye movement and social cognitive patterns are unique to schizophrenia or shared across disorders. For example, gaze-related impairments have also been reported in obsessive-compulsive disorder (Tümkaya et al. 2020), suggesting potential transdiagnostic features. Second, conducting tasks in a computer-based setting may have introduced confounding factors such as attention and motivation. Third, the potential effects of antipsychotic medication on oculomotor behavior were not assessed, despite their known influence. Lastly, the sample's high mean PANSS score indicates more severe symptomatology, which may limit the generalizability of the results. Future studies should include control and clinical comparison groups, assess medication effects, and consider more ecologically valid environments.

In summary, this study demonstrates that in schizophrenia, increased positive symptoms are associated with higher fixation counts and faster path velocity in social contexts, while better social cognition correlates with shorter fixation durations and reduced saccade velocity for faces. These findings highlight distinct visual attention patterns linked to symptomatology and social functioning, offering new insights into the heterogeneity of eye movement abnormalities in schizophrenia. By addressing inconsistencies in prior research and identifying novel relationships, our work underscores the need for further investigation into how these patterns can inform interventions to improve social cognition and quality of life in this population.

Ethics Committee Approval: The study received ethical approval from the Uskudar University Ethics Committee (decision number 2022-50).

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