What is Linguistic Creativity in Schizophrenia?

Keywords: schizophrenia, thought disorder, creativity, language, communication

Abstract

Background

In an experiment in which clinicians were asked to identify formal thought disorder (FTD) in schizophrenia based on writing samples, the mania and creative writing samples received more FTD diagnoses than the FTD samples. We conducted a systematic review to see whether figuration, associated with both schizophrenia and creative uses of language, could contextualise these findings.

Methods

This was a systematic review only PROSPERO (ID:116255). We searched AMED, Child Development and Adolescent Studies, CINAHL, MEDLINE, PsycARTICLES, and PsycINFO.

Results

Many studies used figuration tasks to test creativity and vice versa, and key factors affecting figurative language output and processing were positive and negative symptom ratios, IQ, and schizophrenia subtype.

Discussion/Conclusion

Our review suggests that the clinicians in the experiment mentioned above perceived FTD as characterised by linguistic markers of verbal and figural creativity that are impacted by FTD itself. FTD is more likely characterised by expressional disfluencies in specific contexts.

1 Introduction

In 1974, Andreasen, Tsuang, and Canter asked clinicians to diagnose formal thought disorder (FTD) using proverb interpretations and writing samples from schizophrenia, mania, and creative writing cohorts. Mania and creative writing texts received more FTD diagnoses and mentions of traits thought to indicate FTD, and clinicians did not distinguish the nonpsychotic cohort. The authors reconsidered FTD in terms of thought, language, and communication disorders (Andreasen, 1979a) inclusive of a positive-negative subtype approach (Andreasen, 1979b). Over time, linguistic creativity received less interest. We queried whether figuration, often seen when language is used creatively and associated with speech in schizophrenia (McKenna and Oh, 2005), could contextualise Andreasen's findings and therefore reviewed empirical studies of figurative language and creativity in schizophrenia and psychosis cohorts. Given that languages are influenced by interaction, our review is motivated by the view that FTD and clinical interaction studies are mutually informative.

2 Methods

This was a systematic review only (i.e. an assessment of heterogeneous trials with no summary estimate). A PRISMA-P protocol was developed and registered with PROSPERO

(ID:116255), and the search strategy followed the PICOS framework (Moher, Shamseer, Clarke, Ghersi, Liberati, Petticrew, and Stewart, 2015). We excluded mixed samples (e.g. where individuals with schizophrenia and/or schizoaffective diagnoses were treated as one cohort) to more clearly distinguish psychosis from schizophrenia (Arciniegas, 2015) and figurative language in relation to the latter (see Table 1).

Table 1: inclusion and exclusion criteria

PICOS	inclusion criteria
population	a formal diagnosis of schizophrenia
intervention	a direct investigation of the production and/or comprehension of figuration
comparison	any other group(s) or individual(s)
outcome	any outcome, behaviour, quality, and/or improvement measure
study design	peer-reviewed reports of empirical studies that have employed a quantitative, qualitative, or mixed methodology to generate primary data; seen publication in the English language (i.e. either by origin or translation); hold a publication status of either (1) approved for publication or (2) published
PICOS	exclusion criteria
population	formal diagnosis and/or comorbidity of any psychiatric condition other than schizophrenia
intervention	reference to the production and/or comprehension of figuration consequent to an unrelated main research aim
comparison	multiple psychiatric cohorts allocated to a single sample
outcome	n/a
study design	any methodology that examined secondary data only; non-research articles, dissertations, theses, and/or 'grey' literature

Throughout March 2018--March 2021, we searched AMED, Child Development and Adolescent Studies, CINAHL, MEDLINE, PsycARTICLES, and PsycINFO. Keyword combinations were searched against paper titles via 'AND' and 'TI' operators[1]. We assessed individual paper quality using the Quality Appraisal Tool for Studies of Diverse Designs (QATSDD; Sirriyeh, Lawton, Gardner, and Armitage, 2012). We chose this tool because our objective was a narrative synthesis of papers covering a range of data, collection methods, and analytical approaches. The tool measures study quality across 16 indices: two apply to qualitative and two to quantitative designs. Any given study was therefore scored against 14 criteria. Per index scores range from zero to three, and the maximum score obtainable is 42. We rated studies whose scores fell within the ranges 0--14, 15--28, and 29 or above as low, moderate, and high quality respectively. The appraisal process was conducted by the corresponding author and an independent reviewer blind to the screening and selection

