Language Performance in Chronic Schizophrenia: A Pragmatic Approach

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In this study, the authors examined the language of 43 participants with chronic schizophrenia under the basic assumption that a paradigmatic shift is needed in the methodology used to investigate the language of schizophrenia. The *pragmatic protocol* (C. Prutting & D. Kirchner, 1987) was chosen as the method of analysis to attain a general profile of pragmatic abilities. The results showed that the participants with schizophrenia exhibited a high degree of inappropriate pragmatic abilities compared to participants with mixed anxiety–depression disorder and participants with hemispheric brain damage, as previously assessed by Prutting and Kirchner. Statistical methods for clustering analysis yielded 5 distinct parameter clusters: Topic, Speech Acts, Turn-Taking, Lexical, and Nonverbal. Group clustering analysis of the 43 participants with schizophrenia produced 3 distinct groups with different profiles: minimal impairment, lexical impairment, and interactional impairment. The results are discussed in terms of theoretical implications in the area of pragmatics, the diagnosis of schizophrenia, and other goals.

KEY WORDS: language, pragmatics, schizophrenia

Language disorder has long been considered a diagnostic indicator of schizophrenia (American Psychiatric Association, 1994; Bleuler, 1911/1950; Kraepelin, 1919). Researchers have tried to describe and specify which aspects of language are disturbed in schizophrenia (Maher, 1972; Schwartz, 1978). Some studies have suggested that language disturbances are due to nonlinguistic factors, such as abnormalities of thought (Brown, 1973; Fromkin, 1975) or deficits in information processing (Frith, 1993; Frith & Allen, 1988; Schwartz, 1978). Despite the controversies, there is general agreement that the language of individuals diagnosed with schizophrenia is characterized by disorders in cohesion (Rochester & Martin, 1979), by reduced syntactic complexity (Morice & Ingram, 1983; Morice & McNicol, 1986), and by reduced clausal embedding and verbal production (DeLisi, 2001).

A number of researchers have concluded that the primary language impairment in schizophrenia is in the area of pragmatic performance. Bleuler's (1950) first description of patients with schizophrenia is illuminating in this respect. He stated that there may be a great deal of speech, but it is not intended to convey anything or to communicate with the environment. Bleuler added that thoughts are transformed into speech without relation to the environment. Pavy (1968) argued that the prominence of discourse failures in the language of patients with

schizophrenia shows that formal analysis of discourse is necessary. On the other hand, McGrath (1991), in a review of studies in the area of language and thought disorder, concluded that the reason beyond the failure to structure discourse at higher levels was a lack of executive planning and editing of information. Frith (1993) stated that the defect in planning must apply to expressive rather than receptive aspects of language; hence, he concluded that the disturbances of language in schizophrenia lie at the level of language use rather than language competence. According to Frith, "pragmatics" are the processes by which we use language to communicate our ideas and wishes to others. Griffin, Crowe, Byrne, and Penzien (1994) have assessed the pragmatic abilities of 35 participants with chronic schizophrenia through a test of pragmatic language, discourse analysis, and narrative analysis. The assessment included suprasegmental aspects and overall effectiveness as communicators. Results showed poor pragmatic abilities in all areas assessed, with relevancy of content being the most problematic area. Done, Leinonen, Crow, and Sacker (1998) argued that the language disturbances in schizophrenia do not result from a deficiency in generation of syntax per se. Rather, they are a reflection of the way in which individuals with schizophrenia use language.

Although most researchers have concluded that language impairment in schizophrenia lies at the highest levels of language usage (i.e., Andreasen & Grove, 1986; Frith & Allen, 1988; McGrath, 1991), there is still a lack of broad theoretical grounds for their conclusions. According to Andreasen, Arndt, Alliger, Miller, and Flaum (1995), speech and language behaviors remain the least understood and most unreliable constructs in the diagnosis of schizophrenia. There is a need to clarify and define the area of pragmatics of language and to explore what kind of knowledge is impaired in schizophrenia.

Review of the literature clearly shows that the study of language in schizophrenia underwent a paradigmatic shift similar to the study of normal language development (NLD). The methodology used in different studies ranged from the level of word units (e.g., Maher, 1972; Pavy, 1968) to sentence cohesion (Harvey, 1983; Ragin & Oltmans, 1986; Rochester & Martin, 1979) and finally to a level that is related to pragmatics of language—speech acts in particular—and to the discourse unit and narratives (Chaika & Lambe, 1985; Ribeiro, 1994; Wodak & Van de Craen, 1987; Wrobel, 1990). In a recent paper by DeLisi (2001), however, pragmatics was not included in the review of literature on schizophrenia performed by the author.

In this study, we hypothesize that speakers diagnosed with schizophrenia violate norms of several areas of pragmatics. Our purpose is to systematically delineate the areas of impaired language use. Specifically, we are interested in studying the language of participants with schizophrenia by using a competence model rather than a symptomatic list of deficiencies, such as that provided by the *Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition* (*DSM-IV*; American Psychiatric Association, 1994), as has been done by previous researchers (Andreasen, 1979). The *DSM-IV* is a descriptive approach to the diagnosis of schizophrenia based on descriptions of the clinical features of the disorder. This manual presents diagnostic criteria for schizophrenia reflecting the opinion of the raters regarding what is appropriate or inappropriate language behavior during the diagnostic interview. Flaum, Arndt, and Andreasen (1991) have reported that this approach poses a problem of interrater reliability. Considering the concept of bizarre delusions, which figures prominently in the diagnosis of schizophrenia under the *DSM-IV*, Flaum et al. reported consistently low interrater reliability within and across the group of raters and concluded that this concept is not reliable and should not be given a pivotal position in the current nosology. We assume that such interrater reliability problems are explained in terms of naive views of language and its various dimensions and intuitive applications of such views by the raters. Therefore, a systematic application of a comprehensive view of language and its uses, which rests on firmer theoretical grounds, seems to be required.

Given our basic assumption that a paradigmatic shift is needed in the methodology used in the investigation of language and its uses in participants with schizophrenia, our natural research tool would be a pragmatic analysis, and its application will constitute an initial step of linguistic analysis that can meet the criteria of both an analysis of language in context and of reliability.

The motivation for our study stems from the intrinsic relationship between diagnosis and classification of schizophrenia and the use of language in the context of the psychiatric clinical interview. Our pragmatic analysis of language is intended to deepen the understanding of the language of the participant with schizophrenia and to improve psychiatrist–patient use of language.

In order to attain a general profile of pragmatic abilities, the *pragmatic protocol* (Prutting & Kirchner, 1987) was chosen as a preliminary method of analysis. The justification for this choice lies in the characteristics of the tool—this protocol represents a wide range of pragmatic behaviors that enables the extraction of patterns or clusters of dimensions on which the participant performs well or poorly. In addition, the protocol enables comparisons with other adult populations, specifically those with hemispheric brain damage (HBD).

The Pragmatic Protocol

Prutting and Kirchner (1987) developed a descriptive taxonomy of pragmatic behaviors and assessed the conversational abilities of six different diagnostic groups—children with language disorders, children with articulation disorders, children with normal language, adults with aphasia, adults with right hemispheric brain damage (RBD), and adults with normal language. They observed distinct profiles for each diagnostic group. Further studies (Avent & Wertz, 1996; Avent, Wertz, & Auther, 1998; Goldblum, 1985; Roberts & Wertz, 1993) indicated that the pragmatic protocol is a useful tool for describing differences among disorders, distinguishing differences among subtypes of aphasia, and documenting changes over time.

The pragmatic protocol was designed in such a way that (a) for each parameter, a small but nonnegligible percentage of participants with NLD show inappropriate behavior in that parameter, and (b) most participants with NLD show inappropriate behavior in a small but nonnegligible percentage of parameters. Furthermore, there is no discernible pattern to the inappropriateness displayed by participants with NLD. The sensitivity achieved by this calibration design makes it plausible that participants with impairment will show higher percentages of inappropriateness, affording recognition of specific patterns for different population groups.

We hypothesized that participants with schizophrenia will show a different and specific profile of performance when compared to the control groups (healthy control group without psychiatric diagnosis and psychiatric control group diagnosed with mixed anxiety–depression) and comparison groups (RBD and left hemispheric brain damage [LBD] groups, taken from Prutting and Kirchner's, 1987, data) at the level of pragmatics of language. In the presence of strong evidence for this hypothesis, our purpose was to identify this profile as closely as possible rather than merely establish its existence.

