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# Factor Structure of the BPRS in Deaf People with Schizophrenia: Correlates to Language and Thought

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## Abstract

**Introduction—**There has been a relative lack of research on deaf people with schizophrenia, and no data exist regarding symptom structure in this population. Thus we determined the factor structure of the 24-item Brief Psychiatric Rating Scale (BPRS) in deaf (n=34) and hearing (n=31) people with schizophrenia and compared it to a standard 4-factor solution.

**Method—**An obliquely rotated factor analysis produced a solution for the BPRS that resembled others in the literature. Symptom clusters were additionally compared to cognitive and social-cognitive abilities.

**Results—**Activity and disorganized symptoms were the most consistent correlates of visual- and thought and language-related skills for deaf and hearing subjects respectively. Affective symptoms and facial affect processing were positively correlated among deaf but not hearing subjects.

**Conclusions—**The data suggest that current symptom models of schizophrenia are valid in both hearing and deaf patients. However, relations between symptoms, cognition, and outcome from the general (hearing) literature cannot be generalized to deaf patients. Findings are broadly consistent with pathophysiologic models of schizophrenia suggesting a fundamental cortical processing algorithm operating across several domains of neural activity including vision, and thought and language. Support is provided for recent advances in social-cognitive interventions for people with schizophrenia.

### Keywords

Deafness; schizophrenia; BPRS; factor structure; visuospatial processing; social cognition

Little data exist regarding schizophrenia and deafness, especially in terms of symptoms and their relationship to cognition, social cognition, and functional outcome, all of which receive a great deal of attention in the general (hearing) schizophrenia literature. The current study evaluated these domains in relation to symptom factors derived from the 24-item Brief Psychiatric Rating Scale ([BPRS]Ventura et al., 1993) to determine if the pattern of predictive relations were similar in samples of deaf and hearing people with schizophrenia. A prerequisite to examining relationships between symptom clusters and cognition in the deaf is the determination of whether symptoms correlate with each other the same way they

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do among hearing samples. Because, to our knowledge, such data do not exist, we investigated the issue in an exploratory fashion.

One rationale for this study was that relationships between symptom clusters and cognition may vary for deaf subjects based on the extent to which each involves linguistic ability. The possibility is plausible because there is evidence that habitual use of American Sign Language enhances non-linguistic cognitive processes in nonclinical deaf samples (Emmorey et al., 1993; Emmorey, et al., 1998). In addition, among clinical samples, linguistic and nonlinguistic cognitive abilities are differentially associated with functional outcomes for deaf compared to hearing subjects. For example, nonlinguistic-based cognition (e.g., visuospatial processing) appears to be a more potent predictor of outcome for deaf subjects while linguistic-based cognition (e.g., word memory) may be a more potent predictor for hearing subjects (Horton & Silverstein, 2007; Horton, 2010). Associations between nonlinguistic- and linguistic-based cognition and outcome coincide with the respective population’s reliance on visuospatial versus an aural-oral medium in general. Specifically, in American Sign Language (ASL) grammatical distinctions are conveyed via planes of signing space as well as the spatial loci within these planes (Neville et al., 1997); the corresponding visual-spatial processing requirements for spoken language are far fewer.

## Symptoms and Cognition

Research suggests that cognition is more strongly associated with negative than with positive or disorganized symptoms (Heaton et al., 1994; Corrigan & Toomey, 1995; Cadenhead et al., 1997; Harvey et al., 1998; Harvey et al., 2006; Keefe et al., 2006a, 2006b; Ventura et al., 2009). Nonetheless, there exist at least some specific cognitive correlates to positive and disorganized symptom dimensions. For example, formal thought disorder has been found to co-vary with intellectual ability, complex attention/arithmetic performance (Silverstein, Harrow & Marengo (1993) as well as learning, memory, and vigilance (Subotnik et al. 2006). Disorganized symptoms have correlated significantly with social-cognitive deficits (Sarfati, et al., 1997; Leiser & Bonshtein, 2003; Phillips & Silverstein, 2003; Schenkel et al., 2005), as well as reduced organization in perception, memory, and thought (Silverstein et al., 2000; Phillips & Silverstein, 2003). These latter data in particular are consistent with the view that mental representations underlying thought and language may be structurally similar to the mechanisms underlying visual representations (Chechile et al., 1996; Phillips & Singer, 1997) and, that multiple forms of perceptual and cognitive disorganization in schizophrenia can be accounted for by widespread impairment in contextual modulation (Phillips & Silverstein, 2003).

Because deaf people rely solely on the visuospatial medium for information and linguistic processing, *linguistic* visuospatial processing must be specifically dissociated from *nonlinguistic* visuospatial processing in the evaluation of cognition. The dissociation can be seen in tasks requiring the processing of alphanumeric stimuli compared to tasks requiring the processing of 3-dimensional geometric figures. The current study explored the relationship between vision and thought via an examination of correlations between visual processing—both linguistic and nonlinguistic—and disordered thinking as reflected by disorganization and thought disorder symptoms. Symptom factors were compared to visuospatial memory, early visual processing, processing speed, vigilance, and word memory (measures described in the Method section).

## Symptoms and Social Cognition

We also examined relationships between symptoms and two forms of social cognition. The first, a metarepresentational capacity reflecting the ability to infer the mental states of others (i.e., Theory of Mind [ToM]), has been associated with failures in linguistic- and visual-context processing, greater disorganized symptoms, and poor premorbid functioning (Schenkel et al., 2005). The findings are consistent with research specifically linking more impaired Hinting Task performance (the measure employed herein) to increased levels of conceptual disorganization (Frith & Corcoran, 1996; Langdon et al., 1997; Schenkel et al., 1997; Mazza, et al., 2001; Greig et al., 2004; Uhlhaas et al., 2006; Sprong et al., 2007; Abdel-Hamid et al., 2009). The second social-cognitive domain evaluated was facial affect processing (FAP). Due to the purported influence of conceptual disorganization on social reasoning, inverse associations to FAP as well as ToM were expected (Brüne, 2005a,b).

## Symptoms and Functional Outcome

The final aim of this study was to evaluate relationships between symptoms and functional outcome. Considered together, there is empirical support for the hypothesis that inverse relationships exist between negative symptoms and functional outcome, and slightly weaker relationships typically manifest between both disorganized and positive symptoms and functional outcome (Breier et al., 1991; Glynn, 1998; Green, Kern, Braff & Mintz, 2000; Herbener & Harrow, 2004; Phillips & Silverstein, 2003; Pogue-Geile & Harrow, 1984). Because functional outcome encompasses a wide spectrum of behaviors, relationships between symptom factors and separate scales for adaptive and social outcomes are examined to increase specificity (e.g., adjustment to living and social competence).

