Information Processing and Social Competence in Chronic Schizophrenia

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Abstract

The relationship between social competence and information processing among individuals with chronic schizophrenia was investigated. Thirty-eight inpatients participated in a role play test of social competence and completed a battery of information-processing tasks. Information processing was found to be significantly related to social competence, even after controlling for patient demographics, chronicity, and symptomatology. Higher global social competence was related to more efficient early information processing on a continuous performance/span of apprehension task. Composite indices of specific social competence (i.e., paralinguistic and nonverbal skills) were related to other aspects of information processing (e.g., reaction time). Implications for behavioral assessment and cognitive rehabilitation are discussed.

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One of the central features of schizophrenia is a deterioration in social functioning (American Psychiatric Association 1987). Factors such as a decline in social relationships, work performance, and hygiene are prodromal and residual symptoms of this disorder. Further, individuals with schizophrenia have been shown to have greater impairments in social skills in comparison with other diagnostic groups (Bellack et al. 1990*b*, 1992). In addition to its diagnostic significance, social functioning also has prognostic value. Impairments in social functioning are evident among children and adolescents who later develop schizophrenia (Parnas et al. 1982; Walker and Lewine 1990; Foerster et al. 1991). Premorbid social competence strongly predicts functioning in schizophrenia, including impairments in social skills (Mueser et al. 1990), community adjustment, and quality of interpersonal relationships (Strauss and Carpenter 1977; Zigler and Glick 1986; Tien and Eaton 1992). Individuals with poor social competence who have schizophrenia are more vulnerable to symptom relapses and a poor outcome of their illness (Johnstone et al. 1990; Sullivan et al. 1990; Perlick et al. 1992).

Despite the importance of social competence to schizophrenia, relatively little is known about which factors contribute to the observed impairments. Several studies indicate that positive and negative symptoms are weakly related to social competence in schizophrenia (Bellack et al. 1990*a*, 1990*b*; Appelo et al. 1992). Other studies indicate that social functioning is a clinical domain independent of positive and negative symptomatology (Strauss et al. 1974; Lenzenweger et al. 1991). This suggests that the symptoms of schizophrenia do not explain the prominent impairments in social competence that characterize the disorder.

Over the past 15 years, several investigators have independently proposed models of social competence in schizophrenia that posit an important role for cognitive factors (Trower et al. 1978; McFall

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1982; Liberman et al. 1986; Spaulding et al. 1986). Understanding the contribution of cognitive factors to social competence is also of interest because of the growing popularity of cognitive rehabilitation strategies with this population (Brenner 1987; Flesher 1990; Stuve et al. 1991). Little is currently known about which, if any, cognitive deficits in schizophrenia have impact on social behavior; consequently, questions are raised as to whether successful cognitive remediation will translate into improvements in social functioning (Penn 1991; Bellack 1992; Liberman and Green 1992). This point was underscored by Hogarty and Flesher (1992), who noted that "before one embarks on the remediation of cognitive deficits, it would help to know a bit more how a specific deficit or pattern of deficits systematically relates to schizophrenic disability" (p. 53).

However, a few studies demonstrate a relationship between cognitive processes and aspects of social functioning. Performance on vigilance tasks (e.g., span of apprehension) is associated with the processing of social information (i.e., "social cognition") (Corrigan et al. 1992*a*; Penn et al. 1993), ward behavior (Spaulding et al., in press), and the acquiring of medication management skill (Corrigan et al. 1994). Poor verbal learning (Kern et al. 1992) and memory (Mueser et al. 1991; Corrigan et al. 1992*b*, 1994) are associated with skill impairments in schizophrenia (i.e., social skill, interpersonal problem solving, and medication management), while executive processing deficits are related to social adjustment (Jaeger and Douglas 1992). Contextual processing, as measured by a word association task, has been found to be correlated with occupational functioning (Allen 1990).