[1] 'TI schizophrenia AND TI creativity'; 'TI psychosis AND TI creativity'; 'TI schizophrenia AND TI creative'; 'TI psychosis AND creative'; 'TI schizophrenia AND TI figurative'; 'TI psychosis AND TI figurative'; 'TI schizophrenia AND TI metaphor'; 'TI psychosis AND TI metaphor'; 'TI schizophrenia AND TI speech'; 'TI psychosis AND TI speech'; 'TI schizophrenia AND TI language'; 'TI psychosis AND TI language'; 'TI schizophrenia AND TI linguistic'; 'TI psychosis AND TI linguistic'; 'TI schizophrenia AND TI language AND TI thought'; 'TI psychosis AND TI language AND TI thought'; 'TI schizophrenia AND TI speech AND TI language'; 'TI psychosis AND TI speech AND TI language'; 'TI schizophrenia AND TI language AND TI figurative'; 'TI psychosis AND TI language AND TI figurative'; 'TI schizophrenia AND TI language AND TI metaphor'; 'TI psychosis AND TI language AND TI metaphor'.

processes. We resolved interrater disagreements via discussion when categories, rather than total scores, were discrepant. Apart from four studies (two ‘low’ and two ‘moderate’), we rated the majority as high quality. The final category weightings, as they refer to each study, are outlined in Table 2.

Table 2: paper quality weightings

study	aggregate rating
Abraham, Windmann, McKenna, and Güntürkün, 2007	high
Al-Issa, 1976	low
Andreasen and Powers, 1975	high
Bergemann, Parzer, Jaggy, Auler, Mundt, and Maier-Braunleder, 2008	high
Bilgrami, Guittierez, Sarac, Cecchi, and Corcoran, 2020	low
Billow, Rossman, Lewis, Goldman, and Raps, 1997	high
Binz and Brüne, 2010	high
Brüne and Bodenstein, 2005	high
Chakrabarty Sarkar, Chatterjee, Ghosal, Guha, and Deogaonkar, 2014	high
Cropley and Sikand, 1973	high
Deamer, Palmer, Vuong, Ferrier, Finkelmeyer, Hinzen, and Watson, 2019	high
deBonis and Epelbaum, 1997	high
Elvevåg, Helsen, De Hert, Sweers, and Storms, 2011	high
Forest, Hay, and Kushner, 1969	moderate
Fukuhara, Ogawa, Tanaka, Nagata, Nishida, Haga, Nishikawa, 2017	high
Jaracz, Patrzala, and Rybakowski, 2012	high
Keefe and Magaro, 1980	moderate
Ketteler, Theodoridou, Ketteler, and Jäger, 2012	high
Kircher, Leube, Erb, Grodd, and Rapp, 2007	high
Marini, Spoletini, Rubino, Ciuffa, Bria, Martinotti, and Caltagirone, 2008	high
Mashal, Vishne, Laor, and Titone, 2013	high
Mashal, Vishne, and Laor, 2014	high
Mazza, Di Michele, Pollice, Casacchia, and Roncone, 2008	high
Mo, Su, Chan, Liu, 2008	high

Pawełczyk, Kotlicka-Antczak, Łojek, Ruszpel, and Pawełczyk, 2017	high
Piovan, Gava, and Campeol, 2016	high
Rodriguez-Ferrera, McCarthy, and McKenna, 2001	high
Sampedro, Peña, Ibarretxe-Bilbao, Sánchez, Iriarte-Yoller, Pavón, Hervella, Tous-Espelosin, and Ojeda, 2020	high
Schneider, Wagels, Haeussinger, Fallgatter, Ehlis, and Rapp, 2015	high
Son, Kubota, Miyata, Fukuyama, Aso, Urayama, and Takahashi, 2015	high
Varga, Schnell, Tényi, Németh, Simon, Hajnal, and Herold, 2014	high
Wang, Xu, Wang, Healey, Su, and Pang, 2017	high
Zeev-Wolf, Faust, Levkovitz, Harpaz, and Goldstein, 2015	high

It is important to note that a low QATSDD score does not necessarily mean a low quality study. Factors such as publication conventions and methodological advancements make it harder to apply certain criteria to some papers. Bilgrami et al. (2020) is a good modern example. The study meets all criteria for inclusion in this review, but only a conference presentation summary is available for appraisal.

We synthesised the extracted data narratively, as per Popay, Roberts, Sowden, Petticrew, Arai, Rodgers, Britten, Roen, and Duffy (2006).

The protocol for this review is accessible at https://www.crd.york.ac.uk/PROSPEROFILES/116255_PROTOCOL_20181109.pdf

There was no funding source for this study, and we declare no competing interests.

3 Results

The search returned 912 studies. 912 abstracts (735 excluded) and 177 full texts (144 excluded) were screened against inclusion and exclusion criteria. 33 met inclusion criteria in full. The PRISMA flowchart is under Figure 1, and Table 3 reports study characteristics.

