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Intrinsic Motivation in Schizophrenia: Relationships to Cognitive Function, Depression, Anxiety, and Personality

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The goal of the current project was to assess subjective reports of intrinsic motivation and their relationship to cognitive function, mood, and personality in schizophrenia. The authors used the Motivational Trait Questionnaire to examine 3 components of intrinsic motivation (personal mastery, competitive excellence, motivation related to anxiety). They also examined fluid intelligence, context processing, and working memory, as well as self-reports of mood and personal traits related to motivation. Participants were 66 individuals with schizophrenia or schizoaffective disorder and 44 healthy controls. Self-reports of personal mastery and competitive excellence did not differ between controls and individuals with schizophrenia, though patients did report significantly higher motivation related to anxiety. Among controls, but not patients, self-reports of intrinsic motivation were strongly related to cognitive performance. In contrast, both controls and patients showed similar strong relationships between self-reports of intrinsic motivation and related measures of mood and personality. These results are not consistent with the hypothesis that motivational deficits in schizophrenia reflect impairments in intrinsic motivation. However, they do suggest that the normal relationship between self-reports of intrinsic motivation and cognitive function is disrupted in schizophrenia.

Keywords: schizophrenia, motivation, emotion, functional outcome, negative symptoms

Numerous studies have documented that cognitive dysfunction is a common problem in individuals with schizophrenia (Barch, 2005a; Green, 1998; Green, Kern, & Heaton, 2004). Most theories of schizophrenia assume that such cognitive deficits result from pathophysiological processes involved in this illness. However, it has also been hypothesized that disturbances in motivation may impair performance both on laboratory-based cognitive tasks and in the use of cognition in everyday life. Surprisingly, little empirical work has examined the integrity of motivational processes in this illness. The goal of the current article is to examine the level of self-reported intrinsic motivation in individuals with schizophrenia compared with healthy controls and to examine the relationship between self-reports of intrinsic motivation, personality, negative symptoms, and cognitive function in schizophrenia.

The idea that impairment in motivation is a core feature of schizophrenia has a long clinical and theoretical history (Bleuler, 1950; Kraeplin, 1950). For example, the current *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev. [*DSM–IV–TR*]; American Psychiatric Association, 2000) criteria for schizophrenia include symptoms such as apathy and amotivation, which are considered to be negative symptoms of schizophrenia. According to Ryan and Deci (2000b), amotivation can arise from multiple sources, including not feeling competent to perform an activity, not expecting an action to lead to a desired outcome, and not desiring the outcome in the first place. Although individuals with schizophrenia could experience amotivation for all of these reasons, a growing body of research suggests that individuals with this illness may have difficulty representing the reward value of stimuli not present in their current environment (Juckel et al., 2006), which may relate to a lack of desire for the outcome. In theory, such motivation deficits in schizophrenia could influence many facets of behavior (Rector, Beck, & Stolar, 2005), including the ability to work toward goals that others may find pleasurable, to engage in productive occupational work, and even to engage in therapy (Velligan, Kern, & Gold, 2006). Furthermore, a lack of motivation could also impair cognitive task performance in laboratory settings. We often assume that participants in cognitive studies are motivated to do well on our tasks. However, individuals with schizophrenia could perform poorly because of a lack of such motivation, instead of (or in addition to) because of cognitive deficits intrinsic to the illness.

For the purposes of this article, we distinguish between intrinsic and extrinsic motivation. Intrinsic motivation is defined as the "doing [of] an activity for the inherent satisfaction of the activity itself"(Ryan & Deci, 2000b, p. 71). We define extrinsic motivation as the "performance of an activity in order to attain some separable outcome [tangible reward]" (Ryan & Deci, 2000b, p. 71). Years of research on operant conditioning have demonstrated that behaviors followed by positive reinforcement (a type of tangible reward) are more likely to be repeated (Deci, Koestner, & Ryan, 1999). The beneficial effects of extrinsic rewards may be particularly impor-

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tant for tasks in which the person has low interest, such as some of the tasks that are often used in laboratory-based cognitive research (Ryan & Deci, 2000a, 2000b). One area in which extrinsic motivation has been studied in schizophrenia is the work on token economies, in which adaptive behaviors are prompted through the provisions of tokens that can be used to obtain tangible rewards. As recently reviewed, controlled studies have demonstrated that token economy intervention can clearly improve adaptive behaviors in controlled environments in individuals with schizophrenia (Dickerson, Tenhula, & Green-Paden, 2005). However, it is not clear how well these gains are maintained once explicit reinforcements are removed (Dickerson et al., 2005).

Several studies have also examined the degree to which cognitive task performance in individuals with schizophrenia can be improved by the provision of extrinsic rewards, primarily in the form of contingent monetary reinforcement. The results of these studies suggest that for the most part, monetary reinforcement alone does not significantly improve performance on tasks such as the Wisconsin Card Sorting Task (Bellack, Mueser, Morrison, Tierney, & Podell, 1990; Green, Satz, Ganzell, & Vaclav, 1992; Hellman, Kern, Neilson, & Green, 1998), though one study using larger monetary rewards did find some evidence of improvement (Summerfelt et al., 1991). However, the combination of enhanced instruction and contingent monetary reinforcement can improve performance on the Wisconsin Card Sorting Task and the span of apprehension, with some evidence of maintenance of short periods of time (Bellack et al., 1990; Green et al., 1992; Kern, Green, & Goldstein, 1995).

Although most of the empirical work on motivation in schizophrenia has focused on extrinsic motivation, this may not be the primary motivational process by which individuals complete everyday tasks. For example, performing well in a school or work environment may be as influenced by intrinsic motivations as extrinsic motivations (or even more so). Much of the research on intrinsic motivation is embedded in the achievement motivation literature. This work draws on models of self-regulation that incorporate concepts of need for achievement and fear of failure. One way in which this has been framed is in terms of approach goals or motivations, such as the desire to obtain a positive outcome or achieve personal mastery, and avoidance goals or motivations, such as the desire to avoid a negative outcome or evaluation (Dweck & Elliott, 1983; Elliot & Harackiewicz, 1996). Research suggests that manipulation of approach motivation is associated with enhancement of intrinsic motivation and sometimes improved performance, while manipulations of avoidance motivations are associated with decreased intrinsic motivation and can also be associated with reduced performance (Elliot & Harackiewicz, 1996). Individuals who are intrinsically motivated to achieve some positive outcome (e.g., do well on a test, achieve some level of recognition at work) or to improve their performance in some way (e.g., do better on this test than the last test, gain a better job) may be more likely to initiate a behavioral plan that will achieve the desired outcome. For example, such individuals might choose to study extra hours, check their work an extra time, perform additional or new tasks at work, spend time filling out job applications, and so on, and may do these activities even in the absence of explicit extrinsic motivators. We realize that this is a rather simplistic description of the relationship between intrinsic motivation and behavioral initiation of actions to achieve goals. For example, it is not clear whether variations in intrinsic motivation alter the ease with which certain action plans can be selected, alter the links between either short- or long-term goals and associated action plans, or alter the reward value of intermediate behaviors that bridge the gap between current and future states. The exact mechanisms and processes that determine levels of intrinsic motivation in an individual and how this leads to behavioral initiation and goal attainment are complex and are clearly in need of further research.

