



The Relationship Between Brain-Behavior Systems, Dark Personality Traits, Alexithymia, and Theory of Mind Deficits in Sexual Offenders

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ABSTRACT

The aim of the current research is to examine the relationship between brain-behavior systems, dark personality dimensions, and Alexithymia with theory of mind deficits in sexual offenders. For this purpose, 80 inmates from the central prison of Bojnourd were selected using purposive sampling. The variables were measured using the Gray-Wilson Personality Questionnaire (GWPQ), the Dirty Dozen scale of dark personality traits, the 20-item Toronto Alexithymia Scale (TAS-20), and the Reading the Mind in the Eyes Test (RMET). Data were analyzed using Pearson correlation coefficients and multiple regression analysis. The results showed a significant positive correlation between the fight system and theory of mind deficits; and significant negative correlations between the flight and freeze systems, all aspects of dark personality dimensions, difficulty in identifying and describing feelings, and overall Alexithymia with theory of mind deficits. The regression analysis findings suggest that the fight/flight/freeze systems, dark personality traits, and Alexithymia play predictive roles in mind-reading abilities.

Keywords: Brain-behavior systems, dark personality dimensions, Alexithymia, theory of mind, sexual offenders.

1. Introduction

Sexual offenses are predominantly defined based on coercion and disrespect in establishing a sexual relationship, which is considered a violation of individuals' rights and public order (1). Various studies have examined the factors influencing sexual crimes. Research related to aggressive sexual behaviors indicates the involvement of cognitive distortions (2, 3). Additionally, cognitive theorists, who emphasize the importance of cognitive factors on

individual actions and behavior, believe that cognitions play a significant role in the development of crime and individuals' inclination to commit sexual offenses (2, 3).

One such cognitive process is the theory of mind. Theory of mind refers to the understanding that oneself and others have beliefs, thoughts, and attitudes, and the ability to recognize these mental states. In fact, deficits in theory of mind are a key concept explaining behavioral disorders such as autism, schizophrenia, and personality disorders.

Furthermore, deficits in the theory of mind of sexual offenders have become a significant and controversial topic in recent decades, with the negative and long-term consequences that this harmful act creates in victims consistently emphasized (4).

In examining factors related to the theory of mind in offenders, Alexithymia can be noted (5). Alexithymia refers to a lack of words for feelings and emotions and the inability to identify and describe one's emotional state (6). Individuals' inability to recognize the feelings and consent of others in establishing a sexual relationship can be a significant factor in assault; thus, individuals who commit violence and sexual assault may likely be incapable of understanding and interpreting their own emotional states and those of others, or may misinterpret these states and respond inappropriately, which is not accepted by the other party and constitutes an assault (7).

Investigations have shown that in addition to the inability to recognize facial expressions and the ability to process information, some sexual offenders may enjoy harming others, which increasingly represents an urgent problem that puts the psychological health, security, and well-being of individuals at risk. This characteristic represents a personality style and describes the dark dimensions of personality. The dark side of personality is a term to describe a set of three socially undesirable and maladaptive personality traits, including narcissism, antisocial behavior, and Machiavellianism (8, 9), and is defined by a lack of concern for the feelings of others. Antisocial behavior is characterized by impulsive behaviors, emotional detachment, and low empathy (10, 11). Narcissism is described by feelings of grandiosity, self-centeredness, and a sense of entitlement (12, 13). Finally, Machiavellianism is defined by emotional coldness and manipulation (14, 15). The dark aspects of personality refer to the socially disturbing aspects of personality that are associated with hostile and callous behaviors (13, 14).

In addition to the characteristics of Alexithymia and the dark aspects of personality related to the psychological aspects associated with mind-reading, brain-behavior systems, which refer to a biological feature, are also likely related to individuals' ability to read minds. Accordingly, the relationship between brain-behavior systems and the ability to read minds in offenders is examined. Although no

research has precisely addressed this issue, brain-behavior systems are the basis of individual differences and activate different emotional responses, such as quick arousal, anxiety, and fear. This system includes the three systems of behavioral activation, behavioral inhibition, and fight or flight (10, 15). Therefore, the aim of the current research is to examine the relationship between brain-behavior systems, dark personality dimensions, and Alexithymia with theory of mind deficits in sexual offenders.