The aims of the study were as follows:

1. To find out whether participants with schizophrenia will generate specific clusters of pragmatic parameters when assessed by the pragmatic protocol. This tool has been shown to differentiate between groups of participants with language disorders (i.e., participants with HBD).
2. To describe inappropriate pragmatic parameters in the group of participants with schizophrenia and to compare them to (a) the control groups (healthy control group without psychiatric diagnosis and participants diagnosed with mixed anxiety–depression) and (b) the parameters that have been found to be inappropriate in the participants with HBD (Prutting & Kirchner, 1987).
3. To determine whether the pragmatic parameters represent independent units, or whether they depend on each other and generate clusters.

Method

Participants

Experimental Group

The experimental group consisted of 43 participants with chronic schizophrenia recruited from two major mental health centers. Diagnostic classification of schizophrenia was determined by the treating psychiatrist, following *DSM-IV* criteria in the chronic state of the disease (295.XX Schizophrenia). Twenty-nine participants were hospitalized and 14 were outpatients. See Table 1 for further details.

Inclusion criteria consisted of diagnosis of schizophrenic disorder according to *DSM-IV* criteria, reading and writing abilities in Hebrew, age between 20 and 60 years, and written informed consent. Exclusion criteria included participants with affective disorder, mental retardation, drugs or alcohol abuse, neurological disorder, stress-related thought disorders, or hearing impairment.

Experimental participants' schizophrenic symptoms were evaluated by means of the Positive and Negative Symptoms Scale (PANSS; Kay, Fiszbein, & Opler, 1987). PANSS items were rated by a senior psychiatrist other than the participants' therapist, according to the definitions and criteria provided by the manual.

Table 1. Description of the experimental participants.

Participant data	*M*	*SD*
Age (years)	37.8	9.3
Education (years)	9.6	2.7
Duration of illness (years)	14.6	8.5
Age of first hospitalization (years)	23.4	5.5
Number of hospitalizations	4.3	2.3
Duration of hospitalization (months)	20.5	9.1
Sex distribution		
Female	63%	
Male	37%	
Language distribution		
Monolingual	72%	
Bilingual	28%	
Subtypes		
Paranoid	42%	
Disorganized	33%	
Undifferentiated	16%	

All medication dosage data were gathered from each participant's hospital chart and continued to be used as the daily dosage during the period of the experiment. Mean daily dosage for each of the participants with schizophrenia (n = 43), given in terms of Haloperidol equivalent, was 15.1 mg (range = 0 mg to 42.5 mg, SD = 11.9 mg).

Mixed Anxiety–Depression Participants

Psychiatric participants with no schizophrenia and no psychotic symptoms were chosen for the control group. The control group consisted of 15 participants diagnosed with mixed anxiety–depression (see Table 2 for further details). Diagnostic classification of anxiety–depression was determined by the treating psychiatrist and followed *DSM-IV* criteria (300.XX Anxiety Disorders). These criteria rule out psychotic disorder. The control group participants were all outpatients receiving weekly treatment from the same mental health centers as the experimental group.

The Hebrew translation of the State-Trait Anxiety Inventory (Spielberger, Teichman, & Melnick, 1984) was used to assess the state and trait anxiety of each participant in the control group.

All medication dosage data were gathered from each participant's hospital chart and continued to be used as the daily dosage during the period of the experiment.

Healthy Control Group Without Psychiatric Diagnosis

The control group comprised 15 participants who were recruited according to the following inclusion criteria: Hebrew speakers; absence of neurologic, psychiatric, speech, or hearing disorder; educational level of a minimum of 8 years of schooling; and age range between 20 and 60 years.

All participants gave informed consent for participation, and the Helsinki Hospital ethical committee approved the study.

Description of the Pragmatic Protocol

The pragmatic protocol is a descriptive taxonomy developed by Prutting and Kirchner (1987) to provide a molar analysis of the pragmatic aspects of nonimpaired and disordered populations. The pragmatic protocol comprises 30 parameters that are organized in three aspects: the verbal, the paralinguistic, and the nonverbal aspects. The 30 parameters were extrapolated from developmental child and adult language research. Some of the verbal parameters are based on the speech act theory proposed by Austin (1962) and Searle (1969). The pragmatic protocol follows Levinson's (1983) contention that the range of pragmatic aspects covers a wide spectrum, including both context-dependent aspects of language structure (e.g., cohesion) and aspects that rely on principles of language use that are relatively independent of language structure (e.g., physical proximity, eye gaze). This tool was designed to emphasize interactive aspects of language use and is thus sensitive to interactional aspects of discourse behavior. The tool provides the researcher with a profile of pragmatic competence and deficits across 30 parameters.

Table 2. Description of participants with mixed anxiety–depression.

Participant data	*M*	*SD*
Age (years)	41.8	10.5
Education (years)	11.0	2.8
Duration of illness (years)	6.1	4.4
Sex distribution		
Female	67%	
Male	33%	

Procedures

Participants were selected according to the described criteria. Each participant received two forms: a statement of informed consent and another of confidentiality. All testing was done in the same quiet room for each participant. A table was arranged with coffee, cookies, and two chairs, and a video recorder, which was set on a tripod.

Two conversations were set up for each participant (familiar vs. nonfamiliar partner) to control for consistency of pragmatic profiles across two interactive tasks. Each participant participated in two spontaneous conversations of 15 min each, one with a familiar partner and a second with a nonfamiliar partner. The familiar partner was chosen by the participant and was not a relative, the personal therapist, or another person with schizophrenia. Although Prutting and Kirchner's (1987) criterion for the conversational partner was that a familiar or neutral partner should converse with the participant, we introduced a nonfamiliar partner for the second conversation because pragmatic performance could be influenced by change of partners, and a second conversation could strengthen the validity of the results. For example, a more facilitative familiar partner could encourage the flow of the conversation and even act as a "scaffolding" agent to help the participant use and overcome different constraints. Prutting and Kirchner stated that "in using the tool it is important to consider the role each participant plays in structuring the interaction" (p. 112). The nonfamiliar partners were

paid for their participation and were chosen according to the following criteria: ability to speak, read, and write Hebrew; age of 20 to 50 years; education of at least 8 years; no history of mental, speech and hearing, or neurological disorders; and no history of alcohol and/or drug abuse.

The participants and partners were given the following instructions: "You are going to participate in an experiment about communication and the use of language in a social context. You are going to converse freely for 15 minutes, and the conversation will be videotaped." In every instance, the researcher left the room and returned to stop the conversation at the end of the 15-min period. At the beginning of conversation with a nonfamiliar partner, the researcher presented the participant and partner with their respective names. The videotaped conversations were later analyzed according to the method described by Prutting and Kirchner (1987). The method of assessment is a societal judgment dependent on context and partners of the conversation. Each parameter receives a judgment of appropriateness or inappropriateness. A parameter is marked appropriate if it is judged to facilitate the communicative interaction or is neutral; it is marked inappropriate if it is judged to detract from the communicative exchange and penalize the individual (for clarification of definitions and judgments of each of the pragmatic parameters, see Prutting & Kirchner, 1987).

Reliability

Interobserver reliability data were obtained for 25% of all participants. During reliability sessions, the investigator and a clinician, previously trained to use the protocol, observed the videotaped conversational interactions. Each observer completed the protocol independently at the end of each observational period. Point-by-point reliability was calculated separately for each of the appropriate categories and each of the 30 parameters. Reliability for the control groups was 100% for judgments of both appropriate and inappropriate categories. Reliability for the group diagnosed with schizophrenia averaged 95% agreement for appropriate behaviors and 97% agreement for inappropriate behaviors.

Data Analysis

Statistical tests, p values, and the false discovery rate (FDR) method of multiple comparisons were used. In multiple comparisons, the simultaneous level of significance is the probability that some null hypothesis will be rejected if all null hypotheses are correct. The FDR of Benjamini and Hochberg (1995) is the rate of incorrectly rejected null hypotheses among the rejected null hypotheses, regardless of the pattern of correct null hypotheses. We adopted this new method for multiple testing in this study; it is being increasingly applied in medical and psychological data analysis (Keselman, Cribbie, & Holland, 1999; Mallet, Mazoyer, & Martinot, 1998; Wilkinson, 1999).