Work by a number of individuals has extended this approach to understanding intrinsic motivation into the individual-differences domain (Elliot & Thrash, 2002). For example, Kanfer and colleagues have argued for three dimensions of motivation traits that may influence the degree to which individuals pursue different types of goals (Heggestad & Kanfer, 2000; Kanfer & Ackerman, 2000; Kanfer & Heggestad, 1997). *Personal mastery* refers to the desire to learn new skills or knowledge and setting standards or goals that involve mastery of new skills even when there are no external requirements to do so. Thus, individuals who score high on personal mastery may choose to study extra hours, engage in new tasks, or take on new responsibilities at work because they wish to do so, even if they will not receive any external rewards for doing so. *Competitive excellence* refers to the degree to which an individual likes to compete with others and compare his or her performance with that of others, and the degree to which the individual's evaluations of his or her own performance depend on the extent to which he or she outperformed others. Thus, individuals who score high on competitive excellence may choose to work extra hours at school or work because they wish to do better than their classmates or coworkers. Lastly, *motivation related to anxiety* refers to the degree to which an individual focuses on the likelihood of or consequences of failing. Research has indicated that the traits of personal mastery and competitive excellence are more strongly related to enhanced performance on laboratory-based cognitive tasks than is motivation related to anxiety (Hinsz & Jundt, 2005; Kanfer & Ackerman, 2000). Personal mastery traits are thought to reflect approach-oriented motivational traits or goals. Competitive excellence traits are thought to reflect a mixture of approach- (desire to compete) and avoidance-related (failing compared with others) goals. Motivation related to anxiety traits are thought to primarily reflect avoidance-related goals. Consistent with this last hypothesis, Heggestad and Kanfer (2000) found strong positive correlations between motivation related to anxiety and both neuroticism and trait anxiety. These researchers also found a positive, though not significant, correlation between personal mastery and extraversion, though competitive excellence was not related to either neuroticism or extraversion.

Interestingly, almost no empirical work has examined intrinsic motivation in individuals with schizophrenia. This may relate in part to the perception that it is more difficult to operationalize intrinsic motivation and to assess objective indicators of intrinsic motivation. Although there has been little empirical work focused on the assessment of intrinsic motivation in schizophrenia, the cognitive rehabilitation work in this area has begun to address the importance of enhancing intrinsic motivation (Medalia, Revheim, & Casey, 2002). For example, the neuropsychological education approach to rehabilitation (NEAR) program was designed with an explicit emphasis on enhancing intrinsic motivation by (a) using more engaging and interesting software packages for cognitive

practice, (b) having patients participate in choosing the focus of training, and (c) having the NEAR leader serve as a coach who helps to engage the consumers in active guidance of their own treatment program (Medalia, Revheim, & Herlands, 2002; Velligan et al., 2006). This program has been shown to be effective in improving performance on an externally valid problem-solving task, with gains maintained 4 weeks after treatment (Medalia, Revheim, & Herlands, 2002). In addition, if one uses attendance as a proxy for intrinsic motivation (attendance was voluntary), Medalia and Richardson (2005) found that better attendance was associated with greater improvement.

The goal of the current study was to examine the integrity of intrinsic motivation among individuals with schizophrenia using a reliable and valid self-report measure of the motivational traits described above, entitled the Motivational Trait Questionnaire (MTQ; Heggestad & Kanfer, 2000; Hinsz & Jundt, 2005; Kanfer & Ackerman, 2000). The MTQ has three major subscales that measure personal mastery, competitive excellence, and motivation related to anxiety, each of which has two subscales. The relationship of MTQ scores to cognitive performance and academic achievement has been examined in several studies. In initial work, Kanfer and Ackerman (2000) found only a modest relationship between MTQ scale scores and aggregate measures of fluid and crystallized intelligence in a sample of adults who all had at least a bachelor's level of education. In subsequent work, Hinsz and Jundt (2005) found significant, though modest, positive correlations between higher scores on both personal mastery and competitive excellence and performance on an idea-generation task. In recent work, Ackerman, Bowen, Beier, and Kanfer (2001) found that in a sample of college freshman, the personal mastery subscales (particularly desire to learn) were significantly correlated with crystallized IQ and with performance on tests of academic knowledge. Furthermore, the personal mastery subscales loaded strongly on a Verbal/Intellectual Trait Complex factor that demonstrated significant positive correlations with scores on a range of advanced placement tests. Thus, there is at least some evidence that higher self-reports of intrinsic motivation on the MTQ, particularly for personal mastery, are associated with both laboratory-based cognitive performance and externally valid measures of real-world academic achievement.

We asked the following questions to assess the degree to which intrinsic motivation is impaired in schizophrenia. First, we asked whether individuals with schizophrenia show reduced mean levels of personal mastery, competitive excellence, or motivation related to anxiety. Second, we asked whether individual differences in any of these intrinsic motivation traits are related to the severity of negative symptoms also thought to reflect motivational deficits (amotivation, asociality, anhedonia). Third, we asked whether individual differences in intrinsic motivation traits are related to the level of cognitive task performance. If cognitive deficits in schizophrenia are at least partially related to reductions in intrinsic motivation, then we should find positive relationships between self-reports of intrinsic motivation and cognitive performance in both controls and individuals with schizophrenia. Furthermore, we should find that the group differences in cognitive task performance are reduced after accounting for intrinsic motivation levels. Fourth, we addressed the issue of the validity of self-report measures of intrinsic motivation in schizophrenia by examining whether individuals with schizophrenia and controls showed similar relationships between individual differences in intrinsic motivation and measures of approach- and avoidance-related motivations.

