



Relationship between Coping Styles and Affective Decision-Making Process Among Schizophrenia Patients and Healthy Controls

Kertzman S^{1*}, Rauchverger B^{2*}, Waseem SZ³, Weizman A^{3,4,5}, Portuguese S^{2,6} and Grinshpoon A^{2,6}

¹Department of psychiatry, Adelson School of Medicine, Ariel University, Israel

²Sha'ar Menashe Mental Health Center, Hedera, Israel

³Laboratory of Biological Psychiatry at the Felsentein Medical Research Center, Israel

⁴Research Unit, Geva Mental Health Center, Israel

⁵Sackler Faculty of Medicine, Tel-Aviv University, Israel

⁶Rappaport Faculty of Medicine, Technion, Israel Institute of Technology, Israel

Abstract

Psychiatry has shown a growing interest in the role of emotion in decision-making because emotion appears to make a substantial contribution to the decision-making process. There are no studies analyzing the relationship between affective decision-making and coping skills in Schizophrenia (SZ). Our objective was to investigate the effect of coping skills on decision-making in SZ. We aimed to study the differences in coping styles, measured by the Behavioral Attitudes and Search Evaluation test (BASE), between good and bad performers on the Iowa Gambling Task (IGT). The 37 SZ participants and 46 Healthy Controls (HC) performed the IGT and BASE. Affective decision-making and coping skills are impaired among individuals with SZ compared with HC. A combination of two coping styles, such as preference for search activity and rejection of renunciation of search, was associated with better performance on IGT in both groups. We demonstrate that the association between coping style and performance on the IGT is not bidirectional. Coping strategies affect IGT performance, while performance on IGT does not affect coping style. In conclusion, participants with a more adaptive coping style were better decision-makers. One possible explanation for this association is that the more effective coping style may represent better functioning of the affective systems.

Keywords: Schizophrenia; Risky decision; Search activity; Stereotyped behavior; Renunciations of search

Background

The Iowa Gambling Task [1] is the most commonly used research tool for the investigation of affective decision-making and also serves as a tool for clinical assessment [2]. In this task, participants make repeated choices between four alternatives with different outcomes, and individuals attempt to maximize the net reward over time. Each individual must learn the possibilities using trial and error for this aim. Factors influencing IGT performance have been previously investigated [3,4]. Some authors have looked at the role of cognitive factors [5], while others focused on the influence of personality [6]. Literature about the interaction between the decision-making process and personality characteristics tends to focus on impulsiveness [7], sensation-seeking [8]. The results of previous studies on the association between affective decision-making and emotional characteristics are inconsistent. In psychiatry, understanding individual differences in the ability to cope with stress has been suggested as a key factor in biopsychosocial models of the development and persistence of a disorder [9]. In the present study, the term “coping” is used as a measure of dealing with stressful events. Previously, it was found that coping with stress is closely linked to emotion regulation [10]. There is little systematic analysis of the role of coping ability in affective decisions during IGT performance. Stress influences a shift from a flexible learning process towards more automatic forms of control and an increase in risky choices [11,12]. It has also been suggested that stress facilitates a shift toward inaction [13]. Stress leads to risky decisions in the IGT [14] and slower

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*Correspondence:

Semion Kertzman, Department of psychiatry, Adelson School of Medicine, Ariel University, Ariel, Israel,
E-mail: kertzman@Animascan.com
Rauchverger Boris, Sha'ar Menashe Mental Health Center, Hedera, Israel

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learning during the performance [11]. Despite these suggestions, the current understanding of the relationship between coping ability and the capacity to make correct decisions in various situations with unpredictable outcomes is limited.

Schizophrenia (SZ) is a chronic neurodevelopmental disorder with deficits in affective processing [15]. In fact, in some studies, patients with SZ showed poor IGT performance compared to Healthy Controls (HC) [16-19]. However, other group of authors failed to find differences between patients with SZ and HC [20-22]. Thus, it is important to investigate the role of coping styles in IGT performance among individuals with SZ.

