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Prosodic abnormalities in schizotypal personality disorder☆,☆☆

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ABSTRACT

Objective: Patients with schizophrenia speak with blunted vocal affect but little is known regarding the prosody of persons with schizotypal personality disorder (SPD). This work examined expressive prosody in SPD, its relationship to brain structure, and outlined a framework for measuring elements of prosody in clinical populations.

Methods: Twenty-eight antipsychotic-naïve SPD subjects were matched with 27 healthy comparison (HC) subjects. Subjects read aloud short sentences and responded to probes to record both predetermined and self-generated speech samples. Samples were analyzed acoustically (pause proportion, duration, attack, and pitch variability) and subjectively by raters (amount of pauses, degree of emotion portrayed, and how much they wanted to hear more from the subjects) on paragraph, sentence, word, word-fragment, and syllable levels. Alexithymia and ability to self-monitor behavior were compared between groups. The pars opercularis was manually traced on structural MRI data.

Results: SPD subjects' speech had significantly more pauses, was slower, had less pitch variability, and expressed less emotion than HC subjects. Pitch variability correlated with socio-economic status achievement. There was no difference between groups in left or right pars opercularis volumes. A statistically significant correlation suggested that smaller left pars opercularis volumes in SPD subjects correlated with more pauses and less emotion. SPD subjects reported more alexithymia and difficulty self-monitoring their behavior compared with controls. In SPD subjects the high alexithymia correlated with raters not wanting to hear more from them and SPD subjects' inability to modulate their social behavior correlated with their having fewer friends. Thus, the SPD subjects exhibited insight.

Conclusions: SPD subjects displayed significant prosodic deficits that were measurable in speech samples as brief as a word-fragment. The determinants of these deficits are not known although these may include a dysfunctional pars opercularis. These data add to the nascent literature describing social cognition deficits in SPD.

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1. Introduction

Prosody is the vocal expression of one's internal emotional state or intent. Key components or elements include pitch, pitch variability, attack, pauses between sounds, and duration of the utterance (Leentjens et al., 1998; Shaw et al., 1999; Leitman et al., 2010; Leitman et al., 2011), (Table 1, Elements). By varying these elements in speech, people transmit subtle distinctions of meaning. Pitch variability may be the most important aspect of prosody (Ross et al., 2001; Leitman et al., 2010). For example, simply modulating pitch can change the expressed emotion from anger to sadness. Similar alterations in amount of pauses, duration of an utterance, or attack, can dramatically affect the sound and cadence of speech and, hence, the expression of emotion and meaning (Monnot et al., 2003). The ability to modulate one's voice slightly to reflect accurately one's intention is important for social communication.

Although the hallmark feature of abnormal speech in schizophrenia is in the domain of semantics clinically encapsulated by the term "formal thought disorder", abnormal vocal affect has been demonstrated as well (Borod et al., 1989; Murphy and Cutting, 1990; Leentjens et al., 1998; Ross et al., 2001; Hoekert et al., 2007). Prosodic deficits initially described by Bleuler included abnormalities of duration, amplitude, and pitch (Bleuler, 1911, 1950; Baltaxe and Simmons, 1995). Further

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Table 1
Elements, measurements, and hypotheses. Variables were listed along with how they were measured, comments for clarification of the variable or the measurement, the type of analysis used (either acoustic or subjective), the level of the analysis (speech sample length), the rationale behind inclusion of the variable, and the specific a priori hypotheses associated with the variable. Note that some variables, such as attack, were added post-hoc, and were indicated as such. This table was included for clarification.

Prosodic element	Measurement	Comments	Type of analysis	Level of analysis and sample used	Rationale	Hypotheses
Acoustic analysis						
Pause proportion	Percentage of time the sample contained a pitch above baseline from time of first utterance to final utterance	This would include utterances such as "uh", for example, as well as proper words	Acoustic	Paragraph (Admire, Store) Sentence (Nutmeg)	Self-generated sentences selected as the natural flow of speech was of interest Nutmeg included in contrast as was neutral and pre-determined sentence Analyses performed "blind" to content	Admire, Store SPD > HC Nutmeg SPD = HC
Duration	Time from beginning to end of a defined speech sample Beginning and end were determined by detecting a change in pitch	Analogous to how fast someone speaks a given word	Acoustic	Word ("adorable") Word-fragment ("dora")	Emotional word "adorable" selected as we wanted to measure the impact of emotion on speech speed "Dora" also included as it was unknown how short an utterance would be necessary to see group differences	"adorable" "dora" No hypothesis
Attack	Rise in amplitude (loudness) over time for a given phoneme Beginning defined as change in slope from baseline Occasionally slope changed direction. To ensure reproducibility, end defined by maximum amplitude	Analogous with how much "punch" or stress an utterance was said Element added post-hoc as wished to explore as many variables as possible	Acoustic	Syllable ("Nut", "do")	"Nut" selected as beginning of neutral sentence "Do" was isolated from "adorable" as visual inspection of data blind to diagnostic group suggested most variation in frequency	"Nut" "do" No hypotheses
Pitch variability	Standard deviation in Hertz of the pitch maximum and minimum across an utterance, same as the standard deviation of the fundamental frequency	Change in pitch Analogous to amount of variation in inflection	Acoustic	Sentence (Nutmeg, Puppy) Word ("adorable") Word-fragment ("dora")	Predetermined sentences used in order to control for content "adorable" and "dora" were included as it was unknown how short an utterance could be and still demonstrate group differences	Nutmeg SPD = HC Puppy SPD < HC "adorable" "dora" No hypotheses
Subjective analysis						
Rating of amount of pauses	Mean amount of pauses along Likert scale perceived by raters	Tapped into same aspect of speech as pause proportion above, but subjectively rated	Subjective	Paragraph (Admire, Store)	Self-generated paragraphs used in order to have naturalistic sample Raters likely unable to "blind" themselves to content, that is, their assessments may be affected by content The degree to which raters "tuned out" the "ums" and "ahs" that occur naturally in speech is unknown	Admire SPD > HC Store SPD > HC
Emotion portrayed	Mean degree along Likert scale that the raters thought the subject spoke with emotion	How emotional the subject sounded Admire minus Store added post-hoc	Subjective	Paragraph (Admire, Store) Paragraph (Admire minus Store)	Self-generated paragraphs used in order to have naturalistic sample Admire minus Store was examined to see if subjects altered the emotional valence of their speech with the more evocative probe, Admire, than they did with the less evocative probe, Store Raters likely unable to "blind" themselves to content, that is, their assessments may be affected by content	Admire SPD < HC Store SPD < HC Admire − Store SPD < HC
Hear more	Mean degree along Likert scale that the raters said that they wanted to hear more from the subject		Subjective	Paragraph (Admire, Store)	Self-generated paragraphs used in order to have naturalistic sample Raters likely unable to "blind" themselves to content, that is, their assessments may be affected by content	Admire SPD < HC Store SPD < HC