Method

Participants

Participants were 66 individuals with a *DSM–IV–TR* (First, Spitzer, Gibbon, & Williams, 2001) diagnosis of schizophrenia ($N = 50$) or schizoaffective disorder ($N = 16$) and 44 healthy controls. All participants provided informed consent consistent with the Washington University Human Subject Committee policies and were paid a nominal fee for their participation. The individuals with schizophrenia or schizoaffective disorder were all outpatients recruited at various outpatient facilities in the St. Louis, Missouri, area. All individuals with schizophrenia or schizoaffective disorders were medicated and had been taking the same dose and type of medication for at least 2 weeks. The individuals with schizoaffective disorder had significantly better cognitive performance than those individuals with schizophrenia and significantly higher positive symptoms scores. The groups not differ significantly on any other measure. In addition, all of the correlational analyses presented below were identical if analyses were limited to only those individuals with schizophrenia. Controls were recruited from the same community as the individuals with schizophrenia, using newspaper and Web-based advertisements. Potential participants were excluded for (a) meeting *DSM–IV–TR* criteria for substance abuse or dependence (other than nicotine) within the last 6 months; (b) a history of neurological disorders, head injury, or loss of consciousness lasting more than 5 min; and (c) a history of mental retardation (mild or severe). Controls were also excluded for any current *DSM–IV–TR* Axis I diagnosis other than specific phobia and any past history of psychotic or bipolar disorder. Diagnostic assessments for both the individuals with schizophrenia and the controls used the Structured Clinical Interview for the *DSM–IV* (First et al., 2001) conducted by a master's level clinician who regularly participated in training and reliability sessions through the Washington University Conte Center for the Neuroscience of Mental Disorders. Clinical and demographic variables for both groups are shown in Table 1. The controls and individuals with schizophrenia did not differ on age, $t(108) = -0.14$, $p > .8$; parental education, $t(108) = -1.5$, $p > .14$; or gender, $\chi^2(1) = 0.9$, $p > .4$. However, controls had higher personal education than individuals with schizophrenia, $t(108) = 4.4$, $p < .001$.

Symptom Assessments

Clinician ratings. Clinical symptoms in both the individuals with schizophrenia and the controls were assessed with the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1983a) and the Scale for the Assessment of Positive Symptoms (SAPS; Andreasen, 1983b). As per standard SANS and SAPS instructions, the time scale for the assessment of negative symptoms was the past month, and the time scale for the assessment of positive symptoms was the past week. In making these ratings, the clinician had access to patient reports and medical records. The same master's level clinician described above conducted these ratings. The following scores were derived from the SAPS and SANS: disorganization (global scores for bizarre behavior, posi-

Table 1
Clinical and Demographic Characteristics

Characteristic	Group				Effect size of group difference (Cohen's *d*)
	Healthy controls ($N = 44$)		Individuals with schizophrenia ($N = 66$)		
	M	*SD*	*M*	*SD*	
Demographics					
Age (in years)	36.8	11.2	37.1	10.0	−0.03
Sex (% male)	66		65		
Race (% non-Caucasian)	51		59		
Education (in years)	15.2	3.9	12.6	2.4	0.79
Parental education (in years)	13.0	2.5	13.8	2.7	−0.30
Clinical ratings					
Positive symptoms[a]	0.02	0.1	1.7	1.4	−1.23
Disorganization symptoms[a]	0.5	0.5	1.3	0.9	−0.98
Negative symptoms[a]	0.4	0.4	1.8	0.8	−1.40
Anhedonia/asociality	0.8	1.0	2.6	1.3	−1.24
Anergia/avolition	0.4	0.7	2.4	1.3	−1.36

[a] Mean across items.

tive thought disorder, and attention), reality distortion (hallucination and delusions), and negative symptoms (alogia, blunted affect, anhedonia/asociality, and anergia/amotivation). We also examined anhedonia/asociality and anergia/amotivation individually.

Self-reports of anhedonia. Participants also completed the Revised Social and Physical Anhedonia Scales, which are well-validated self-report measures of hedonic capacity (Chapman, Chapman, & Kwapil, 1995; Eckblad, Chapman, Chapman, & Mishlove, 1982).

Measure of Motivation and Other Related Personality Traits

Motivational Trait Questionnaire. We used the short form of the MTQ developed by Kanfer and colleagues (Kanfer & Ackerman, 2000; Kanfer & Heggestad, 1997). The short form consists of 42 questions, divided into three major domains, each with two subdomains, as described below. Participants respond using a 6-point Likert-type scale, with 1 being *very untrue of me* and 6 being *very true of me.* The first domain is personal mastery. Example questions are "I prefer activities that provide me the opportunity to learn something new" and "I set high standards for myself and work toward achieving them." The second domain is competitive excellence. Example questions are "I would rather cooperate than compete (reverse coded)" and "Whether or not I feel good about my performance depends on how it compares to the performance of others." The third domain is motivation related to anxiety. Example questions are "Before beginning an important project, I think of the consequences of failing" and "I am able to remain calm and relaxed before I take a test (reverse coded)."

Mood and Personality Measures

To examine whether group differences in motivational levels were related to level of depression, we administered the Beck Depression Inventory (BDI; Beck & Steere, 1987), a well-validated self-report measure of depression. To examine the relationship of motivation to general anxiety, we administered the Beck Anxiety Inventory (BAI), a well-validated self-report measure of state anxiety (Beck, Epstein, Brown, & Steer, 1988).

To examine the relationship between the motivational traits and other measures of avoidance- and approach-related motivations and goals (as one means of providing evidence about the validity of self-reports of different aspects of motivation in schizophrenia), we administered (a) the Behavioral Inhibition System and Behavioral Activation System questionnaire (BIS/BAS), a measure of sensitivity to approach- and avoidance-related cues and motivation (Carver & White, 1994); (b) the short form of the Eysenck Personality Questionnaire (EPQ-SF; Eysenck, Wilson, & Jackson, 1996), which assesses the personality traits of neuroticism, extraversion, and psychoticism; and (c) the Positive and Negative Affect Scale—Expanded Form (PANAS–X), which assess positive and negative affectivity (Watson & Clark, 1994). Although neuroticism and extraversion were not intended as constructs assessing approach- and avoidance-related motivations, prior research suggests a strong relationship between measures of behavioral inhibition (BIS) and neuroticism and between measures of behavioral activation (BAS) and extraversion (Zelenski & Larsen, 1999). Such evidence suggests that measures of both neuroticism and behavioral inhibition assess sensitivity to avoidance cues or motivations and that measures of both extraversion and behavioral activation assess sensitivity to approach cues or motivations (Zelenski & Larsen, 1999).