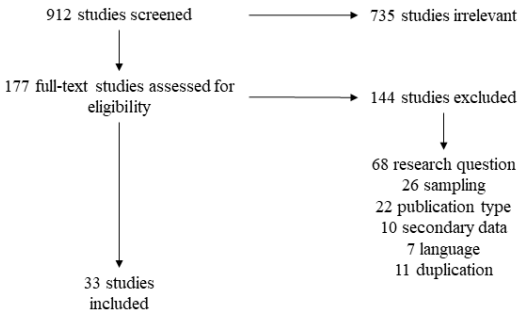

Figure 1, PRISMA flowchart

Table 3: study characteristics

Author(s)	setting(s)	sample(s) (m:f)	linguistic interest(s)
Abraham et al. 2007	Germany; United Kingdom	schizophrenia: 28 (23:5); non-psychiatric comparison: 18 (14:4)	production: irony
Al-Issa, 1976	Canada	schizophrenia: 50	production and comprehension: figuration
Andreasen and Powers, 1975	United States of America	schizophrenia: (15); mania: (16); non-psychiatric comparison (15)	production: figuration
Bergemann et al. 2008	Germany	schizophrenia, paranoid: 19 (0:19)	comprehension: figuration
Billow et al. 1997	United States of America	schizophrenia: 36 (36:0); borderline personality: 36 (36:0); non-psychiatric comparison: 36 (36:0)	production: figuration
Bilgrami et al. 2020	United States of America	schizophrenia: 25; clinical high-risk: 63; non-psychiatric comparison: 33	production: metaphor
Binz and Brüne, 2010	Germany	schizophrenia: 49 (34:25); non-psychiatric comparison: 29 (10:19)	production: irony; comprehension: proverb
Brüne and Bodenstein, 2005	Germany	schizophrenia (23:8); non-psychiatric comparison (10:11)	comprehension: proverb

Chakrabarty et al. 2014	India; United States of America	schizophrenia: 16 (7:9); non-psychiatric comparison: 16 (7:9)	comprehension and production: figuration
Cropley and Sikand, 1973	Canada	schizophrenia: 20 (15:5); creative writers: 20 (17:3); non-psychiatric comparison to schizophrenia group: 20 (17:3); non-psychiatric comparison to creative writing group: 20 (15:5)	comprehension: figuration
Deamer et al. 2019	United Kingdom	schizophrenia: 19 (6:13); non-psychiatric comparison: 15 (8:7)	production and comprehension: figuration
deBonis et al. 1997	France	schizophrenia: 20; major depressive: 13; non-psychiatric comparison: 20	comprehension: metaphor and proverb
Elvevåg et al. 2011	Belgium	schizophrenia: 21; non-psychiatric comparison: 20	production and comprehension: figuration
Forest et al. 1969	United Kingdom	schizophrenia[35]: 10; non-psychiatric comparison[35]: 10; schizophrenia[36]: 22; non-psychiatric comparison[36]: 25	production and comprehension: figuration
Fukuhara et al. 2017	Japan	schizophrenia: 34 (25:9); non-psychiatric comparison: 34 (24:10)	comprehension: irony
Jaracz et al. 2012	Poland	paranoid schizophrenia: 43 (22:21); non-psychiatric comparison: 45 (17:28)	production: figuration
Keefe and Magaro, 1980	United States of America	paranoid schizophrenia: 10; non-paranoid schizophrenia: 10; nonpsychotic psychiatric comparison: 10; non-psychiatric comparison: 10	production and comprehension: figuration
Ketteler et al. 2012	Germany	schizophrenia: 40 (27:13); non-psychiatric comparison: 40 (27:13)	comprehension: figuration
Kircher et al. 2007	Germany	schizophrenia: 12; non-psychiatric comparison: 12	comprehension: figuration
Marini et al. 2008	Italy	schizophrenia: 29; non-psychiatric comparison: 48	production and comprehension: irony

Mashal et al. 2013	Canada/Israel/United States of America	schizophrenia: 14 (9:5); non-psychiatric comparison: 14 (7:7)	comprehension: figuration
Mashal et al. 2014	Israel/United States of America	schizophrenia: 12 (7:5); non-psychiatric comparison: 12 (5:7)	comprehension: figuration
Mazza et al. 2008	Italy	schziophrenia: 38 (30:8); first degree relatives: 34 (20:14); non-psychiatric comparison: 44 (18:26)	comprehension: irony
Mo et al. 2008	China	schizophrenia: 33 (17:16); non-psychiatric comparison: 22 (12:10)	comprehension: metaphor and irony
Pawełczyk et al. 2017	Poland	schizophrenia: 40 (23:17); non-psychiatric comparison: 39 (23:16)	production and comprehension: metaphor and irony
Piovan et al. 2016	Italy	schizophrenia: 30 (19:11); non-psychiatric comparison: 24 (12:12)	production and comprehension: figuration
Rodriguez-Ferrera et al. 2001	United Kingdom	schizophrenia: 40 (29:11)	production and comprehension: metaphor, irony, and proverb
Sampedro et al. 2019	Spain	schizophrenia: 45 (35:10); non-psychiatric comparison: 45 (15:30)	production and comprehension: figuration
Schneider et al. 2015	Germany	schizophrenia: 22 (15:7); non-psychiatric comparison: 22 (10:12)	comprehension: figuration
Son et al. 2015	Japan	schizophrenia: 43 (21:23); non-psychiatric comparison: 36 (12:24)	production: figuration
Varga et al. 2014	Hungary	paranoid schizophrenia: 19 (10:9); non-psychiatric comparison 19 (8:11)	comprehension: irony
Wang et al. 2017	China/United States of America;	schizophrenia: 43; low-schizotypy: 39; high-schizotypy	production: figuration
Zeev-Wolf et al. 2015	Israel	schizophrenia: 15; non-psychiatric comparison: 17	production and comprehension: figuration