Although it is postulated that stress plays an important role in the pathophysiology of SZ, little research has been done to investigate the interaction between affective decision-making in the IGT and coping skills in patients with SZ. Empirical studies indicate that individuals with SZ use specific coping strategies to limit the effects of stress-related overstimulation [23]. However, most patients with SZ use maladaptive coping strategies. Deficiencies in active problem-focused behavior leads to ineffective and inflexible coping strategies (submissiveness, lying, denial), and passive behavior in situations of confrontation with negative emotions [24]. Stressful situations provoke one of four styles of coping behaviors [25]:

1. Search activity: Attempting to control the unpredictable situation by continuous monitoring of the outcomes during the activity. "Search activity" may be a coping style that increases the effectiveness of decision making in situations with unpredictable outcomes.
2. Stereotyped behavior, which uses habitual skills and algorithms with predictable outcomes. "Stereotyped behavior" includes a shift from a flexible learning process towards automatic forms of control.
3. Chaotic (panic) behavior directed to several alternatives without monitoring the outcomes of the activity, which is inefficient.
4. Renunciation of search (passive behavior) manifesting itself in giving up and learned helplessness leading to maladaptive anxiety and depression. The "renunciation of search" represents an inefficient coping behavior, and a shift towards indecisiveness.

In the present study, both "renunciation of search" and "stereotyped behavior" were expected to be preferred coping styles in individuals with SZ compared to HC.

It was found that uncertainty has been shown to lead to acute stress reactions [26]. Despite evidence of a range of emotional and cognitive factors as the precursors of affective decision, the precise nature of the coping styles in IGT performance has not been investigated.

The purpose of this study was to investigate the effect of sensitivity to stress as a factor that limits decision-making abilities and increases risky choices. It is not clear if a good performance on IGT could be a resilience factor in coping with stress, but a risky decision may increase sensitivity to stress. The second hypothesis has received significantly less attention than the first. To test these two hypotheses, we examined the association between the four BASE scales score and the net score of the IGT in individuals with SZ and HC. We expect that participants in both groups with maladaptive coping styles should display poorer affective decision-making. SZ participants would demonstrate the stereotyped, and passive styles of coping while HC would express the search activity style.

Participants and Methods

All 37 male participants, aged 18 to 50 years, in the SZ group, were hospitalized at Shaar Menashe Mental Health Center. All participants lived with family or in their own homes. All participants were taking antipsychotic medications at the time of their participation in the study. Inclusion criteria were: 1) Psychiatric diagnoses (F20.0, F20.2, F20.5, F25) were established by two senior psychiatrists based on psychiatric interviews, supported by anamnesis, and observations by the hospital staff, medical records, and interviews with family members; 2) Capability to participate in the neuropsychological assessment. Exclusion criteria for patients with SZ were: 1) Acute psychotic state with agitation, violence and disorganized behavior interfering with the ability to perform tests; 2) Participants suffering from any clinically significant physical disorder; 3) Participants with neurological diseases, borderline cognitive functioning or intellectual disability.

The HC group consisted of 46 male volunteers from the hospital staff. They underwent psychiatric interviews and revealed no evidence of a history of psychiatric disorders, substance use disorders, physical or neurological diseases or current psychopharmacological treatments.

Initial data collection procedure: The following demographic and medical data were collected: Age, education, marital status, ethnicity, years of work, psychiatric disorders in first degree relatives; history of psychiatric disorders, previous hospitalizations and psychopharmacological treatments; history of alcohol and substance use disorders.

Study procedure

Patients with SZ and healthy participants were assessed using the Behavioral Attitudes and Search Evaluation test (BASE) [27], which examines coping strategies. They also underwent a computerized Iowa Gambling Test [28] which mimics real-life decisions in terms of gains and losses in order to test for risk-taking propensity (IGT) [29]. All tests were carried out in accordance with relevant guidelines and regulations.