These studies, while suggestive, have a number of methodological limitations. Research on the relationship between cognitive factors and social cognition (Corrigan et al. 1992*a*; Penn et al. 1993) does not directly address the question of whether cognitive impairments are related to poor social competence (i.e., behavior) in schizophrenia. Those studies that examined behavioral measures of social competence did one of the following: investigated a circumscribed number of cognitive variables (e.g., Allen 1990; Mueser et al. 1991); had very small samples (e.g., N = 16 in Kern et al. 1992); focused on role functioning rather than interactional skills (e.g., Spaulding et al., in press); or assessed a circumscribed range of behavior (e.g., self-administration of medication in Corrigan et al. 1992*b*, 1994). To our knowledge, no study has examined the relationship between a broad array of cognitive variables, from early information processing to conceptual abilities, and behavioral measures of social competence (as measured by role play assessment) in a sufficiently large sample of individuals with schizophrenia.

The present study was designed to overcome the limitations cited above. The relationship between a battery of information-processing tasks and social competence during a role play test was investigated among inpatients with schizophrenia. In addition, positive and negative symptoms, subject demographic variables (e.g., age), and medication level (i.e., chlorpromazine equivalent) were included in subsequent analyses to determine whether associations between information processing and social competence are mediated by "third variables." Variables such as gender, chronicity, and neuroleptic dose have been shown to affect information processing (see review in Spohn and Strauss 1989) and social competence (Bellack et al. 1990*b*; Mueser et al. 1990). Ratings of ward behavior were collected to determine how social competence relates to more naturalistic measures of social functioning.

Method

Subjects. Thirty-eight patients hospitalized at the Lincoln Regional Center, Extended Care Unit (ECU), in Lincoln, Nebraska, were subjects in the study. The ECU is a psychiatric rehabilitation program from which patients are typically discharged to a less restrictive setting after 12–36 months of treatment. Table 1 summarizes the demographic and clinical characteristics of the subjects. Subjects met criteria for schizophrenia or schizoaffective disorder according to the Structured Clinical Interview for *DSM–III–R*, patient version (SCID–P; Spitzer and Williams 1985). The SCID–P was administered by two research psychiatrists blind to the hypotheses of the study. Schizoaffective patients were included because both family studies and treatment findings suggest that individuals with schizoaffective disorder and with schizophrenia are closely related (e.g., have similar responses to neuroleptics) (Mattes and Nayak 1984; Levinson and Levitt 1987; Kramer et al. 1989; Levinson and Mowry 1991).

Type and severity of symptomatology were assessed with the Positive and Negative Syndrome Scale (PANSS; Kay et al. 1987) by the research psychiatrists who con-

Table 1. Demographic and clinical characteristics of subjects

Characteristic	Total sample (n = 38)	SD
Age (years, mean)	36.2	8.0
Sex		
Male	21	
Female	17	
Prior hospitalizations (mean)	3.8	3.6
Diagnosis		
Schizophrenia	35	
Schizoaffective	3	
Medication (percentage)		
Neuroleptic	97	
Anticholinergic	57	
CPZ equivalent[1] (mg/day)	1,084	1,039
PANSS		
Positive symptoms (mean)	15.81	5.5
Negative symptoms (mean)	15.49	5.9

Note—SD = standard deviation, CPZ = chlorpromazine; PANSS = Positive and Negative Syndrome Scale (Kay et al. 1987).

[1]Neuroleptic medication converted to chlorpromazine equivalent according to Baldessarini (1985).

ducted the SCID–P interviews. Raters were trained on SCID–P and PANSS by watching practice interview tapes, rating them independently, and discussing differences in ratings until a consensus rating/diagnosis was obtained. Raters then conducted their own interviews and rated each other's tapes. Reliability was assessed for five randomly selected subjects (kappa): SCID–P = 0.80; PANSS positive symptom scale = 0.90; PANSS negative symptom scale = 0.89.

Measures.

Cognitive assessment. Information processing was assessed with COGLAB, a computer-based battery of cognitive tests developed for research on cognitive deficits in schizophrenia[1] (Spaulding et al. 1989*b*). COGLAB has been used to assess cognitive functioning in schizophrenia in the United States (Spaulding et al. 1989*b*), the Netherlands (Penn et al. 1993), and Norway (Rund 1993). COGLAB is composed of validated test paradigms selected from the experimental psychopathology literature. Tasks include reaction time (RT); a concept manipulation task based on the Wisconsin Card Sorting Test (WCST; Heaton 1981); the Muller-Lyer illusion (Cromwell and Spaulding 1978); size estimation; backward masking (MASK); and a combination continuous performance/span of apprehension task (CP/SPAN; Neale 1971; Orzack and Kornetsky 1971).[2] The complete battery is administered and scored by an Apple II microcomputer. COGLAB discriminates normal subjects from chronic schizophrenia patients with an overlap of less than 20 percent (Spaulding et al. 1989*a*). A full description of the procedure for administering and scoring COGLAB can be found in Spaulding et al. (1989*b*).