3.1 Date

Articles were published between 1969 and 2020. The majority were published post 2001 (n=27). The study pool has good international representation, with most based in Germany (Bergemann et al. 2007; Binz et al. 2010; Brüne and Bodenstein, 2005; Ketteler et al. 2012; Kircher et al.2005; Schneider et al. 2015). Other countries included the United States of America (Andreasen and Powers, 1975; Bilgrami et al. 2020; Billow et al. 1997; Keefe and

Magaro, 1980), Italy (Piovan et al. 2016; Mazza et al. 2008; Marini et al. 2008), Canada (Al Issa, 1976; Cropley and Sikand, 1973), Japan (Fukuhara et al. 2017; Son et al. 2015), Poland (Jaracz et al. 2012; Pawełczyk et al. 2018), the United Kingdom (Deamer et al. 2019; Forrest et al. 1969; Rodriguez-Ferrera et al. 2001), China (Mo et al. 2008), France (de Bonis and Epelbaum, 1997), Belgium (Elvevåg, 2011), Hungary (Varga et al. 2014), Spain (Sampedro et al. 2019), and Israel (Zeev-Wolf et al. 2015). The remaining studies involved transnational collaboration (Abraham et al. 2007: Germany and the United Kingdom; Chakrabarty et al. 2014: India and the United States of America; Mashal et al. 2013: Canada, Israel, and the United States of America; Mashal et al. 2014: Israel and the United States of America; Wang et al. 2017: China and the United States of America).

3.2 Demographics

The most common psychosocial matching criteria were age (n=22) and participant education (n=18). In a few cases, full or subscale IQ measures were used (Abraham et al. 2007; Deamer et al. 2019; Forrest et al. 1969; Kircher et al.2005; Rodriguez-Ferrera et al. 2001; Schneider et al. 2015; Varga et al. 2014). Other variables included participant and parent education (Mashal et al. 2013; Mashal et al. 2014), socioeconomic status (Chakrabarty et al. 2014; Keefe and Magaro, 1980; Pawełczyk et al. 2018), and marital status (Keefe and Magaro, 1980).

3.3 Assessments

All studies established a diagnosis of schizophrenia (either current or historic), and symptomatology was assessed alongside [diagnosis] in many cases. Nine studies did not assess symptomatology (Al Issa, 1976; Andreasen and Powers, 1975; Bilgrami et al. 2020; Billow et al. 1997; Cropley and Sikand, 1973; Deamer et al. 2019; Forrest et al. 1969; Fukuhara et al. 2017; Zeev-Wolf et al. 2015). IQ measures were taken in 18 cases. Seven studies reported appropriate IQ matching procedures (Abraham et al. 2007; Deamer et al. 2019; Forrest et al. 1969; Kircher et al.2005; Rodriguez-Ferrera et al. 2001; Schneider et al. 2015; Varga et al. 2014). Abraham et al. (2007) included participants with preserved premorbid intellectual functioning. Deamer et al. (2019) obtained a pre-morbid IQ and generated a full-scale IQ. In four cases, executive functioning was used as a matching criterion (Brüne and Bodenstein, 2005; Marini et al. 2008; Mazza et al. 2008; Schneider et al. 2015). In the seven studies to establish right handedness, three employed measurement (Schneider et al. 2015; Son et al. 2015; Zeev-Wolf et al. 2015) and four utilised self-report (Mashal et al. 2013; Mashal et al. 2014; Pawełczyk et al. 2018; Kircher et al.2005). All studies focused on adults. Nine did not report female ratios (Al Issa, 1976; Bilgrami et al. 2020; de Bonis, 1997; Elvevåg et al. 2011; Forrest et al. 1969; Keefe and Magaro, 1980; Marini et al. 2008; Kircher et al.2005; Wang et al. 2017). Across studies, participants totalled 1,972.

3.4 Cohorts

Authors categorised their cohorts as follows: [subtype independent] schizophrenia (n=847), non-paranoid [subtype dependent] schizophrenia (n=10), paranoid [subtype dependent] schizophrenia (n=91), borderline personality (n=36), mania (n=16), major depression (n=13), low schizotypy (n=39), high schizotypy (n=35), first degree relative (n=34), professional creatives (n=20), non-psychotic psychiatric comparison (n=10), non-psychiatric comparison (n=758), and clinical high-risk (n=63).

