Formal Thought Disorder: Self-report in Non-clinical Populations

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ABSTRACT

This study present data from 300 unselected individuals who had completed the Formal Thought Disorder-Self Scale (FTD-S) (Study 1) and from a separate sample of over 150 unselected individuals who had completed the FTD-S and also had a relative or friend complete the Formal Thought Disorder-Other Scale (FTD-O) (Study 2). The questionnaire, originally devised to measure self-ratings of thought disorder in clinical samples, was adapted from a yes-no questionnaire to a 4 point Likert format, to more sensitively determine the extent to which such characteristics may be reported amongst the healthy population. Principal Components Analysis of the FTD-S scale suggested a three-component solution for which we proposed the nomenclature of: odd speech, conversational ability and working memory deficit. Study 2 found that the FTD-S (self-report) and the FTD-O (other rated) reached a significant but low correlation ($r= .29$; $p <0.01$); these findings are discussed in terms of its significance for self-report of Formal Thought Disorder and proneness to psychosis.
Key words: language disorder, psychosis proneness, self-report.

Novelty and Significance

What is already known about the topic?

- Formal thought disorder (FTD) refers to the peculiar and difficult to follow speech shown by some people with schizophrenia. In people with schizophrenia FTD seems to be associated with some neuropsychological deficits such as executive or semantic dysfunction.

What this paper adds?

- FTD can be reliably captured in non-clinical populations. Three components of FTD were identified, namely 'odd speech', 'conversational ability' and 'working memory'; their neuropsychological correlates needs further research.
- These findings are important given the evidence that subclinical FTD may have a genetic basis and it may act as marker of vulnerability to schizophrenia.

Formal thought disorder (FTD), a range of language and cognitive deficits clinically characterized by loose associations and incoherent speech (Andreasen, 1979), can be found in people with schizophrenia and other psychoses [Lott, Guggenbühl, Schneeberger, Pulver, & Stassen, 2002), some personality and severe anxiety disorders (Gandolfo, Templer, Cappeletty, & Cannon, 1991; Lee, Zoung-Soul, Kwon, & 2005), developmental disorders (Dykens, Volkmar, & Glick, 1991; Caplan, Guthrie, Tang, Nuechterlein, & Asarnow, 2011), and crucially, at subclinical levels in a minority of non-clinical individuals (Barrera, 2006). Its proposed cognitive correlates include executive [Kerns & Berenbaum, 2002; Barrera, McKenna, & Berrios, 2005; Stirling, Hellewell, Blakey, & Deakin, 2006; Dibben, Rice, Laws, & McKenna, 2009), semantic (Melinder

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& Barch, 2003; Doughty & Done, 2009), and working memory deficits (Kiefer, Martens, Weisbrod, Hermle, & Spitzer, 2009; Barch & Berenbaum, 1997; Berenbaum, Kerns, Vernon, & Gómez, 2008).

Subclinical FTD is a consistent finding in relatives of schizophrenia patients and occurs at an incidence greater than that of schizophrenia itself (Gambini, Campana, Macciardi, & Scarone, 1997; Levy, Coleman, Sung, Ji, Matthysse, Mendell, & Titone, 2010; Kiang, 2010; Bove, 2008). Symptoms of FTD can be observed in children considered to be at risk of schizophrenia (Ott, Roberts, Rock, Allen, & Erlenmeyer-Kimling, 2002). Relatives of schizophrenia, mania, and schizo-affective patients show FTD that mirrors, with lower severity, that of their affected relatives (Soloway, Holzman, Coleman, Gale, & Shenton, 1989). There is an association between being related to someone with schizophrenia and manifesting (subclinical) formal thought disorder (Romney, 1990). Such findings testify to the importance of assessing these characteristics in the non-clinical population. An instrument focused on assessing FTD would also complement other self-report scales for various psychosis-prone experiences in healthy individuals, including delusions and hallucinations (Peters, Joseph, & Garety, 1999; Launey & Slade, 1982).

Within the literature focused on schizotypal personality, the Schizotypal Personality Questionnaire (SPQ) (Raine, 1991), modelled on DSM-III-R criteria, contains one subscale that assesses vague and confused speech but without gross incoherence. Although this 'odd speech' scale ascertains attenuated features of FTD in people with schizotypal personality, it does not cover classical symptoms of FTD (e.g. clanging, neologisms) or the non-verbal and paralinguistic characteristics of the heterogeneous presentation of formal thought disorder.