The Behavioral Attitudes and Search Evaluation test (BASE)

These BASE combines principles of projective technique and a personality questionnaire [27]. It includes descriptions of 16 open situations with four possible reactions to each of them. The examinee has to choose two reactions in each situation: The most appropriate from his/her point of view (scored +1) and the least appropriate (scored -1). The preferences and rejections of the subject provide an opportunity for quantitative measurement of four behavioral attitudes: Search Activity (A), Stereotyped Behavior (ST), Chaotic Behavior (C), and Renunciation of Search (P). The total score of the four scales can range from -16 to +16. Previously, the test was validated in Israel [30]. All test situations seem equally acceptable both ethically and pragmatically. An example to illustrate the general principle:

A group of hikers went to a cavern unfamiliar to them. Just as they arrived inside the cavern, a landslide buried the exit. While discussing the situation, the following suggestions arose:

A. I suggest searching for another exit. We'll mark our way with small mounds of stones so that we might recognize the places we have already passed even by touch when our flash lights are out.

B. Of course, we must search for another exit! But we cannot waste our time on excessive precautions. Remember that we do not have food.

C. Let us wait until our friends find us. If we economize our strength, our poor provisions will be enough to maintain our lives while waiting.

D. I suggest trying to dig a passage through the landslide. This can take a lot of time, but at least we know that the exit is here. We don't know whether there is another exit elsewhere."

In this situation, answer A corresponds to the search orientation because it suggests an activity with an unpredictable outcome, and fixation of all intermediate results (marking the way with stones). Answer B indicates chaotic tendency because it denies fixation of the results. Answer C reflects a passive attitude because it does not suggest any type of activity. Answer D shows a tendency to stereotyped behavior: high level of activity without considering possible obstacles.

The IGT

The IGT was developed to test emotion-based learning [31]. IGT participants select cards from four decks. Participants aim to make as much "money" as possible during the task. Each deck has different frequencies of reward and punishment. Two disadvantageous decks have large rewards and more pronounced punishments, resulting in a significant loss of "money". Advantageous decks offer moderate rewards and small punishments [1]. In our experiment we used the "Casino" version of IGT [28] that differs from the original version in two ways. First, the task immediately shows the result of each choice. Second, instructions were presented on the computer screen rather than verbally. Instructions included the following hint, previously shown to be critical to good IGT performance [32]: "The only hint I can give you, and the most important thing to note is this: Out of these four decks of cards, there are some that are worse than others, and to win you should try to stay away from bad decks".

Data collection and analysis

Data were analyzed using the IBM® SPSS® (v. 26) software for Windows. All analyses used two-tailed levels of significance ($p < 0.05$). Descriptive statistics were calculated for age, education level (years) and sex differences. ANOVA and Mann-Whitney U tests were used to compare group differences in demographic characteristics. Evaluation of BASE parameters was carried out using GLM Univariate and Multivariate Mode. BASE characteristics such as Search Activity, Stereotyped Behavior, Chaotic Behavior, and Passive Behavior were assigned as dependent variables, while Group was used as independent variable. Age and education were entered as covariates.

For analyzing the profile of IGT performance we conducted GLM Univariate and Repeated Measures tests with scores in "blocks" as the within-subject factor, "Group" as the between-subject factor and "Education" as a covariate. To determine potential predictors of IGT performance, we conducted a multiple stepwise regression analysis with total IGT score as the dependent variable and the BASE parameters as independent variables.

Procedure

Participants performed the IGT and BASE alone in a quiet testing room. Experimental tasks were run on a PC using Microsoft Windows 10. Stimuli were presented in full-screen mode on a 24-inch display at the native screen resolution of 1680×1050 pixels.

Results

Between-group comparison of socio-demographic characteristics

Age [Mean and (SD)] was not different between the SZ [37.76 (9.95)] and HC [35.09 (10.52)] groups [$F(1.82) = 2.37, p = 0.089$]. However, SZ participants (10.26 ± 1.15) were significantly less educated (in years) than HC (12.34 ± 0.896) participants [$F(1.82) = 35.98, p < 0.001$]. Thus, education level was entered as covariate for further analysis.