Cognitive Function

We assessed four domains relevant to understanding cognitive function and potentially functional ability in schizophrenia: (a) verbal crystallized IQ (related to educational achievement and premorbid IQ); (b) fluid IQ, an important individual-differences measure of cognitive ability; (c) working memory (2-back version of the *n*-back task), a key cognitive function impaired in schizophrenia; and (d) context processing (the AX version of the con-

tinuous performance task [AX-CPT]), another cognitive function known to be impaired in schizophrenia. We chose these tests on the basis of prior evidence of impairment in schizophrenia (e.g., Barch, Carter, & Cohen, 2003; Callicott et al., 2000; Delawalla et al., 2006; Perlstein, Dixit, Carter, Noll, & Cohen, 2003) and because they tap constructs (e.g., working memory) previously shown to be associated with functional outcome in schizophrenia (e.g., Cervellione, Burdick, Cottone, Rhinewine, & Kumra, 2007; Gold, Goldberg, McNary, Dixon, & Lehman, 2002; Heinrichs, Goldberg, Miles, & Vaz, 2008; McClure et al., 2007; Williams et al., 2007). The working memory and context processing tests were completed by a subset of the participants, with 37 controls and 57 individuals with schizophrenia completing the AX-CPT and 41 controls and 55 individuals with schizophrenia completing the *n*-back. These two cognitive tests were completed at a follow-up session, and the reason for the reduced number of participants was attrition at follow-up. None of the results presented below differed if all analyses were restricted to the subsample that completed both cognitive measures.

Verbal IQ. We administered the Vocabulary subtest of the Wechsler Adult Intelligence Scale—Third Edition (WAIS–III; Wechsler, 1997) as a measure of verbal crystallized intelligence.

Fluid IQ. We administered the Matrix Reasoning subtest of the WAIS–III (Wechsler, 1997) as a measure of fluid intelligence.

The n-back. The *n*-back is a commonly used measure of working memory (Braver et al., 1997; Casey et al., 1995; Cohen et al., 1996) that has been frequently shown to elicit performance deficits among individuals with schizophrenia and their unaffected relatives (Barch, Csernansky, Conturo, Snyder, & Ollinger, 2002; Callicott et al., 2000, 2003; Egan et al., 2001; Menon, Anagnoson, Mathalon, Glover, & Pfefferbaum, 2001; Perlstein, Carter, Noll, & Cohen,, 2001). In the current study, participants observed letters presented on a computer screen one at a time, white letters against a black background. There were three conditions: (a) 0-back, (b) 1-back, and (c) 2-back. In the 0-back condition, participants responded to a single prespecified target letter (e.g., *X*). In the 1-back condition, the target was any letter identical to the one immediately preceding it (i.e., one trial back). In the 2-back condition, the target was any letter identical to the one presented two trials back. Thus, working memory load increased incrementally from the 0-back to the 2-back conditions.

AX-CPT. The AX-CPT is a well-validated measure of context processing that robustly elicits performance deficits among individuals with schizophrenia (Barch et al., 2001, 2003; Cohen, Barch, Carter, & Servan-Schreiber, 1999; Stratta, Daneluzzo, Bustini, Casacchia, & Rossi, 1998). Sequences of letters were visually presented one at a time on a computer display. Participants were instructed to make a positive response on target trials and a negative response otherwise. Target trials were defined as a cue–probe sequence, in which the letter *A* appeared as the cue and the letter *X* appeared as the probe. The remaining letters of the alphabet served as invalid cues (i.e., cues that were not *A*s) and nontarget probes (i.e., probes that were not *X*s). Letter sequences were presented in pseudorandom order, such that target (*A–X*) trials occurred with 70% frequency and nontarget trials occurred with 30% frequency. Nontargets were divided evenly (10% each) among the following trial types: BX trials, in which an invalid cue (i.e., non-*A*) preceded the probe; AY trials, in which a valid cue was followed by a nontarget probe (i.e., non-*X*); and BY trials, in which an invalid cue was followed by a nontarget probe. The delay between cue and probe was manipulated so that half of the trials had a short delay and half had a long delay. On short-delay trials, the cue–probe interval was 1 s, and the intertrial interval was 5,000 ms. On long-delay trials, the cue–probe interval was 5 s, and the intertrial interval was 1 s. The task was presented in four blocks of 50 trials, all of which were either short-delay (two blocks) or long-delay (two blocks) trials, with the order of short- and long-delay blocks counterbalanced across subjects.

Functional Outcome

We also wished to examine whether cognitive performance or intrinsic motivation was related to functional outcome in schizophrenia. Because of evidence that nuanced self-reports of social, occupational, and educational function from individuals with schizophrenia have questionable validity (Bowie et al., 2007), we focused on two relatively objective indicators of function: (a) living status and (b) occupational/educational status. For both living status and occupational/educational status, we used the categories outlined on the Birchwood Social Function Scale (Birchwood, Smith, Cochran, Wetton, & Copestake, 1990).

Procedure

Participants were tested in two sessions. The first session involved the diagnostic interview, the clinical ratings, and the administration of the personality questionnaires. The second session involved administration of the cognitive computer tasks and the WAIS–III Vocabulary and Matrix Reasoning tests. A trained research assistant administered all tasks.