Homogenization

Participant heterogeneity is a confounding factor that should be either incorporated into the model (in large-sample studies) or factored out. Evidence for this factor is present when (a) empirical correlations are positive and close to each other and (b) the first principal component consists of very similar positive terms, as is the case in our study. Multivariate analysis methods geared toward Gaussian distributions, such as downplaying this first principal component in favor of the following ones, are ruled out due to the low participant-to-item ratio and the dichotomous (0–1) nature of the data, with high variability in terms of averages and variances. An attempt was made to factor out heterogeneity in a way that takes dichotomy into account and adjusts as few parameters as possible. The new technique (see S. R. Meilijson & I. Meilijson, 2004), applied for this purpose, was given a different name—homogenization—to avoid confusion with factor analysis. It is being investigated in the context of neural networks to study training of patterns with varying coding level. This method estimates the homogenized covariance matrix, a hypothetical covariance matrix of the (homogeneously) severe cases.

Classification and Regression Trees (CART) Clustering (Breiman, Friedman, Olshen, & Stone, 1984)

This method divides a cloud of points into two subclouds as differentiated as possible separated by a plane. It then proceeds recursively to split the most heterogeneous subcloud further, until further splits are judged to be unjustified. The representation of each item (pragmatic parameter, participant) as a point in a low-dimensional space, as required for the application of CART, was achieved by principal components analysis.

Results

This study examined the pragmatic abilities of a group of participants with chronic schizophrenia as measured by the pragmatic protocol. The results showed that these participants exhibited a high degree of inappropriate pragmatic abilities (see Figure 1) compared to

Figure 1. Pragmatic protocol applied to 43 participants with schizophrenia—progressive profile of inappropriateness. White: appropriate in both conversations; gray: inappropriate in one conversation; black: inappropriate in both conversations.

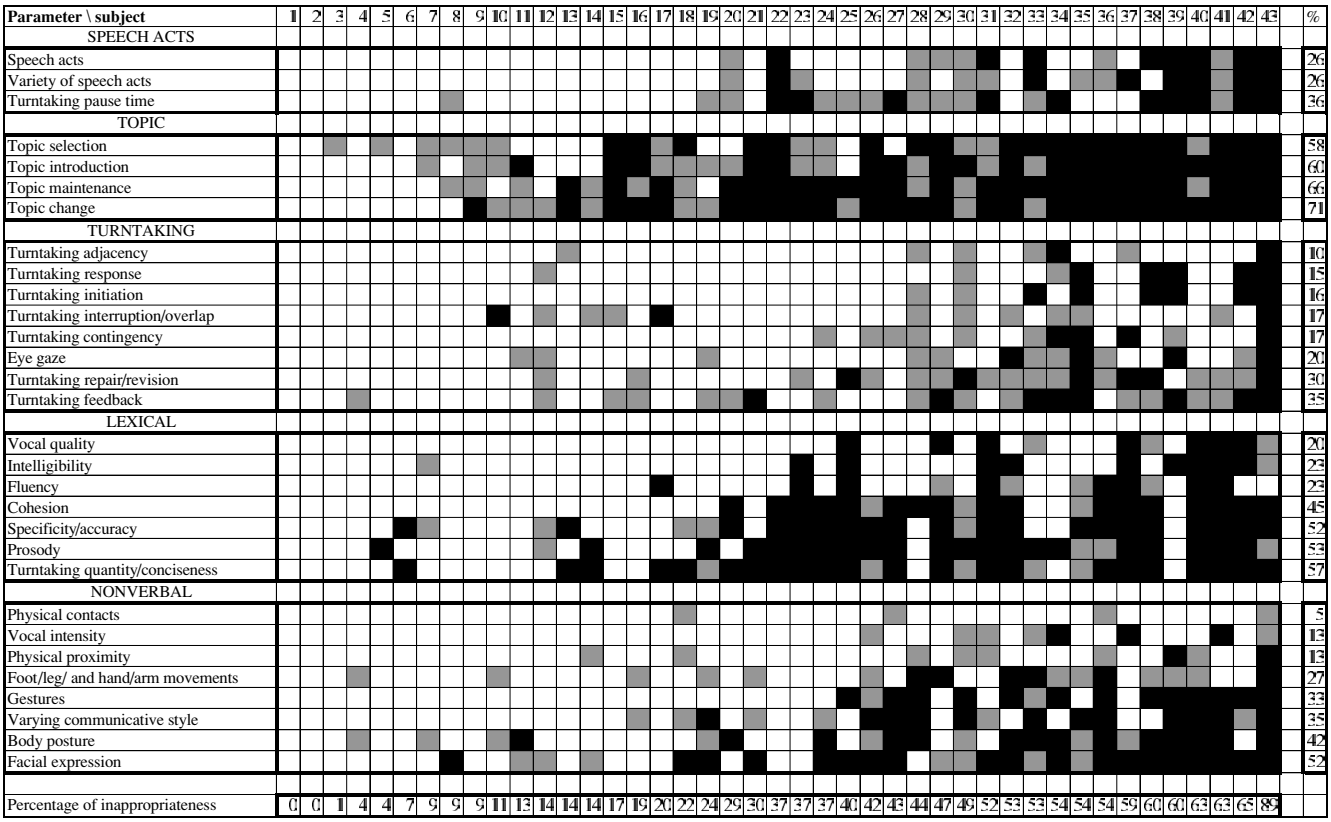


Figure 2. Parameter clusters versus participant with schizophrenia groups: percentage of inappropriateness.

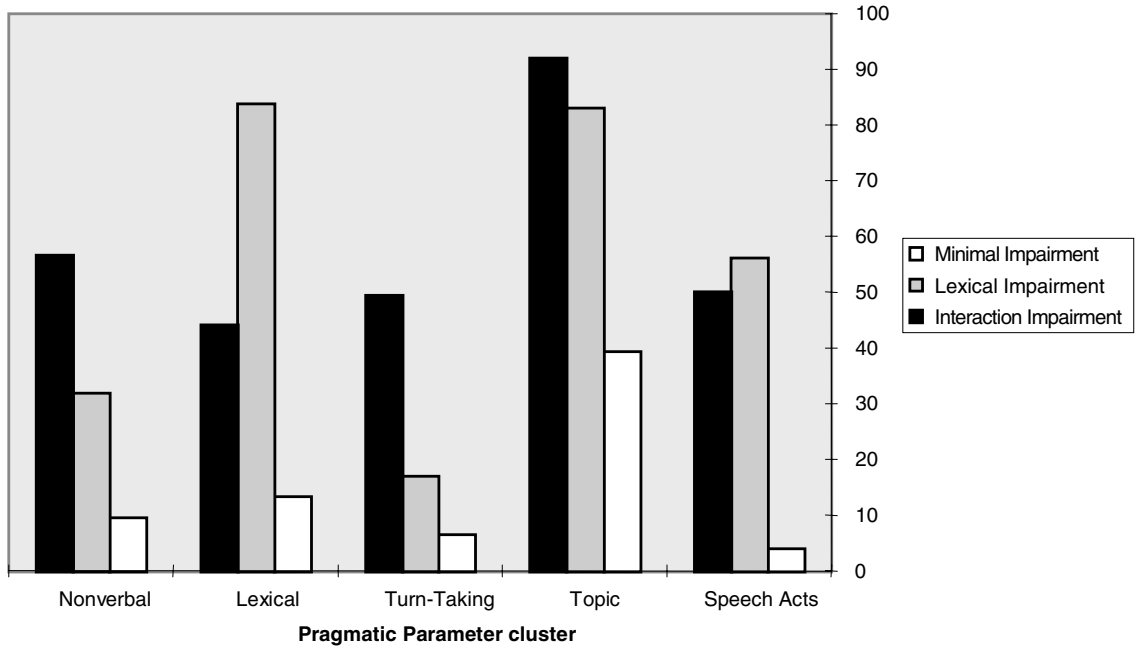


Table 3. Clustering history: participants with schizophrenia (cluster variances are in parentheses).

2 clusters	3 clusters	4 clusters	5 clusters
Turn-Taking, Nonverbal (57)	Lexical (41)	Topic (21)	Topic (21)
Topic, Speech Acts, Lexical (106)	Turn-Taking, Nonverbal (57)	Speech Acts (21)	Speech Acts (21)
	Topic, Speech Acts (98)	Lexical (41)	Turn-Taking (28)
		Turn-Taking, Nonverbal (56)	Lexical (41)
			Nonverbal (43)

those with HBD (data from Prutting & Kirchner, 1987) and participants with mixed anxiety–depression (psychiatric control group of the current study). Furthermore, the group diagnosed with schizophrenia presented a specific profile of inappropriateness that differed from the other groups. The results are presented separately for each of the tasks that composed the pragmatic battery and a comparison is drawn among the different populations.