Several instruments have been developed to assess FTD including the Thought, Language and Communication Scale (TLC) (Andreasen, 1979), the Thought and Language Index (TLI) (Liddle, Ngan, Caissie, Anderson, Bates, Quested, White, & Weg, 2002), and the Thought Disorder Index (TDI) (Johnston & Holzman, 1979). More recently, the Formal Thought Disorder-Self scale was developed for the self-assessment by patients, along with an observer based questionnaire completed by someone who knows the subject ('FTD-O: observer') (Barrera, McKenna, & Berrios, 2008). Since both FTD scales assess classical symptoms of FTD along with pragmatics, paralinguistic, non-verbal, and cognitive aspects of speech they seem to provide a comprehensive and detailed assessment of communication disturbances seen among people with severe mental illness. We suggest that these instruments would help research into the different components of FTD as well as would allow the screening of populations for subjects with higher levels of thought disorder.

An issue often debated is whether patients with clinical levels of thought disorder lack insight into their communication difficulties; the few empirical studies available actually reveal a degree of awareness of FTD in those with thought disorder (McGrath, Allman 2000; Barrera, McKenna, & Berrios, 2009). Crucially, the importance of assessing FTD in healthy individuals is underscored by work showing that children of parents with schizophrenia display higher levels of thought disorder, suggesting that its early detection may act as an endophenotypic marker of schizophrenia diathesis (Gooding, Coleman, Roberts, Shenton, Levy, & Erlenmeyer-Kimling, 2012). The current study

presents normative adaptations of the FTD-S and FTD-O scales for their use in non-clinical participants.

Study 1

Method

Participants

A non-clinical sample of 300 staff and students from the University of Hertfordshire (mean age 32.8; *SD*=13.7; 71.3% women) anonymously completed an online version of the FTD-S.

Instruments

The original FTD-S Scale was devised for the self-report of thinking/language symptoms exhibited by individuals with psychosis (e.g. derailment, illogicality) (Barrera, McKenna, & Berrios, 2008). It is a 29 item instrument (e.g. "I tend to use too many words to say simple things") where positive endorsements are totalled to give an overall FTD score. It was designed to encompass disturbances of pragmatics, lexical selection, non-verbal communication, paralinguistic, and classical symptoms of FTD (e.g. neologisms) based on classical descriptions (Andreasen, 1979; Séglas, 1892; Hamilton, 1976; Prutting & Kirchner, 1987) as well as neurological language symptoms. The FTD-S scale was validated in a sample of 90 schizophrenia patients (Barrera, McKenna & Berrios, 2008). Its internal reliability (Cronbach's α) was 0.93 with significant 12 months test-retest reliability (r= 0.72). The FTD-s scale ratings were significantly correlated with positive FTD (r= 0.30) as assessed by the Comprehensive Assessment of Symptoms and History (CASH) (Andreasen, Flaum, Arndt, 1992) (but not with negative FTD) and were also significantly correlated with less independent living arrangements (Barrera, McKenna, & Berrios, 2008), suggesting external validity.

In the current study, we adapted the original 29 items for use with a 4-point Likert scale: 1= "almost never", 2= "sometimes", 3= "often" or 4= "almost always". This method rather than the forced-choice one was adopted to tap more sensitively into the range of responses in the non-clinical population.

Procedure

Participants completed the FTD-S scale. This study was approved by the University Research Ethics Committee

Results

The FTD-self scale mean was 59.62 (*SD*=14.76) and the internal reliability was 0.93 (Cronbach's α). The mean FTD scores for men and women did not differ (see

Table 1); age was almost significantly negatively correlated with FTD-self scores ($r=$ -.13, $p=$ .05).

Table 1. Descriptive statistics for the FTD-self-scale.

	Mean FTD-Self (*SD*)
Men (*n*= 86)	59.95 (15.87)
Women(*n*= 214)	59.44 (14.33)
Total (*N*= 300)	59.62 (14.76)

The correlation matrix of the 29 items (*N*= 300) was explored using Principal Components Analysis (PCA). Oblique and orthogonal rotations produced the same component structure; however, since the correlations between the three components (after Oblimin rotation) were between .30 and .40, suggesting 10% (or more) overlap among the components, oblique rotation was utilised (Tabachnick & Fidell, 2007). The index of sampling adequacy (KMO) of .91 exceeded the recommended level of .6 (Kaiser, 1974) and the Bartlett test of Sphericity was .3903, $p < 0.001$, indicating that the assumptions for a component analysis were met.

