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Action (verb) fluency in schizophrenia: Getting a grip on odd speech

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ABSTRACT

Background: Formal thought disorder (TD) is a key symptom of schizophrenia with a significant impact on interpersonal relationships. Current cognitive models emphasize disordered language functioning and abnormalities accessing semantic representations. The cortical mechanisms for language and motor function are closely linked, hence action-related language may be impaired in TD, yet existing studies have focussed exclusively on object (noun) rather than action (verb) semantics.
Method: In order to examine this issue both action (verb) and traditional semantic (tools, fruits, musical instruments) and phonological (FAS) fluency tasks were completed by individuals with schizophrenia (N = 53) and healthy controls (N = 69). Fluency performance was measured as the total number of correct words generated in 60 s. The Schizotypal Personality Questionnaire (SPQ) was used to index odd and disorganized speech, as well as positive and negative symptoms.
Results: Fluency on all tasks was impaired in schizophrenia, compared to controls, with a similar effect size. Within the schizophrenia group Odd Speech was correlated with poor fluency for actions, tools and musical instruments but not fruit or phonological fluency. These action-related fluency deficits were also correlated with Constricted Affect and Social Anxiety but not with Unusual Perceptions/Odd Beliefs.
Conclusion: These results point to a unique connection and possible common aetiology between action fluency and odd speech in schizophrenia rather than a general impairment in language/executive functions common to fluency tasks. The findings provide the first evidence of a specific role of action-based language production deficits in TD together with a joint effect on social interaction skills.

1. Introduction

Formal thought disorder (TD) occurs in a range of acute psychotic conditions but in individuals with schizophrenia a residual level of thought disorder often persists, including during periods of remission and drug treatment (Levy et al., 2010). These trait-like disturbances in the form of thought are largely assessed by examining the patient's spoken language, which is characterized by odd, disorganized or disconnected speech and verbal under-productivity (Andreasen and Grove, 1986; Harvey et al., 1984, 1990; Marengo and Harrow, 1987). Ongoing speech and language disturbance makes it difficult to engage in psychological treatments (Chrichton and Galletly, 2009; Clegg et al., 2007) or in everyday social interactions (Bowie and Harvey, 2008) and is a significant predictor of poor outcome (Norman et al., 1999).

Despite the clinical and personal significance of TD, researchers continue to grapple with the exact mechanisms involved. There is a growing convergence on the view that TD involves specific, rather than generalized, impairments in speech and language production (Covington et al., 2005; Marini, et al., 2008; Walenski et al., 2010) and semantic processing (Doughty et al., 2008; Elvevåg et al., 2002; Levy et al., 2010; Soriano et al., 2008).

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For example, Marini and colleagues concluded that language production in schizophrenia consists of relatively mild and variable difficulties at the microlinguistic level (involving phonology, morphology and syntax), with more severe and pervasive deficits emerging at the macrolinguistic level (relating to pragmatics).

Overall, studies of TD also point to the importance of left-sided, frontally-mediated mechanisms involved in language production (Dibben et al., 2009; Horn et al., 2009; Champagne-Lavau and Stip, 2010). Tests of verbal fluency, involving the rapid generation of words under different constraints, are generally considered to be particularly sensitive to frontal lobe functioning (Costafreda et al., 2006, 2009) and reduced hemispheric lateralization (Kircher et al., 2009; Knecht et al., 2000). Large effect sizes are present in both phonological and semantic fluency in individuals with schizophrenia compared to healthy, non-clinical controls suggesting uniform difficulties in word generation at the diagnostic level (Elvevåg et al., 2001), whilst at the symptom level poor semantic fluency may be particularly associated with the presence of TD (Doughty and Done, 2009) though the evidence is inconsistent (DeFreitas et al., 2009). Previous fluency studies, however, have focused almost exclusively on object (noun) semantics despite mounting evidence that action-related words (e.g. verbs) automatically engage a distributed network of motor-related regions in the frontal lobes (Fischer and Zwaan, 2008; Hickok, 2010; Pulvermüller, 2005; Tomasino et al., 2010). These motor processes are not merely by-products of post-lexical imagery, they are critical to normal speech and language production. Furthermore, research by Semin (2009) shows that verbs possess functional properties (e.g. influencing causal attributions) that are central to successful interpersonal communication. Preliminary evidence of verb generation difficulties in schizophrenia has been provided in a study by Woods et al. (2007) but neither specific symptom correlates nor the influence of motor abnormalites has been examined.

