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"A room of one's own": Exploring the role of delusions and social isolation on disorganisation in thought disorder

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Abstract

Purpose Thought disorder (TD) is a complex constellation of experiences often manifested as disorganised speech. While both social isolation and delusions have been independently linked to TD, little is known about how these factors may interact. This study investigated whether social isolation and delusions predict the disorganised dimension of TD and whether delusions moderate the association between social isolation and disorganisation, controlling for relevant covariates.

Methods Data from two clinical samples of individuals diagnosed with psychotic-spectrum disorders were combined ($n = 148$). Participant speech samples were transcribed and scored using the Thought, Language, and Communication (TLC) scale. Factor analysis identified key components of TD. Moderation analyses using linear regression examined whether delusions moderated the relationship between social isolation and disorganisation, controlling for covariates.

Results Both social isolation and delusions independently predicted TD disorganisation. Moderation analyses revealed that delusions significantly amplified the association between social isolation and disorganisation, particularly at moderate-to-high levels of delusional severity. The model accounted for approximately 40% of variance in disorganisation.

Conclusion Findings indicate that delusions moderate the impact of social isolation on the disorganisation factor of TD. This underscores the importance of integrated interventions that target both social connectivity and delusional symptoms to improve communicative functioning in individuals with psychotic-spectrum disorders.

Keywords Thought disorder · Disorganisation · Social isolation · Psychosis · Delusions · Intermingling

Introduction

Formal thought disorder (TD) is an overarching term encompassing cognitive, speech, and communication disturbances commonly observed in psychotic-spectrum disorders [1–3]. These symptoms and experiences are common in

psychotic-spectrum disorders but their presence varies, with estimates of affected patients ranging from 27.4% to 81% depending on whether studies use a narrower or broader definition of TD [4]. Despite its higher expression and persistent course in psychosis [5, 3], it is established that TD is transdiagnostic phenomena [6] with studies reporting features of TD in participants diagnosed with depression [2] and other non-psychotic disorders [5], bipolar disorder [7, 2, 8], neurodevelopmental conditions such as autism [9] and in nonpsychiatric controls [10].

In psychotic-spectrum disorders, TD is associated with poorer outcomes in occupational functioning [11–14], quality of life [15], social functioning [16, 17], and insight [18]. TD is also associated with increased number of admissions and poorer prognostic outcomes [4]. Roche et al. [13] reported an association between disorganised forms of TD and higher rates of admissions and longer inpatient stays. In other studies, TD has been associated to greater illness severity [19, 20] and with poorer outcomes in cognitive behaviour therapy for psychosis, marking it as a key

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treatment target [21]. Importantly, TD can be identified in ultra-high-risk populations and appears to predict psychosis before its onset [22–24] providing an important window for early intervention. However, despite the relevance of TD, there has been paucity of therapeutic case conceptualisations of TD within the literature with some notable exceptions [25, 26].

Multidimensional structure of TD

TD is widely recognised as a non-unitary concept, prompting substantial efforts to clarify its underlying factor structure [7]. In a systematic review of 16 studies, Zamperoni et al. [27] found the most support for a three-factor structure of TD: a disorganisation factor characterised by unclear, disordered, and unsystematic speech; a second factor reflecting impoverishment of speech and reduced speech output; and a third associated with verbosity. However, considerable variation in methodologies and rating scales used to assess TD contributed to high heterogeneity across studies and inconsistencies in the reported factor structures. The multidimensionality of TD implies that no singular process is likely to explain all experiences under the TD umbrella. The underlying psychological mechanisms may involve abnormalities with semantic priming [dyssemantic hypothesis; [28]], socio-cognitive deficits [communicative competence; [29]], or difficulties with executive functions [dysexecutive hypothesis; [30]]. A similarly multifaceted perspective is likely needed when considering the social predictors or determinants of TD.

Intermingling and TD

Harrow and colleagues conducted a series of studies showing that the speech of individuals with TD can be difficult to follow because personal concerns of the patient intrude into and blend with the conversation context [31–34]. They referred to this phenomenon as “intermingling” [31], describing it as the incorporation of decontextualised past and recent personal experiences into ongoing communication, resulting in speech that appears bizarre and hard to follow. In one study, Harrow et al. [31] analysed speech samples of psychotic participants using their Bizarre-Idiosyncratic Thinking (BIT) scale [5]. They found that 68% of participants produced verbalisations influenced by intermingled personal material. Notably, most of these individuals still maintained some adherence to the original question and did not entirely lose the cognitive set. This pattern has been replicated in subsequent studies [33, 34]. For example, the same group reported that participants exhibiting TD during proverb interpretation also showed high levels of intermingling on an object-sorting task [35]. More broadly,

evidence also suggests that thought-disordered individuals rarely disregard contextual cues altogether [36].