Parallel analysis using the program 'Monte Carlo PCA for Parallel Analysis' (Watkins, 2000) suggested that three components be retained which accounted for 48.36% of the total variance. The Eigen values ranged from 10 for the first component (accounting 34.7% the variance before rotation and 18.9% after rotation), down to 2.06 for component 2 (accounting for 7.12% of the variance before rotation and 16.12% after rotation), and component three with an Eigen value of 1.88 (accounting for 6.5% of the variance before rotation and 13.36% after rotation).

All 29 items achieved a salient loading of at least .30. Only item 25 had substantial weights on two components. Table 2 shows the component loadings for each item. We labelled component 1 as 'Odd Speech', component 2 as 'Conversational Ability' and component 3 as 'Working Memory Deficit'. Odd speech correlated with conversational ability ($r=$ .69) and working memory deficit ($r=$ .55), while conversational ability also correlated with working memory deficit ($r=$ .60). Cronbach's alpha values in excess of 0.8 for each of the three components suggest that they are internally reliable (Table 3).

Age showed a small, but significant correlation with total FTD-self scale ($r=$ -.14, $p <.05$) and odd speech ($r=$ -.19, $P <.01$), but not with conversational ability or working memory deficit ($r=$ -.07 and $r=$ -.06, respectively). Male and female participants did not differ on any mean component scores. All items correlated with the total FTS-S score (from .37 to .72, all $p <.001$).

Study 2

Study 2 examined the relationship between the FTD scale completed by the participants (the FTD-Self Scale) and one completed about the participant by a close friend or relative (the FTD-Other Scale).

Handedness is correlated with cerebral lateralisation of language (Knecht, Dräger, Deppe, Bobe, Lohmann, Flöel, Ringelstein, & Henningsen, 2000) and it has been linked with language disorganization in schizotypal personality (Schürhoff, Laguerre,

Table 2. Pattern matrix with loadings for FTD-Self on the three factors identified.

Item			Mean	SD	Loading
19	I like repeating words just spoken to me by others		1.87	0.89	0.71
18	I have found myself repeating things said by others unintentionally		2.02	0.87	0.68
13	I speak so fast (or slowly) that others might find it silly or inappropriate		1.78	0.85	0.67
15	I have found myself talking in ways that other people may find strange		1.68	0.85	0.63
27	I find myself talking without meaning to		1.85	0.88	0.62
14	I enjoy making up new words, which only have meaning for me		1.89	1.00	0.60
28	I go on beating about the bush instead of getting to the point of the conversation		2.16	0.89	0.57
23	I tend to use too many words to say simple things	*Odd Speech*	2.29	0.88	0.57
16	I find myself drawing strange conclusions during conversations		1.90	0.87	0.50
12	When I talk, more words than I need to say something come in to my head		2.35	0.94	0.49
7	I speak in whispers or mutter under breath for no obvious reason		1.66	0.87	0.49
24	I notice that in conversations, I tend to go round in circles		1.99	0.88	0.48
17	I use long, sophisticated and unusual words to say simple things		2.03	0.88	0.41
25	I do not know how to ask others to explain what they mean		1.54	0.71	0.37
22	It takes me an excessively long time to answer questions		1.91	0.77	0.31
9	I find it hard to start conversations		2.29	1.00	-0.89
8	I tend to dry up in conversations		2.20	0.91	-0.87
10	I find it a struggle to talk for very long		2.02	0.92	-0.72
20	Talking leaves me psychologically exhausted	*Alogia*	1.73	0.87	-0.67
11	The more people there are in a conversation, the more I get lost		2.01	0.99	-0.52
4	During conversations I am not always fully 'with it'		2.19	0.89	-0.46
26	I find it hard to put into words what I want to say		2.42	0.84	-0.30
1	I lose track of what I have just said in a conversation		2.46	0.73	0.88
5	I forget what others have just previously said in conversations		2.56	0.78	0.82
3	When I am speaking, my mind suddenly goes blank	*Working*	2.39	0.79	0.74
21	I have only a 'patchy' memory of what has been said during a conversation	*Memory*	2.17	0.90	0.64
2	I tend to forget the point I was trying to make in a conversation	*Deficit*	2.34	0.87	0.52
29	I find it hard to give instructions, such as directions to a place		2.21	0.90	0.44
6	My speech gets suddenly 'blocked' and I cannot get the words out		1.92	0.89	0.32

Table 3. Descriptive statistics for each FTD-Self factor.