2. Methods and Materials

2.1. Study Design and Participants

The present study is a descriptive-correlational research. The population of this study consists of sexual offenders in prisons or detention centers in the city of Bojnurd, North Khorasan Province. The sample included 90 male sexual offenders selected through convenience sampling based on inclusion and exclusion criteria and after obtaining the consent of the individuals. The inclusion criteria were: aged between 20 to 60 years, committed to sexual assault, not simultaneously suffering from a serious physical illness, not suffering from a psychotic disorder such as schizophrenia and related disorders, no substance abuse or dependence, no intellectual disability, and the patient's willingness to participate in the study and complete the questionnaires. The exclusion criteria were the patient's unwillingness to continue the research or the occurrence of an acute condition for the patient that prevented participation in the study. Due to the limited number of available sexual offender prisoners in the Bojnurd prison, it was decided that the research would be conducted on all prisoner offenders within the range of 80 to 100 individuals.

To conduct the research, interviews were held with sexual offenders in prison. Before the participants' involvement, they were informed about the research and its procedures, and reassurance was provided about the confidentiality of their personal information and that the data obtained would be used strictly for research purposes. Participants were also informed that they were free to withdraw from the research at any stage if they chose to do so. After obtaining consent, the designated questionnaires and the mind-reading test were administered to them.

2.2. Measures

2.2.1. Deficit Based on Theory of Mind

The computerized version of the revised Reading the Mind in the Eyes Test (16) was used to assess theory of mind. The revised version of this test (36-item form) includes photographs of the eye region of male and female actors. With each item, four mental state descriptions are presented (one target and three foils with the same emotional value), and respondents are asked to choose the word that best describes the thought or feeling of the eyes' owner using only visual information. A correct response is scored as one, with scores ranging from zero to 36. Scores above 30 indicate a high theory of mind, scores between 22-30 indicate a medium theory of mind, and scores below 22 indicate a low theory of mind. Bafandeh, Alilou, Bakhshipour, Khanjani, and Ranjbar (2011) administered this test in a preliminary study on a sample of 200 individuals, yielding an internal consistency reliability of 0.69 using the Kuder-Richardson formula. The reliability of this test was 0.71 (17).

2.2.2. Alexithymia

The Toronto Alexithymia Scale is a 20-item test measuring three subscales: Difficulty Identifying Feelings (DIE) with 7 items, Difficulty Describing Feelings (DDE) with 5 items, and Externally-Oriented Thinking (EOT) with 8 items, rated on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). A total score is calculated by summing the scores of the three subscales. The psychometric properties of the Toronto Alexithymia Scale-20 have been examined and confirmed in multiple studies. Besharat (2007) normed the Toronto Alexithymia Scale-20 and reported Cronbach's alpha coefficients for the total Alexithymia and the three subscales as 0.85, 0.82, 0.75, and 0.72 respectively, indicating suitable internal consistency (6, 18).

2.2.3. Brain-Behavior Systems

The Gray-Wilson Personality Questionnaire was designed by Wilson, Barrett, and Gray in 1989. This questionnaire evaluates the dominance and sensitivity of brain-behavior systems and their components and consists of

120 items. Forty items are considered to assess the activity of each of the behavioral activation system, behavioral inhibition system, and fight-flight system. Of the 40 items related to the activity of the behavioral activation system, 20 items are related to the approach component, and 20 items are related to the active avoidance component. Of the 40 items related to assessing the activity of the behavioral inhibition system, 20 items are related to passive avoidance, and 20 items are related to the shutdown component. Lastly, of the 40 items related to the activity of the fight-flight system, 20 items are assigned to the fight component, and 20 items are assigned to the flight component. Regarding the reliability of this questionnaire, Wilson, Barrett, and Gray obtained Cronbach's alpha coefficients for the approach, active avoidance, passive avoidance, shutdown, fight, and flight components as follows: for men, 0.71, 0.61, 0.58, 0.61, 0.65, and 0.65, and for women, 0.68, 0.35, 0.59, 0.63, 0.71, and 0.71, indicating adequate internal stability of the test. Ashrafi (2006) reported Cronbach's alpha coefficients for the approach, active avoidance, passive avoidance, shutdown, fight, and flight components as 0.60, 0.54, 0.61, 0.66, 0.65, and 0.69, respectively, and reliability coefficients via the split-half method as 0.53, 0.57, 0.52, 0.62, 0.64, and 0.64, respectively (10, 15).

