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**IS CREATIVITY A RISK FACTOR FOR PSYCHOTIC AND CLUSTER
A PERSONALITY DISORDERS? A SYSTEMATIC REVIEW**

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Abstract

Background: creativity is an aptitude that has been suggested to be associated with the dimension of schizophrenia under an inverted U distribution: schizotypal traits could enhance creativity while the extreme of schizophrenia inhibits it.

Objective: The main objective was to investigate whether creativity could be identified as a risk factor for schizophrenia spectrum disorders and provide an updated synthesis on the relationship between the creativity variable and psychotic disorders/traits.

Methods: A systematic review was conducted with literature since 1980 and 3 databases. After a screening process of 2,743 nonduplicates, 46 articles were finally selected and analyzed focusing on the results and methodology.

Results: Although the results did not follow clear patterns and many of the associations found were neutral, certain trends could be observed. General and positive schizotypy tended to correlate more positively with creativity, while negative schizotypy and any form of schizophrenia tended to correlate more negatively.

Conclusions: Although no robust conclusions can be made due to the correlational nature of the data extracted and the absence of meta-analytic analysis, based on the findings it is suggested that a trend towards the theorized inverted U distribution has been found in the relationship between creativity and the spectrum of schizophrenia.

Key words: creativity, divergent thinking, genius, psychotic, schizotypy, schizophrenia, A cluster

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1 BACKGROUND

1.1 CREATIVITY

Creativity is an essential aptitude to foster well-being and personal and interpersonal development (Shi et al., 2018). Creativity is defined as the ability to produce something novel, original, useful, and valued, for instance in the domains of art, science or technology. It is being debated if the nature of creativity is general or domain-specific (Parnas et al, 2019a). Divergent thinking is considered a cognitive component of creativity, and although it is not an equivalent of general creativity, it is one of the main variables used to measure creativity. (Wang et al., 2018). And although divergent thinking does not guarantee creative behavior either, it has been shown that it is a variable that has a certain predictive power of creative behavior (Runco and Acar, 2012). A commonly argued limitation has to do with the evaluation of creativity. Because creativity is a complex and multidimensional aptitude, it is a frequent limitation of creativity tests that they cannot measure it totally, and only partially. Measurement of creativity with a single instrument is often a source of research bias (Sampedro et al, 2020c).

1.2 THE SCHIZOPHRENIA SPECTRUM: PSYCHOTIC DISORDERS AND TRAITS

1.2.1 Psychotic disorders

Schizophrenia is a severe mental disorder associated with symptoms like delusions, disorganized speech, hallucinations, catatonic behavior, and negative symptoms (Biedermann et al, 2016). It is suggested that schizophrenia is a result of humans' evolution, a compromise for communication, cognitive aptitudes, and creativity (Srinivasan et al., 2017).

Schizoaffective disorder meets psychotic and mood symptoms. Like schizophrenia, it tends to be a disorder with a large period of evolution, and not a cross-sectional phenomenon (Biedermann et al, 2016).

Schizophreniform disorder has been considered an unclear diagnostic, less frequent than schizophrenia and schizoaffective disorders, which lies between schizophrenia and mood disorders and sometimes is identified as an early manifestation of schizophrenia (Iancu et al, 2002).

1.2.2 Cluster A personality disorders (PD)

People with Cluster A personality disorders are usually described as eccentric and odd (American Psychiatric Association, 2013). Cluster A is conformed by schizotypal personality disorder, paranoid, and schizoid. Schizoid and paranoid are less frequent diagnosed and consequently its research is limited (Lejuez et al, 2020).

The schizotypal PD is commonly considered part of the schizophrenia spectrum, according to past research (Geng et al., 2013) and is characterized by symptoms more similar to schizophrenia positive, negative, and disorganized symptoms, but in less severe and dysfunctional levels.

Schizoid PD is more associated than schizotypal PD with some of the decreased motivation and pleasure and increased social withdrawal symptoms of schizophrenia (Lejuez et al, 2020).

Paranoid PD is associated to delusional-like persecutory beliefs and has been suggested that could be a disorder more related to delusional disorder (Lejuez et al, 2020).

1.2.3 Schizotypy

Schizotypy is a term coined by Meehl in 1962 that refers to trait dimensions analogous to the symptoms present in schizophrenia. (Holt, 2016) and it is commonly associated with some subclinical mental health issues, like sleep disturbances. (Polner et al., 2018). Has also been described as an organization of personality with liability for schizophrenia. (Lejuez et al, 2020). Even it is a concept usually used interchangeably with the schizotypal PD, people with high schizotypy does not normally meet enough criteria for the schizotypal PD diagnosis (Lejuez et al, 2020).