Mostly, authors did not distinguish between schizophrenia subtypes (n=29). The remainder focused on paranoid schizophrenia specifically (Bergemann et al. 2007; Jaracz et al. 2012;

Keefe and Magaro, 1980; Varga et al. 2014). Of these, two studies (Bilgrami et al. 2020; Keefe and Magaro, 1980) involved more than one comparison group: clinical high risk and healthy controls (Bilgrami et al. 2020) and non-paranoid schizophrenia, non-psychotic psychiatric comparison, and non-psychiatric comparison (Keefe and Magaro, 1980). Two studies (Jaracz et al. 2012; Varga et al. 2014) utilised one non-psychiatric comparison group. The remainder was a randomised controlled trial (Bergemann et al. 2007). In studies of subtype independent schizophrenia (n=28), the majority involved one non-psychiatric comparison sample (n=23), whereas a smaller number involved either two (Andreasen and Powers, 1975; Bilgrami et al. 2020; Billow et al. 1997; de Bonis and Epelbaum, 1997) Mazza et al. 2008; Wang et al. 2017) or three (Cropley and Sikand, 1973) comparison samples. Andreasen and Powers (1975) compared schizophrenia, mania, and non-psychiatric/healthy volunteer groups. Bilgrami et al. (2020) compared schizophrenia, clinical high-risk, and non-psychiatric comparison groups. Billow et al. (1997) compared schizophrenia, borderline personality, and non-psychiatric groups. Cropley and Sikand (1973) compared individuals with schizophrenia, professional creatives, and two non-psychiatric comparison groups (one for the schizophrenia group and another for the professional creative group). De Bonis and Epelbaum (1997) compared schizophrenia, major depression, and non-psychiatric groups. Mazza et al. (2008) compared schizophrenia, first degree relative, and non-psychiatric groups. Wang et al. (2017) compared schizophrenia, low schizotypy (non-psychiatric) and high schizotypy (non-psychiatric).

3.5 Designs

In two cases, all participant groups were blind to the aims of the study (Brüne and Bodenstein, 2005; Varga et al. 2014). Bar one randomised controlled trial (Bergemann et al. 2007), all studies were observational (n=32). The majority of these were controlled experiments (n=29), one used open-ended interviewing (Balgrami et al. 2020), and the remainder were single cohort (Al Issa, 1976; Rodriguez Fererra et al. 2001).

3.6 Linguistic focus

Studies focused variously on language production (Abraham et al. 2007; Andreasen and Powers, 1975; Bilgrami et al. 2020; Billow et al. 1997; Jaracz et al. 2012; Son et al. 2015; Wang et al. 2017), comprehension (Bergemann et al. 2007; Brüne and Bodenstein, 2005; Cropley and Sikand, 1973; de Bonis and Epelbaum, 1997; Fukuhara et al. 2017; Ketteler et al. 2012; Mashal et al. 2013; Mashal et al. 2014; Mazza et al. 2008; Mo et al. 2008; Kircher et al.2005; Schneider et al. 2015; Varga et al. 2014), or a combination of the two (Al Issa 1976; Binz and Brüne, 2010; Chakrabarty et al. 2014; Deamer et al. 2019; Elvevåg et al. 2011; Forrest et al. 1969; Keefe and Magaro, 1980; Marini et al. 2008; Pawełczyk et al. 2018; Piovan et al. 2016; Sampedro et al. 2019; Rodriguez Ferrera et al. 2001, Zeev-Wolf et al. 2015). The majority of studies examined one linguistic device only (n=15); ten examined figuration (Bergemann et al. 2007; Billow et al. 1997; Chakrabarty et al. 2014; Elvevåg et al. 2011; Keefe and Magaro, 1980; Mashal et al. 2013; Mashal et al. 2014; Kircher et al.2005; Schneider et al. 2015; Zeev-Wolf et al. 2015), three focused on irony (Abraham et al. 2007; Marini et al. 2008; Mazza et al. 2008), and one explored proverb (Brüne and Bodenstein, 2005). A moderate number examined multiple devices (n=13) and/or used natural language elicitation procedures that may have prompted a range of figurative responses (Al Issa, 1976; Andreasen and Powers, 1975; Bilgrami et al. 2020; Cropley and Sikand, 1973; Deamer et al. 2019; Forrest et al. 1969; Jaracz et al. 2012; Ketteler et al. 2012; Piovan et al. 2016; Rodriguez Ferrera et al. 2011; Sampedro et al. 2019; Son et al. 2015; Wang et al. 2017). Six studies focused on two devices. Of these, most tended toward figuration and irony (Fukuhara

et al. 2017; Mo et al. 2008; Pawełczyk et al. 2018; Varga et al. 2014), over irony and proverb (Binz and Brüne, 2010), or figuration and proverb (de Bonis and Epelbaum, 1997).