Six summary measures of performance were obtained from COGLAB: (1) RT; (2) hits across the three conditions of the CP–SPAN—single distractor, array of six distractors, and new target and array of six distractors; (3) number of false alarms on the continuous performance/span of apprehension task (FALRM); (4) number of correct identifications across the three conditions on MASK—no mask, 40 and 80 msec stimulus onset synchrony; (5) number of perseverative errors on the card sorting task (CARDS–P); and (6) number of random errors—nonperseverative on the card sorting task (CARDS–R).

Social competence. Social competence was assessed in the laboratory with an unstructured role play test (i.e., a simulated social interaction). Research has demonstrated that role play assessments have good discriminant validity (Fingeret et al. 1985; Bellack et al. 1990*a*); are highly related to more naturalistic interactions with family members and social functioning in

[1]Software for COGLAB may be obtained by contacting William Spaulding, Ph.D., at Department of Psychology, University of Nebraska–Lincoln, 209 Burnett Hall, Lincoln, NE 68588–0308.

[2]Previous studies (e.g., Penn et al. 1993; Spaulding et al., in press) failed to find a significant association between performance on the Muller-Lyer and size estimation tasks with social functioning. Thus, to reduce the number of cognitive variables, data from these cognitive tasks were omitted from subsequent analyses.

the community (Bellack et al. 1990*a*); and are stable over time in the absence of social learning interventions (Mueser et al. 1991). An unstructured role play format was selected for the present study because evidence suggests that such a format provides a more ecologically valid measure of social competence than briefer, highly structured role play (Torgrud and Holborn 1992).

The role play procedure was described to the subject, who was then informed that a female research assistant would play the role of a new volunteer on the ward. Subjects were told that the subject and the "volunteer" would have 3 minutes to get to know each other and they were to respond as if the research assistant were actually a volunteer at the hospital. The research assistant was given a list of standard prompt lines (e.g., "Tell me about yourself" and "What are your hobbies?") to deliver after 10 seconds of silence had elapsed.

Behavioral ratings of social competence on the role play were made by two other research assistants who were blind to the hypotheses of the study. Ratings were made of global social competence and specific components of social competence. For the global ratings the research assistants were provided the following instructions: "Make ratings based on how socially skilled the subject is during the role play. Take into consideration what the subject says, how he/she says it, and how appropriate he/she is during the role play." Ratings were made on a 100-point scale from "not at all skilled" (0) to "very socially skilled" (100).

Component ratings of social competence were made for the following behaviors: eye contact, speech rate, shaking (in extremities), long pauses (greater than 3 seconds), rocking, fidgeting (e.g., touching or scratching oneself), restlessness (e.g., foot tapping), facial twitches, and speech fluency. These behaviors cover the topographical range of skills commonly subsumed under the rubric of "social competence" (Liberman 1982). All behaviors were rated on 5-point scales, with shaking, long pauses, rocking, fidgeting, restlessness, and facial twitching being rated from "none" to "excessive." The anchor points for eye contact, speech rate, and speech fluency, respectively, were "too little" and "too much," "too slow" and "too fast," and "broken" and "smooth." Ratings of global social skill for all subjects were completed first, followed by the component ratings.

Research assistants were trained to make ratings by viewing practice tapes, discussing scoring criteria, and arriving at consensus ratings. Training was conducted on the first 10 subjects, and interrater reliability was assessed for the next 28 subjects. Pearson correlation coefficients for the two raters on indices of social competence were as follows: global social competence, $r = 0.85$; eye contact, $r = 0.79$; speech rate, $r = 0.78$; shaking, $r = 0.95$; long pauses, $r = 0.90$; fidgeting, $r = 0.93$; restlessness, $r = 0.94$; facial twitches, $r = 0.90$; and speech fluency, $r = 0.72$.