	Min-Max	Mean	*SD*	Skew	Kurtosis	Cronbach's *α*
Factor 1 (Odd speech: *n*=15)	15-50	26.95	7.70	.41	-.31	.876
Factor 2 (Alogia: *n*=7)	7-28	14.89	4.76	.48	-.32	.873
Factor 3 (Working memory deficit: *n*=7)	7-27	16.04	4.09	.18	-.47	.816
Total	30-104	59.62	14.76	.32	-.37	.930

Roy, Beaumont, & Leboyer, 2008; Somers, Sommer, Boks, & Kahn, 2008) and FTD in schizophrenia (Manoach, 1994). Similarly, functional imaging evidence suggests defective language lateralisation among thought disordered schizophrenia patients (Kircher, Liddle, Brammer, Williams, Murray, & McGuire, 2002). Hence, this study also explored the association between handedness, as a marker of language lateralisation, and FTD-S and FTD-O ratings.

Finally, as FTD can be exhibited to some extent by a proportion of patients with a range of psychiatric diagnoses (see Introduction) this study explored associations between self-reported personal or family history of mental illness and FTD-S and FTD-O scores.

METHOD

Participants

A non-clinical sample of 159 staff and students from the University of Oxford (mean age= 24.7; *SD*= 10.2; 51.2% male) completed the FTD-S questionnaire. 114 friends or family members returned completed FTD-O scales.

Instruments

The FTD-O scale has 33 items (e.g. "she/he cannot keep to the point of a conversation"). Like the FTD-S, the responses were rated on a 4-point scale and it is completed by a friend or family member of the subject. When validated in a sample of 90 carers of schizophrenia patients the FTD-O scale showed internal reliability (Cronbach's *α*) of 0.95 and significant 12 months test-retest reliability (*r*= 0.61).

The Edinburgh Handedness Inventory (EHI) (Oldfield, 1971; Bryden, 1977) consists of 10 items (e.g. writing) and it gives a score between +100 (completely right-handed) and -100 (completely left-handed).

Procedure

Participants completed the FTD-S scale and were given the FTD-O scale to ask a friend or family member to complete it and return it. The participants completed the EHI and a questionnaire concerning personal and family history of mental health. This study was approved by the University of Oxford Research Ethics Committee.

Results

The FTD-S scale mean was 45.26 (*SD*: 8.89), significantly lower than that in the Study 1 using anonymous online data collection. This may well point to a difference in the level of disclosure when tested face-to-face versus online (45.26 vs. 59.62: *p* <.001) and also possibly related to the 8 year mean age difference between the two cohorts (*t*= 10.1, *p* <.001). The FTD-S had high internal reliability (Cronbach's α= 0.857) and there was a low but significant correlation between FTD-S score and age (*r*= -0.164; *p* < 0.05). The FTD-O scale mean was 53.30 (*SD*=8.46) and its internal reliability was 0.859 (Cronbach's α). For the 114 participants for whom the FTD-S and the FTD-O were completed, their total scores were significantly correlated (*r*= .29; *p* < 0.01); after controlling for age, their association remained significant (*r*= .312; *p*= 0.001). The mean FTD-S and FTD-O scores for males and females did not differ significantly (*t*= 0.74; *p*= .46 and *t*= 1.31; *p*= .19, respectively).

The sample's handedness (EHI) was 73.83 (*SD*: 47.57) with no significant association between handedness and FTD-S score (*r*= .104; *p*= 0.195) or FTD-O score (*r*= .162; *p*= 0.087). Seventeen subjects (10.7%) reported a personal history of mental disorders (depressive and eating disorders). They showed a non-significant tendency to have higher FTD-S scores than those who did not report that personal history (48.71 [*SD*=11.17] vs. 44.85 [*SD*=8.53]; *t*= -1.699; *p*= 0.091). The participants that report that history did not have significantly higher FTD-O ratings. Sixty one subjects (38.3%) reported a family history of mental disorders (e.g. depressive and eating disorders). Participants with and without a family history of mental disorder had not significantly different FTD-S or FTD-O scores.

We compared those participants with (*n*= 114) and without (*n*= 45) a returned FTD-O. Those with a returned FTD-O were significantly older (26.36 [*SD*= 11.1] vs. 20.49 [5.71]; *t*= -4.366 *p*= .001); both groups did not significantly differ in terms of FTD-S score (*t*= 1.40; *p* < 0.163), gender (Chi-Square= 2.706; *p*= .258), personal history (Chi-Square= .459; *p*= .498) or family history (Chi-Square= 2.806; *p*= .094).