Building on these findings, Harrow and colleagues proposed that during periods of heightened cognitive or emotional arousal, personally salient material from an individual’s affective inner life becomes more prominent. This material may intrude upon the task at hand, disrupting attentional focus and leading to idiosyncratic, difficult-to-follow communication characteristic of TD [31]. This account aligns with consistent findings that individuals diagnosed with Schizophrenia and Bipolar Disorder exhibit more pronounced TD under emotionally salient conditions, such as when recalling personally significant memories [10, 37–39]. Importantly, in a follow-up study [11], Harrow and colleagues reported that thought-disordered patients were significantly more likely to experience delusions than controls [32, 40]. One implication is that individuals may be intermingling delusional content into their speech, as such beliefs often reflect deeply personal concerns, goals, and preoccupations [41–43].

Social disconnection, psychosis, and TD

Over the last couple of decades, research has increasingly highlighted the role of the social environment in the development and maintenance of psychotic experiences [44, 45]. Within this literature, the broader construct of social disconnection has gained attention as a framework for understanding interpersonal and social difficulties in psychosis [46–49], and may be particularly relevant for understanding symptoms of TD and disorganised speech. Social disconnection encompasses both objective indicators of reduced social contact, such as social isolation or smaller social networks, and subjective experiences, including loneliness, perceived lack of belonging, and low social support [50–53]. These dimensions are related but distinct, and both objective and subjective forms of social disconnection have been associated with poorer mental health outcomes [54], including greater symptoms severity in psychosis [53, 50].

Individuals with psychotic disorders frequently experience substantial social disconnection [49]. For example, research has consistently demonstrated that people diagnosed with schizophrenia tend to have smaller and less diverse social networks compared with the general population. Degan et al. [55] reviewed studies that explored social network size in schizophrenia and found that smaller social networks were associated with more severe overall psychiatric symptoms as well as more pronounced negative symptoms, with robust effect sizes. Social disconnection may also contribute to the persistence of psychotic symptoms by limiting opportunities for corrective feedback and reality testing [49, 56]. Such processes may be especially

relevant for TD and disorganised speech, where the maintenance of coherent communication depends on alignment with shared social and linguistic norms.

In addition to objective social isolation, subjective experiences of social disconnection, particularly loneliness, have received increasing research attention [57]. Loneliness reflects the perceived discrepancy between desired and actual social relationships and has been linked to a range of adverse psychological outcomes [58]. Individuals with psychotic disorders often report elevated levels of loneliness [51], even when objective social contact is present [59]. Emerging evidence suggests that loneliness may be associated with increased symptom severity and psychological distress [60, 52], and may plausibly exacerbate disorganisation by increasing self-focused processing [61, 26] and reducing engagement with external social cues [62].

Associations between social disconnection and TD have been reported in psychosis, both in studies using objective methodologies to assess TD [63, 62] and in those relying on subjective reports of TD [64]. Similar patterns have also emerged in schizotypy research, where several studies have reported significant associations between disorganised schizotypy and loneliness [65–67]. One proposed mechanism to explain this association is that social interaction provides opportunities for corrective interpersonal feedback essential for establishing understanding and common perspective, maintaining shared meaning, coherence, and pragmatic appropriateness in conversation [68]. Reduced exposure to such feedback may limit opportunities to refine communicative behaviour and may contribute to increasing divergence from socially shared linguistic norms. In individuals with psychosis, this process may be compounded by difficulties in socio-cognitive functioning, including impairments in theory of mind and pragmatic language processing, which are themselves associated with disorganisation [62, 69]. Another possible pathway is that social disconnection may impact cognition overtime [cognitive and executive function; [70] leading to TD and disorganised speech through its impact on frontal-executive functioning often associated with TD [71]. In one study, loneliness in participants diagnosed with psychotic spectrum disorders was associated with both subjective TD and poor performance on digit symbol coding test [64] and in another prospective study, baseline social isolation (not loneliness) significantly predicted poorer performance on language and delayed recall subtests at 2 year follow-up in male patients [72].