To reduce the number of specific behaviors for subsequent analyses, an exploratory factor analysis was conducted. The factor analysis used a principal component extraction procedure and a varimax rotation. Two factors emerged that accounted for 43 percent of the variance in the model: Factor 1 comprised speech rate, long pauses, and speech fluency and was labeled "paralinguistic" skills; Factor 2 comprised eye contact, shaking, fidgeting, restlessness, and facial twitches and was labeled "nonverbal" skills. These categories are similar to those rated by Bellack et al. (1990*b*). Composite indices were computed for the factors by summing standardized scores (i.e., z scores) for each specific behavior. Pearson correlations conducted on the three indices of social competence (global, paralinguistic, and nonverbal) revealed a significant relationship between global and paralinguistic skill ($r = 0.45$, $p < 0.01$), but not between global and nonverbal skill ($r = -0.01$, not significant [NS]) or paralinguistic and nonverbal skill ($r = -0.09$, NS). Thus, the three indices of social skill appear to measure relatively unique aspects of social competence in this sample.

Ward behavior. Ward behavior was assessed with the Nurse's Observation Scale for Inpatient Evaluation (NOSIE-30; Honigfeld et al. 1966). Six indices of ward functioning are rated: social competence, social interest, neatness, irritability, psychoticism, and psychomotor retardation. The NOSIE is a behavioral checklist based on observation of patient behavior over at least the previous 72 hours. Each behavior is rated on a 5-point Likert-type frequency scale based on the endpoints "never" and "always." NOSIE data are collected routinely as part of the psychiatric rehabilitation program at the ECU. Staff psychiatric technicians blind to the hypotheses of the study made the weekly NOSIE ratings. Periodic reliability analyses revealed Pearson correlations between 0.68 and 0.72 for all scales. To control for minor fluctuations

in functioning, weekly NOSIE ratings were averaged over a 4-week period.

Procedure. After SCID–P and PANSS interviews, subjects participated in the role play and were then administered COGLAB within the same month as the role play. NOSIE ratings were conducted within 1 month of the role play assessment.

Results

To facilitate interpretation of the information-processing variables, the degree of overlap among the COGLAB measures was investigated by conducting Pearson correlations. As illustrated in table 2, there is shared variance among the COGLAB summary scores, with RT, vigilance, and masking tasks being significantly intercorrelated (RT, CP/SPAN, FALRM), and relatively independent from performance on the CARDS–P, CARDS–R.

Table 3 summarizes the performance of subjects on the COGLAB and role play tasks. Paralinguistic and nonverbal ratings are omitted from the table, since they are derived from z scores. Cognitive functioning is generally more impaired in this chronic sample than in the adolescent schizophrenia sample assessed with COGLAB in a previous study (Penn et al. 1993). The average rating of social competence suggests that subjects did not impress the raters as particularly socially skilled or unskilled.

To assess the pattern of relationship between information and social functioning, Pearson correlational analyses were conducted between COGLAB summary scores and the three indices of social competence. Significant correlations are noted in table 4 for both conventional and Bonferroni-corrected alpha levels. As illustrated in table 4, higher global social competence is associated with better performance on the CP/SPAN and RT tasks. The significant relationship between FALRM and global social competence holds after Bonferroni correction. Better nonverbal skills were associated with fewer errors on the CARDS–R. Greater paralinguistic skill was associated both with faster RT and with fewer errors on the CARDS–R.

To determine the most parsimonious combination of COGLAB summary scores predicting the three indices of social competence,

Table 2. Intercorrelations among COGLAB summary scores

COGLAB task	2	3	4	5	6
RT	−0.44[1]	0.41[1]	−0.51[1]	0.17	0.11
CP/SPAN	—	−0.27	0.55[1]	0.01	0.01
FALRM		—	−0.26	0.12	0.02
MASK			—	−0.10	−0.08
CARDS–P				—	0.79[1]
CARDS–R					—

Note.—RT = reaction time; CP/SPAN = total hits on continuous performance/span of apprehension task (Neale 1971; Orzack and Kornetsky 1971); FALRM = total false alarms on CP/SPAN task; MASK = total hits on backward masking; CARDS–P = perseverative errors on Wisconsin Card Sorting Test (WCST; Heaton 1981); CARDS–R = random errors on WCST.

[1]$p < 0.01$.