2.2.4. Dark Personality Traits

The Dirty Dozen is a 12-item measure used in this study to assess the Dark Triad personality traits, which include Narcissism, Machiavellianism, and Psychopathy. This questionnaire was developed by Jonason and Webster (2010) and consists of 12 questions measured on a 3-point scale. Jonason and Webster (2010) evaluated the psychometric properties of this scale including construct validity, discriminant validity, concurrent validity, and test-retest reliability in four different studies involving a total of 1085 participants. From an initial pool of 91 items, 12 items were retained for the final form. The findings from these studies have shown that the scale is associated with aggression, interpersonal conflict, and short-lived marriages. The creators reported that the scale exhibited good psychometric properties in all the studies conducted. In various studies, Cronbach's alpha for Machiavellianism ranged from 0.72 to 0.77, for Psychopathy from 0.66 to 0.69, and for Narcissism from 0.78 to 0.85. Additionally, the

reliability of the Dark Triad questionnaire in the current study, as measured by Cronbach's alpha, was 0.74 for Machiavellianism, 0.63 for Psychopathy, and 0.83 for Narcissism. In Iran, Hajloo, Ghaseminejad, and Ansarhossein (2014) confirmed the factor structure of this scale through confirmatory factor analysis with a root mean square error of approximation (RMSEA) of 0.06, and they reported Cronbach's alpha coefficients for Machiavellianism, Psychopathy, and Narcissism as 0.74, 0.63, and 0.83, respectively (8).

2.3. Data Analysis

The statistical analysis of the data was performed using SPSS-23, employing descriptive and inferential analysis methods including minimum scores, maximum scores, percentage, frequency, mean, standard deviation, standard deviation, and variance. Correlation methods including Pearson correlation coefficient and regression were used to examine the relationships between variables.

3. Findings and Results

In Table 1, the means and standard deviations of the research variables are shown.

Table 1

Descriptive Data for Research Variables

Research Variables	Frequency	Mean	Standard Deviation	Minimum Score	Maximum Score
Difficulty Identifying Feelings	80	23.17	5.83	7.00	32.00
Difficulty Describing Feelings	80	16.15	2.94	7.00	23.00
Externally-Oriented Thinking	80	23.88	0.79	22.00	25.00
Total	80	63.21	8.67	37.00	76.00
Narcissism	80	10.96	1.48	4.00	12.00
Antisocial	80	6.62	1.54	4.00	11.00
Machiavellianism	80	7.43	2.56	4.00	12.00
Total	80	25.03	4.23	14.00	33.00
Behavioral Activation System	80	14.33	4.61	7.00	27.00
Behavioral Inhibition System	80	12.90	3.03	6.00	23.00
Fight System	80	15.92	4.00	8.00	24.00
Flight System	80	18.61	2.25	13.00	25.00
Freeze System	80	17.50	3.45	9.00	26.00
Total	80	79.27	9.19	62.00	104.00
Theory of Mind	80	16.22	5.25	7.00	29.00

Pearson correlation results showed that the relationship between the behavioral activation system and theory of mind deficits in sexual offenders was not significant. The relationship between the behavioral inhibition system and theory of mind deficits in sexual offenders was not significant. The relationship between the fight system and theory of mind deficits in sexual offenders was significant with a correlation coefficient of +0.31 ($p < .01$). The relationship between the flight system and theory of mind deficits in sexual offenders was significant with a correlation coefficient of -0.23 ($p < .05$). The relationship between the freeze system and theory of mind deficits in sexual offenders was significant with a correlation coefficient of -0.33 ($p < .05$). The relationship between the antisocial aspect of personality and theory of mind deficits in sexual offenders

was significant with a correlation coefficient of -0.34 ($p < .01$). The relationship between the narcissistic aspect of personality and theory of mind deficits in sexual offenders was significant with a correlation coefficient of -0.29 ($p < .01$). The relationship between the Machiavellian aspect of personality and theory of mind deficits in sexual offenders was significant with a correlation coefficient of -0.42 ($p < .01$). The relationship between the dark dimensions of personality and theory of mind deficits in sexual offenders was significant with a correlation coefficient of -0.48 ($p < .01$). The relationship between difficulty in identifying feelings and theory of mind deficits in sexual offenders was significant with a correlation coefficient of -0.53 ($p < .01$). The relationship between difficulty in describing feelings and theory of mind deficits in sexual offenders was

significant with a correlation coefficient of -0.49 ($p < .01$). The relationship between externally-oriented thinking and theory of mind deficits in sexual offenders was not significant. The relationship between Alexithymia and theory of mind deficits in sexual offenders was significant

with a correlation coefficient of -0.54 ($p < .01$). Table 2 presents the summary of the regression analysis model. The regression analysis results for examining the predictive effect of variables on explaining the variance in theory of mind are shown.