The two conversations (familiar and nonfamiliar partner) were compared via *t* tests, one for each pragmatic parameter. Although we hypothesized that conversations with familiar partners would show higher pragmatic appropriateness, we found no statistical evidence in this direction. This result suggests that the pragmatic protocol presents a high re-rating reliability in addition to its well-reported interrater reliability (see Figure 2).

Reliability Tests for Sex and Language Background Differences (Participants With Schizophrenia)

A two-way analysis of variance (ANOVA) of participant type versus participant's sex showed no differences with respect to sex nor interaction between sex and type. The participants with schizophrenia were divided into native Hebrew speakers and those who learned Hebrew as a second language. A two-way ANOVA of participant type versus linguistic background (monolingual/bilingual) showed neither differences nor an interaction between language background and type.

Clustering of the Pragmatic Parameters (Participants With Schizophrenia)

In an attempt to identify dependence structures between pragmatic parameters, a statistical clustering method that identifies groups of similarly related parameters was applied. The CART (Breiman et al., 1984) pragmatic parameter clustering based on the 86 conversations of the participants with schizophrenia yielded five distinct and meaningful parameter clusters (see Figure 2). Clustering analysis was also performed on a set of 158 conversations, including the conversations of the participants with schizophrenia (86) and those of four groups taken from the data of Prutting and Kirchner (1987). Prutting and Kirchner's group consisted of 17 children with articulation disorder, 35 children with language disorder, 11 adults with LBD, and 9 adults with

Table 4. CART progressive clustering of the pragmatic parameters: participants with schizophrenia.

Cluster	% inappropriate	Variance
Topic	63.9	21.5
Topic selection	58.1	
Topic introduction	60.5	
Topic maintenance	66.3	
Topic change	70.9	
Speech Acts	29.1	21.7
Speech acts	25.6	
Variety of speech acts	25.6	
Turn-Taking pause time	36.0	
Turn-Taking	20.2	28.5
Turn-Taking adjacency	10.5	
Turn-Taking response	15.1	
Turn-Taking initiation	16.3	
Turn-Taking interruption/overlap	17.4	
Turn-Taking contingency	17.4	
Eye gaze	19.8	
Turn-Taking repair/revision	30.2	
Turn-Taking feedback	34.9	
Lexical	39.2	41.2
Vocal quality	19.8	
Intelligibility	23.3	
Fluency	23.3	
Cohesion	45.3	
Specificity/accuracy	52.3	
Prosody	53.5	
Turn-Taking quantity/conciseness	57.0	
Nonverbal	27.3	43.6
Physical contacts	4.6	
Vocal intensity	12.8	
Physical proximity	12.8	
Foot/leg and hand/arm movements	26.7	
Gestures	32.6	
Varying communicative style	34.9	
Body posture	41.9	
Facial expressions	52.3	

Table 5. Raw correlation coefficients between degree of inappropriateness of $n = 43$ participants with schizophrenia in pragmatic protocol clusters.

Cluster	Speech Acts	Turn-Taking	Topic	Lexical	Nonverbal
Speech Acts	1.000	.499**	.468**	.514**	.475**
Turn-Taking		1.000	.479**	.288	.540**
Topic			1.000	.473**	.442**
Lexical				1.000	.403*
Nonverbal					1.000

Note. Correlations above .4 are individually significant with two-tailed $p < .01$. False discovery rate (FDR) assigns a two-tailed p value of .01 to the statement that all correlations except Turn-Taking–Lexical are significant and a two-tailed FDR p value of .005 for significance of all correlations except Turn-Taking–Lexical and Lexical–Nonverbal.

RBD. These clusters turned out somewhat weaker than, but essentially similar to, those based on the participants with schizophrenia only (see Table 4).

Clusters are ordered (see Tables 4 and 5) by increasing degree of heterogeneity (variance). The variance of the 30 parameters taken as one cluster is 100.

The first splitting (see Table 3) puts Turn-Taking and Nonverbal together; they remain divided until their separation in the last splitting into five clusters, indicating mutual interrelatedness. This is consistent with the high correlation between the two, as observed in both raw and homogenized correlation matrices (see Tables 5 and 6). The Lexical cluster is the first one to define itself (see Table 6), becoming differentiated from Topic and Speech Acts in the second splitting, which in turn define themselves as the most homogeneous clusters in the third splitting.

Coping With Heterogeneity of Participants With Schizophrenia

The heterogeneity of participants, displayed in Figure 1, may create spurious positive correlations between the degree of inappropriateness in different parameters. The correlation coefficients between the average degree of inappropriateness of each participant with schizophrenia in the various parameter clusters are given in Table 5.

These empirically measured correlation coefficients, all close to each other, indicate a fairly high degree of participant heterogeneity in the sample of conversations. The corresponding homogenized correlation coefficients are displayed in Table 6. The process of homogenization (S. R. Meilijson & I. Meilijson, in preparation) estimates a correlation matrix corresponding to the severe cases, in which only truly related variables should display nonzero correlations. Lacking distributional analysis, such as p values, inference statements based on homogenization are nonrigorous.

The homogenized correlation coefficients (see Table 6) uncover the following structure:

1. The Topic, Lexical, and Nonverbal clusters appear to be mutually independent.
2. Speech Acts are strongly correlated with all other clusters. Principal components analysis shows that once the effect of heterogeneity of the participants has been removed, the degree of appropriateness in Speech Acts becomes essentially the average of the degrees of appropriateness in the three mutually independent clusters. Thus, the knowledge to perform and understand Speech Acts determines whether the speaker/hearer will tend to perform appropriately in the other parameters. Moreover, the global performance in the three independent parameter clusters determines the degree of appropriateness in Speech Acts.

Table 6. Homogenized correlation coefficients between degree of inappropriateness in pragmatic protocol clusters.

Cluster	Speech Acts	Turn-Taking	Topic	Lexical	Nonverbal
Speech Acts	1.00	.43	.34	.42	.39
Turn-Taking		1.00	.34	.10	.48
Topic			1.00	.17	.19
Lexical				1.00	.25
Nonverbal					1.00

3. Turn-Taking is also strongly correlated with all other clusters, except Lexical. As also indicated by CART, there is an especially strong tie between the Turn-Taking and Nonverbal clusters.

Pragmatic Parameter Analysis of the Participants With Schizophrenia

Table 4 displays the degree of inappropriateness of the participants with schizophrenia in each of the five pragmatic parameter clusters. A one-way ANOVA showed highly significant global differences, $F(3, 42) = 25.32$, $p < .0001$, between these parameter clusters (see Table 9 for means and standard deviations). Individual differences were examined via t tests. These pairwise t tests showed that the Topic cluster was highly significantly different from any other cluster, and that Lexical was very significantly different from Turn-Taking and significantly different from Nonverbal. The t scores are as follows: Topic versus Lexical, $t(42) = 4.78$, $p < .001$; Topic versus Speech Acts, $t(42) = 6.62$, $p < .001$; Topic versus Nonverbal, $t(42) = 8.09$, $p < .001$; Topic versus Turn-Taking, $t(42) = 9.26$, $p < .001$; Lexical versus Turn-Taking, $t(42) = 3.39$, $p = .002$; and Lexical versus Nonverbal, $t(42) = 2.42$, $p = .02$.

Clustering of the Participants With Schizophrenia

The application of the CART clustering algorithm to participant behavior produced in its first stage a division into two clusters: the most homogeneous cluster (minimal impairment) comprised the 21 participants with most appropriate behavior, and the heterogeneous cluster comprised the other 22 participants. Thus, the overall degree of inappropriateness, rather than a specific profile of inappropriateness, seems to be the major difference between participants. However, the second stage split the heterogeneous cluster into two clusters of 11 participants each, having an approximately equal degree of inappropriateness. This suggests the existence of different profiles of inappropriateness (lexical impairment, interaction impairment). In order to avoid confusion with parameter clusters, the three participant clusters are termed *types* rather than clusters.