3.7 Metaphor decoding

Eleven studies found evidence for metaphor decoding difficulties in subtype independent schizophrenia cohorts (Binz and Brüne, 2010; Chakrabarty et al. 2014; Deamer et al. 2019; Elvevåg et al. 2011; Mashal et al. 2013; Mashal et al. 2014; Mo et al. 2008; Piovan et al. 2016; Kircher et al.2005; Schneider et al. 2015; Zeev-Wolf et al. 2015). Five examined conventional and novel metaphors (Chakrabarty et al. 2014; Deamer et al. 2019; Mashal et al. 2013; Mashal et al. 2014; Zeev-Wolf et al. 2015), and two examined conventional and novel metaphors in addition to unrelated word pairs (Chakrabarty et al. 2014; Zeev-Wolf et al. 2015). Two studies found evidence for atypical left hemispheric activity during metaphor comprehension tasks (Mashal et al. 2013; Kircher et al.2005). Two studies found evidence for reduced decoding accuracy, independent of verbal IQ (Mo et al. 2008; Schneider et al. 2015). Two studies reported metaphor and irony comprehension difficulties (Mo et al. 2008; Piovan et al. 2016). Two studies found conflicting evidence for increased accuracies in the cases of novel metaphors (Schneider et al. 2015; Zeev-Wolf et al. 2015). Deamer et al. (2019) noted a tendency to select pictures that depicted metaphoric story elements represented literally. Elvevåg et al. (2011) observed an increased tendency to interpret metaphoric speech literally but also reported a general trend, across groups, for non-emotional metaphors to elicit a higher number of literal concrete responses. Kircher et al. (2005) noted increased left hemispheric activation during metaphor processing tasks that followed a literal decoding task directly and significant activation of the left and right precuneus during literal item tasks that followed a metaphor item task directly. Mashal et al. (2013) reported greater left inferior frontal gyrus, fusiform, thalamus, and visual cortical activity in the specific cases of novel metaphors. In a subsequent study, correlations between novel metaphor decoding accuracy and increased activity in the right precuneus were noted (Mashal et al. 2014). Mo et al. (2008) noted reduced comprehension accuracy for both metaphor and irony, independent of both global and verbal IQ measures. Significant performance differences between paranoid and non-paranoid schizophrenia subgroups were observed on measures of irony comprehension specifically. In addition, metaphor and irony decoding performances were found to correlate with one another. Pawełczyk et al. (2018) noted difficulties with the comprehension of humour, which is often figuration dependent. In Schneider et al. (2015), accuracy was higher for literal and meaningless phrases over metaphoric items, independent of age, education, and verbal IQ. Contrary to the findings of other studies, Zeev Wolf et al. (2015) noted increased accuracy for novel metaphors specifically independent of age and gender.

3.8 Figurative production

Five studies examined figurative production in subtype independent schizophrenia cohorts (Bilgrami et al. 2020; Billow et al. 1997; Elvevåg et al. 2011; Pawełczyk et al. 2018; Sampedro et al. 2019; Schneider et al. 2015), one of which reported significant strengths on commentary tasks (Pawełczyk et al. 2018). Bilgrami et al. reported participants in the schizophrenia and clinical high-risk groups used metaphors significantly more than healthy controls. Billow et al. (1997) noted increases in the use of autistic bizarre and tangential forms and a reduction in the use of idiomatic and evocative forms. Elvevåg et al. (2011) identified a general reduction in the use of figurative language. Pawełczyk et al. (2018) observed difficulties with the explanation of written and picture metaphor prompts. Schneider et al. (2015) reported increased uses of meaningful partly concrete and meaningful entirely concrete forms in circumstances that called for meaningful abstract forms. Sampedro et al.

(2019) noted significant differences between schizophrenia and non-psychiatric comparison groups for only some figural creativity subscales: figural abstractness of titles, figural strengths, and total figural creativity score. Significant group differences were present for all verbal creativity submeasures (i.e. verbal fluency, flexibility, and creativity). Importantly, there were no significant group differences on the remaining figural submeasures (i.e. figural originality, fluency, elaboration, flexibility, and resistance to closure).

3.9 Correlations

3.9.1 Decoding

Only four studies reported correlations between higher symptom severity and lower figuration task performance scores (Mashal et al. 2013; Piovan et al. 2016; Kircher et al. 2005; Schneider et al. 2015). Bergemann et al. (2007) observed improvements in metaphoric priming abilities following the administration of 17β Estradiol. Kircher et al. (2005) noted an inverse correlation between concretism and metaphor comprehension scores. Higher scores on measures of concretism correlated with decreased activity in the inferior frontal gyrus and cerebellum. Mashal et al. (2013) reported a link between higher 'difficulty with abstract thinking' symptom scores and greater difficulties with the decoding of conventional metaphors. Piovan et al. (2016) observed that the severity of negative symptoms correlated with metaphor decoding errors, independent of the 'difficulty with abstract thinking' symptom measure. Schneider et al. (2015) reported a correlation between the severity of FTD and decreased P200 (non-literal language processing) activity in the period directly following exposure to metaphoric items. Three studies identified correlations between comprehension task performance and IQ results (Piovan et al. 2016; Rodriguez Ferrera et al. 2001; Varge et al. 2014).