Data Analysis

For the MTQ, we used the total scores for the three major domains as the dependent variables. The dependent scores for the WAIS–III Vocabulary and Matrix Reasoning tests were the scaled scores. For examining group differences in *n*-back performance, the dependent variables were the accuracy scores for each load level. For examining correlations with the *n*-back, we focused on the 2-back level. For examining group differences in AX-CPT performance, dependent variables were accuracy for each trial type at each delay and d' computed for each delay using just false alarms to the BX trials (referred to as d' context; Barch et al., 2001, 2003; Cohen et al., 1999). For examining correlations with the AX-CPT, we focused on d' context at the long delay, as we have argued that this should be the most sensitive measure of context processing deficits (Barch et al., 2001, 2003; Cohen et al., 1999). Group differences on the BDI, the BAI, and the WAIS–III Vocabulary and Matrix Reasoning tests were examined using independent-sample *t* tests. Group differences on the MTQ were examined using a multivariate analysis of variance (MANOVA) with group as a between-subjects factor and the three domain scores as dependent measures. Group differences on the BIS/BAS, the EPQ-SF, and the PANAS–X were also examined using MANOVAs. Significant omnibus tests were followed up by univariate analyses. Group differences on the *n*-back were assessed using a repeated measures ANOVA with group (control, schizophrenia) as a between-subjects factor and load level (0, 1, 2) as a

within-subject factor. Group differences in accuracy on the AX-CPT were assessed using a repeated measures ANOVA with group as a between-subjects factor and both delay (short, long) and trial type (AX, AY, BX, BY) as within-subject factors. Group differences in d' context were assessed using a repeated measures ANOVA with group as a between-subjects factor and delay as a within-subject factor.

Results

Group Differences

Clinical symptoms. The MANOVA for the clinical symptom domain scores indicated a significant omnibus effect of diagnostic group, $F(3, 106) = 57.6$, $p < .001$. As shown in Table 1, follow-up univariate tests indicated that individuals with schizophrenia scored higher than controls on negative, positive, and disorganization symptoms (all ps $< .001$). The MANOVA for anhedonia and avolition also indicated a significant omnibus effect of diagnostic group, $F(3, 106) = 60.6$, $p < .001$, with individuals with schizophrenia scoring higher than controls on both scales (both ps $< .001$).

Chapman scales. The MANOVA on Chapman social and physical anhedonia (see Table 2) also indicated a significant omnibus effect of diagnostic group, $F(3, 106) = 13.57$, $p < .001$, with individuals with schizophrenia scoring higher than controls on both scales (both ps $< .001$).

MTQ. The MTQ MANOVA indicated a significant omnibus effect of diagnostic group, $F(3, 106) = 7.72$, $p < .001$ (see Table 2). Surprisingly, follow-up univariate tests indicated that individuals with schizophrenia and controls did not differ in personal mastery, $F(1, 108) = 1.2$, $p > .25$, or competitive excellence, $F(1, 108) = 1.6$, $p > .20$. However, individuals with schizophrenia scored higher than controls on motivation related to anxiety, $F(1, 108) = 19.5$, $p < .001$.

Mood. Independent-sample t tests indicated that individuals with schizophrenia scored higher than controls on both the BDI, $t(108) = -4.6$, $p < .001$, and the BAI, $t(108) = -5.4$, $p < .001$.

Personality. The MANOVA for the BIS/BAS scales indicated a trend-level omnibus effect of diagnostic group, $F(2, 107) = 2.7$, $p = .07$. As shown in Table 2, individuals with schizophrenia scored slightly higher than controls on behavioral inhibition, $F(1, 108) = 4.4$, $p < .05$, but not behavioral activation, $F(1, 108) = 0.5$, $p > .4$. The MANOVA for the EPQ-SF scales indicated a significant omnibus effect of diagnostic group, $F(2, 107) = 19.5$, $p < .001$. As shown in Table 2, individuals with schizophrenia scored higher than controls on neuroticism, $F(1, 108) = 32.3$, $p < .001$, but lower than controls on extraversion, $F(1, 108) = 14.3$, $p < .001$. The MANOVA for the PANAS–X indicated a significant omnibus effect of diagnostic group, $F(1, 107) = 16.87$, $p < .01$. As shown in Table 2, individuals with schizophrenia scored lower on positive affectivity than controls, $F(1, 108) = 10.63$, $p < .01$, but higher than controls on negative affectivity, $F(1, 108) = 23.03$, $p < .01$.

Cognitive Measures

IQ. Independent-sample t tests demonstrated that individuals with schizophrenia scored significantly lower than controls on the WAIS–III Vocabulary test, a measure of crystallized intelligence, $t(107) = 2.6$, $p < .01$, and on the WAIS–III Matrix Reasoning test, a measure of fluid intelligence, $t(107) = 3.6$, $p < .001$.

AX-CPT. The ANOVA indicated a main effect of group, $F(1, 92) = 5.56$, $p < .05$; a main effect of delay, $F(1, 92) = 27.5$, $p < .001$; a main effect of trial type, $F(3, 276) = 11.18$, $p < .001$; and a Group × Trial Type interaction, $F(3, 276) = 4.0$, $p < .01$. As

Table 2
Motivation, Mood, and Personality Measures

Measure	Group: Healthy controls ($N = 44$) *M*	Group: Healthy controls ($N = 44$) *SD*	Group: Individuals with schizophrenia ($N = 66$) *M*	Group: Individuals with schizophrenia ($N = 66$) *SD*	Effect size of group difference (Cohen's *d*)
Chapman Anhedonia Scales					
Chapman Social Anhedonia Scale	11.5	4.8	14.7	4.8	−0.65
Chapman Physical Anhedonia Scale	11.7	4.5	17.0	5.7	−0.90
Motivational Trait Questionnaire					
Personal mastery	70.7	11.9	68.1	12.2	0.21
Competitive excellence	46.2	8.2	43.8	10.6	0.25
Motivation related to anxiety	56.2	14.6	68.8	14.7	−0.79
Mood					
Beck Depression Inventory	6.0	7.0	14.9	11.3	−0.83
Beck Anxiety Inventory	26.4	6.5	37.1	12.0	−0.94
Personality					
Behavioral inhibition	18.4	4.1	20.1	4.3	−0.40
Behavioral activation	37.7	4.0	36.9	7.0	0.13
Neuroticism	6.6	4.5	11.9	5.0	−0.96
Extraversion	14.1	4.2	10.7	4.8	0.80
Positive affectivity	37.0	6.9	31.2	9.2	0.61
Negative affectivity	14.6	5.5	22.0	9.1	−0.85

shown in Table 3, the main effect of delay reflected overall more errors at the long delay. Planned contrasts to follow up on the Group × Trial Type interaction indicated that the individuals with schizophrenia made more errors than controls on AX, $F(1, 92) = 5.5$, $p < .05$, and BX, $F(1, 92) = 6.8$, $p < .05$, but not on AY, $F(1, 92) = 0.0$, $p > .90$, or BY, $F(1, 92) = 0.07$, $p > .70$, trials. Furthermore, individuals with schizophrenia, $F(1, 92) = 13.4$, $p < .01$, but not controls, $F(1, 92) = 0.01$, $p > .90$, made more BX than AY errors.