Finally, the FTD-O total ratings were correlated significantly with FTD-S component subscale scores for odd speech (*r*= .24) and conversational ability (*r*= .30), but not for working memory deficit (*r*= .16).

Discussion

We present normative data from non-clinical samples on a new questionnaire -the Formal Thought Disorder-Self Scale (FTD-S). The questionnaire, originally devised to measure self and carer ratings of FTD in clinical samples (Barrera, McKenna, & Berrios, 2008), was adapted from the original dichotomous response questionnaire to a 4-point Likert format, to more sensitively determine the extent to which such characteristics are reported by individuals with no clinical diagnosis.

A principal components analysis of the FTD-S scale revealed a three-component solution for which we proposed the nomenclature of odd speech, conversational ability and working memory deficit. It is now agreed that FTD is multidimensional in clinical samples, although factor-analytic studies have yielded varied results (Cuesta & Peralta, 1999). Most clinical studies have used the TLC Scale (Andreasen, 1979) and have generated two-factor models (Andreasen, 1979; Berenbaum, Oltmanns, & Gottesman, 1985; Taylor, Reed, & Berenbaum, 1994), namely disorganized speech and restricted production. Factor analysis of responses from the TDI scale (Liddle, Ngan, Caissie, Anderson, Bates, Quested, White, & Weg, 2002) has produced three factors: disorganisation, impoverishment and dysregulation which correspond closely to the components reported here. Others, however, have generated as many as seven factors (Peralta, Cuesta, & León, 1992) and indeed, the original 'yes-no' version of the FTD-S in schizophrenia patients yielded seven components (Barrera, McKenna, & Berrios, 2008) (verbal working memory, lexical/semantic activation, affective overexcitement, circumstantiality, language intentionality, conversational drive, and attention) which overlap to some extent with the three reported here. In this context, multiple-choice item formats are thought to be "more reliable, give more stable results, and produce better scales" (Comrey, 1988) and produce greater component reliability than dichotomous responses (Floyd & Widaman, 1995). Importantly, differences in number of factors may well reflect the fact that cognitive measures which share variance in the intact brain can dissociate and thus contribute to unique variance in the damaged brain (Delis, Jacobson, Bondi, Hamilton, & Salmon, 2003).

Studies have reported that FTD is associated with deficits in working memory (Kiefer, Martens, Weisbrod, Hermle, & Spitzer, 2009; Berenbaum, Kerns, Vernon, & Gómez, 2008). Indeed, some studies have shown that increasing cognitive load upon working memory induces speech disturbances in healthy individuals (Kerns & Berenbaum, 2002; Kerns, 2007). Similarly, schizophrenia patients tend to show greater impairment on tasks tapping controlled rather than automatic language processes (Titone, Levy, & Holzman, 2000; Titone, Libben, Niman, Ranbom, & Levy. 2007; Titone & Levy, 2004; Kerns, 2007). Hence, individuals with working memory deficits would have fewer resources for controlled language processing. In fact, it has been argued (Grant & Beck AT, 2009) that people with FTD may have social anxiety which then competes for resources involved in the controlled process of speech production.

It is possible that some items of questionnaires elicit the same responses from clinical and non-clinical groups, but for quite different reasons. Indeed, we labelled our second component as 'conversational ability' rather than the clinically-loaded term of alogia -largely because in some individuals, conversational difficulties may reflect shyness rather than thought disorder. Indeed, some have argued that non-clinical measures of negative schizotypy assess shyness that is not on a continuum with clinical social withdrawal and anhedonia (Cochrane, Petch, & Pickering, 2010). Furthermore, some have suggested that shyness "...can even be mistaken for certain aspects of a schizophrenic illness" (Orr, 1988). Of course, shyness may also form a part of the pathology associated with schizophrenia (Goldberg & Schmidt, 2001) and therefore needs to be assessed separately. While this latter issue requires further examination in clinical samples, our

data will nonetheless permit researchers to identify extreme scores within normal samples (whether they result from shyness or not).