## Method

Measures were administered by the first author whose ASL ability was rated by a deaf native gold-standard evaluator as “superior.” The superior range of the Sign Communication Proficiency Interview (Caccamise & Newell, 1996, 1999) reflects the ability to have a fully shared conversation, with in-depth elaboration; very broad sign language vocabulary; near native-like production and fluency; excellent use of sign language grammatical features, and excellent comprehension.

The Structured Clinical Interview for DSM-IV Axis I Disorders-Patient Edition (SCID) (First et al., 1997) and the Hinting Test (Corcoran et al., 1995) were translated by the first author and back-translated by a native (hearing) signer. Eight of ten SCID modules were included in the translation process (somatoform and eating disorders modules were excluded). Each translation’s accuracy was evaluated by the congruence between the original document (in written English) and the back-translated version of the measure (i.e., the ASL version translated “back” to English). Thus the reliability of the ASL version is indirectly supported by the correlation between the English versions (SCID: $r = .86$; Hinting Test: $r = .80$). During back-translation, one set of items on the SCID and two items on the Hinting Test included ASL phrases that lacked written English equivalents. Options were discussed and minor adjustments in the ASL translation were made to insure concept congruency between the English and ASL versions (Brauer, 1993; Crowe, 2002).

### Subjects

From among all deaf and hearing consumers at a psychiatric rehabilitation agency in the Midwest (approximately 3,000 consumers), 87 people agreed to participate in the study; twenty-two (22) did not meet the diagnostic inclusion criteria. A diagnosis of schizophrenia or schizoaffective disorder was determined by the first author’s administration of the SCID. Case record reviews and/or self-reports determined that all deaf subjects were pre-linguistically deafened (people who became deaf prior to the acquisition of spoken language) and had severe-to-profound (70–89 dB loss) or profound (>90 dB loss) hearing losses (Adams et al., 1999; Rich, 1993); exact causes were unknown. Because rubella as well as other pre/post-natal insults are associated with cognitive deficits in the deaf (e.g., toxoplasmosis, cytomegalovirus, herpes symplex virus, premature birth, postnatal meningitis) subjects with developmental delays or other severe cognitive deficits (e.g., a history of head injury) were excluded (Hindley, 1999; Haskins, 2004). For the study sample's deaf group, listening to and lip-reading speech would have provided insufficient linguistic details for them as children—even with powerful hearing aids and cochlear implants—to acquire spoken language spontaneously within the standard, developmental time frame (Mayberry, 2007). The final sample included 65 subjects (34 deaf, 31 hearing). Among the 34 deaf subjects, two did not participate in the final testing session; cognitive data are missing for these subjects.

Deaf and hearing groups were similar with respect to gender, race, diagnosis, housing status, employment status, and level of functional outcome (see Table 1). The mean age of illness onset was 21 years for hearing subjects (sd = 5, range = 14–38; median = 20) and 18 years for deaf subjects (sd = 6, range 4–30; median = 19). The average total number of lifetime hospitalizations was 8 for deaf subjects (sd=6; range = 1–22; median = 6) and 7 for hearing subjects (sd = 4; range = 2–20; median = 8) and the average illness duration was 25 years for both groups (deaf: sd=10; range = 1–46; hearing: sd = 10; range = 3–42). The sample represents a psychiatrically stable sample of people with schizophrenia, the majority of whom lived independently and had received long-term community based mental health services.

Consent and recruitment procedures were approved by the institutional review boards (IRB) at the University of Chicago and the agency that hosted the research. Because of concerns that deaf participants may have reduced English comprehension, the IRB approved procedure included ASL translations of each consent form and a series of questions to confirm their understanding (e.g., *Can you decide to leave/not to take part/refuse to participate? What should you do if you feel uncomfortable? What do you do if you change your mind about being in the study?).* Once the study procedures had been fully explained, written informed consent was obtained from each participant.

## Measures

Test instructions and stimuli were administered in sign language for deaf subjects (either ASL or a form of signed English) and spoken English for hearing subjects. Over a four month period each subject participated in a diagnostic session and a separate session testing cognitive abilities. Deaf subjects participated in an additional session for an evaluation of linguistic ability. A random number generator was used to order the presentation of the cognitive measures.

**Age of Sign Language Acquisition—**Information regarding the age at which the deaf subjects were first exposed to sign language was acquired in two ways: (1) subjects were asked about the setting of their early education (e.g., deaf residential school, hearing public school with interpreters, deaf contained classroom in a public school); (2) subjects were asked about their early experiences with sign language and with the deaf community (e.g., *How old were you when you learned sign language? How old were you when you first met another deaf person?*). Additional information regarding subjects' early experience with sign language was gathered from staff persons who had attended school with participants; because the deaf community is small, it is common for deaf staff working in human service agencies to have pre-existing relationships with consumers, typically from early schooling. The information was triangulated to produce an age of first exposure to adequate sign language models (usually teachers and deaf classmates) (mean = 7.3 years; sd = 5 years, range = 0–20 years). Those who were exposed to sign language from birth (e.g., deaf children born to deaf parents) are considered native signers (n=2). The reliability of this variable is similar to that generated from other self-report data wherein measurement error, in part, is dependent upon memory skills of participants.

**Cognition—**Four domains of cognition were measured: visuospatial memory (VSM), early visual processing (EVP), sustained attention/vigilance, and word memory. Visuospatial memory was operationalized by the Complex Figure Test (Osterrieth, 1944; Visser, 1970–1973). Subjects were asked to copy an asymmetric geometric figure and following a delay, draw it again from memory. Two indices are reported: perceptual organization (VSM-copy) and immediate recall (VSM-recall). Because the task employs a geometric figure, it is conceptualized as measuring a nonlinguistic-based cognitive ability. EVP was measured with the Partial Report Span of Apprehension test ([Span] Asarnow & Nuechterlein, 1994) which measures the amount of visual information that can be processed during a brief display. The Span is a computer-based measure requiring subjects to identify which of two target letters (T or F) appear on the monitor by pressing one of two response buttons as quickly as possible (marked T and F respectively). Two different series of stimuli are displayed randomly: a matrix of 3 letters and a matrix of 12 letters.