Table 2

Regression Analysis Results Based on the Model

Model	R	R ²	Adjusted R ²	Standard Error
1	0.54	0.291	0.282	4.45
2	0.61	0.373	0.357	4.21
3	0.65	0.425	0.400	4.06

Model 1 - Predictor: Total Alexithymia

Model 2 - Predictor: Total Alexithymia, Freeze System

Model 3 - Predictor: Total Alexithymia, Freeze, Overall Dark Personality Traits

Table 2 indicates whether the regression model can significantly (and suitably) predict changes in the dependent variable (criterion). For assessing significance, the last column of the table (significance level) is considered. This column shows the statistical significance of the regression model, with results less than 0.05 indicating that the employed model is a good predictor for the variable of mind-

reading ability. As observed, the analysis of variance results shows that the significance level in this study is less than 0.05, indicating that the regression model is significant. Therefore, the independent variables of the research (Alexithymia, dark personality traits, and fight/flight/freeze) have played a predictive role in changes in the dependent variable (mind-reading ability).

Table 3

Analysis of Variance Results for Examining the Effect of the Brain System, Dark Personality Traits, and Alexithymia on Theory of Mind

Model	Source	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance Level
1	Regression	635.301	1	635.301	32.081	< .0001
	Residual	1544.649	78	19.803		
	Total	2179.950	79			
2	Regression	813.142	2	406.571	22.904	< .0001
	Residual	1366.808	77	17.751		
	Total	2179.950	79			
3	Regression	926.526	3	308.842	18.726	< .0001
	Residual	1253.424	76	16.492		
	Total	2179.950	79			

Table 3 shows the standardized and unstandardized coefficients of the regression analysis. Table 3 provides

essential information for predicting the dependent variable based on Models 1, 2, and 3.

Table 4

Standardized and Unstandardized Regression Coefficients

Model	B	Standard Error	Beta	t	Significance Level
1	Constant				
	Total Alexithymia	36.895	0.327	-3.683	-10.017
2	Constant				
	Total Alexithymia	43.517	0.311	-4.067	-10.701
	Freeze System	-0.436	0.138	-0.287	-3.165
3	Constant				

Total Alexithymia	46.244	0.236	-4.055	-11.403
Freeze System	-0.397	0.134	-0.261	-2.965
Overall Dark Personality	-0.327	0.125	-0.262	-2.622

According to the regression analysis results, the variables of total Alexithymia, behavioral freeze system, and overall dark personality traits (according to Models 1, 2, and 3) have played a powerful role in predicting and explaining the variance in theory of mind. All three models were significant (as indicated by the significance level column). After determining the significance of the constant and the variables of Alexithymia, dark personality dimensions, and the behavioral freeze system, the beta value represents the standardized regression coefficient, indicating the impact of the independent variables (Alexithymia, dark personality dimensions, and freeze system) on the dependent variable (mind-reading ability).

4. Discussion and Conclusion

The goal of the present research was to investigate the relationship between brain-behavior systems, dark personality traits, and Alexithymia with the Reading the Mind in the Eyes Test in sexual offenders. The findings demonstrated that there is a significant relationship between difficulties in identifying emotions, difficulties in describing emotions, and overall Alexithymia with deficits in theory of mind in sexual offenders. These findings align with previous research (19, 20). Based on Taylor's perspective (2000), the core features of Alexithymia include difficulty in identifying emotions and distinguishing them from bodily sensations associated with emotional arousal, difficulty in describing emotions to others, and an externally oriented cognitive style, reflecting three specific deficits: 1) deficits in the cognitive-experiential components of the emotional response system; 2) deficits in regulating emotions in interpersonal relations; 3) limited capacity for fantasizing (21). Current conceptualizations define Alexithymia as a trait deficit in the cognitive processes of emotional experiences related to understanding and perceiving mental states (19, 22, 23), such that these individuals have a limited capacity to symbolize emotions and expand emotional experiences (18).