Importantly, the relationship between social disconnection and TD and disorganised speech is likely to be bidirectional. TD can disrupt effective communication and social functioning, potentially leading to social withdrawal and further disconnection. In turn, reduced social contact may exacerbate difficulties in maintaining coherent speech

and communication in reciprocal causation. A reciprocal dynamic would suggest that social disconnection may play a meaningful role in both the development and maintenance of TD and disorganised speech.

Current study

The present study aimed to examine social isolation as a potential correlate of disorganisation symptoms within TD. The authors focused on objective social isolation as an indicator of reduced social contact and tested its association with the disorganisation dimension of TD. Drawing on intermingling accounts of TD, the authors hypothesised that personally salient material, such as delusional beliefs, may intrude into and disrupt ongoing communication. Delusions may increase the salience of internally generated content, potentially amplifying the effects of reduced social feedback on disorganised speech and therefore, the authors tested whether delusions moderate the association between social isolation and disorganisation, such that the relationship between social isolation and disorganised communication would be stronger in individuals reporting higher levels of delusional beliefs.

Methods

Participants

Data were drawn from two distinct clinical samples of patients diagnosed with psychotic-spectrum disorders [DSM-IV-TR; [73]], and a group of non-psychiatric controls for reference. The first clinical sample had 80 patients [Sample 1; details of recruitment can be found in [63] and the second had 68 patients, recruited from local mental health trusts in the Northwest of England [Sample 2; details of recruitment can be found in [62].

Measures

Psychotic symptoms

The Positive and Negative Symptoms Scale [PANSS; [74]] measured symptom severity. The PANSS is a clinician administered, semi-structured interview which assesses positive and negative symptoms, and general psychopathology in individuals with schizophrenia. It has 30-items divided into three subscales, with 7 items for positive symptoms, 7 items for negative symptoms, and 16 items for general psychopathology. Each item is rated on a 7-point scale ranging from 1 (absent) to 7 (extreme). The PANSS has a good validity and reliability [75].

Thought disorder

TD was scored on both samples with the Thought, Language, and Communication disorders scale [TLC; [76]]. The TLC is a clinician rated scoring system that assesses disturbances in thought and speech associated with psychosis (e.g., derailment, tangentiality etc.). The 18 items each represent an aspect of TD, and items are rated from 0 to 4 (or 0 to 3 for some items) based on frequency and severity, with higher scores indicating greater severity of TD. Eleven of the items are considered “more pathological” (e.g., derailment, illogicality etc.) and therefore these scores are multiplied by 2. The total sum is calculated by adding the values for the individual items. The TLC has a good validity and reliability [1].

Social isolation

Social isolation was measured in both samples using the Lubben Social Network Scale [LSNS-18; [77]]. This self-report scale measures the size, closeness, and frequency of contacts within the social network. The 18 items (e.g., “How many friends do you see or hear from at least once a month?”) cover different domains of the social network. Items are rated on a 6-point scale, and total scores range from 0 to 90 with higher scores representing more social integration (we reversed the original scoring for interpretability).

Chlorpromazine equivalents (CPZ)

Antipsychotic medications were converted to CPZ to account for any variation in medication and dose as per agreed methods [78]. This approach has been widely used in schizophrenia research [79] and applied in studies exploring TD in clinical groups [10, 62].

Speech samples

Speech samples for clinical sample 1 were generated using a salient interview that had been previously developed to elicit TD [38, 37]. The interviewer asks the participant fifteen questions, promoting self-disclosure by asking about negative autobiographical memories (e.g., “Can you tell me about a close relative or friend who died?”). The speech samples for clinical sample 2 were taken from the PANSS [74] interview conducted with the participants.

Procedure

Both research projects were approved by UK National Research Ethics Service, R&D departments of local NHS Mental Health Trusts in the Northwest of England and were

sponsored by the University of Liverpool. All participants recruited gave fully informed consent and were tested within two weeks. Participants in the clinical groups were interviewed using the PANSS (Kay et al., 1987) whereas controls were screened with the Psychotic Screening Questionnaire (Bebbington & Nayani, 1995) to rule out psychotic symptoms. In sample 1, first author and a research assistant independently coded 10% (22) of the speech samples for reliability purposes. For some TLC items it was not possible to calculate a Kappa, as they were too infrequent (e.g., neologisms, clanging, etc.). For the remaining TLC items the Kappa values were sizable. The highest level of agreement was achieved with tangentiality ($K=0.82$) and the lowest with self-reference ($K=0.62$). For sample 2, again some items were too infrequent (e.g., neologisms, clanging, etc.) but for the remaining TLC items intra-class correlations were all acceptable ($ICC>0.75$).