Vigilance was assessed with the Degraded Stimulus Continuous Performance Test ([DS-CPT] Nuechterlein & Asarnow, 1999). Subjects monitor a random series of single numbers (zero–nine) that are presented continuously, at a rate of approximately one per second. Subjects are asked to indicate that they have detected a target event by pressing a response button and they are to avoid responding to nontarget stimuli. The DS-CPT's use of degraded (blurred) stimuli appears to reliably elicit deficits in schizophrenic populations (Heinrichs & Zakzanis, 1998). Word memory (short- and long-term) was measured with the Rey Auditory Verbal Learning Test ([RAVLT] Rey, 1964). The RALVT consists of several lists containing 15 words each. During multiple trials subjects must recall words stated/signed by the examiner. The total score includes the number of words recalled correctly across all trials. The measures of EVP, vigilance, and word memory employ alphanumeric stimuli and are conceptualized as language-based cognitive tasks.

**Linguistic Ability—**Linguistic ability (e.g., grammar, fluency, comprehension) was measured in deaf subjects only and was operationalized via the Sign Communication Proficiency Interview (Caccamise & Newell, 1996, 1999). A deaf native signer engaged participants for approximately 1.5 hours in a videotaped structured interview. In a previous study, ASL ability was analyzed in relation to functional outcome in the same deaf subjects evaluated herein (Horton, 2010). The domain proved to be a strong predictor of functional outcome levels, above and beyond the contribution of cognition and social cognition. In the current study, correlations between linguistic ability and symptom factors as well as linguistic ability and social cognition were examined to support analyses related to disordered thought, language, and visual processing.

**Social Cognition—**Theory of mind was operationalized by the Hinting Test (Corcoran et al., 1995). The test comprises 10 vignettes, each involving two characters. One of the two characters drops a hint at the end of each story, and the subject has to determine the underlying meaning or desire behind the hint. The Facial Emotion Identification Task and the Facial Emotion Discrimination Task (Kerr & Neale, 1993) were used to operationalize facial affect processing (FAP). The emotion identification task includes 50 black-and-white photos of faces representing six emotions: happiness, sadness, anger, fear, surprise, and shame. Subjects were asked to label each emotion as it was displayed (FAP-I). The emotion discrimination task includes 77 item pairs and required the subject to decide whether the same or different emotions were depicted in the pairs of photographs (FAP-D).

**Functional Outcome—**The Multnomah Community Ability Scale ([MCAS] Barker et al., 1994a; 1994b) was used to operationalize functional outcome. Scores were based on functioning in the past month. The measure contains four subscales, two adaptive and two social, respectively: Interference with Functioning (e.g., *How impaired are the client's thought processes as evidenced by such symptoms as hallucinations, delusions, tangentiality, loose associations, response latencies, ambivalence, incoherence, etc.?*), Adjustment to Living (e.g., *How well does the client perform independently in day-to-day living [personal hygiene, dressing appropriately, obtaining regular nutrition, etc.]?*), Social Competence (e.g., *How frequently does the client initiate social contact or respond to others' initiation of social contact?*), and Behavioral Problems (e.g., *How* frequently does the client exhibit episodes of extreme acting out?). The first author and caseworkers met individually and completed an MCAS for each participant. Reliability, calculated using Cronbach's alpha revealed good internal stability ($\alpha = .90$, $F = 10.11$, $p < .001$).

**Symptoms—**The Brief Psychiatric Rating Scale ([BPRS] Ventura et al., 1993) was administered to all subjects (first author's interclass correlation = 0.82 against a gold standard). Reliability for the BPRS (internal consistency assessed via Cronbach's alpha) was moderate ($\alpha =.73$, $F = 3.73$, $p<.001$). The resultant data was subjected to a confirmatory factor analysis (CFA) to establish symptom structure in the sample. CFA parameters are described in the results section.

### Statistical Analyses

Data were analyzed with the Statistical Package for the Social Sciences software (SPSS). Levels of skew and kurtosis were analyzed for all variables. Most were normally distributed, except VSM-copy, verbal memory (recall), and ToM which were transformed (squared) for analysis. The BPRS symptom factors were also transformed (constant added, reciprocal computed for Disorganization, Anergia, and Activity; constant added and square root computed for Thought Disorder and Affect). All variables are standardized to facilitate interpretation of beta coefficients. No more than 5% of cases were removed (n=3) from any single analysis of all subjects (65).

Because dimension reduction is inappropriate when the sample size is below 50, separate factor analyses for deaf and hearing samples were not conducted (Cohen & Cohen 1983; Garson, 2009). Upon comparing the CFA to other empirical solutions, the extracted factors were analyzed in two ways. First, factors were compared to cognition, social cognition and functional outcome for the total sample. Second, factor scores for deaf and hearing subjects were separated, and compared to the same variables. Descriptive statistics (correlations, t-tests) are used to facilitate the discussion and traditional 2-sided significance levels are presented. However, the decomposition of variance (via comparing subsamples) reduces further the already low power to detect differences. Thus the significance levels, for all comparisons, are presented solely to facilitate a discussion of the data. The comparisons should be considered exploratory and tentative.

## Results

### Symptom Structure

A confirmatory factor analysis (CFA) tested whether the data fit a specified model by determining whether observed deviations were greater than would be expected by chance alone (Mueser et al., 1997). Because of evidence that people with schizophrenia present with concurrent symptoms of various dimensions, an oblique rotation method, which allows factors to be correlated, is clinically and empirically appropriate (Thomas et al., 2004; Peralta & Cuesta, 2001). An obliquely rotated (principal axis) factor analysis with an extraction set to five factors, produced a solution for the 24-item BPRS that exhibited high over-determination and simple structure. Table 2 presents the CFA's rotated factor pattern matrix, communalities, and interfactor correlations.

The study's relatively small sample size (n=65) nonetheless resulted in a factor solution with adequate communalities (mean=.61; range=.32–.79). The correlation matrix was adequate for factor extraction ([df: 276] $\chi^2 = 673.36$, $p<.001$) and a test of sampling adequacy (Kaiser-Meyer-Olkin) was in the low-moderate range (.56). The amount of variance explained by the CFA (47%) falls within the range reported by others (e.g., .42– .92) (Van der Does et al., 1993; Dingemans et al., 1995; Burger et al., 1997; Thomas et al., 2004). With one exception items were included in a factor if their pattern coefficient loading exceeded .40 (Thomas et al., 2004). The BPRS item *guilt*, loaded at .38 on a factor labeled "Affect;" its inclusion was supported by the literature. Overall, the factor solution resembles others in the literature (e.g., Van der Does et al., 1993; Dingemans et al., 1995; Ventura et al., 1995; Mueser et al., 1997; Burger et al., 1997).