Figure 3 is a rearrangement of the columns of Figure 1, to exhibit the three participant types. The first 21 participants compose the minimal impairment type, clearly less inappropriate than the remaining two types, but with a pattern of inappropriateness more similar to the interaction impairment type. This pattern is characterized by a constant degree of inappropriateness in all parameter clusters except Topic. The lexical impairment type is characterized by a low degree of inappropriateness in the Turn-Taking and Nonverbal parameters and a high degree of inappropriateness in the Lexical parameters.

Pragmatic Parameter Cluster Versus Participant With Schizophrenia Type

A two-way ANOVA of the three participant types versus the five parameter clusters showed highly significant differences among participant types, as expected due to the high heterogeneity of the participants, $F(2, 42) = 73.34$, $p < .0001$; among pragmatic parameter clusters, $F(4, 42) = 34.32$, $p < .0001$; and a highly significant interaction between the two, $F(8, 42) = 7.59$, $p < .0001$.

A two-way ANOVA of the two most impaired participant types versus the five parameter clusters did not show differences between participant groups, but preserved the highly significant differences between parameter clusters, $F(4, 42) = 19.95$, $p < .0001$, and the interaction between the two, $F(4, 42) = 9.51$, $p < .0001$.

Comparison of Participants With Schizophrenia (This Study) and HBD (From Prutting & Kirchner, 1987)

The participants with schizophrenia were compared to the participants with HBD: LBD, RBD, and the two together—brain hemispheric damage (BHD).

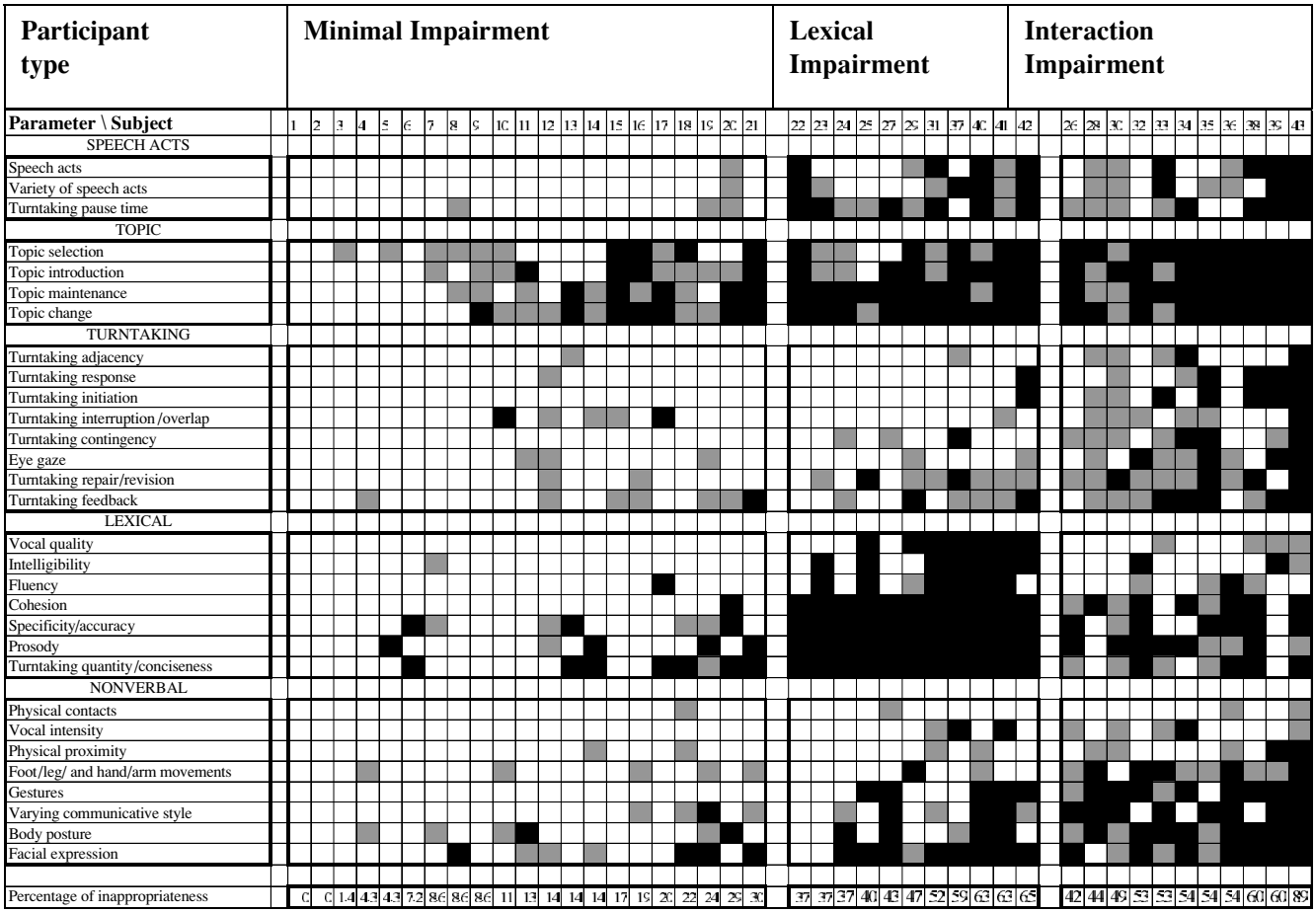
Participant Group Versus Parameter Cluster

A two-way ANOVA of participant groups (schizophrenic, LBD, RBD) versus parameter clusters showed significant global differences between participant groups, $F(2, 60) = 4.60$, $p = .0138$; highly significant global differences between pragmatic parameter clusters, $F(4, 24) = 7.84$, $p < .0001$; and a highly significant interaction between participant group and pragmatic parameter cluster, $F(8, 24) = 8.49$, $p < .0001$. It is therefore of interest to study pragmatic parameter clusters versus pairs of participant groups, and participant groups versus pairs of parameter clusters.

Parameter Cluster Versus Pairs of Participant Groups

Individual two-way ANOVA tests of pragmatic parameter clusters versus each of the four pairs of groups showed highly significant interaction between cluster and group and highly significant differences between clusters. These tests are summarized in Table 7.

Figure 3. Pragmatic protocol—joint clustering of pragmatic parameters (five clusters) and participants with schizophrenia (three types). White: appropriate in both conversations; gray: inappropriate in one conversation; black: inappropriate in both conversations.



Participant Group Versus Pairs of Parameter Clusters

Individual two-way ANOVA tests of pairs of clusters versus group (schizophrenic, RBD, LBD) showed highly significant interaction (FDR *p* value below .001) between group and each pair of clusters, of which one was Topic, and no significant interaction when one of the clusters was Lexical. Differences between groups that were seen to be significant in the global test were nonsignificant versus pairs of clusters when the Topic cluster was excluded and very significant (FDR *p* value below .01) when it was included. These tests are summarized in Table 8.

Table 7. Analysis of variance (ANOVA) of parameter clusters versus pairs of participant groups.

		Interaction		Diff bet/clusters		Diff bet/groups	
Group	*df*	*F*	*p*	*F*	*p*	*F*	*p*
{LBD, RBD}	4, 72	8.13	<.0001	8.09	<.0001		*ns*
{Schiz, BHD}	4, 244	11.63	<.0001	13.22	<.0001	9.28	.0034
{Schiz, LBD}	4, 208	12.07	<.0001	12.17	<.0001		*ns*
{Schiz, RBD}	4, 200	4.94	.0008	6.73	<.0001		*ns*

Note. Diff bet = difference between; LBD = left hemispheric brain damage; RBD = right hemispheric brain damage; BHD = brain hemispheric damage.

Table 8. ANOVA of participant group versus pairs of parameter clusters.