Data analysis

Descriptive analyses were conducted to compare the merged clinical samples using independent samples t-tests for continuous variables and chi-square tests for categorical variables. These comparisons assessed the harmonisation of the samples and justified merging them for subsequent analyses. The suitability of the combined dataset for factor analysis was evaluated using Bartlett’s test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. Exploratory factor analysis was performed using principal axis factoring (PAF), chosen because it is robust to violations of multivariate normality and is appropriate for identifying latent constructs when common variance is of interest [80]. A Promax rotation with Kaiser normalisation was applied to achieve an interpretable, oblique factor solution, allowing factors to correlate and aligning with the expected covariation of constructs within clinical symptom domains. The internal consistency of the derived factors was evaluated using Cronbach’s alpha coefficients. Spearman’s rank-order correlations examined associations between the five extracted factors and key study variables (e.g., social isolation and delusions). The nonparametric Spearman method was selected because of observed skewness and kurtosis in factor scores, and Holm-Bonferroni corrections were applied [81]. To examine whether the association between social isolation and the disorganisation factor varies with delusion severity, a moderation analysis on PROCESS [82] was conducted. The regression model was adjusted for several covariates including sample group, sex, ethnicity, age, years of education, diagnosis, antipsychotic medication dosage, and PANSS negative and general psychopathology scores. Interaction plot was developed on ggplot2 on R.

Results

Descriptive statistics and group comparisons between samples

Descriptive statistics for key demographic and clinical variables across the two clinical samples and the nonpsychiatric controls are provided in Table 1, which summarizes our statistical comparisons between the groups. The samples did not differ on age, but significant differences on sex, ethnicity, diagnosis, years of education and CPZ equivalents were observed. Furthermore, significant differences across the samples on the positive, negative, general and total scores of the PANSS together with the items delusions (P1) and hallucinations (P3) positioned clinical sample 2 presenting as more symptomatic. There were no significant differences on TLC scores and on social isolation.

Factor analysis of the TLC scores

The KMO measure of sampling adequacy was 0.789, suggesting that the correlations between items were appropriate for factor extraction. Bartlett's test was significant $X^2(153)=959.43$, $p < .001$, suggesting that the correlation matrix was significantly different from the identity matrix and that there was enough shared variance.

The PAF of the 18 items of the TLC yielded a five-factor solution based on eigenvalues greater than 1 displayed in Table 2, accounting for 51.03% of the total variance. The factors were interpreted using the item content and loading patterns (≥ 0.30). Factor 1 (Eigenvalue=5.178; 26.00% of variance) was characterized by high loadings for tangentiality (0.840), incoherence (0.801), illogicality (0.748),

derailment (0.729), loss of goal (0.619), and self-reference (0.337) and appeared to reflect disorganisation, incoherence of speech, and loosening of associations. Factor 2 (Eigenvalue=1.966; 8.51% of variance) had high loadings for stilted speech (0.885), neologisms (0.796), clanging (0.498), and word approximations (0.446), and appeared to represent linguistic idiosyncrasies and unusual language use. Factor 3 (Eigenvalue=1.723; 7.19% of variance) had high loadings for pressure of speech (0.884), circumstantiality (0.401), distractible speech (0.397), and perseveration (0.350). Notably, perseveration was a cross-loading item and loaded on factor 1 (0.323) as well. This factor seemed to reflect verbosity, and excessive speech production. Factor 4 (Eigenvalue=1.331; 5.13% of variance) had high loadings for echolalia (0.959), and less for thought blocking (0.390); therefore, being difficult to interpret as theoretically these two symptoms seem unrelated. However, perhaps both items reflect disrupted automatic and involuntary processes. Finally, factor 5 (Eigenvalue=1.159; 3.89% of variance) was characterized by high loadings for poverty of the content of speech (0.739) and poverty of speech (0.417). This pattern seemingly represents impoverishment of speech and thought processes and has been identified in the literature and in 3-factor solutions [27].

To check the internal consistency of the factors, Cronbach's alphas were calculated for each. Factor 4, which is difficult to interpret, had a marginally acceptable alpha of 0.651. The remaining factors had acceptable values ranging between 0.765 and 0.903.

Table 1 Demographic and clinical characteristics of clinical samples and controls.