Mueser et al.'s (1997) 4-factor (CFA) oblique solution for the BPRS is employed as a model for comparison. Mueser and colleagues (1997) conducted a comprehensive investigation of BPRS symptom structure in a large community-based sample of people with schizophrenia including detailed fit comparisons to previous factor analytic investigations. Other research replicating Mueser et al.'s (1997) solution has found symptom constructs to endure over at least a 3-year period (Long & Brekke, 1999).

The decision to extract five factors is in line with assertions that more than four dimensions of psychopathology may underlie schizophrenia (Kay & Sevy, 1990; Mueser et al., 1997; Voruganti et al., 1997; Blanchard & Cohen, 2006). Various models of symptom structure have been explored (e.g., deLeon et al., 1992; Ventura et al., 2004) and increasingly, solutions with four to seven factors have been reported (Dingemans et al., 1995; Czobor & Volavka, 1996; Burger et al., 1997; White et al., 1997; Peralta & Cuesta 1999; Van Os et al., 1999).

## Factor Solution Comparison

Reliability coefficients for each factor, item loadings, and a side-by-side comparison with Mueser et al.'s (1997) solution are presented in Table 3. In the current study, Disorganization was the first factor extracted ($\alpha$ =.80); eight items loaded on Factor 1 (partially explaining its numerous correlations to the other domains measured). Anergia, the second factor extracted, had the highest reliability coefficient (.87) and Thought Disorder and Affect (Factors 3 and 4), had the lowest reliability coefficients (.65 and .66 respectively). The fifth and final factor extracted, Activity, reflected the second highest reliability coefficient (.82).

The BPRS item *uncooperativeness* loaded on to both Factor 1 and 5. Disorganization and Activity were only weakly correlated $F(2, 34)$ $r = .277$, $p = .11$) and aside from *uncooperativeness*, the remaining items loaded strongly on to one factor or the other. Activity symptoms (Factor 5) were evident in 13 deaf subjects and 2 hearing subjects. The symptom cluster was considered inappropriate for additional analyses in the hearing sample.

Closer examination of the model parameters indicated that item 24 (*mannerisms and posturing*) failed to significantly load on any factor; it typically loads on to Disorganization or Activity (Peralta & Cuesta, 2001). Ninety-two percent of the responses for this indicator were coded "not present," and thus there was little variance to explain in the measurement model. Similarly, item 7, *elevated mood,* only weakly loaded on to the Affect factor (.32) and was not present in 90% of the sample. In all, Anergia is the most robust factor in the sample, followed by Activity (meaningful for deaf subjects only), Disorganization, Affect and Thought Disorder.

Symptom factors were not mutually exclusive. Most participants (52%) presented with high scores on two or more symptom clusters and no differences were apparent between deaf and hearing subjects in terms of the number of manifest symptom clusters. Of all factors, deaf subjects scored highest on the Disorganization factor (mean=2.02/7) while hearing subjects scored highest on the Affect factor (mean=2.17/7). Levels of BPRS illness severity were equivalent across deaf and hearing subjects ($t_{63} = -.424$, $p = .627$).

## Symptom Factors and Cognition

Results regarding symptom-cognition relationships for the total sample are presented in Table 4. A graphic display of the strongest relationships for the total sample is presented in Figure 1. Symptom-cognition correlations across subsamples are presented in Table 5. To facilitate a discussion regarding patterns of association within and across the samples, intercorrelations between key variables are presented in Table 6.

Among all subjects, Factors 1 (Disorganization) and 2 (Anergia) were the strongest correlates of cognition. Factor 1 had the strongest association to cognition for hearing subjects (four significant correlations) and Factor 2 had the strongest association to cognition for deaf subjects (four correlations, two significant) (Table 5).

One of the most robust symptom-cognition correlations in the (total) sample was between Disorganization and VSM-recall (processing speed was slightly stronger). Higher levels of conceptual disorganization (e.g., thought blocking, incoherence, derailment) were associated with a reduction in the ability to reproduce, from memory, a complex geometric figure. The relationship was slightly stronger in hearing compared to deaf subjects and is supported by the construct validity of the VSM measure, the Complex Figure Test. The instrument is considered resistant to linguistic mediation because the stimulus taxes the upper range of visuospatial processing better than other "complex" geometric stimuli (Casey et al., 1991; Fastenau et al., 1999). It is also one of the few measures validated for use with the deaf (Hauser et al., 2006; see also, Eldredge, 1984; Parasnis & Kirk, 2004; Spitz & Kegl, 2004). Two linguistic-based cognitive abilities, processing speed and EVP, were the next strongest correlates to Disorganization in the total sample and may be explained, in part, by the grammatical demands/components of each domain (this is supported by significant correlations to linguistic ability for Factor 1 and EVP in the deaf, described below).

Factors 3, 4 and 5 (Thought Disorder, Affect and Activity) were not associated with cognition for the total group. However the subsample analysis revealed meaningful associations. Factor 4 (Affect) was manifest at a higher level than all other factors for hearing subjects and covaried with deficits in three language-based domains of cognition for this group (vigilance, short, and long-term word memory). Of note is that vigilance was associated with 3/5 symptom factors for hearing subjects (Factor 1 was significant) supporting the well-established link between schizophrenia and reduced attention.

For deaf subjects, in addition to Anergia, higher levels of Activity symptoms (Factor 5) were significantly associated with early visual processing. Specifically, weaker EVP was associated higher levels of *tension* and *motor hyperactivity*. These symptoms also interfered with facial affect processing and functional outcome. Activity symptoms thus significantly co-varied with all of the domains tested for deaf subjects (cognitive, social cognitive, and functional outcome); Disorganization showed a similar pattern for hearing subjects (Table 5).

## Symptom Factors and Social Cognition

As expected based on previous literature, Factor 1 (Disorganization) was significantly and inversely correlated with each domain of social cognition and in particular, the discrimination of facial affect. Slightly stronger correlations between Factor 1 and social cognition (.35 – .50) were evident compared to those found between Factor 1 and cognition (.30 – .38). Differences in patterns of association between ToM, FAP, and symptom factors are revealed by an analysis of the subsamples (Tables 5 and 6). ToM is described first, followed by FAP.