Cluster	*df*	Interaction		Diff bet/clusters		Diff bet/groups	
		F	*p*	*F*	*p*	*F*	*p*
{Topic, Lexical}	2, 60	18.11	<.0001		*ns*	6.85	.0021
{Topic, Speech Acts}	2, 60	15.50	<.0001		*ns*	7.54	.0012
{Topic, Nonverbal}	2, 60	8.62	.0005	13.52	.0005	15.11	<.0001
{Topic, Turn-Taking}	2, 60	17.24	<.0001	10.71	.0018	11.19	.0001
{Speech Acts, Turn-Taking}	2, 60	6.41	.0003		*ns*		*ns*
{Speech Acts, Nonverbal}	2, 60	5.23	.0008		*ns*		*ns*
{Turn-Taking, Nonverbal}	2, 60	4.08	.0218		*ns*		*ns*
{Lexical, Nonverbal}			*ns*	21.34	<.0001		*ns*
{Lexical, Turn-Taking}			*ns*	14.90	.0003		*ns*
{Lexical, Speech Acts}			*ns*	5.58	.0214		*ns*

Differences Between Participant Groups in Each Pragmatic Parameter Cluster as Measured by Pairwise *t* Tests

Speech Acts (FDR p = .017). There were significant differences between LBD and RBD, $t(18) = 3.139$, $p = .0057$, but no significant differences between participants with schizophrenia and either of the two BHD groups. Due to the very small sample sizes of the BHD groups, it was difficult to find significant differences, although there was some evidence (see Table 9) that the RBD group (6% inappropriate) outperformed the two other groups (29% and 36% inappropriate).

Topic (FDR p = .00045). There were very significant differences between participants with schizophrenia and each of the BHD participant groups: +LBD, $t(52) = -5.014$, $p < .0001$; +RBD, $t(50) = -3.922$, $p = .0003$, with BHD participants outperforming participants with schizophrenia by a very wide margin (86% vs. 36% appropriate). There were no significant differences between the two BHD groups.

Turn-Taking (FDR p = .066). There were no significant differences between participants with schizophrenia and any of the BHD participant groups. Although individually significant, $t(18) = -2.511$, $p = .022$, the differences between the two BHD groups did not provide global significance under multiple comparisons.

Lexical (FDR p = .041). There were no significant differences between participants with schizophrenia and any of the BHD groups, but the latter were significantly different from each other, $t(18) = 2.731$, $p = .0137$.

Nonverbal (FDR p = .0165). There were significant differences between participants with schizophrenia and LBD participants, $t(52) = -2.898$, $p = .0055$, and no significant differences between participants with schizophrenia and RBD, nor between LBD and RBD.

Table 9. Percentage of inappropriateness by participant group and pragmatic parameter cluster (LBD and RBD data from Prutting & Kirchner, 1987).

Cluster/group	Schiz		LBD		RBD	
	M	*SD*	*M*	*SD*	*M*	*SD*
Topic	64.0	35.17	9.1	16.07	15.9	22.03
Lexical	39.2	33.72	42.9	13.62	20.8	22.27
Speech Acts	29.1	34.68	36.4	26.42	6.1	12.86
Nonverbal	27.3	24.59	5.7	0.00	9.1	14.19
Turn-Taking	20.2	23.53	5.7	9.78	19.3	14.46
Sample size		43		11		9

Discussion

This study shows that participants with schizophrenia present a specific pragmatic profile, which differentiates them from both the control and the comparison groups. Moreover, their performance on the pragmatic protocol was seen to be significantly lower than that of the control groups and of the comparison group with brain damage (Prutting & Kirchner, 1987), with different performance patterns in comparison to each of the other groups.

Many studies of language and schizophrenia have found deviant language in persons with schizophrenia (Condray, van Kammen, Steinhauer, & Kasparek, 1995; Done et al., 1998; Morice & Ingram, 1983; Rochester & Martin, 1979; Thomas, Kearney, & Napier, 1996; Thomas, King, Fraser, & Kendell, 1990; Wrobel, 1990). In this study we have tried to overcome some of the methodological deficits encountered in previous studies. Most previous studies (L. J. Chapman, Chapman, & Miller, 1964; Rochester & Martin, 1979; Thomas et al., 1996; Wodak & Van de Craen, 1987) have been based on transcripts of the speech of participants with schizophrenia, using different rules in the transcription process and missing all the information included in the paralinguistic

(e.g., intonation) and nonverbal (e.g., facial expressions) behaviors. The theoretical paradigmatic shift offered in this study leads to a parallel paradigmatic shift in the method of assessment of the language of persons with schizophrenia. The videotaping techniques and the use of natural language context instead of the stimulus–response techniques have contributed to the study of pragmatic knowledge that is not used effectively by the speaker/hearer with schizophrenia. In addition, our results have been formalized by the application of strict tools for statistical inference (CART clustering analysis and the FDR approach to multiple comparisons).

Familiar and Nonfamiliar Conversational Partners

The results of the pragmatic protocol were based on the analysis of 86 conversations between patients with chronic schizophrenia and a partner. According to the criterion presented by Prutting and Kirchner (1987), the assessed speaker is requested to converse with a familiar or neutral partner. The methodological change introduced in our study, the addition of a nonfamiliar partner, was based on the assumption that pragmatic performance could be influenced by the change of partners. Our results showed no statistical evidence in this direction. The participants with schizophrenia however, displayed more inappropriate behavior in the Topic parameter cluster when conversing with a nonfamiliar partner (see Figure 2).

In a study that investigated the reliability of various psychopathological scales through repeated assessment at 14-day intervals, it was found that most psychopathology scores are sufficiently stable and reproducible over time (Stassen et al., 1995). In addition, Stassen et al. determined the stability of acoustic variables in the voice patterns of persons with schizophrenia and found no significant fluctuations throughout the observation period of 14 days. These results corroborate our findings and support the high reliability of the pragmatic protocol. However, they do not rule out the possibility of a mutual influence between interactional partners in a conversation.

From a discourse analysis point of view, it is possible that the conversational partner in the observed dyad could influence the structure and content of the interaction. For example, our participants seemed to display more appropriate behavior in the nonverbal parameters physical contacts and physical proximity when conversing with nonfamiliar partners. Krause, Steimer, Sanger-Alt, and Wagner (1989), in a study of conversations between participants with schizophrenia and a stranger as a partner, postulated that the participant with schizophrenia will tend to maintain the greatest possible distance during the interactions and that this would be reflected in reduced facial activity and affectivity. In addition, these researchers found that the interaction partners also showed less facial productivity as compared to a control group.

Another direction of mutual influence in the dyads of our study was that the participants with schizophrenia seemed to display consistently more inappropriate performance in Topic and Turn-Taking parameters when conversing with the nonfamiliar partner. It is possible that the more facilitative, familiar partner encouraged initiation and participation, allowing more opportunities for initiation on the part of the patient. This mutuality between conversational partners can be explained using the concept of scaffolding introduced by Bruner (1975). In his discussion of the ontogenesis of speech acts, he emphasized the role of the regulation of joint attention and joint activity in the mutual play of mother and child in the development of formal structures of language. Kirchner, Skarakis-Doyle, and Prutting (1984) described a language-impaired adolescent who formulated complex sentences primarily by utilizing the utterances of his conversational partner as a scaffold to compensate for his reduced syntactic ability. Most of the familiar partners who conversed with the participants with schizophrenia in our study had ample opportunity to learn and adapt to participants' conversational style, and were thus able to act as scaffold in the interaction and allow more appropriate performance in the specific parameters cited above.

Clustering Analysis

Clustering analysis of the pragmatic protocol yielded five distinct and meaningful parameter clusters: Speech Acts, Topic, Turn-Taking, Lexical, and Nonverbal. Clustering history (see Table 3) is the order in which CART created the various clusters, by successive dichotomous split of the most heterogeneous cluster. The first split created the relatively homogeneous block consisting of Turn-Taking and Nonverbal that will separate in the final split. The second split, which had a minor effect on reducing heterogeneity, created the Lexical cluster. By the third split, the homogenous clusters Topic, Speech Acts, and Lexical have been defined, to be followed by the final separation of the Turn-Taking and Nonverbal block into its two individual components.

The original and cumbersome 30-parameter organization presented by Prutting and Kirchner (1987) can now be replaced by these five new and distinct parameter clusters (see Table 4). The pragmatic protocol has been used to assess pragmatic performance and determine change in performance over time of persons with BHD (Avent et al., 1998; Goldblum, 1985; Roberts & Wertz, 1993). Byrne, Crowe, Hale, Meek, and Epps

(1996) used a 10-item parameter from the original pragmatic protocol to assess the pragmatic abilities of participants in an adult literacy program. All of the above assessments reported high reliability scores (above 90%). However, these studies have used the original Prutting and Kirchner taxonomy without the benefit of our new clustering analysis.