Even though the FTD-S and FTD-O scales contain questions posed to tap personal experience and observable behaviour respectively, their moderate correlation ($r= .30$) is around the so-called ".3 barrier" indicating the validity of the self-report measure (McCrae, 1982). The fact that the correlation is far from unity raises interesting possible explanations including methodological ones. Firstly, university students and staff may provide poor samples to test the validity of the FTD-S since they are likely to show restricted variance in genuine FTD, and they are also likely to be self-critical if their language is less than optimally fluent and cogent. Regarding the items of the scales, although both scales were developed in parallel and validated in samples of schizophrenia patients, their items only partially overlap and actually contain a different number of items, 29 and 33 respectively. In other words, they do not mirror each other and they may reflect and tap on different aspects of the phenomenon of FTD. This is a situation not dissimilar to, for example, the correlation between the Communication Disturbances Index (CDI) and the TLC scale ($r= 0.14$) (Docherty, 2012): both instruments are meant to tap on the same phenomenon but they do so from different points of view (discourse cohesion and clinical symptoms, respectively).

Secondly, some participants may be reporting more cognitive and language difficulties than those observed by their friends or relatives. It is not possible to rule out whether this is only due to poor self-esteem or whether these subjects are aware of communication difficulties yet to be manifested. This could be the result of, for example, some participants having schizotypal features associated with increased self-reported subjective dysexecutive complaints. In fact, subjective dysexecutive difficulties might precede objective dysexecutive deficits detectable by cognitive testing (Laws, Patel, Tyson, 2008). Similarly, some participants may be reporting language production difficulties which precede their overt manifestation and therefore are not yet detected by others which would decrease the strength of the correlation between FTD-S and FTD-O. Future research could elucidate this issue by including self-report and other-reported instruments of dysexecutive function (Wilson, Alderman, Burgess, Emslie, & Evans, 1996) and schizotypal personality (Launey & Slade, 1982).

Thirdly, another possibility is that healthy individuals have poor insight into the experiences assessed by the FTD-S. The discrepancy between self and other-observed signs in clinical cases is often viewed as a lack of insight on the part of the patient. In schizophrenia patients, the clinical assessment of FTD using the CASH failed to correlate with the FTD-S but correlated significantly with FTD-O ratings (Barrera, McKenna, & Berrios, 2009). Obviously, the completion of all self-report questionnaires requires some degree of self-awareness and healthy samples might be expected to provide a comparatively more accurate self-assessment than clinical cases. Indeed, the fact that individuals were more inclined to endorse FTD experiences through the anonymity of an online questionnaire than face-to-face might be viewed as consistent with greater self-awareness in healthy individuals; a finding that may have implications for the assessment of FTD in clinical samples. Another possibility is that certain thought disorder features are more evident to observers. Indeed, correlations in Study 2 revealed that odd

speech and conversational ability were significantly correlated with FTD-O ratings while working memory deficit was not, suggesting that the more observable characteristics are key indicators for observers when assessing speech abnormality in others.

We found no association of handedness either with FTD-S score or with FTD-O score. Thus, among non-clinical subjects, handedness was not related to FTD, a finding in agreement with what was found in schizophrenia patients (Manschreck, Maher, Redmond, Miller, & Beaudette, 1996) but contradicting another study that reported an association between FTD and atypical handedness (Manoach, 1994). These contradictory findings suggest that the factors mediating the relationship between FTD and handedness in non-clinical subjects may be different from those mediating it in the brain of people with schizophrenia. This aspect is clearly in need of further research. Similarly, we found a no significant association between self-reported personal history of mental illness and the FTD-S score, a finding that could be the result of reluctance to report either factor; future research could try and clarify this issue by more reliably ascertaining personal and family history of mental disorder.

Certainly, the studies reported here have several limitations. Firstly, both samples are largely comprised of university students and so, demographically more diverse samples are required. Secondly, we could have assessed criterion validity of the FTD-S and FTD-O scales more strongly if we had rated all subjects using an established measure such as the CASH Scale; future studies will need to address this issue. Thirdly, we did not use examine convergent and divergent validity and future studies could assess whether FTD is correlated with, for example, self-reported delusions or hallucinations. Similarly, future research might also attempt to determine whether shyness and self-esteem affect the report of thought disorder in clinical and non-clinical groups. Finally, although we specifically asked the participants that the FTD-O should be completed by someone who knew them well we were unable to ensure that the subjects did not surreptitiously complete themselves the FTD-O so future research should also address this issue.

We believe that further research using these two scales in conjunction with cognitive and symptoms measures will help reveal the underlying mechanisms of the described components ('odd speech', 'conversational ability' and 'working memory'). This is particularly important given the evidence that subclinical thought disorder may have a genetic basis. Finally, since many studies examine schizotypal personality as well as subclinical symptoms of delusions and hallucinations, work on thought disorder is required to fully evaluate the continuum hypothesis of psychosis.

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