Table 3. Means and standard deviations (SD) of COGLAB summary scores and global social competence

COGLAB task	Mean	SD
RT (ms)	407.3	103.6
CP/SPAN (hits)	26.1[1]	3.3
FALRM	5.3[1]	4.7
MASK (hits)	31.3[2]	9.2
CARDS–P (errors)	22.3	20.4
CARDS–R (errors)	20.4	19.0
GLOBAL	44.8[3]	16.3

Note.—RT = reaction time; CP/SPAN = total hits on continuous performance/span of apprehension task (Neale 1971; Orzack and Kornetsky 1971); FALRM = total false alarms on CP/SPAN task; MASK = total hits on backward masking; CARDS–P = perseverative errors on Wisconsin Card Sorting Test (WCST; Heaton 1981); CARDS–R = random errors on WCST; GLOBAL = global social competence.

[1]Range = 0–30.
[2]Range = 0–60.
[3]Range = 0–100.

Table 4. Intercorrelations between COGLAB summary scores and social competence measures

COGLAB task	Social competence measures		
	Global	Nonverbal	Paralinguistic
RT	−0.32[1]	−0.25	−0.36[1]
CP/SPAN	0.28[1]	0.12	0.18
FALRM	−0.51[2]	0.11	−0.15
MASK	0.21	0.09	0.08
CARDS–P	−0.14	−0.13	−0.19
CARDS–R	−0.22	−0.32[1]	−0.31[1]

Note.—RT = reaction time; CP/SPAN = total hits on continuous performance/span of apprehension task (Neale 1971; Orzack and Kornetsky 1971); FALRM = total false alarms on CP/SPAN task; MASK = total hits on backward masking; CARDS–P = perseverative errors on Wisconsin Card Sorting Test (WCST; Heaton 1981); CARDS–R = random errors on WCST.

[1] $p < 0.05$

[2] $p < 0.01$ (Bonferroni correction).

backward multiple regression analyses were conducted.[3] Table 5 summarizes the final model for each criterion variable. Higher global social competence was significantly predicted by fewer FALRM on the CP/SPAN task. Better nonverbal skills were predicted by fewer errors on the CARDS–R. Paralinguistic skill was significantly predicted by faster RT.

Subsequent analyses were conducted to evaluate whether any third variables (i.e., age, gender, prior hospitalizations, neuroleptic and anticholinergic dosage level, and symptomatology) mediated the observed relationship between social competence and COGLAB. Multivariate analyses of variance (MANOVAs) were first conducted to evaluate whether males and females differed in either cognitive functioning or social competence on the role play test. A MANOVA performed with the COGLAB measures as the dependent variables, and gender as the independent variable was not statistically significant ($F = 0.63$, $df = 6,29$, NS), indicating that males did not differ from females in their performance on COGLAB. A second MANOVA was conducted on the role play test with the three summary social competence measures as the dependent variables. The multivariate effect for gender was also nonsignificant ($F = 0.55$, $df = 3,33$, NS), indicating that performance of males on the role play test was comparable to that of females.

To evaluate the role of the remaining third variables, the following steps were taken; first, Pearson correlations were computed between the third variables and the social competence and COGLAB variables in the final three regression models. Because only 57 percent of the sample was on anticholinergic medication, a different statistical approach was used to address the "third variable" issue. The sample was divided into two groups, anticholinergic and nonanticholinergic. *T* tests were then conducted on each of the six variables comprising the final regression models. None of the analyses were significant: global ($t = 0.21$, $df = 1,36$, NS; nonverbal ($t = 0.20$, $df = 1,36$, NS; paralinguistic ($t =$

Table 5. Final backward multiple regression models predicting social competence from COGLAB summary scores

CV	PV	Beta	R^2	F[1]
Global	FALRM	−0.52	0.27	12.5[2]
Nonverbal	CARDS–R	−0.32	0.11	3.9[3]
Paralinguistic	RT	−0.36	0.13	5.1[4]

Note.—CV = criterion variable, PV = predictor variable; FALRM = total false alarms; CARDS–R = random errors on the Wisconsin Card Sorting Test (Heaton 1981); RT = total reaction time.

[1] *F* values are based on the 36 subjects who had complete data for all predictor and criterion variables

[2] $p < 0.01$.

[3] $p < 0.06$.