3.9.1 Production

Rodriguez Ferrera et al. (2001) identified a relationship between FTD and difficulties on one expressive (picture description) task. Expressive difficulties were also found to correlate with higher global symptom scores. Forrest et al. (1969) identified a relationship between abstract response accuracies and IQ.

A tabular summary of the above is shown in Table 4.

Table 4: tabular summary of sections 3.7--3.9

Decoding	**[subtype independent] schizophrenia**	**paranoid schizophrenia**
metaphor	comprehension difficulties (n=11) atypical left hemispheric activity during metaphor comprehension tasks (n=2) reduced decoding accuracy, independent of verbal IQ (n=2)	
novel metaphors	mixed evidence for increased accuracy (n=1:1)	
pictorial forms of metaphoric story elements	tendency toward literal representations (n=1)	
metaphoric speech	increased tendency to interpret literally (n=1)	
non-emotional metaphors	higher number of literal concrete responses (n=1)	higher number of literal concrete responses (n=1)
metaphor processing tasks that follow a literal decoding task directly	increased left hemispheric activation (n=1)	
literal item tasks that follow a metaphor item task directly	significant activation of the left and right precuneus (n=1)	
novel metaphors	greater left inferior frontal gyrus, fusiform, thalamus, and visual cortical activity (n=1) increased activity in the right precuneus (n=1) increased accuracy (n=1)	

metaphor and irony	reduced comprehension accuracy, independent of both global and verbal IQ measures (n=1)	
	performance correlated (n=1)	performance correlated (n=1)
irony	comprehension difficulties (n=2)	preserved accuracy (n=2)
humour	comprehension difficulties (n=1)	
literal and meaningless phrases, compared with metaphoric items	higher accuracy, independent of age, education, and verbal IQ (n=1)	
production	**[subtype independent] schizophrenia**	**paranoid schizophrenia**
metaphor	significantly more in speech (n=1) Difficulty explaining written and picture prompts (n=1)	
autistic bizarre and tangential forms	increased use in speech (n=1)	
idiomatic and evocative forms	reduced use in speech (n=1)	
general figurative language	reduced used in speech (n=1)	
meaningful partly-concrete and meaninful entirely-concrete forms	increased use in speech circumstances that called for meaningful abstract forms (n=1)	
verbal fluency, flexibility, and creativity	significant differences to non-psychiatric comparison (n=1)	
figural abstractness of titles , strengths, and total creativity	significant differences to non-psychiatric comparison (n=1)	preserved
figural originality, fluency, elaboration, flexibility, and resistance to closure	no significant differences to non-psychiatric comparison (n=1)	
decoding correlations	**[subtype independent] schizophrenia**	**paranoid schizophrenia**
symptom severity and lower figuration task performance	metaphoric priming abilities improved with 17β Estradiol (n=1) inverse correlation between concretism and metaphor comprehension scores (n=1)	
decreased activity in the inferior frontal gyrus and cerebellum	higher scores on measures of concretism (n=1)	
higher 'difficulty with abstract thinking' symptom scores	greater difficulties with the decoding of conventional metaphors (n=1)	
severity of negative symptoms	more metaphor decoding errors, independent of the 'difficulty with abstract thinking' symptom measure (n=1)	
severity of FTD	decreased P200 (non-literal language processing) activity in the period directly following exposure to metaphoric items (n=1)	
IQ results	comprehension task performance (n=3)	
production correlations	**[subtype independent] schizophrenia**	**paranoid schizophrenia**
expressive difficulties and formal thought disorder	one specific picture description task (n=1)	
expressive difficulties	higher global symptom scores (n=1)	
abstract response accuracy	IQ (n=1)	

4 Discussion

The results reveal the important roles of schizophrenia subtype, symptomatology, and IQ when discussing figurative language. Production performance is better in the positive syndrome; the corollary sees negative symptoms restrict creative cognition. Higher irony comprehension accuracy in paranoid schizophrenia (relative to nonparanoid), irrespective of correlations between metaphor and irony comprehension, reveals a need to study irony comprehension in nonparanoid subtypes. It is also worth noting that authors who studied irony did not distinguish between the types of irony examined. Potential further avenues include comparing linguistic, situational, and dramatic irony comprehension in paranoid and non-paranoid cohorts.