Speech Acts and Modularity

The Speech Acts cluster correlates with all other clusters. However, interaction analysis of the pragmatic protocol versus basic speech acts (Meilijson, 1999) provides some indication of the cognitive independence between performance in speech acts and relative performance in the other features of linguistic competence. It has been suggested that the area of basic speech acts should be investigated from a modular perspective (Kasher, 1984, 1991a, 1991b, 1994, 1998). Basic speech act types are those that have to be present in linguistic faculty for one to have mastered the use of a natural language. Assertion, command, question, and request are examples of basic speech act types. It may well be the case that those speech act types are the only basic speech act types. Prutting and Kirchner's (1987) definitions of the assessment of speech acts (directive/compliance, query/response, request/response, and comment/acknowledgment) correspond closely to basic speech acts and we regard them as such in this study.

A natural hypothesis concerning the modularity of basic speech acts is that each one of these is the domain of a separate pragmatic module. According to Kasher (1994),

> in order to show that a cognitive subsystem is a module we have to demonstrate its independence of other systems on the theoretical level of the principles that govern it, on the psychological level of its information processing, on the neural level of its embodiment in human brain and on the psychological level of its acquisition. (pp. 314–315)

Speech acts have been analyzed in the literature as involving at least two major components: a radical or propositional content, which represents a state of affairs, and a force, such as that of assertion or of request (Kasher, 1994). The theoretical possibility thus emerges of an interaction between different cognitive systems. Whereas the force of a speech act is always linguistically characterized by lexical, grammatical, intonational, or other means, its radical can be provided by either some ordinary linguistic system or by a nonlinguistic cognitive system (e.g., pictures or paintings). Thus, modularity of assertion is a property of its force, independently of the system used for providing it with its input, which in turn could be linguistic or pictorial.

As mentioned earlier, Speech Acts correlate with all other clusters. Moreover, principal components analysis of the homogenized correlation matrix (see Table 6) shows that the performance in Speech Acts is very close to the average performance in the Topic, Lexical, and Nonverbal clusters. This suggests that speech acts are a necessary basic tool for all other clusters. In that role, speech acts are a good predictor of the global degree of appropriateness. This intrinsic property of speech acts means that if the performance in Speech Acts is high, so is the general degree of appropriateness. The knowledge of basic speech act types, such as assertions, questions, and commands, is considered to be universally required to master a natural language. Kasher (1991a) referred to this type of knowledge as core pragmatics. According to Kasher's "basic formula of the modular structure of pragmatics," speech acts are part of the specific domain of the pragmatic module. The question of whether or not core pragmatics is informationally encapsulated seems to depend on the delimitation of the class of speech acts. As stated above, in the pragmatic protocol assessment of the Speech Acts cluster the scoring is not totally confined to syntactically marked speech acts. Therefore, we cannot assume nor refute encapsulation of core pragmatics. Both Morice and Ingram (1983) and Thomas et al. (1990, 1996) found that the impoverished use of syntax reflects a premorbid deficit in syntactic production, probably a sign of abnormal neurodevelopment. Furthermore, these researchers found that all measures of syntactic complexity produce a single-factor solution when analyzed by principal components analysis. This important result implies that there is a common syntactic process mechanism. This finding may provide further evidence for the modularity of basic speech acts.

There are significant correlations between any two of the three clusters (Speech Acts, Turn-Taking, and Nonverbal). A possible explanation of the correlation between Speech Acts and Turn-Taking is that the identification of a speech act performed during a conversation is necessary for its appropriate continuation. For example, if a question is not recognized as such, the ensuing reaction is not meant as an answer and could therefore be inappropriate. As for the correlation between Speech Acts and Nonverbal, gestures may well depend to some extent on the force of the speech act they accompany. Fein and Kasher (1996) explored the relationship between gestures and utterance in a study of Asterix comic books. Participants were shown a set of photographed gestures and were asked to propose an utterance for the gestures and to ascribe possible meanings to them. Their results showed that the meaning of a gesture lies in the "ingesticulary" act—what we do in gesticulating—independently of the exact propositional content. Kendon (1995) has claimed that speakers use gestures as they use speech, to produce different effects.

Lexical and Paralinguistic Clusters

The strongest correlation occurs between the Lexical and the Paralinguistic aspects, which can be said to form a strong two-aspect block. Except for the global correlation with Speech Acts, it is rather unrelated to everything else. Developmentally, Lexical and Paralinguistic aspects of language use are highly related. In addition to the affective information conveyed by the prosodic contour of an utterance, prosody is used to carry linguistic or pragmatic information that allows a listener to discriminate among questions, statements, or exclamations, or to perceive emphatic stress within sentences. Prosodic variation also carries lexical distinctions. Prosody is known to play a role in the child's development of grammar: Infants 7 to 10 months of age are sensitive to prosodic cues that help them segment speech into perceptual units corresponding to clauses. Thus, paralinguistic cues are embedded into grammatical units of language early in development (Nelson, Hirsh-Pasek, Jusczyk, & Cassidy, 1989). Bortolini and Leonard (1996) emphasized the important influence of prosodic factors on the degree and profile of grammatical morphemes used by children speaking English or Italian. Heilman, Bowers, Speedie, and Coslett (1984) examined both affective and linguistic prosody comprehension of RBD and LBD participants. Relative to control participants, RBD patients showed impaired comprehension of emotional prosody, while both RBD and LBD participants showed impaired comprehension of linguistic prosody.

Turn-Taking and Nonverbal Clusters

Another significant correlation appears between the Turn-Taking and Nonverbal clusters. The history of the clustering analysis procedure clearly shows that the affinity of these two clusters remains until the final split, where they separate (see Table 3). The Nonverbal parameters (e.g., facial expression, eye-gaze, and body movements) may serve as devices for the performance of Turn-Taking.

Facial expression, one of the parameters of the Nonverbal cluster, deserves special consideration, because (a) it was found to be the most inappropriate among the Nonverbal parameters (see Table 4) and (b) it has been studied by a number of researchers. The general conclusion that participants with schizophrenia are deficient relative to comparison groups with regard to the encoding and decoding of emotional facial expressions is not supported by the study of Flack, Cavallaro, Laird, and Miller (1997). In contrast, a review of the literature by Morrison, Bellack, and Mueser (1988) concluded that persons with schizophrenia (a) show deficits in decoding basic emotional expressions, but the causes of such deficits are unknown, and (b) show greater deficits in the decoding of unpleasant, as opposed to pleasant, emotional expressions. The inconsistency between these studies may be due to differences in methodology. In our study, facial expression was assessed in terms of the effect it had on the conversational interaction and whether it supplemented and supported the respective speech act. Among the Nonverbal parameters assessed, facial expression scored the lowest on inappropriateness, followed by body posture (see Table 4). If, indeed, the participants with schizophrenia do not suffer from a basic deficit in reading facial expressions, then the problem remains at the level of the interface with the central system. This would be the case in a molar assessment, as in the protocol where scoring is based on whether the nonverbal parameter had any effect on the respective speech act produced in conversation.

Gestures is another Nonverbal parameter in which participants with schizophrenia showed inappropriateness (see Table 4). According to Prutting and Kirchner (1987), gestures are analyzed as any movement that supports, complements, or replaces verbal behavior. In nonimpaired adult discourse, speech and gestures are highly congruent. As stated before, gestures can perform a speech act or act as a turn-taking device. Our results suggest that participants with schizophrenia have difficulties in performing and understanding appropriate gestures when using language in context. According to McNeill, Cassell, and McCullough (1994), the listener normally takes in both gesture and speech. This is part of an interaction between image and word involved in linguistic processes, and it is done without the necessity of conscious attention; the two channels combine smoothly into one. Thus, it is possible that by way of interface between the auditory and the visual perceptual channels with the central system, content will mesh into a coherent picture of speech and gesture. Even if gesture and speech do not fall together, the listener will drive toward getting unitary information. Because of attentional deficits and overload, the speaker with schizophrenia may fail to interpret appropriately the information from the two channels.