The n-back. The ANOVA indicated a main effect of group, $F(1, 94) = 8.35$, $p < .005$; a main effect of condition, $F(2, 188) = 61.3$, $p < .001$; and a Group × Condition interaction, $F(2, 188) = 4.6$, $p < .05$. Follow-up contrasts indicated that the groups differed at the 1-back, $F(1, 94) = 6.39$, $p < .01$, and 2-back, $F(1, 94) = 13.02$, $p < .001$, but not at the 0-back, $F(1, 94) = 0.4$, $p > .40$.

Relationship Between Motivation and Clinical Symptoms

Given the number of variables examined in these correlations, we used a more conservative p value (.01) than the standard .05 to protect against false positives. Among individuals with schizophrenia, there were no significant correlations between any of the MTQ scales and either the SANS/SAPS symptom domains or either SANS anhedonia/asociality or amotivation/anergia ($-.15 < r < .20$). However, there was a trend for motivation related to anxiety to be significantly positively correlated with Chapman physical anhedonia ($r = .27$, $p < .05$). Personal mastery and competitive excellence were not significantly correlated with the Chapman anhedonia scales ($-.02 < r < .20$). Not surprisingly, there were no significant correlations in controls between any of the MTQ scales and any of the clinical ratings. However, in controls, Chapman physical anhedonia was correlated significantly with personal mastery ($r = -.40$, $p < .01$) and at a trend level for competitive excellence ($r = -.30$, $p < .05$).

Relationship Between Motivational Traits and Cognitive Function

As shown in Table 4, among controls, there was a relatively strong and consistent positive relationship between both personal mastery and competitive excellence and the measures of cognitive function. There was some evidence of a negative relationship between motivation related to anxiety and cognitive performance among controls, though this was significant only for d' context at the long-delay AX-CPT. In contrast, there was a striking absence of any such positive relationship between either personal mastery or competitive excellence scores and cognitive performance among the individuals with schizophrenia. Furthermore, individuals with schizophrenia tended to show a positive relationship between motivation related to anxiety and cognitive performance, with this relationship significant for d' context at the long delay. Fisher's r-to-z transformation tests indicated that the controls showed significantly stronger correlations between personal mastery and both matrix reasoning and d' context than did individuals with schizophrenia (ps $< .05$) and significantly stronger correlations between competitive excellence and both vocabulary and matrix reasoning (ps $< .05$). Furthermore, there were significant differences in the magnitude of the correlation between motivation related to anxiety and d' context among controls as compared with individuals with schizophrenia ($z = -3.1$, $p < .01$).

Table 3
Cognitive Measures

	Group				
	Healthy controls ($N = 37$)		Individuals with schizophrenia ($N = 55$)		
Measure	*M*	*SD*	*M*	*SD*	Effect size of group difference (Cohen's *d*)
WAIS–III Vocabulary	10.4	3.6	8.5	3.7	0.50
WAIS–III Matrix Reasoning	11.9	3.9	9.4	3.3	0.67
AX-CPT					
Short-delay performance					
AX errors	0.01	0.02	0.06	0.08	−0.77
AY errors	0.09	0.02	0.13	0.15	−0.25
BX errors	0.09	0.17	0.24	0.31	−0.56
BY errors	0.03	0.14	0.04	0.11	−0.08
d' context	3.4	0.6	2.5	1.3	0.79
Long-delay performance					
AX errors	0.13	0.25	0.21	0.24	−0.33
AY errors	0.12	0.18	0.09	0.16	0.18
BX errors	0.11	0.18	0.25	0.34	−0.48
BY errors	0.4	0.17	0.4	0.11	0
d' context	2.6	1.4	1.8	1.2	0.59
n-back					
0-back accuracy	0.95	0.09	0.94	0.10	0.10
1-back accuracy	0.93	0.08	0.88	0.09	0.55
2-back accuracy	0.87	0.10	0.79	0.10	0.73

Note. AX-CPT = AX version of the continuous performance task; WAIS–III = Wechsler Adult Intelligence Scale—Third Edition.

Table 4
Correlations Between Motivational Traits and Cognitive Function

Measure	1	2	3	4	5	6	7
1. Personal mastery	—	.28	−.23	.32*	.50**	.52**	.36*
2. Competitive excellence	.22	—	.08	.30*	.38*	.35*	.14
3. Motivation related to anxiety	.13	.19	—	.05	−.24	−.36*	−.20
4. WAIS–III Vocabulary	.19	−.09	.09	—	.64**	.35*	.58**
5. WAIS–III Matrix Reasoning	.18	.01	.18	.67**	—	.58**	.61**
6. AX-CPT *d′* context (long delay)	.17	.09	.30*	.46**	.50**	—	.36*
7. 2-back accuracy	.21	.14	.10	.33*	.51**	.45**	—

Note. Correlations above the diagonal are for controls ($N = 37$); correlations below the diagonal are for individuals with schizophrenia ($N = 55$). AX-CPT = AX version of the continuous performance task; WAIS–III = Wechsler Adult Intelligence Scale—Third Edition.
* $p < .05$. ** $p < .001$.

Relationship Between Motivation Traits and Measures of Mood and Personality

We had a number of different measures of mood and personality. We were concerned about examining the correlations between the three MTQ traits and all of these measures because of multiple comparisons issues. Thus, we first examined whether the mood and personality measures could be summarized into a smaller number of factors. We conducted a principal-components analysis of the following measures in each group separately, using varimax rotation and extraction of factors based on scree plot examination: (a) BDI, (b) BAI, (c) BIS, (d) BAS, (e) extraversion, (f) neuroticism, (g) positive affectivity, and (h) negative affectivity. Examinations of the scree plots in the results of the principal-components analysis in both patients and controls suggested the presence of two factors, which together accounted for 57% (controls) and 54% (individuals with schizophrenia) of the variance in each group. For both groups (controls, schizophrenia), Factor 1 had high loadings on BAI (.74, .70), BDI (.62, .73), BIS (.51, .62), neuroticism (.83, .78), and negative affectivity (.78, .77), and Factor 2 had high loadings on BAS (.82, .86), extraversion (.70, .73), and positive affectivity (.68, .29). We computed factor scores for these two factors and examined their correlations with the three MTQ scales in each group (see Table 5). For both personal mastery and motivation related to anxiety, the pattern of correlations came out as predicted in both groups: (a) a positive correlation between personal mastery and approach-related traits and (b) a positive correlation between motivation related to anxiety and avoidance-related traits. However, competitive excellence was not correlated with either approach- or avoidance-related traits in either controls or individuals with schizophrenia. In sum, these data suggest that the relationships among measures of mood and personality and between measures of motivation and mood/personality are similar in individuals with schizophrenia and healthy controls.