Variable	Clinical sample 1 (<i>n</i> =80)	Clinical sample 2 (<i>n</i> =68)	Controls (<i>n</i> =30)	Test statistic (sample 1 vs. 2)	<i>p</i> -value
Age (years), M (SD)	39.28 (11.62)	38.43 (13.15)	38.43 (13.32)	$t(146) = 0.417$	$p = .677$
Sex, Male (%)	72.5%	52.9%	70%	$\chi^2(1, 148) = 6.07$	$p = .014$
Ethnicity, White British (%)	92.5%	79.4%	93.3%	$\chi^2(6, 148) = 14.45$	$p = .025$
Diagnosis (SCZ/other)	60.0%	39.7%	n.a.	$\chi^2(3, 148) = 8.57$	$p = .036$
Years of education, M (SD)	11.20 (1.95)	16.50 (2.18)	12.67 (2.28)	$t(146) = -15.621$	$p < .001$
CPZ equivalents (mg/day), M (SD)	469.75 (389.05)	319.71 (282.21)	n.a.	$t(142.63) = 2.711$	$p = .008$
PANSS – Positive, M (SD)	17.14 (5.18)	20.49 (7.06)	n.a.	$t(120.92) = -3.239$	$p = .002$
P1 (Delusions)	3.23 (1.53)	4.26 (1.84)	n.a.	$t(146) = -3.747$	$p < .001$
P3 (Hallucinations)	2.64 (1.55)	3.41 (1.81)	n.a.	$t(132.77) = -2.763$	$p = .003$
PANSS – Negative, M (SD)	14.04 (4.72)	17.81 (6.27)	n.a.	$t(122.89) = -4.078$	$p < .001$
PANSS – General, M (SD)	38.58 (8.93)	46.59 (9.87)	n.a.	$t(146) = -5.181$	$p < .001$
PANSS – Total, M (SD)	69.75 (15.84)	84.88 (18.78)	n.a.	$t(146) = -5.318$	$p < .001$
Lubben's Social Network scale, M (SD)	60.21 (16.30)	62.99 (17.12)	40.77 (13.74)	$t(146) = -1.008$	$p = .315$
TLC score, M (SD)	12.10 (9.51)	12.12 (12.77)	1.70 (2.54)	$t(122.00) = -0.009$	$p = .993$

p-values and test statistics reflect comparisons between clinical sample 1 and clinical sample 2 only. Controls are included for descriptive comparison only and were not included in the statistical tests. SCZ = Schizophrenia, CPZ = Chlorpromazine. PANSS = Positive and Negative Syndrome Scale. TLC = Thought, Language, and Communication Disorder scale

Table 2 Factor loadings for the TLC items (after rotation), eigenvalues, explained variance and Cronbach's alphas

TLC item	Factor 1 Disorganisation	Factor 2 Linguistic idiosyncrasies	Factor 3 Verbosity	Factor 4 Involuntary	Factor 5 Impoverishment
Poverty of speech	0.074	-0.165	-0.142	0.212	0.417
Poverty of the content of speech	0.001	0.200	0.060	-0.045	0.739
Pressure of speech	-0.201	-0.066	0.884	0.050	-0.060
Distractible speech	0.214	-0.079	0.397	0.021	0.136
Tangentiality	0.840	-0.321	-0.019	0.054	0.144
Derailment	0.729	0.082	0.151	-0.077	-0.033
Incoherence	0.801	0.103	-0.118	-0.132	0.080
Illogicality	0.748	0.133	-0.258	0.076	-0.092
Clanging	0.170	0.498	0.189	0.200	0.015
Neologisms	-0.024	0.796	-0.020	0.073	0.032
Word approximations	0.181	0.446	-0.081	0.122	-0.135
Circumstantiality	0.265	0.166	0.401	-0.022	-0.034
Loss of goal	0.619	0.148	0.155	-0.091	-0.151
Perseveration	0.323	-0.028	0.350	0.048	0.182
Echolalia	-0.010	0.043	0.025	0.959	-0.025
Thought blocking	-0.124	0.052	0.046	0.390	0.068
Stilted speech	-0.140	0.885	-0.095	-0.122	0.164
Self-reference	0.337	-0.157	0.237	-0.080	-0.081
Eigenvalue	5.178	1.966	1.723	1.331	1.159
Variance explained (%)	26.30%	8.51%	7.19%	5.13%	3.89%
Cumulative variance (%)	26.30%	34.82%	42.01%	47.13%	51.03%
Cronbach's α	0.903	0.783	0.799	0.651	0.765

Extraction method: Principal axis factoring. Rotation Method: Promax with Kaiser normalisation

Table 3 Spearman correlations (two-tailed) between the five TLC factors and demographics, PANSS scores, and social isolation