Furthermore, the findings of the present research indicated that there is a relationship between the antisocial, narcissistic, Machiavellian, and overall dark personality

dimensions with theory of mind deficits in sexual offenders. Generally, personality dimensions are consistent patterns of behavior, emotions, thoughts, and individual characteristics that distinguish one person from others (8, 13-15). In explaining this finding, it can be stated that an individual's nature, developmental experiences in the family, quality of family relationships, quality of relationships with parents and peers, models available for acquiring adaptive skills, and genetic and biological factors play roles in shaping personality and the etiology of personality disorders. Given that individuals with dark personality traits (including antisocial, narcissistic, and Machiavellian traits) have unusual thoughts and cognitions, consider themselves unique, are exploitative in interpersonal relationships, have low empathy, and are unable to put themselves in others' shoes or understand them, they exhibit aggressive behavior, are unable to establish relationships with others, and act impulsively. It can be said that the ability to understand that others possess mental states that can be different from one's own or from reality, and that human actions are prompted by internal mental states such as beliefs, desires, and intentions, is called mind-reading ability (24), and a deficit in this feature can coincide with a lack of concern for others' feelings, impulsive behaviors, emotional disinterest, low empathy, emotional coldness and manipulation, and hostile and callous behaviors, all of which are characteristics of dark personality traits.

In general, given the results of this research, it can be said that variables such as overall Alexithymia, the behavioral freeze system, and dark personality traits play a role in predicting the theory of mind abilities of sexual offenders. Individuals who commit crimes, sexual assaults, and risky behaviors and thus have higher sensation-seeking may show deficiencies in outputs from the behavioral inhibition system, including conditioned punishment cues, conditioned frustration of non-reward, and novel stimuli. The fight/flight system is also responsive to unconditional aversive stimuli, with inputs of punishment and non-reward and outputs of unconditional flight (rapid escape from a threat source) and fight (defensive aggression). Responses of this system appear as unconditional defensive aggression or avoidance

behavior (10, 15), increasing the likelihood of violence and risky behaviors. Criminals have cognitive characteristics that distinguish them from other members of society. They lack skills in managing interpersonal relationships and have a poor ability to cope with stressful events. They suffer from problems in emotional regulation and ultimately these deficiencies and aggressive sexual behaviors exacerbate their various cognitive distortions (4). Such characteristics, indicating problems in mind-reading ability, suggest a link between deficiencies in the brain-behavior system and mind-reading deficits. It is essential to note that the present study only indicates the significance of the relationship between variables and cannot definitively state which variable is a cause for the precedent of another.

The design of the present study, as a correlational design, poses limitations regarding the causal attribution of the variables examined, which must be considered. The study population is limited to a sample of available criminals. Therefore, caution must be exercised in interpreting and generalizing the findings of the research. Another limitation of this research is its self-report method, meaning that responses may be influenced by the individuals' current mood and relationships and may not reflect their usual states, behaviors, and relationships. Lack of proper cooperation from prison administrations and other staff resulted in at least a 10% reduction in sample size. Given that the research design was descriptive-correlational, conducting experimental studies in this field is recommended, as well as expanding the sample group. It is suggested that longitudinal studies be conducted to examine the stability of the variables of this research over time. This research should also be carried out with clinical samples and normal individuals. In prisons, there is an emerging minority of female offenders who could not be sampled due to security and ethical issues, but it is recommended that future research examine the psychological processes of these individuals, investigate their theory of mind, and even compare them with other male offenders. It is suggested that to prevent problems that criminals or any individual may face due to an inability in mind-reading, this ability should be examined in the early years of adolescence through schools in a unified manner, and if a problem in this capability occurs, it should be promptly addressed and resolved.

In summary, the findings of the present study showed that theory of mind is significantly related to the inability to identify and describe emotions, all dark personality dimensions, and the brain-behavior systems of fight, flight, and freeze. The findings of this research can be used to develop educational and therapeutic programs and interventions in prisons, crime prevention centers, and high schools.

Authors' Contributions

S.H.A. conceptualized the study, designed the research methodology, and supervised the data collection process. M.M.A., the corresponding author, performed the data analysis using Pearson correlation coefficients and multiple regression analysis, interpreted the results, and took the lead in drafting and revising the manuscript. Z.K. contributed to the development and validation of the measurement instruments, assisted in data collection, and participated in the literature review. All authors contributed to discussing the results, critically reviewed the manuscript for important intellectual content, and approved the final version for publication.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study placed a high emphasis on ethical considerations. Informed consent obtained from all participants, ensuring they are fully aware of the nature of the study and their role in it. Confidentiality strictly maintained, with data anonymized to protect individual privacy. The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki.

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