**Theory of Mind—**The BPRS item *unusual thought content* typically loads on Disorganization and/or Thought Disorder; both factors seem fairly well-established as correlates to ToM (Arndt et al., 1991; Peralta et al., 1992; Palacious-Araus et al., 1995; Schenkel et al., 2005; Pousa et al., 2008). Herein, *unusual thought content* had the highest loading of all items comprising Factor 3 (Thought Disorder), followed by *grandiosity, suspiciousness,* and *somatic concern*. Yet items comprising Factor 1 (Disorganization) (e.g., *disorientation, conceptual disorganization, bizarre behavior, distractibility, hostility, uncooperativeness*) were the ones significantly associated with inferring mental states.

Correlations between linguistic ability and symptom factors as well as linguistic ability and social cognition were examined to determine which domains may be more influenced by disordered thinking (insofar as expressive language skill is a reflection of thinking). For deaf subjects only, when compared to symptom factors, superior linguistic (sign) ability was uncorrelated to Thought Disorder but significantly associated with lower levels of Disorganization and Activity (Table 6). The disassociation between linguistic ability and Thought Disorder, and in turn, Thought Disorder's lack of association with other linguistic-based cognitive and social-cognitive abilities lends credence to the idea that this factor captured a dimension of disordered thinking independent of grammatical ability while Disorganization appeared to have some overlap with this skill. In comparison to social cognition, superior linguistic ability significantly co-varied with higher levels of ToM (among the strongest relationships for deaf subjects), but not FAP (Table 6).

Taken together, relationships with regard to ToM reflect an overlap between mentalizing, FAP, EVP, and VSM for the hearing subjects and an overlap between mentalizing, FAP-D, and linguistic ability for the deaf subjects. Visual processing (linguistic and nonlinguistic) was not associated with ToM for the deaf and requires additional hypothesis testing; dissociations may be related to the complex visual processing demands associated ASL; that is, two hands moving through space instantiating multiple syntactic and semantic roles (cf. Boudreault & Mayberry, 2006, pg. 612). For both groups, Disorganization was the symptom cluster with the strongest correlation to mentalizing ability.

In addition to providing further support for the idea that ToM is intrinsically linguistic (Langdon et al., 2002a; 2002b; Brüne & Bodenstein, 2005; Pousa et al., 2008), the data indicate that the attribution of mental states may be a social-cognitive form of context processing since it requires coordinating several pieces of information at once (Schenkel et al., 2005; Silverstein & Schenkel, 1997; Uhlhaas et al., 2006). The significant relationships for deaf subjects between Disorganization, linguistic ability and ToM in particular, also support the idea that the control of linguistic ability is warranted in the investigation of mentalizing and schizophrenic symptomatology.

**Facial Affect Processing—**Affective face processing (FAP) ability was differentially associated with the primary study variables for deaf and hearing subjects (Table 5). Namely, higher levels of Disorganization and Thought Disorder (Factors 1 and 3) were significantly associated with poorer facial affect processing for hearing but not deaf subjects. For deaf subjects, decoding and discriminating emotion faces were significantly correlated to Affect and Activity symptoms (Factors 4 and 5). Unexpectedly, *better* FAP was associated with *higher* levels of Affect symptoms for the deaf. *Anxiety, suicidality, depression,* and *guilt* (items comprising Factor 4) were manifest at low levels compared to other BPRS items for the deaf yet a heightened ability, or perhaps, heightened sensitivity to emotion faces was evident among those with higher levels of mood disturbance; linguistic ability does not appear to be influencing the relationship as it was uncorrelated to both domains. Higher levels of Affect symptoms also trended toward significance in relation to *better* ToM ability for deaf subjects (Tables 5 and 6). More research is needed to disentangle basic relationships, however preliminary support exists for the idea that affect processing may be associated to symptomatology differently for deaf and hearing people with schizophrenia.

### Symptom Factors and Functional Outcome

Similar to the results regarding cognition and social cognition, higher levels of Disorganization were associated with each domain of functional outcome for the total sample. The relationships remained significant when subsamples were analyzed separately and no meaningful patterns emerged for either group in terms of symptoms and adaptive or social outcomes. In all, three factors were associated with functional outcome for the deaf (1, 2, and 5) and two factors were associated with functional outcome for hearing subjects (1 and 4).

Factor 5 (Activity) may represent a domain deserving further research to test the possibility that its components are core to the manifestation of schizophrenia among the deaf. As described, the BPRS item *uncooperativeness* loaded on both Disorganization and Activity however Factors 1 and 5 were only weakly correlated among deaf subjects and each reflected distinct patterns of association to the primary study variables (save functional outcome). In addition, the reliability coefficients for Disorganization and Activity were moderately strong.

Though Activity (e.g., *tension, excitement*) represented the lowest factor score for deaf subjects (mean=1.56/6), it was significantly correlated to cognition (EVP), social cognition (FAP) and each domain of functional outcome for this group; no other symptom cluster significantly co-varied across the three measured domains. Continued investigation of diagnostic boundaries between symptom clusters will be needed in order to generate additional hypotheses regarding Activity symptoms, as well as how they influence, and are influenced by cognition, social cognition, and functional outcome.

## Discussion

We conducted a confirmatory factor analysis of the Brief Psychiatric Rating Scale to determine symptom structure in a sample of deaf and hearing people with schizophrenia. The five factors extracted were labeled Disorganization, Anergia, Thought Disorder, Affect and Activity. The factor structure closely resembles Mueser et al.'s (1997) 4-factor solution with the addition of Activity symptoms.

Notwithstanding the study's limitations, which are discussed below, there is at least some evidence for differences with regard to symptom-cognition, symptom-social cognition, and symptom-outcome relationships between deaf and hearing subjects. Namely, Activity and Anergia symptoms were the strongest correlates of cognitive, social-cognitive, and functional outcome domains in the deaf sample while Disorganization and Affect were significant predictors of one or more of these domains for hearing subjects.

The consistent finding described in the literature between cognition and Anergia was supported among deaf but not hearing subjects. For hearing subjects, Disorganization was more strongly correlated with cognition than were negative or positive symptoms. The data also partially support past findings that thought disorder and cognition, and separately, thought disorder and outcome, are uncorrelated (McGurk et al., 2000; Cameron et al., 2002). This was especially so among deaf subjects for whom Thought Disorder was uncorrelated to all measured domains.