		PANSS								
		Age	Education	CPZ	Delusions (P1)	Conceptual disorg. (P2)	Halluci- nations (P3)	Negative scale	General scale	Social isolation
TLC factors	Disorganisation	0.333***	-0.137	0.215**	0.381***	0.838***	0.037	0.186*	0.369***	0.462***
	Linguistic idiosyncrasies	0.120	0.218**	0.005	0.237**	0.396***	0.025	-0.038	0.125	0.233**
	Verbosity	0.355***	-0.015	0.182*	0.154	0.573***	-0.067	-0.132	-0.141	0.232**
	Involuntary	-0.048	-0.121	0.031	-0.007	0.018	-0.033	0.133	0.034	0.020
	Impoverishment	-0.061	-0.337***	0.048	-0.098	-0.001	-0.001	0.130	-0.046	-0.026

*** $p < .001$, ** $p < .01$, * $p < .05$. Holm-Bonferroni correction applied: $\alpha_{adjusted} = \frac{.05}{(45 - rank + 1)}$. **Bolded** results indicate significance after Holm-Bonferroni correction

Correlations between TD factors and clinical variables

Spearman's rho (two-tailed) was used due to non-parametric nature of the TLC factors. To minimise Type 1 errors, Holm-Bonferroni corrections were applied to adjust the significance threshold (45 tests; $\alpha_{adjusted} = \frac{.05}{(45 - rank + 1)}$). The results are shown in Table 3.

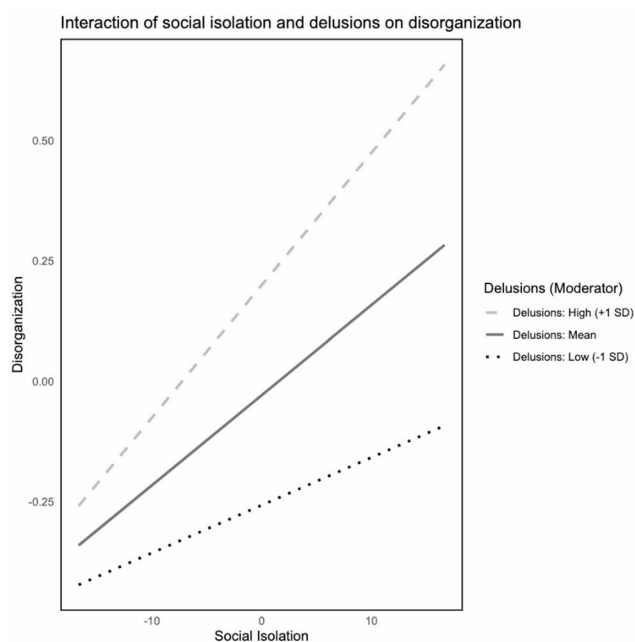
The disorganisation factor yielded a positive, significant correlation with the item conceptual disorganisation of the PANSS (P2) ($r = .838$, $p < .001$) and with age ($r = .333$, $p < .001$), and the general scale of the PANSS ($r = .369$, $p < .001$).

Importantly, this factor also correlated significantly with social isolation ($r = .462$, $p < .001$), and the delusions (P1) item from the PANSS ($r = .381$, $p < .001$), which were the variables included in our moderation analysis. No other correlations survived the adjusted significance threshold.

The linguistic idiosyncrasies factor correlated positively with several variables but only the correlation with the conceptual disorganisation (P2) item of the PANSS ($r = .396$, $p < .001$) survived correction for multiple comparisons. The verbosity factor correlated positively with age ($r = .355$, $p < .001$) and conceptual disorganisation (P2) item of the PANSS ($r = .573$, $p < .001$). Finally, the impoverishment factor was negatively correlated with number of years in

Table 4 Regression model with covariates, main effects, and interaction effect

Predictors	B	Std Error	t	p-value	95% CI
Delusions	0.018	0.004	4.413	< 0.001	0.010; 0.027
Social isolation	0.13	0.049	2.682	0.008	0.034; 0.226
Delusions x social isolation	0.005	0.002	2.186	0.031	0.001; 0.009
Group	0.164	0.247	0.662	0.509	-0.325; 0.653
Sex	-0.121	0.149	-0.811	0.419	-0.415; 0.174
Age	0.014	0.005	2.567	0.011	0.003; 0.025
Education	-0.038	0.034	-1.125	0.262	-0.104; 0.029
Diagnosis	0.051	0.079	0.651	0.517	-0.105; 0.208
Ethnicity	0.099	0.058	1.706	0.090	-0.016; 0.214
CPZ	0.000	0.000	0.725	0.469	-0.000; 0.001
PANSS negative	-0.015	0.015	-1.02	0.309	-0.045; 0.014
PANSS general	0.013	0.011	1.185	0.238	-0.009; 0.034

**Fig. 1** Interaction of social isolation and delusions on disorganisation

education ($r = -.337$, $p < .001$); surprisingly, there was no correlation between this factor and the negative scale from the PANSS.