Between-group differences in Iowa Gambling task performance

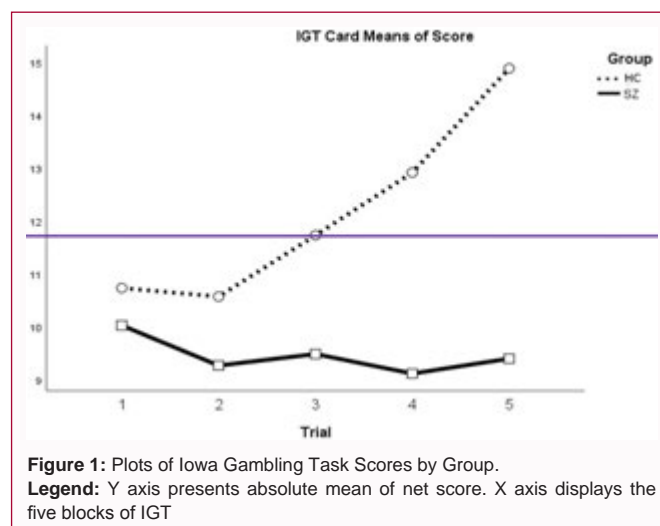
Table 1 presents mean net score as a function of each 20-trial block. As shown, performance improved over time and had a curvilinear shape only in the HC group. To determine the improvement of performance during all trials, a GLM repeated-measures analysis was carried out on net scores, which confirmed a significant effect of block [$F(4.78) = 21.64, p < 0.001, \eta^2 = 0.520$] and a significant Block X Group interaction [$F(4.78) = 26.99, p < 0.001, \eta^2 = 0.250$]. The effect of education was not significant as the Block X Education effect was [$F(4.78) = 2.12, p = 0.068$]. For HC, net scores in Blocks 2 to 5 were significantly higher than net scores in Block 1 ($p < 0.01$), which was not the case for SZ (Figure 1).

Between-group differences in the Behavioral Attitudes and Search Evaluation test (BASE)

In healthy subjects the score of the search activity was $+2.59 \pm 2.57$, the score of stereotyped activity was $+0.68 \pm 1.67$, the score of chaotic activity was $+0.35 \pm 2.37$ and score of passive behavior was -3.84 ± 2.30 . In patients with SZ, search activity scored $+0.97 \pm 2.17$, stereotyped activity scored $+1.63 \pm 2.27$, chaotic activity scored -0.80 ± 2.50 and passive behavior scored -1.57 ± 2.35 . In patients with SZ the search activity was significantly lower ($p < 0.001$) and passive behavior significantly higher ($p < 0.001$) than in healthy subjects (Table 2 and Figure 2). Patients with SZ showed significantly higher stereotyped activity ($p < 0.03$) than healthy subjects.

Correlations between IGT blocks and BASE measures are displayed in Table 3.

Multiple regression analysis was introduced to analyze the predictive values of each BASE characteristic, and the "Group" variable on Iowa Gambling Test scores. Group, Search Activity score,