4.1 Metaphor comprehension

4.1.1 Symptomatology and metaphor type

Individuals with negative symptoms encounter metaphor comprehension difficulties. This may have to do with concretism specifically, given the inverse relationship between high concretism and low metaphor comprehension in Kircher et al. (2005). Whilst conventional metaphor decoding difficulties were found to correlate with higher scores on the 'difficulty with abstract thinking' measure (Mashal et al. 2013), general metaphor decoding difficulties were observed independent of this index (Piovan et al. 2016). Future studies could explore whether or how novel metaphors are affected by negative symptoms and whether the 'difficulty with abstract thinking' measure affects conventional metaphors only.

4.1.2 IQ and metaphor type

Preferences for literal interpretations are thought to result from an inability to inhibit first-order literal interpretations. Mashal et al. (2013)'s inverted pattern of inferior frontal gyrus activation suggests that more is happening than this alone, however. Mo et al. (2008) noted metaphor and irony comprehension difficulties independent of both global and verbal IQ but reported significant between group IQ differences. The correlation between metaphor comprehension and verbal IQ reported by Schneider et al. (2015) is more stable under appropriate matching. Robust IQ and neuropsychological matching protocols are important in studies of language in schizophrenia (Heinrichs and Zakzanis, 1998 given evidence for nuanced alterations in brain function, rather than broad structural abnormalities (Ortiz-Gil, Pomarol-Clotet, Salvador, Canales-Rodríguez, Sarro, Gomar, and McKenna, 2011). Even in the cases of those few studies whose IQ matching procedures were of good quality, mixed results were reported. Of these, greater difficulties with both unconventional and, to a subtler degree, conventional metaphors correlated with lower overall IQ in some cases (Rodriguez Ferrera et al. 2001; Varga et al. 2014) but not with verbal IQ in others (Schneider et al. 2015). Potential relationships between elements of non-verbal IQ and non-literal language processing could be explored further. There is also a need to review how studies of language in schizophrenia are designed and conducted. For example, Deamer et al.'s (2019) picture description task, whilst a valid test of metaphor comprehension, uses "incorrect" choices that may appeal to overinclusive thinking.

4.2 Figurative production

4.2.1 Expressivity and formal thought disorder

Correlations between expressional disfluencies in picture description tasks, global symptom severity, and the extent of FTD (Rodriguez Fererra, 2001) suggest more complex production interactions. Similar outputs were reported in Pawełczyk et al. (2018), although no symptom correlations were noted. An interesting line of further research involves exploring how FTD and global symptom severity relate to observed difficulties with figural abstractness of titles, figural strengths, total figural creativity score, verbal fluency, verbal flexibility, and verbal creativity and preservation of figural originality, fluency, elaboration, flexibility, and resistance to closure (Sampedro, 2019). Such an investigation may lead to a more specific definition of FTD and symptom severity and their relationship with expressional disfluency.

Whilst the production studies included here elicited natural language responses, they did so within controlled (i.e. task-dependent) contexts. Future production studies might compare post-task interview responses with interviews more akin to general conversation to see whether task contexts influence responses.

4.2.2 Expressivity and affect

Negative symptom and figurative task performance relations also raise questions about relationships between affect and creativity. This relationship may depend on task type, affect intensity, and the time window between creative affective and affective-referent states (Davis, 2009): given that a portion of the negative symptoms (e.g. anhedonia sociality) dull affective intensity. When we consider Elvevåg et al.'s (2011) observation of a group-independent link between non-emotional metaphors and literal-concrete responses and Andreasen and Powers' (1975) reports of higher creativity scores in individuals with mania, we could conceive of a study in which non-emotional and emotional metaphors are assessed from production and comprehension standpoints, with clinical and non-clinical groups and symptomatology factored into account.

4.2.3 IQ and assessment

Higher IQ correlated with the accuracy of abstract response productions in one study of good matching quality (Forrest et al. 1969); this finding is, however, restricted to the context of the instrument used, rather than that of natural interaction(s) in the broader sense. Language assessment practitioners should therefore consider their own positionality (including during the development of their measures) when assessing the linguistics of schizophrenia. As many creativity measures involve or leverage tests of executive function, working memory, and/or cognitive flexibility, known to be impaired in schizophrenia, it is worth defining creativity for the purposes of that given investigation and selecting appropriate measures on that basis.

4.2.4 Schizophrenia, mania, creative writing, and FTD

Clinicians in Andreasen's (1974) experiment viewed writing samples from mania and creative writing cohorts as more indicative of FTD in schizophrenia than FTD in schizophrenia. Within the context of our review, one potential reason for this could be that the clinicians perceived FTD as characterised by linguistic markers of verbal and figural creativity that are impacted by the negative syndrome, global symptom severity, and the presence of FTD itself. These markers are more likely to be preserved in the positive syndrome, mania cohorts, and non-psychiatric cohorts doing creative things with language. Our review suggests that FTD is more likely characterised by expressional disfluencies in specific contexts. Linguistic creativity in schizophrenia remains present but is selectively impaired by the balance of positive and negative symptoms, the presence or absence of FTD, global symptom severity, verbal IQ, and other factors requiring further study (such as affect).

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