Moderation analysis

To explore the interaction between delusions and social isolation in predicting the disorganisation factor, a moderation analysis was conducted using PROCESS macro model 1 [82]. The model included several covariates: group, sex, age, education, diagnosis, ethnicity, CPZ, and PANSS negative and general scale scores. All the continuous variables were mean centred. The overall model was significant, $F(12, 135) = 7.45$, $p < .001$, explaining 39.9% of the variance in

disorganisation ($R^2 = 0.3985$). Age was the only significant covariate ($p = .011$) all other covariates were non-significant. Please see Table 4 below for full model.

The interaction between social isolation and delusions was significant ($B = 0.005$, $p = .031$), suggesting a moderation effect. The interaction term accounted for an additional 2.1% of the variance in disorganisation ($\Delta R^2 = 0.0213$), with the strength of the association between social isolation and disorganisation varying across severity of delusions (Fig. 1). Simple slopes analysis found the relationship between social isolation and disorganisation was significant at mean ($B = 0.0187$, $p < .001$) and high levels of delusions (+1 SD; $B = 0.0275$, $p < .001$), but not at low levels of delusions (-1 SD; $B = 0.0099$, $p = .101$). The Johnson-Neyman technique further confirmed that the effect of social isolation on disorganisation became statistically significant when delusions scored exceeded -1.513 SDs from the mean, affecting roughly 72% of the sample.

Discussion

This study explored how social isolation, and delusions contribute to the disorganisation dimension of TD, situating these relationships within a broader framework of social disconnection in psychosis. To derive a suitable measure of TD, we conducted a factor analysis which revealed a five-factor structure underlying the symptoms assessed with the TLC [76], consistent with evidence that TD is a multidimensional construct [27, 4]. While the disorganisation and impoverishment dimensions have been reliably replicated [83, 3] along with verbosity and linguistic idiosyncrasies [7], there was less support for the disrupted involuntary processes factor. This factor demonstrated the lowest internal consistency, likely reflecting the low frequency of symptoms such as echolalia and thought blocking in our samples. Given our focus, the disorganisation factor showed excellent internal consistency ($\alpha = 0.903$) and was therefore retained for hypothesis testing.

Building on prior work, we examined the interaction between social isolation and delusions in predicting disorganisation. This was motivated by two key observations: first, that individuals with TD often intermingle personal concerns into their speech, reducing coherence and comprehensibility [31, 35, 33, 34]; and second, that in psychosis, such concerns may take the form of delusional beliefs [42, 41], which have been shown to correlate with TD across diagnostic groups [40, 32]. We observed a significant, moderate association between delusions and disorganisation, which remained robust after correction for multiple comparisons. One possible interpretation is that, during states of heightened emotional arousal, speech becomes increasingly

reactive and disorganised [10, 38, 37, 84] with delusions functioning as highly salient internal cognitions that disrupt communicative coherence, potentially reinforced by reduced opportunities for interpersonal reality testing in the context of social disconnection. From this perspective, the traditional distinction between formal thought disorder and disturbances of thought content [85] may be less clear-cut than typically assumed, as both may reflect interacting components of a broader disruption in meaning-making and communication.

Importantly, our findings also align with emerging accounts linking social disconnection to disorganisation in psychosis [64] and schizotypy research [65–67]. Social disconnection is conceptualised here as a multidimensional construct encompassing both objective indicators (e.g., social isolation, reduced network size) and subjective experiences (e.g., loneliness and perceived lack of belonging). Within this framework, impairments associated with TD may be particularly relevant, as TD has been linked with impairments in socio-cognitive functioning [29, 86, 87], including difficulties in perspective-taking and adapting communication to the listener's knowledge state [88]. In previous work, we found that the association between social isolation and TD was mediated by performance on a socio-cognitive task (the Hinting Task) [89], suggesting that reduced social engagement may limit opportunities to develop and maintain these skills. From a social disconnection perspective, reduced social contact may also restrict exposure to corrective interpersonal feedback, which is essential for maintaining shared meaning, coherence, and alignment with socially shared linguistic norms. In the absence of such feedback, individuals may be less able to monitor and adjust their speech in line with these shared norms. In parallel, subjective aspects of social disconnection, particularly loneliness and reduced perceived belonging, may increase self-focused processing and reduce engagement with external social cues, further contributing to disorganised communication. Additionally, social isolation may have downstream effects on cognitive and executive functioning over time [70] which are closely linked to disorganisation in psychosis [71], language ability [72] which has also been implicated in TD [28], or even affect reactivity [10, 39, 84]. These processes may be further compounded by socio-cognitive difficulties, including impairments in theory of mind and pragmatic language processing, ultimately increasing vulnerability to disorganised speech.