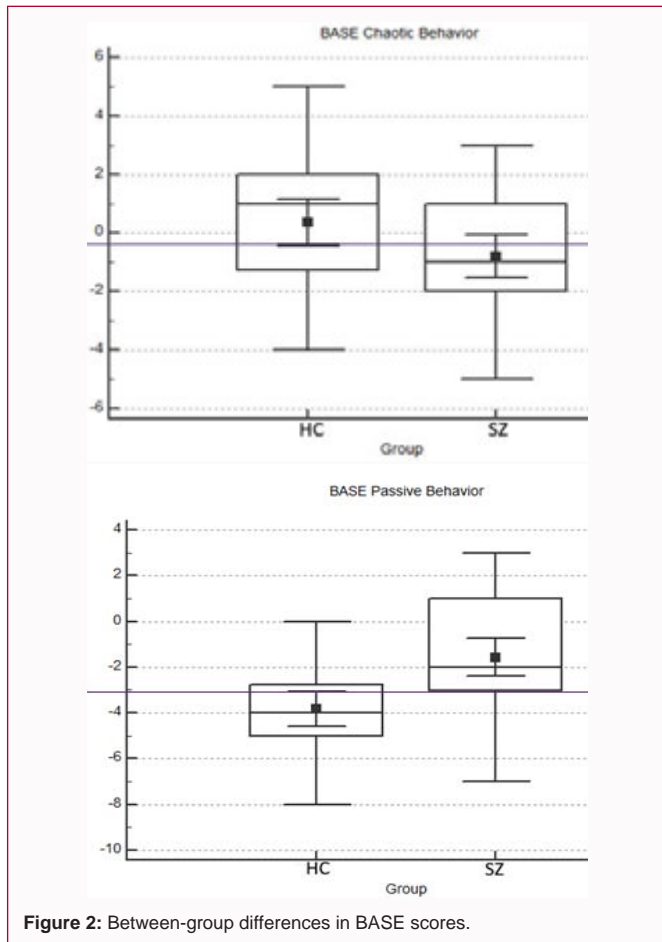


Figure 2: Between-group differences in BASE scores.

Stereotyped Behavior score, Chaotic Behavior score and Passive Behavior score were assigned as independent variables while IGT score were used as the dependent variable. Only variables with a statistically significant contribution to prediction (e.g. $p < 0.05$) are presented in Table 4.

As shown in Table 4, three BASE parameters were significant in predicting IGT score [$F(4,78) = 8.187, p = 0.003, R^2 = 0.437$]. The ability of the BASE score to predict IGT performance for SZ patients was 13.57-fold lower than in healthy controls.

On opposite side to verify possible predictive influence of IGT net score on BASE characteristics GLM Multivariate Analysis (MANOVA) with parameters estimate was introduced. Main BASE characteristics listed above were assigned as dependent variables, Group was fixed factor and IGT net score used as covariate. The results demonstrated that IGT Score had no predictive value for BASE characteristics.

Table 1: Mean net scores in each of the five blocks of the Iowa Gambling Test in the two research groups.

	SZ	HC	F	p	η^2
Blocks of IGT	Net Score	Net Score			
1 st Block	10.02 (1.43)	10.73 (2.40)	2.73	=0.102	
2 nd Block	9.26 (1.75)	10.57 (2.46)	8.29	<0.001	0.093
3 rd Block	9.48 (2.04)	11.77 (2.08)	21.11	<0.001	0.207
4 th Block	9.11 (2.60)	12.92 (2.50)	39.71	<0.001	0.329
5 th Block	9.31 (2.51)	14.89 (2.25)	105.9	<0.001	0.567

Table 2: BASE - Adjusted means (and standard deviations).

Variable/Condition	SZ	HC	F*	p	η^2
BASE					
Search Activity	0.97 (2.17)	2.59 (2.57)	22.93	<0.001	0.156
Stereotyped Behavior	1.63 (2.27)	0.68 (1.67)	8.31	=0.004	0.053
Chaotic Behavior	-0.80 (2.50)	0.35 (2.37)	2.57	=0.101	
Passive Behavior	-1.57 (2.35)	-3.84 (2.30)	33.97	<0.001	0.174

*df(1,82)

Table 3: Spearman correlations between IGT and BASE scores in the five blocks (All participants).

BASE/IGT	1 st	2 nd	3 rd	4 th	5 th
Search Activity	0.058	0.178	0.253*	0.288**	0.377**
Stereotyped Behavior	-0.183	-0.181	-0.155	-0.174	-0.141
Chaotic Behavior	0.096	0.212	0.078	0.138	0.127
Passive Behavior	0.101	-.269*	-0.292**	-0.372**	-0.392**

**Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

Table 4: Multiple hierarchical regression analysis of the predictive value of the "Group" variable and BASE scores on IGT net score.