Of all relationships evaluated, the strongest association for deaf subjects was between increased Disorganization and poorer ToM performance. For hearing subjects, the strongest association was between increased Disorganization and poorer FAP skill. Linguistic ability plays a role for the deaf as it explained at least some portion of the overlap between Disorganization, ToM, EVP, and VSM in particular. Thus, social cognition was an important correlate of the Disorganized syndrome for both groups.

Broadly, these findings support recent work that incorporates social cognition as a target of psychiatric intervention [e.g., *Social Cognition and Interaction Training Program* (Penn et al., 2007)]. For the deaf, social-cognitive interventions may be particularly effective in light of ASL's significant association with ToM as well as functional outcomes. Further, the significant overlap between disorganized symptoms and multiple domains of cognition and social cognition—for both groups—implicates the use of higher-order mechanisms that may facilitate the coordination and integration of language, vision, and thought (Phillips & Silverstein, 2003; Uhlhaas & Mishara, 2007). Differences across deaf and hearing subjects with regard to relationships between symptom manifestation, ToM, and FAP in particular suggest that further investigation in the deaf may be fruitful. For example, language and affect relations should be addressed via investigations of linguistic (i.e. grammaticized) and non-linguistic (i.e., affective) face processing in the population (for examples with nonclinical signing populations see Bettger et al., 1997; Corina et al., 1999; McCullough et al., 2005). General face processing skill (matching unfamiliar faces) is an important covariate as there is evidence that it is uncorrelated to FAP among deaf but not hearing clinical subjects (Kubota et al., 2003).

This area of research has the potential to reveal whether double disassociations exist in clinical deaf and hearing samples, as they do in nonclinical samples, between linguistic and nonlinguistic cognitive processing (see e.g., Tucker 1992; Campbell, 1997; Neville et al., 1998; Corina et al., 1999; Hickok et al., 1999). Linguistic ability's influence on processes of encoding and decoding affective stimuli in schizophrenia can thus be further delineated.

As with many studies of neurocognitive assessment, this study had several limitations. Most notable of these was the relatively small number of subjects and corresponding low level of power to detect differences at all levels of analysis. The model fit for the CFA was moderate yet given the number of tests conducted—in addition to the CFA—an alpha adjustment could have been used. The decision to leave the alpha uncorrected was based on the exploratory nature of the work. The data may be heuristic in the development of models of thought and language disturbance in deaf people with schizophrenia.

## Conclusions

These data suggest that while current symptom models of schizophrenia are valid in both hearing and deaf patients, data on relationships between cognition, symptoms, and outcome from the general (hearing) literature cannot be generalized to deaf patients. For deaf people with schizophrenia, differences in the form and processing of language interact with illness features to generate different pathways to disability than those found among hearing samples. Because past data on predictors of outcome (e.g., cognition) have led to interventions that improve social functioning in hearing people with schizophrenia (e.g., cognitive rehabilitation), data from this and future studies may lead to unique rehabilitative interventions to promote more effective adaptation among deaf people with schizophrenia.

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**Figure 1.**
Pearson correlations (total sample): BPRS symptom factors, cognition, social cognition, and functional outcome.
BPRS: Brief Psychiatric Rating Scale; EVP: early visual processing; FAP-I, FAP-D: facial affect processing-identification, -discrimination; ToM: Theory of Mind; VSM: visuospatial memory.
Notes: *Disorganization is associated with each domain of social cognition and functional outcome.*

## Table 1

Demographic and clinical characteristics of subjects.

| Characteristic | Deaf (n=34) | | Hearing (n=31) | | Total (n=65) | |
|---|---|---|---|---|---|---|
| | mean (sd) | | mean (sd) | | mean (sd) | |
| **Age** (years) | | | | | | |
| (range 23–66) | 45 (9) | | 47 (9) | | 46 (9) | |
| **Functional outcome** | | | | | | |
| (range 35–82/85) | 59 (14) | | 61 (10) | | 60 (12) | |
| | n | % | n | % | n | % |
| **Sex** | | | | | | |
| Female | 13 | .38 | 9 | .29 | 22 | .34 |
| Male | 21 | .62 | 22 | .71 | 43 | .66 |
| **Race** | | | | | | |
| White | 18 | .53 | 12 | .39 | 30 | .46 |
| Black | 12 | .35 | 15 | .48 | 27 | .42 |
| Other | 4 | .12 | 4 | .13 | 8 | .12 |
| **Education** | | | | | | |
| No highschool or some highschool | 4 | .12 | 14 | .45 | 18 | .28 |
| Any college | 11 | .32 | 11 | .35 | 22 | .34 |
| College grad. | 2 | .06 | 4 | .13 | 6 | .10 |
| **Housing status** | | | | | | |
| Residential program or nursing home | 15 | .44 | 11 | .35 | 26 | .40 |
| Semi-independent | 5 | .15 | 10 | .32 | 15 | .23 |
| SRO or hotel | 0 | .00 | 3 | .10 | 3 | .05 |
| Own apartment | 14 | .41 | 7 | .23 | 21 | .32 |
| **Diagnosis** | | | | | | |
| Schizophrenia | 26 | .76 | 24 | .77 | 50 | .77 |
| Schizoaffective | 8 | .23 | 7 | .23 | 15 | .23 |

SRO: Single room occupancy.

**Table 2**

Brief Psychiatric Rating Scale: rotated factor pattern matrix (oblique) and interfactor correlations (n=65).