Given these findings we hypothesized that impaired production of action-related language may be an important mechanism underpinning TD in schizophrenia. In order to investigate this possibility we first compared action (verb), semantic (noun) and phonological (letter) fluency performance between individuals with schizophrenia and healthy controls in order to examine whether action fluency is differentially impaired in the former. Following this we examined the association between action fluency and odd speech within the schizophrenia group to test the hypothesis that impaired action fluency is linked to increasing levels of odd speech. In order to test the specificity of our findings we also examined the association between odd speech and phonological fluency, together with fluency for word categories that are, or are not, semantically linked to actions (tools, musical instruments vs. fruit respectively). Finally, we examined the role of motor asymmetry (handedness) and motor speed in the production of action-related language.

2. Method

The study was approved by the Human Research Ethics Committees of The University of Western Australia and the North Metropolitan Area Mental Health Service in Perth, Western Australia. Written informed consent was obtained from all participants prior to testing.

2.1. Participants

The following analysis is based on a sample of participants drawn from the West Australian Family Study of Schizophrenia (WAFSS; Hallmayer et al., 2005; Jablensky, 2006). All participants who had completed the Action (Verb) fluency task were included in the analysis (subject to exclusion criteria detailed below), yielding 53 patients (18–53 years) with a DSM-IV and ICD-10 diagnosis of schizophrenia or schizophrenia spectrum disorder (SZ group), together with 69 healthy (non-clinical) controls (HC; 19–60 years). Participant characteristics are shown in Table 1. Individuals with schizophrenia were recruited from both inpatient and community-based services associated with Graylands Hospital, Perth and at the time of testing were taking their usual antipsychotic medications (of 31% who were taking antipsychotics — 52.8% were receiving atypicals only, 5.7% typicals only, and 58.5% typicals and atypicals).

Healthy controls consisted of community volunteers, with no self-reported personal or family history of psychosis, recruited from the local community by random sampling from local telephone directories or among Red Cross blood donors. Participants from both groups were screened to exclude a history of moderate–severe head trauma (loss of consciousness > 10 min), or neurological disorders, substance abuse leading to treatment and systemic medical disease likely to compromise cognitive function. Subjects who were not fluent speakers of English, had not completed at least 8th grade education and/or were unable to give informed consent were also excluded.

2.2. Clinical evaluation

Diagnostic assessment was based on standardized interviews employing the Diagnostic Interview for Psychosis (DIP;

Table 1
Demographic, cognitive and clinical characteristics of participants.

	SZ group (n = 53)	HC group (n = 69)	p-value [a]	Effect size [b]
	N (% males)	N (% males)		
Sex	46 (86.8)	49 (71.0)	<0.05	
	Mean (SD)	Mean (SD)		
Age (years)	31.8 (8.8)	40.2 (13.2)	<0.01	
Education (years)	10.7 (1.6)	13.4 (2.4)	<0.01	1.32
Premorbid IQ (NART)	95.0 (10.5)	109.6 (6.8)	<0.01	1.65
Current IQ (SILS)	89.0 (14.2)	110.7 (5.9)	<0.01	1.99
Medication (CPZ equivalent)	698.4 (346)	–		
Length of illness (years)	10.8 (8.2)	–		
SPQ total score	38.2 (16.7)	14.8 (9.9)	<0.001	1.71
Cognitive–perceptual	16.8 (8.5)	5.0 (4.2)	<0.001	1.76
Interpersonal	17.6 (7.7)	6.8 (6.2)	<0.001	1.54
Disorganization	8.2 (4.4)	4.1 (3.5)	<0.001	1.03

Note. SPQ, Schizotypal Personality Questionnaire; NART, National Adult Reading Test — Revised; SILS, Shipley Institute of Living Scales.
[a] χ^2/t-test.
[b] Cohen's d estimate.