The relatively high percentage of inappropriateness of pause time in participants with schizophrenia (see Table 4) has been also found in a number of studies. Inappropriate pause time is an interval that is either too short or too long between certain units of language. Prutting and Kirchner (1987) considered pause time between words, in response to a question, or between sentences. Alpert, Clarck, and Pouget (1994) found that the spontaneous speech of participants with negative syndrome schizophrenia is underproductive and contains many hesitations and pauses. Acoustic analysis of

the participants' speech during interviews reveals that the duration of pauses, independent of other linguistic or paralinguistic measures, correlates strongly with the clinician's impressions of the participant's flat affect and alogia. Pausing is less related to social skills and other aspects of the negative syndrome. The hesitations appear to reflect a word-finding difficulty that, together with neuropsychological evidence of compromised performance on word fluency tasks, suggests a specific speech generation difficulty. According to these studies, the hesitant speech of participants with alogia appears to reflect some fault in the mechanics of word finding: The participant may scan his or her lexicon more slowly or may be more subject to distraction. Participants with schizophrenia were found to present longer pauses as compared to healthy individuals and to participants with depression. In addition, it was found that participants with thought-disordered schizophrenia tend to have longer between-clause pauses than participants without thought disorder (Clemmer, 1980; Resnick & Oltmanns, 1984; Rochester, Martin, & Thurston, 1977). These studies found that very long between-clause pauses (more than 5 s) are often followed by incoherent speech, and it is specifically between-clause pauses that are associated with thought disorder. This pause type did not show a differential association with flat affect and alogia (Alpert et al., 1994). Goren, Fine, Manahim, and Apter (1995) showed that blocking symptoms were expressed linguistically by pauses causing the patient to lose track of the conversation. In this case study, blocking is viewed as an expression of a central cognitive deficit in carrying out a plan.

Pragmatically Independent Clusters

The strongest result in terms of independence of clusters is the finding that the clusters Topic, Lexical, and Nonverbal are not pairwise correlated. Since dichotomous variables are independent as soon as they are uncorrelated, this suggests that Topic, Lexical, and Nonverbal may be cognitively independent pragmatic aspects.

Topic

The pragmatic protocol includes four aspects of Topic: selection, introduction, maintenance, and change. Although not statistically significant, participants with schizophrenia showed most inappropriate performance in Topic change, followed by Topic maintenance (see Table 4). Topic may be described as a competence involved in producing the integrated understanding of what has been said in a given context of an utterance, as a function of presumed linguistic interpretation of what has been said and additional information with respect to the intentional activity under consideration. The highly inappropriate performance in the Topic cluster is consistent with the early clinical observation that participants with schizophrenia inappropriately introduce topics in conversations (Bellack, Morrison, & Mueser, 1989; Bleuler, 1950; Brown, 1973; De Decker & Van de Craen, 1987; Rutter, 1985; Wrobel, 1990). Thus, the highly cohesive and independent qualities of the Topic parameter cluster may be used as a basic assessment tool for describing the language deviance of the participant with schizophrenia and differentiating her or his illness from other psychiatric conditions.

The central role played by the Topic parameter cluster in the pragmatic performance of participants with schizophrenia should be further investigated in future studies, complementing our global analysis with deeper analysis tools. Mentis and Prutting (1991) have developed a multidimensional topic analysis that can provide a sensitive and reliable tool for the assessment of topic management of participants with schizophrenia.

The Pragmatic Protocol and Clinical Assessment of Psychotic Symptoms

We found no correlation between the results of the pragmatic protocol and the PANSS clinical assessment of participants with schizophrenia when taken as one group, nor when taken as three groups. This lack of correlation is not surprising since we argue for a different theoretical and methodological approach in describing the language performance of participants with schizophrenia. Other studies have also found no correlation between symptoms and language measures. Condray et al. (1995) found that language comprehension was not correlated with positive symptoms of psychosis or with other clinical measures. This is consistent with Morice and Ingram (1983), who found a lack of association between psychotic symptoms and the syntactic complexity of participants' speech.

Researchers have suggested different approaches to the classification of schizophrenia. Dolfus et al. (1996), applying cluster analysis, identified subtypes of schizophrenia, concluding that the common negative–positive dichotomy is an oversimplification and that the existence of a more complex structure needs to be taken into account in future research. Carpenter (1994) suggested two different approaches to classifying schizophrenia: a clinical approach assigning participants to a cluster according to the prevailing symptoms, and a domains or syndromes approach. In this study, we have also attempted to identify subtypes of schizophrenia by cluster analysis. The clustering analysis of participants, as

assessed by the pragmatic protocol, yielded three distinct groups, each with a specific pragmatic language competence profile. The classification of participants with schizophrenia into three groups—minimal impairment, lexical impairment, and interaction impairment—shows that participants with schizophrenia do differ in their competence in the use of language in context. Evidence for the existence of a minimal impairment group, comprising about 50% of the participants in our study, has been reported previously in a number of studies (Fromkin, 1975; Gerver, 1967; Rochester, Harris, & Seeman, 1973). However, in our study we have found specific deficits that characterize this group: Figure 3 displays mild inappropriateness in the Topic and Lexical clusters, with scattered inappropriateness in the Nonverbal, Turn-Taking, and Speech Acts clusters. The two highly impaired groups display different profiles of pragmatic performance. Developmental studies in schizophrenia may provide an explanation for the differences in language performance in the three groups.

Kenny et al. (1997) reported that there are serious cognitive impairments in adolescents with schizophrenia. During adolescence there are neurodevelopmental events, including changes in synaptic density and morphology in the frontal lobe, a decline in the ratio of gray matter to white matter, marked sleep EEG changes, and a decline in cerebral metabolism. These changes are believed to involve maturational reorganization consisting of selective synaptic enhancement and elimination of redundant axons (i.e., pruning).

These maturational events have been summoned in support of what Keshaven, Anderson, and Pettergrew (1994) have described as a "late" neurodevelopmental model of the etiology of schizophrenia in contrast to the "early" developmental model, which posits a fixed lesion from early life interacting with normal neurodevelopmental events occurring at a later point. The main findings of Keshaven et al. were that adolescents with schizophrenia showed generalized neuropsychological impairment on measures of attention, working memory, secondary memory, generative naming, and executive functions. Considering this hypothesis, it well may be that the lexical impairment subgroup fits the "early" development hypothesis and that the interaction impairment subgroup suggests a "late" development etiology. Only longitudinal studies could show whether this is indeed so, but it seems plausible that the lexical impairment group has an earlier beginning as opposed to the interaction impairment group. In addition, it may be that lexical impairment is related to the negative symptoms dimension. The relationship between negative symptoms and disordered cerebral function has proven robust. It appears that the pattern of cerebral activity associated with negative symptoms is not a static loss of frontal function, but instead is part of a dynamic imbalance between cortical and subcortical activity (Liddle et al., 1992).

Clinical Implications

There are two main contributions to diagnostic classification of schizophrenia that stem from the results of this study. The pragmatic protocol can be used as an additional assessment to provide a specific profile for each patient. The pragmatic protocol will also yield a molar analysis of five parameter clusters that can be further analyzed for rehabilitation purposes. The second contribution is the assignation of each patient to a specific language profile group, using clustering analysis. It is of great importance to be able to detect whether the patient belongs to the minimal impairment group or to one of the grossly impaired groups (lexical impairment, interaction impairment), both for assessment purposes and for rehabilitation. Future studies should include a larger group of participants in order to provide further evidence for the three-group division found in this study: minimal impairment, lexical impairment, and interaction impairment.

The application of the pragmatic protocol can provide an accurate assessment of the language use abilities of each participant. This assessment provides specific clinical parameters to plan treatment goals for the participant. In the first step of the program, a comprehensive evaluation of each participant's individual profile should be obtained, and the participant's type (minimal impairment, lexical impairment, or interaction impairment) will determine participation in the treatment phase. Although the pragmatic protocol presents a molar analysis of the pragmatic language performance of each participant, it is also possible to further analyze the specific parameter clusters that were found to be inappropriate and that need to be focused on in therapy. An example of this fine-grained analysis is the analysis of Topic, which was found to be the most inappropriate cluster in the general profile of schizophrenic participants. Topic management represents an essential level of organization in discourse, and successful topic management is necessary for the establishment of discourse coherence (Mentis & Prutting, 1991).

The next objective in this research area should be to test whether the pragmatic assessment can provide reliable and appropriate information to plan specific goals in a rehabilitation program in the area of language skills, in addition to reliability in assessment. We propose to start the investigation by planning a rehabilitation program for the participant type closest to minimal impairment, as it provides a higher probability of success, and by later implementing a treatment program

for the lower functioning groups. Treatment is most effective when it focuses on the specific problems of carefully defined, clinically relevant subtypes of schizophrenia. Rehabilitation strategies will be more effective if the heterogeneity of this population is taken into consideration (Torrey & Drake, 1994).

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