| Item | Disorganization (1) | Anergia (2) | Thought Disorder (3) | Affect (4) | Activity (5) | Communality |
|---|---|---|---|---|---|---|
| 1. Somatic Concern | .05 | −.19 | **.42** | −.04 | −.12 | .42 |
| 2. Anxiety | −.04 | −.04 | .34 | **.69** | .18 | .63 |
| 3. Depression | .26 | .11 | −.12 | **.45** | −.07 | .47 |
| 4. Suicidality | .02 | −.06 | −.15 | **.59** | −.16 | .48 |
| 5. Guilt | .26 | −.27 | .20 | **.38** | −.29 | .64 |
| 6. Hostility | **.53** | −.16 | .17 | .08 | −.02 | .66 |
| 7. Elevated Mood | −.09 | .09 | .05 | .32 | .13 | .50 |
| 8. Grandiosity | .08 | .06 | **.53** | .19 | −.04 | .46 |
| 9. Suspiciousness | .01 | .15 | **.53** | −.09 | .06 | .50 |
| 10. Hallucinations | .40 | .08 | .00 | .13 | −.02 | .59 |
| 11. Unusual Thought Content | .01 | .14 | **.77** | −.07 | −.01 | .66 |
| 12. Bizarre Behavior | **.58** | .00 | .06 | .28 | .01 | .61 |
| 13. Self-Neglect | .46 | .29 | −.08 | −.17 | −.06 | .58 |
| 14. Disorientation | **.68** | .10 | −.18 | −.14 | .19 | .67 |
| 15. Conceptual Disorg. | **.65** | −.05 | .30 | −.29 | .18 | .71 |
| 16. Blunted Affect | −.13 | **.93** | .11 | .08 | −.03 | .74 |
| 17. Emotional Withdrawal | .14 | **.79** | .00 | .06 | −.03 | .72 |
| 18. Motor Retardation | .08 | **.72** | .13 | .04 | −.23 | .69 |
| 19. Tension | −.02 | −.12 | .03 | .03 | **.85** | .74 |
| 20. Uncooperativeness | **.50** | −.04 | .08 | −.06 | **.47** | .75 |
| 21. Excitement | .15 | −.12 | .03 | −.01 | **.74** | .79 |
| 22. Distractability | **.55** | .03 | .06 | −.08 | .23 | .67 |
| 23. Motor Hyperactivity | .09 | −.02 | −.1 | .11 | **.68** | .67 |
| 24. Mannerisms and Posturing | .15 | .10 | −.24 | −.14 | .06 | .32 |
| | | *Intercorrelations* | | | | |
| Factor 1 | — | | | | | |
| Factor 2 | .01 | — | | | | |
| Factor 3 | −.18 | .19 | — | | | |

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| Item | Disorganization (1) | Anergia (2) | Thought Disorder (3) | Affect (4) | Activity (5) | Communality |
|---|---|---|---|---|---|---|
| Factor 4 | −.06 | .07 | .23+ | — | | |
| Factor 5 | .03 | .13 | .01 | .20+ | — | |

+Trend, $p < .10$

Note: *The highest factor loadings for each item are in boldface type.*

## Table 3

BPRS item loadings, reliabilities, and side-by-side comparison to Mueser et al.'s 1997 4-factor solution.

| Study Solution | | Mueser Solution |
|---|---|---|
| **Disorganization** | | |
| Factor 1 *(alpha = .80)* | | (Factor Four) |
| 14. Disorientation | .68 | |
| 15. Conceptual disorganization | .65 | Conceptual disorganization (1) |
| **12. Bizarre Behavior** | .58 | |
| **22. Distractibility** | .55 | |
| 6. Hostility | .53 | |
| 20. Uncooperativeness | .50 | |
| **13. Self-neglect** | .46 | |
| 10. Hallucinations | .40 | |
| | | Tension (2) |
| | | Mannerisms and Posturing (3) |
| **Anergia** | | |
| Factor 2 *(alpha=.87)* | | (Factor Two) |
| 16. Blunted affect | .93 | Blunted affect (4) |
| 17. Emotional withdrawal | .79 | Emotional withdrawal (1) |
| 18. Motor retardation | .72 | Motor retardation (2) |
| | | Uncooperativeness (3) |
| **Thought Disorder** | | |
| Factor 3 *(alpha=.65)* | | (Factor One) |
| 11. Unusual thought content | .77 | Unusual thought content (4) |
| 8. Grandiosity | .53 | Grandiosity (1) |
| 9. Suspiciousness | .53 | Suspiciousness (2) |
| 1. Somatic concern | .42 | |
| | | Hallucinations (3) |
| **Affect** | | |
| **Factor 4** *(alpha = .66)* | | (Factor Three) |
| 2. Anxiety | .69 | Anxiety (2) |
| **4. Suicidality** | .59 | |
| 3. Depression | .45 | Depression (4) |
| 5. Guilt | .38 | Guilt (3) |
| | | Somatic concern (1) |
| **Activity** | | |
| **Factor 5** *(alpha=.82)* | | — |
| 19. Tension | .85 | |
| 21. Excitement | .74 | |
| **23. Motor hyperactivity** | .68 | |

| Study Solution | | Mueser Solution |
|---|---|---|
| 20. Uncooperativeness | .47 | |

Note: Six BPRS items were not included in Mueser et al.'s (2007) CFA (18 items versus 24)—five are bolded, the sixth, elevated mood, weakly loaded on the Affect factor in the current study's solution and is not listed in the table; mannerisms and posturing is the other item that did not load.

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**Table 4**

Pearson correlations (total sample): BPRS symptom factors, cognition, social cognition, and functional outcome.

| | | Disorganization (1) | Anergia (2) | Thought Disorder (3) | Affect (4) | Activity (5) |
|---|---|---|---|---|---|---|
| **Cognition** | | *Correlation Coefficients* | | | | |
| Non-Linguistic-based tasks | VSM-Copy | .229+ | .055 | .059 | .000 | .005 |
| | VSM-Recall | .335** | .015 | .011 | .031 | .029 |
| Linguistic-based Tasks | EVP | .326** | .233+ | .032 | .101 | .199 |
| | Processing Speed | .375** | .290* | .013 | .050 | .032 |
| | Vigilance | .075 | .283* | .005 | .119 | .012 |
| | Word Memory | .314* | .231+ | .079 | .180 | .048 |
| **Social Cognition** | ToM | .480** | .044 | .179 | (.239)+ | .129 |
| | FAP-I | .346** | .175 | .101 | (.287)* | .033 |
| | FAP-D | .500** | .084 | .229+ | .003 | .075 |
| **Functional Outcome Subscales** | Interference with Functioning | *.716* | *.196* | *.154* | *.042* | *.266* |
| | Adjustment to Living | .478** | .215+ | .127 | .248* | .388** |
| | Social Competence | .586** | .268* | .205 | .230+ | .253* |
| | Behavioral Problems | .617** | .058 | .211+ | .151 | .151 |
| | Total Score | .676** | .181 | .200 | .192 | .294* |

*p<.05

**p<.01

+Trend p<.10

BPRS: Brief Psychiatric Rating Scale; EVP: early visual processing; FAP-I, FAP-D: facial affect processing-identification, -discrimination; ToM: Theory of Mind; VSM: visuospatial memory.