[4] $p < 0.05$.

[3] Backward regression analyses tend to be appropriate for building predictor models and eliminating superfluous variables from the predictor set (Tabachnick and Fidell 1989). This analysis helps to identify the most efficient combination of predictors necessary to predict a criterion variable. Variables were removed from the regression model if the contribution of the variable within the predictor set with the criterion was greater than $p = 0.10$ (Norusis 1988).

1.4, df = 1,36, NS); RT (t = 1.4, df = 1,34, NS); FALRM (t = 0.58, df = 1,35, NS); and CARDS–R (t = 0.51, df = 1,35, NS). Thus, anticholinergic medication does not seem to mediate the relationship between the COGLAB variables and social competence.

Second, backward regression analyses were repeated for each third variable that was significantly correlated with either social competence or COGLAB. The bivariate correlations between gender and the COGLAB and social competence measures in the final regression models were not significant.

Four correlations were significant: between global social competence and number of prior hospitalizations ($r = -0.54$, $p < 0.01$); between FALRM on the CP/SPAN task and number of prior hospitalizations ($r = 0.39$, $p < 0.01$); between paralinguistic skill and chlorpromazine equivalent ($r = -0.37$, $p < 0.02$); and between paralinguistic skill and negative symptoms ($r = -0.33$, $p < 0.03$). Backward regression analyses, including each significant third variable as a predictor with the COGLAB variables, revealed a pattern of results similar to the first set of analyses. In each case, the COGLAB variable remained in the final model. These results suggest that the relationships between social competence and COGLAB cannot be "explained" by demographic variables, chronicity, or symptomatology.

To determine the relationship between social competence and ward behavior, Pearson correlations were computed. Significant correlations were found between global social competence and neatness ($r = 0.33$, $p < 0.03$); and between paralinguistic skills and social interest ($r = 0.35$, $p < 0.02$) and neatness ($r = 0.39$, $p < 0.01$). Nonverbal skill was not significantly related to any indices of ward functioning, although its relationship with social competence approached significance ($r = 0.26$, $p < 0.065$).

Discussion

The results from this study suggest that cognitive functioning is significantly related to social competence in schizophrenia. Measures of information-processing ability, assessed with the computer-administered assessment battery COGLAB, were associated with an independent assessment of patients' social competence during an unstructured role play interaction. Furthermore, the relationship between COGLAB measures and social competence remained after controlling for patient demographic variables, chronicity, and symptomatology. These data support models of social skill that posit an important role for cognitive factors in social competence (Trower et al. 1978; McFall 1982; Liberman et al. 1986; Spaulding et al. 1986).

The overall pattern of correlations suggests differentiated rather than global relationships between cognition and social competence. That is, there are different relationships between specific cognitive and specific social measures, rather than a general association of impaired cognition with impaired social competence. This finding is consistent with accumulating findings of differentiated relationships between cognitive functioning and functioning in other domains (e.g., Spaulding et al., in press). However, the possibility cannot be ruled out that the observed patterns reflect differential psychometric sensitivity of the various measures to global functional impairment rather than truly different relationships. With this caveat in mind, we discuss possible interpretations of the specific relationships found in this study.

Higher ratings of global social competence were related to both fewer total FALRM and more total hits on the CP/SPAN task. These tasks are presumed to be a measure of "early information processing," that is, cognitive functioning that does not require higher order skills (e.g., conceptual reasoning) and that occurs within the first few seconds of stimulus presentation. Deficits in early information processing have been detected in unaffected first-degree adult relatives of patients with schizophrenia and predict social dysfunction among high-risk individuals (Cornblatt et al. 1992; Erlenmeyer-Kimling et al. 1993; Cornblatt and Kelip 1994). Thus, the present study adds to the growing body of research indicating that early information-processing efficiency plays a role in mediating impairments in social functioning among individuals with schizophrenia.