Table 5
Correlations Between Motivational Traits and Mood and Personality Measures

Measure	Factor 1 (Avoidance)	Factor 2 (Approach)
Controls		
Personal mastery	−.25	.32*
Competitive excellence	−.006	.15
Motivation related to anxiety	.68**	−.21
Individuals with schizophrenia		
Personal mastery	.12	.30*
Competitive excellence	.11	.20
Motivation related to anxiety	.71**	.005

* $p < .05$. ** $p < .001$.

Relationship Between Cognitive Function, Motivation Traits, and Functional Outcome

Ninety-six percent of the control sample were categorized as living independently, and 93% were categorized as working full or part time. Thus, there did not seem to be enough variance in our measures of function in controls to allow us to validly examine their relationships to cognition and motivation. However, there was more variability among the individuals with schizophrenia, with only 35% of individuals with schizophrenia categorized as living independently and only 29% categorized as working full or part time. Among the individuals with schizophrenia, we found that living status was significantly positively correlated with WAIS–III Matrix Reasoning performance ($r = .26$, $p < .05$) but was not correlated with any of the other cognitive measures or MTQ scales. In contrast, occupational status was significantly positively correlated with personal mastery scores ($r = .26$, $p < .05$) but was not significantly positively correlated with the other MTQ scales or the other cognitive measures. We also used regression equations to examine whether self-reports of intrinsic motivation and cognitive function interacted to predict living or occupational function (e.g., Is personal mastery more related to occupational function among individuals with better cognitive function?). However, none of the interaction terms in these equations were significant.

Discussion

The goal of the current study was to provide empirical data on the nature of self-reported intrinsic motivation processes in schizophrenia. Surprisingly, we did not find that individuals with schizophrenia reported lower levels of either personal mastery or competitive excellence. However, individuals with schizophrenia did show higher levels of motivation related to anxiety. Among controls, we found strong positive relationships between self-reports

of intrinsic motivation and cognitive task performance. However, individuals with schizophrenia did not show such relationships between intrinsic motivation self-reports and cognitive function. At the same time, individuals with schizophrenia and healthy controls did show similar relationships between self-reports of intrinsic motivation and self-reports of other aspects of mood and personality. Furthermore, among the individuals with schizophrenia, higher self-reports of personal mastery were associated with better occupational status. Each of these findings is discussed in more detail below, particularly in relation to understanding the function of motivational systems in schizophrenia.

As noted in the introduction, clinical theories of schizophrenia often assume impairments in intrinsic motivation in this illness. Furthermore, clinical assessments and behavioral observations suggest that individuals with schizophrenia do not seem to be motivated to pursue or engage in a range of experience that one might characterize as intrinsically motivating, such as interpersonal relationships, academic and occupational pursuits, and hobbies or recreational experiences. However, despite these clinical observations, individuals with schizophrenia did not self-report having lower levels of either personal mastery or competitive excellence. Instead, individuals with schizophrenia reported being as motivated as controls to learn new skills and knowledge even without explicit extrinsic rewards and reported being motivated to compete with others. At the same time, the individuals with schizophrenia did report significantly higher levels of motivation related to anxiety. In other words, they reported worrying more about the consequences of failing and having more apprehension and worry associated with achievement or performance evaluation situations. One might argue that higher levels of motivation related to anxiety (expecting more negative outcomes) do reflect reduced intrinsic motivation. However, motivational anxiety is clearly is different from self-reported reduced personal mastery or competitive excellence, and expecting more negative outcomes does not necessarily imply that one has any less desire to achieve positive outcomes. Importantly, measures of anhedonia and amotivation were not related to self-reports of personal mastery or competitive excellence among the individuals with schizophrenia, though motivation related to anxiety was associated with higher scores on both social and physical anhedonia.

Not surprisingly, the individuals with schizophrenia displayed impaired cognitive performance across all domains, including crystallized and fluid IQ, working memory, and context processing. As expected, the healthy controls showed robust positive relationships between higher self-reported levels of intrinsic motivation and better cognitive task performance in all domains, similar to relationships found in prior research (Hinsz & Jundt, 2005; Kanfer & Ackerman, 2000). However, self-reports of intrinsic motivation were for the most part unrelated to cognitive task performance among the individuals with schizophrenia. Importantly, however, self-reports of personal mastery were related to occupational status, with individuals reporting higher personal mastery more likely to be gainfully employed.

A first important question raised by this pattern of results is whether individuals with schizophrenia can provide valid self-reports of intrinsic motivation. In other words, maybe individuals with schizophrenia do not report lower levels of personal mastery or competitive excellence because they do not have veridical access to their internal states. Alternatively, individuals with schizophrenia may be more likely to experience demand characteristics and respond as they think the experimenter wants them to respond or as they think the average person would respond. Such problems could also lead to a lack of correlation with the cognitive measures if such self-reports are inaccurate among individuals with schizophrenia. However, several other pieces of data suggest that individuals with schizophrenia are able to provide accurate self-reports of their internal states. First, individuals with schizophrenia did show a relationship between self-reports of intrinsic motivation and occupational function. Second, individuals with schizophrenia did report higher levels of depression and anxiety, results that are consistent with a relatively large literature suggesting the common presence of enhanced depression and anxiety in individuals with schizophrenia (Schothorst, Emck, & van Engeland, 2006), which may have important relationships to quality of life (Hansson, 2006). Second, individuals with schizophrenia also reported higher levels of behavioral inhibition and neuroticism and lower levels of extraversion, again consistent with prior studies (Berenbaum & Fujita, 1994; Blanchard, Bellack, & Mueser, 1994; Blanchard, Horan, & Brown, 2001). Importantly, if individuals with schizophrenia were responding on the basis of what they thought the experimenter expected (or the way a healthy person would respond), we would not expect increased reports of depression, anxiety, and neuroticism. Third, we found the same pattern of results even if we examined only individuals who scored a 0 on the EPQ-SF lie scale. Lastly, individuals with schizophrenia and controls showed the same relationships between self-reports of intrinsic motivation and other aspects of mood and personality, providing evidence for the validity of self-reports of internal states among the participants with schizophrenia in this sample. Furthermore, other work has also provided evidence of valid self-reports of internal states in schizophrenia. For example, recent work by Bell suggested that individuals with schizophrenia, even those with poor insight, can provide reasonably accurate self-reports of mood and personality, as validated by clinician rating (Bell, Fiszdon, Richardson, Lysaker, & Bryson, 2007). In addition, work in the memory literature has shown that individuals with schizophrenia provide self-reports of memory recognition experiences (explicit recollection vs. familiarity) that show relationships to validation measures similar to those found in controls (Huron, Danion, Rizzo, Killofer, & Damiens, 2003). Taken together, such results indicate that individuals with schizophrenia can provide accurate reports on at least some aspects of their internal states.