Notes: *Directional indicators are removed for readability. Relationships reflect inverse associations save factor scores in parentheses. Because conceptual overlap exists between the functional outcome subscale 'Interference with Functioning' and symptoms, the corresponding relationships were ignored (italicized in table).*

## Table 5

Pearson correlations (deaf, hearing): BPRS symptom factors, cognition, social cognition, and functional outcome.

| | | Correlation Coefficients | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Disorganization Factor 1 | | Anergia Factor 2 | | Thought Dis. Factor 3 | | Affect Factor 4 | | Activity Factor 5 | |
| **Cognition** | | **Deaf** | **Hearing** | **Deaf** | **Hearing** | **Deaf** | **Hearing** | **Deaf** | **Hearing** | **Deaf** | **Hearing** |
| Non-Linguistic | VSM Copy | .124 | .323$^{+}$ | .056 | .175 | .071 | .187 | .057 | .051 | .189 | .123 |
| | VSM Recall | .319$^{+}$ | .329$^{+}$ | .029 | .069 | .056 | .083 | .035 | .040 | .075 | .027 |
| Linguistic | EVP | .251 | .384$^{*}$ | .299$^{+}$ | .182 | .021 | .041 | .122 | .142 | .387$^{*}$ | .113 |
| | Processing Speed | .326$^{+}$ | .407$^{*}$ | .405$^{*}$ | .184 | .042 | .015 | .185 | .049 | .070 | .198 |
| | Vigilance | .086 | .367$^{*}$ | .310$^{+}$ | .270 | .220 | .327$^{+}$ | .022 | .334$^{+}$ | .013 | .051 |
| | Word Memory | .221 | .416$^{*}$ | .362$^{*}$ | .082 | .095 | .064 | .200 | .331$^{+}$ | .043 | .010 |
| **Social Cognition** | | | | | | | | | | | |
| | ToM | .594$^{**}$ | .507$^{**}$ | .041 | .125 | .237 | .145 | (.262) | .056 | .261 | .402 |
| | FAP-I | .192 | .513$^{**}$ | .171 | .180 | .158 | .054 | (.404$^{*}$) | .198 | .014 | .182 |
| | FAP-D | .277 | .695$^{**}$ | .115 | .060 | .038 | .380$^{*}$ | (.448$^{*}$) | .257 | .386$^{*}$ | .213 |
| **Functional Outcome** | | | | | | | | | | | |
| Interference with Functioning | | *.745* | *.696* | *.267* | *.105* | *.013* | *.361* | *.058* | *.033* | *.455* | *.072* |
| Adjustment to Living | | .584$^{**}$ | .407$^{*}$ | .339$^{*}$ | .027 | .107 | .202 | .240 | .154 | .420$^{*}$ | .096 |
| Social Competence | | .646$^{**}$ | .511$^{**}$ | .345$^{*}$ | .172 | .227 | .186 | .208 | .391$^{*}$ | .395$^{*}$ | .099 |
| Behavioral Problems | | .687$^{**}$ | .565$^{**}$ | .003 | .113 | .184 | .235 | .110 | .183 | .407$^{*}$ | .185 |
| Total Score | | .719$^{**}$ | .646$^{**}$ | .278 | .046 | .151 | .287 | .173 | .233 | .453$^{**}$ | .035 |

$^{*}$p<.05

$^{**}$p<.01

$^{+}$Trend p<.10

$^{++}$Trend p<.06

BPRS: Brief Psychiatric Rating Scale; EVP: early visual processing; FAP-I, FAP-D: facial affect processing-identification, -discrimination; ToM: Theory of Mind; VSM: visuospatial memory.

Notes: *Directional indicators are removed for readability. Relationships reflect inverse associations save factor scores in parentheses (+). Because conceptual overlap exists between the subscale 'Interference with Functioning' and symptoms, the corresponding relationships were ignored (italicized in table).*

## Table 6

Correlations and levels of significance (deaf, hearing): key variables.

| | | Illness Severity | ASL Ability | ToM | FAP-I | FAP-D | EVP | VSM Copy | VSM Recall | Factor 1 | Factor 3 | Factor 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Illness Severity | Deaf | 1.00 | **−.644**$^{**}$ .000 | **−.538**$^{**}$ .000 | −.180 .325 | −.242 .182 | **−.356**$^{*}$ .046 | −.094 .608 | **−.352**$^{*}$ .048 | **.814**$^{**}$ .000 | .271 .122 | **.449**$^{**}$ .008 |
| | Hearing | 1.00 | − | **−.411**$^{*}$ .022 | −.281 .126 | **−.571**$^{**}$ .001 | −.255 .166 | −.096 .607 | −.164 .377 | **.749**$^{**}$ .000 | **.737**$^{**}$ .000 | .273 .144 |
| ASL Ability | Deaf | | 1.00 | **.614**$^{**}$ .000 | .177 .333 | .239 .187 | **.417**$^{*}$ .018 | .045 .808 | .071 .698 | **.586**$^{**}$ .000 | .067 .705 | **.466**$^{**}$ .005 |
| | Hearing | - | - | - | - | - | - | - | - | - | - | - |
| ToM | Deaf | | | 1.00 | .118 .521 | **.317**+ .077 | .155 .397 | .121 .510 | .164 .369 | | | |
| | Hearing | | | 1.00 | .264 .151 | **.365**$^{*}$ .043 | **.348**+ .055 | .152 .415 | **.446**$^{*}$ .012 | | | |
| FAP-I | Deaf | | | | 1.00 | .255 .160 | **.315**+ .079 | **.357**$^{*}$ .045 | .089 .627 | | | |
| | Hearing | | | | 1.00 | **.624**$^{**}$ .000 | **.373**$^{*}$ .039 | **.293**+ .109 | .243 .187 | | | |
| FAP-D | Deaf | | | | | 1.00 | **.389**$^{*}$ .028 | .216 .235 | .186 .309 | | | |
| | Hearing | | | | | 1.00 | .210 .256 | .041 .827 | .172 .335 | | | |
| EVP | Deaf | | | | | | 1.00 | **.539**$^{**}$ .001 | **.376**$^{*}$ .034 | | | |
| | Hearing | | | | | | 1.00 | .202 .275 | **.395**$^{*}$ .028 | | | |
| VSM Copy | Deaf | | | | | | | 1.00 | **.396**$^{*}$ .025 | | | |
| | Hearing | | | | | | | 1.00 | **.500**$^{**}$ .004 | | | |

$^{*}$ $p < .05$

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** $p < .01$

+ $p < .10$

ASL: American Sign Language; EVP: early visual processing; Factor 1: Disorganization; Factor 3: Thought Disorder; Factor 5: Activity; FAP-I, FAP-D: facial affect processing-identification, -discrimination; ToM: Theory of Mind; VSM: visuospatial memory.

Note: *Significant relationships and trends are in boldface type.*