IGT	B	95% CI B	β	R ²	r partial
TOTAL SCORE		LL UL			
Model				0.398**	
Group	-13.016	-17.041 -8.9	-0.597		-0.561***
Search Activity	1.233	0.298 2.141	0.281		0.281*
Stereotyped Behavior	-1.179	-1.037 -2.313	-0.044		-0.224*
Passive Behavior	-1.171	-1.994 -0.349	-0.3		-0.300**

Note: B: Unstandardized regression coefficient; CI: Confidence Interval; LL: Lower Limit; UL: Upper Limit; β : Standardized coefficient; R²: Coefficient of determination; r partial: Pearson correlation coefficient; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Discussion

The purpose of this study was to characterize the associations between coping behavior and risky decisions among individuals with SZ as compared to HC. The current study confirms that the affective decision-making process of individuals with SZ is impaired, as was found in several previous studies [33]. Despite extensive investigation of risky decision-making, there is no consensus as to whether SZ disorders are associated with impaired performance on the IGT. Purcell [33] concluded that show impaired IGT performance because a decreased ability to perceive risk-relevant information and to discriminate between "safe" and dangerous options [16,17,19] but not others [18,20-22,34]. In accordance with previous studies [35,36], SZ patients have decreased coping skills. The available studies did not analyze the role of the "search activity" in IGT performance. We found that the "search activity" score was significantly lower in SZ patients than in HC, while "stereotyped" and "renunciation of search" (passive behavior) scores were higher in SZ than in HC.

In order to evaluate the effect of coping skills on the decision-making process, we assessed the association between BASE scores and the IGT net score. A combination of two coping styles such "preference of search activity" and "rejection of passive behavior" was associated with better IGT performance in both groups.

Moreover, both healthy participants and SZ patients who have more effective coping skills perform better on the IGT. One possible explanation for this association is that a more effective coping style

and better IGT performance in both samples represent a better function of the affective systems.

The association between coping style according to the BASE and the net score of the IGT in individuals with SZ was significantly weaker than in the HC (Table 3). It seems that SZ can reduce the association between coping skills and IGT performance. Some authors have noted that a poor net score on the IGT among individuals with SZ can be related to a wide range of factors [2,36] beyond the effect of coping skills. Impaired IGT performance can be related to multiple cognitive and affective deficits such as impaired working memory, hypersensitivity to reward and/or hyposensitivity to punishment which is more pronounced in SZ patients. Moreover, low introspection in participants with SZ can decrease the correlations between coping style and IGT performance.

The current study demonstrates that the association between coping style and performance on the IGT is not bidirectional. Coping strategies affect IGT performance while performance on the IGT does not affect coping style. For example, a passive coping style such as the renunciation of the search was associated with lower learning ability on the IGT. However, in both groups, poor learning ability on the IGT was not associated with the use of a passive coping style.

Another major finding is that in our human sample, results are in concordance with previous experiment in rats. Nobrega [37] showed that the Rat Gambling Task did not predict escape deficits in the learned helplessness experiment. In contrast, exposure to the learned helplessness protocol resulted in a significant increase in risky choices on the Rat Gambling Task.

Limitations

Although using a self-reported questionnaire such as BASE for evaluating coping styles in SZ is a promising approach, it is limited by the influences of social desirability. Personality characteristics can also influence coping styles and affective decisions. However, this issue is beyond the scope of the present study. Our sample consisted only of men; thus, the current study could not analyze for the impact of gender on the relationship between coping style and decisions. Finally, the results should be replicated and confirmed in a larger clinical population consisting of men and women with SZ.

Conclusion

The current study found that the associations between coping skills and affective decisions were similar in SZ and HC. To our knowledge, this is the first study to demonstrate that using the "search activity" coping style was associated with good performance on the IGT, but the "renunciation of search" style is associated with a worse affective decision-making process. Even after adjustment for education level, the association between coping style and the IGT performance remained significant. These findings have important implications for understanding the role of coping style in the regulation of affective decisions. The present findings provide novel insight into the role of coping styles in the regulation of the affective decision-making process. Coping styles significantly affect the decision-making process, while decision making does not influence the coping styles in individuals with SZ or HC.

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