Another potential limitation to this study is that the MTQ was designed to help understand motivation traits associated with productive work behaviors. As such, one might argue that it thus does not capture aspects of intrinsic motivation relevant to understanding schizophrenia. For example, the MTQ does not assess approach motivation for (putatively) pleasurable activities such as interpersonal interactions, consummatory behaviors such as eating and drinking, or sexual activities. However, the MTQ does assess intrinsic motivation related to a host of learning and work-related behaviors that would seem highly relevant to understanding the influence of intrinsic motivation on cognitive performance and occupational and educational function in schizophrenia. Example statements from the MTQ are "I am an intellectually curious person," "I work hard at everything I undertake until I am satisfied with the result," and "I am motivated to do things better than others." These sorts of statements do seem to tap into aspects of

intrinsic motivation that are relevant to understanding life function in this disorder. Furthermore, we found that personal mastery self-reports in schizophrenia were related to work behavior, with higher personal mastery being associated with being gainfully employed. Thus, although examining further aspects of intrinsic motivation not measured by the MTQ is clearly warranted in schizophrenia, the constructs tapped by this measure do assess relevant domains of motivation.

If we believe that the self-report data provided by individuals with schizophrenia are accurate, then the current data suggest that individuals with schizophrenia do not necessarily experience reduced intrinsic motivation levels. Furthermore, the current data suggest that impairments in cognitive function in schizophrenia are not simply secondary to reduced intrinsic motivation. In fact, these data suggest that cognitive function among individuals with schizophrenia is actually less related to intrinsic motivation than it is among healthy controls. Such a result is consistent with the hypothesis that deficits in cognitive function are a core component of the pathophysiology of schizophrenia and suggests that the normative relationships between intrinsic motivational levels and cognitive function may be masked or altered by the mechanisms that cause such cognitive deficits. In other words, among healthy controls, enhanced intrinsic motivation may contribute to improved performance on laboratory-based cognitive tasks. However, among individuals with schizophrenia, the presence of cognitive deficits may preclude enhanced motivation from being able to improve cognitive performance to the same degree as seen in controls. Such a hypothesis is consistent with the literature suggesting that motivational manipulations alone (at least in terms of extrinsic motivation) are not sufficient to robustly improve cognitive performance in schizophrenia (Bellack et al., 1990; Green et al., 1992; Hellman et al., 1998), though adding enhanced instruction (which may help compensate for the cognitive deficits) can help improve performance (Bellack et al., 1990; Green et al., 1992; Kern et al., 1995).

It is somewhat surprising that self-reports of intrinsic motivation were unrelated to clinical symptoms and, in particular, negative symptoms. As noted in the introduction, a lack of motivation among individuals with schizophrenia could stem from many sources. The current data do not support the hypothesis that such reduced motivation reflects deficits in the inherent pleasure or intent to perform activities that many find inherently rewarding. However, these results do not rule out the possibility that amotivation in schizophrenia stems from difficulty representing the reward value of stimuli not present in their current environment. In other words, although individuals with schizophrenia may report being interested in activities that they would find rewarding should such activities be available, they may be having difficulty holding a representation of such putatively rewarding stimuli in a way that can actually drive behavior toward such goals or activities. Such stimuli may be activities that are intrinsically rewarding (e.g., learning new information, mastering a new skill), those that are extrinsically rewarding (e.g., earning money or other consumables), or potentially both (e.g., interpersonal interactions). Such a hypothesis is consistent with prior research suggesting that deficits in working memory may moderate the ability of individuals with schizophrenia to predict or anticipate rewarding stimuli (Burbridge & Barch, 2007; Heerey & Gold, 2007) and suggests a role for both prefrontal (working memory; Barch, 2005b; Burbridge & Barch, 2007; Heerey & Gold, 2007) and ventral striatal (reward prediction; Berridge, 2004) regions in contributing to amotivation in schizophrenia. This hypothesis would predict that the ability to represent information not present in the current environment (e.g., working memory) might moderate the relationship between self-reported intrinsic motivation and the pursuit of real-life activities or experiences that would presumably fulfill or match such motivational traits. For example, self-reported personal mastery and competitive excellence might do a better job of predicting engagement in vocational rehabilitation or educational pursuit among individuals with better working memory abilities. In the current study, we found a modest but significant relationship between higher personal mastery and better occupational status in schizophrenia. However, we did not find an interaction between self-reports of intrinsic motivation and cognitive function in predicting functional status. However, we had only relatively gross measures of vocational and education function, and it will be important to ask this question in future research with more comprehensive assessments of function that include informant reports.

In summary, the current results suggest that individuals with schizophrenia do not show reductions in self-reported levels of personal mastery and competitive excellence, two components of intrinsic motivation. However, they do show higher levels of motivation related to anxiety, which is strongly correlated with other avoidance-related mood and personality traits among both controls and individuals with schizophrenia. Although individuals with schizophrenia did not report lower levels of intrinsic motivation, their self-reports were significantly less associated with cognitive function than among controls, suggesting a disruption of the normative relationship between intrinsic motivation levels and performance on cognitively challenging tasks. However, individuals with schizophrenia did show a relationship between self-reports of intrinsic motivation and work function, suggesting some aspects of the relationship between motivation and life function are intact in this illness. Future research is needed to determine whether deficits in the ability to represent potentially rewarding stimuli not present in the current environment influence behavioral deficits in motivation in schizophrenia, as well as influence the relationship between self-reports of intrinsic motivation and goal pursuit behaviors.

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