Global social competence, in contrast to ratings of paralinguistic and nonverbal skills, involves assessment of the appropriateness of verbal content. Further, global social competence was the only skill variable related to performance on the CP/SPAN task, in which the subject is required to remember a target digit and respond when that digit appears. An important requirement of social competence in the role play task is for the subject to keep track of the conversational topic. Impairments in ability to internally represent stimuli for current and future use (Cohen and Servan-Schreiber 1993), a variant of working memory (Goldman-Rakic

1991), may be the common denominator underlying performance on both these tasks. Alternatively, vigilance deficits, which are ubiquitous in schizophrenia (Asarnow et al. 1992), may account for the observed relationship between overall social competence and CP/SPAN task performance. Future research is needed to disentangle these hypotheses, because the nature of underlying processes has implications for both theory and psychiatric rehabilitation.

In a previous study on cognitive functioning and performance on the Means-Ends Problem Solving (MEPS) Test in schizophrenia (Penn et al. 1993), a high rate of FALRM on the CP/SPAN task was associated with generation of more "means" (i.e., a particular strategy bringing one closer to solving a problem) and alternative solutions to a problem situation. At first glance, the findings of Penn et al. (1993) appear at odds with those reported here. However, that study assessed social cognition rather than social behavior. The positive association between generation of social-cognitive strategies with FALRM rate may reflect the tendency of some individuals with schizophrenia to respond "liberally" to stimuli without regard to the appropriateness of their responses. Such a response style could improve the scores on the MEPS Test, which emphasizes the ability to generate solutions irrespective of quality, but it might also result in poorer overall social skill during an unstructured interaction.

More skilled nonverbal behavior was associated with fewer errors on the CARDS–R. Random errors on this task suggest problems in maintaining set (i.e., the subject applies the correct rule on some trials but not on others [Heaton 1981]). Factors contributing to set maintenance can include memory (e.g., forgetting the rule) and attention (e.g., focusing during some trials but not during others). Nonverbal skills in schizophrenia such as eye contact, fidgeting, and restlessness may reflect internal states such as anxiety (e.g., Penn et al. 1994) and distraction, factors indicative of overarousal, which can compromise cognitive functioning (Gjerde 1983). Thus, the relationship between nonverbal skills and errors on the CARDS–R task may be mediated by the capacity to focus and sustain attention.

Poorer paralinguistic skills in the role play were associated with slower RT assessed on COGLAB. This relationship suggests that impaired paralinguistic skills, such as frequent pauses, speech dysfluencies, and slow speech rate, are direct reflections of a longer latency to respond during a social encounter. Thus, slow RT, which is one of the most robust cognitive deficits present in schizophrenia (see, e.g., Shakow 1977) and which predicts response to psychiatric rehabilitation (Wykes et al. 1990), may be manifested by impaired paralinguistic skills during social interactions. This hypothesis needs to be explored more systematically in future research. It was noteworthy, however, that RT did not appear to be related to global social competence during the unstructured role play, possibly because of the importance of patients' verbal content during the interaction.

The three measures of social competence had different associations with the more naturalistic measure of ward behavior, the NOSIE–30. Global social competence and paralinguistic skills demonstrated a stronger relationship with ward behavior than nonverbal skills did. This finding suggests that assessment of global social competence and paralinguistic skills based on role play performance provides a more ecologically valid measure of ward behavior than assessment of nonverbal skills provides. These findings underscore the need to evaluate laboratory measures of social competence with respect to their relationship to an independent criterion of social functioning (Bellack et al. 1990*a*).

The findings from this study have implications for cognitive rehabilitation and behavioral assessment. The role of vigilance and RT in social competence suggests that cognitive remediation should be directed at more of the early aspects of information processing, such as sustained attention and maintaining set. Recently, Green (1993) suggested that this level of analysis may be especially appropriate for intervention, as it has been documented as a vulnerability indicator for psychotic episodes (Nuechterlein and Dawson 1984). Future research needs to determine the extent to which early information processing can be improved with cognitive and behavioral training (e.g., positive reinforcement). Alternatively, if improving early information-processing deficits proves unfeasible, patients with schizophrenia may need to be taught strategies for compensating for these deficits.

The lack of a consistent association between role play performance and social functioning on the ward warrants further study. This finding suggests that functioning in the microsocial domain (i.e., interactional skills) may be independent of functioning in the macrosocial domain (i.e., role per-

formance) among chronic schizophrenia patients (Spaulding 1986). Recent findings from our laboratory support this hypothesis (Penn et al., in press).