The moderation analysis provides additional support for this framework. Delusions significantly strengthened the association between social isolation and disorganisation, with the model explaining approximately 40% of the variance. While social isolation was associated with higher disorganisation overall, this relationship was significantly

stronger at higher levels of delusions. Simple slope analyses indicated that social isolation predicted disorganisation at mean and high levels of delusions, but not at low levels, with effects emerging at approximately 1.51 standard deviations below the mean. These findings suggest that social disconnection may be particularly detrimental in the presence of highly salient internal beliefs, which may dominate cognitive processing and further disrupt communication.

Importantly, these results do not imply that only delusional content is interwoven into disorganised speech. Rather, a range of internal concerns, both delusional and non-delusional, may become salient and interfere with communication. For example, cognitive models of TD emphasise the role of negative automatic thoughts, maladaptive appraisals, and socio-evaluative concerns (e.g., sensitivity to rejection) in increasing emotional arousal and depleting cognitive resources [26, 61]. Beck and colleagues [26] qualified some of these cognitions as “hypersalient” automatic thoughts for their attention-grabbing and emotionally-charged nature. Within a social disconnection framework, such processes may be exacerbated by reduced social engagement and increased loneliness, which together may amplify self-referential processing and limit opportunities for external regulation of thought and speech.

Finally, the relationship between social disconnection and disorganisation is likely to be bidirectional. While reduced social contact may contribute to the development and maintenance of TD, disorganised speech itself may impair communication and social functioning, leading to further withdrawal and disconnection. This reciprocal dynamic highlights the potential importance of targeting social disconnection, not only as a contextual factor, but as a mechanism that may play a role in both the emergence and persistence of disorganisation in psychosis.

Limitations and avenues for future research

Some limitations warrant consideration. The sample comprised of two clinical samples which differed significantly on demographic and clinical variables. Secondly, whilst the methods used to elicit speech samples are supported by previous research, there is growing recognition that different elicitation methods (e.g., autobiographical narratives, or open-ended conversation) can limit reliability of scoring schemes [27, 90]. For example, perhaps the salient interview and the PANSS may have captured different dimensions of TD.

Future research could consider several directions. First, future studies could recruit a more homogeneous sample or statistically controlled group to test the replicability of the findings in this study. It would be beneficial to test a larger clinical sample as methodologies such as factor analysis

are sensitive to statistical power [80]. Second, as the participants in our clinical samples were predominantly diagnosed with schizophrenia, future research could explore the relationship between social isolation and delusions in predicting disorganisation across diagnostic groups such as schizoaffective disorder or BPAD. Notably, the samples were skewed in sex and ethnicity. Future studies should test these hypotheses with a more diverse sample. Finally, one way to test whether idiosyncratic, unusual beliefs or delusions, are intermingled in the communication of thought-disordered patients is to use qualitative methods to examine their narratives.

Clinical implications

There has been a call for a growing recognition in clinical practice of social disconnection and loneliness in psychosis [91] and the current study aimed to contribute to this effort. Findings suggest that the impact of social isolation on TD is moderated by the severity of delusions in individuals diagnosed with psychosis. Therefore, current Cognitive Behavioural Therapy for Psychosis (CBTp) models of TD [e.g. [25]], may benefit from integrating interventions targeting delusions and unusual beliefs [92, 93] with interventions that reduce social isolation such as engagement in structured social opportunities [94] alongside individual therapy.

Author contributions P.S. and R.H. were responsible for conceptualisation. Methodology, formal analysis, data collection, and data curation were carried out by P.S. and R.H. drafted the original manuscript, while W.S. and R.B. reviewed and provided critical revisions. P.S. performed the final editing. Supervision was provided by W.S. and R.B., and project administration was managed by P.S., W.S., and R.B.

Data availability The datasets generated and/or analysed during the current study are available from the corresponding author upon reasonable request.

Declarations

Competing interests The authors declare no competing interests.

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