The results from this study point to a number of future directions for research. To improve generalizability, role play assessments should be conducted across a range of different social situations, including both structured and unstructured formats. Furthermore, research is needed that examines the relationship between social competence and information processing in less severely ill outpatients with schizophrenia. Future research should further explore the role of gender in mediating the relationship between cognition and social functioning. Although MANOVA and correlational analyses indicated that gender was not a significant "third variable," exploratory post hoc analyses suggest some correlational pattern differences as a function of gender. Pearson correlational analyses revealed that COGLAB was more consistently correlated with social competence among female subjects than among male subjects. However, given both the small sample size (i.e., 21 males and 17 females) and the post hoc nature of the analysis, this finding needs replication before confident conclusions can be drawn. Data from a recently completed study (Mueser et al., in press) suggest that this might be a worthy area of study.

A more comprehensive evaluation of the ecological validity of social competence indices should be attempted. The current findings may be an underestimate of ecological validity, because the criterion (i.e., ward behavior) does not require the rater to interact with the patient. Thus, a more appropriate method for determining ecological validity may be ratings of social competence during interactions outside the hospital (e.g., when the patient is on a community outing; Wong et al. 1993).

A number of caveats should be noted about findings from the present study. First, assessment of information processing did not include a direct measure of memory functioning, a variable related to social skill acquisition (see, e.g., Mueser et al. 1991). Thus, the current findings are limited to information processes such as attention, speed of processing, response style/bias, and conceptual skills. Second, the current study did not include assessment of extrapyramidal side effects. Ratings of movement disorder would have improved evaluation of the role of medication side effects in mediating the relationship between cognition and behavior. Further, it would have shed light on the hypothesis that nonverbal behavior during the role play (e.g., fidgeting) was a manifestation of anxiety. Third, Bonferroni correction resulted in only one correlation remaining significant (FALRM on the CP/SPAN task with global social competence). Thus, replication of this study is needed before confident conclusions can be drawn from the reported findings. Supplementary analyses suggest, however, that the results of the regression analyses are fairly robust.

Tabachnick and Fidell (1989) recommend cross-validation to address the instability of backward multiple regression analysis. Thus, the sample was divided in half (groups X and Y), with the multiple regression analyses conducted on each group. The results were virtually identical to those obtained with the full sample. For group X, the same variables comprised the final regression models (i.e., FALRM, RT, and CARDS–R) as reported with the full sample. This was also the case with group Y, with the exception of the model predicting global social competence. In this analysis, FALRM was joined by CARDS–P, CARDS–R, and CP/SPAN task in the final regression model. However, the B weight of FALRM had the highest *F* value among the predictor variables. This analysis lends support to the stability of the study's findings.

Finally, assessment of information processing should be reevaluated for tasks that are traditionally administered manually (e.g., WCST), since computer administration may change the parameters of certain cognitive tasks (see, e.g., Miller et al. 1990).

In summary, the present study indicated that cognitive variables were significantly predictive of social competence, even after controlling for other mediating variables such as symptomatology. Future research should investigate situational variables that may have an impact on the relationship between cognitive factors and social competence. For example, the strength of the association may be increased for role plays that demand more cognitive effort, such as conflict resolution (Godfrey et al. 1989). By increasing our understanding of how cognitive and social domains of functioning relate to one another, we may develop efficient interventions to improve social functioning in schizophrenia.

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Announcement

On September 30, 1994, the largest international prizes for outstanding research on schizophrenia and depression, the $50,000 **Lieber Prize** and the $50,000 **Selo Prize,** were awarded by the National Alliance for Research on Schizophrenia and Depression (NARSAD).

The Lieber Prize for outstanding research in schizophrenia was awarded to Arvid Emil Carlsson, M.D., Professor Emeritus, University of Gothenburg, Sweden; the Selo Prize for outstanding research in depression was awarded to Jules Angst, M.D., Professor of Psychiatry, Psychiatric University Hospital, Zurich, Switzerland; and Myrna M. Weissman, Ph.D., College of Physicians & Surgeons of Columbia University and New York State Psychiatric Institute, New York, New York.

The Selo and Lieber Prizes reward past achievement and provide further incentive for outstanding working scientists to continue to do exceptional research. The Selo Prize was established in 1993, and is awarded to honor the memory of Werner Selo, through a grant from his daughter, Mary Lou Selo, a NARSAD board member.

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