1.3 THE LINK BETWEEN CREATIVITY AND PSYCHOTIC DISORDERS OR TRAITS:

1.3.1 From the myth to the evidence

The Mad Genius is a recurring stereotype of contemporary cultural expression, and many famous personalities and creators have had mental disorders (Reddy et al., 2018). There has been debate since classical times about whether or not mental disorder is the price humanity pays for exceptional creativity. Research methodologies have added increasingly robust empirical data to this debate. Exceptionally creative writers have been found to suffer more from affective disorders, while studies with general population have found that people with bipolar disorder, but not schizophrenia, have exceptionally high scholastic achievement. (Hurlow & MacCabe, 2011).

The relationship between psychopathology and creativity has been a controversial study topic for decades (Parnas et al, 2019a). The biggest problem is agreeing on a definition of creativity both at a theoretical and operational level (Parnas et al., 2019b). Highly creative people have been identified as having a higher risk of developing mental disorders, such as psychotic or mood disorders (Li et al., 2016). Creativity can be related to the continuum between psychotic disorders and normality. Schizotypal traits, that is, personality traits resembling the positive, negative, disorganized and affective symptoms of schizophrenia, have been associated with creative potential and achievement in healthy populations (Bertalan & Szabolcs, 2015). Anyway, must be considered that the empirical association between psychopathology and creativity is usually correlational and fraught with suspiciously causal interpretations (Ramey & Chrysikou, 2014).

Schizotypy and creativity are commonly associated, and it has been argued that links with creativity are complex and perhaps bidirectional (Kar and Barreto, 2018; Holt, 2016). It has been suggested that the positive traits of schizotypy have a positive correlation (enhances) with creativity, while negative symptoms are negatively correlated (inhibits). In a more detailed view, positive schizotypy only seems to be significantly related to certain

skills of creativity, such as the generation of novelty. It has also been shown that other cognitive variables, such as executive functions, are relevant moderators of the association between positive schizotypy and creativity. (Holt, 2016). However, a considerable amount of null associations between these two constructs have also been reported. This heterogeneity could be due to the multidimensionality of both constructs. (Aguilera & Rodriguez-Ferreiro, 2021).

1.3.2 Previous systematic reviews

This topic research has previously explored through systematic reviews, but none of them has been found to have the same focus as in this one.

Thys et al. (2014) explored the association between creativity and general psychopathology, with the great difference that they accepted the occupation (and similar) as an operative variable of creativity. They found positive correlations between creativity and both schizotypy and bipolar disorder (to be cautiously interpreted), and also concluded that research on this topic is restricted by important methodological problems, such as the assessment of creativity.

Taylor (2017) conducted a systematic review and meta-analysis to explore links between creativity and mood disorder from distinct research approaches. They found that those relationships had different patterns according to the research approach (e.g., positive with bipolar disorder and negative with dysthymia), and concluded that those differences were due to various moderator variables and the specific creativity variable or domain assessed. They also suggested that questions of whether there is an association between general creativity and any mental disorder may be too general to find an absolute answer.

Another related article was a meta-analytic review in which was investigated the relationship between creativity and schizophrenia (Acar et al., 2017). They found that important moderators of the link were the creativity measure (this is, the operative variable) and the severity of schizophrenia. The relationship was generally negative but the greatest

negative effect sizes were found a) with verbal measures of creativity and b) at chronic and long time evolution stages of schizophrenia.

1.3.3 The Shared vulnerability model

Carson (2011) proposed the “shared vulnerability model” to explain higher risk among creative persons to develop psychopathology. This model theorizes that both creative and mentally disturbed persons share some factors such as stronger attention, cognitive disinhibition, neural hyperconnectivity and novelty generation. Carson described that those vulnerabilities could enhance creative skills when they are accompanied by “protective factors” such as superior working memory, high IQ and cognitive flexibility because creativity benefits from those factors (Acar et al., 2018). Carson's insists in “protective factors” because schizophrenia is linked with lower IQ, memory, and cognitive flexibility.

In the same line, epidemiological evidence supports common genetic determinants between psychosis spectrum populations and creative individuals. Aspects of personality may contribute to protecting the creative artist from psychosis vulnerability (Crabtree and Newton-John, 2019; Li et al., 2020), but possibly the neurodynamics of both phenomena (creativity and psychopathology) are the same (Thaler, 2016).

1.3.4 The U inverted relationship

It has been suggested and supported through evidence that the association between creativity and the schizophrenia spectrum follows an inverted-U distribution, in which milder forms of the spectrum (such as schizotypy) confer an advantage for creativity while more severe states of the spectrum (such as schizophrenia) are detrimental to creativity. According to this, the relationship with creativity would change across schizophrenia, psychotic disorders, and schizotypal disorders. (Acar et al., 2018). It has been also said that schizotypal personality disorder, a disorder falling somewhere in the middle of the spectrum, is still advantageous to creativity (Rodrigue & Perkins, 2012).

1.4 WHY IT IS IMPORTANT TO DO THIS REVIEW

The study of the relationships between creativity and clinical and sub-clinical psychopathologies is important, because it provides insight into the cognitive and behavioral correlates of creativity. (Milas & Šimunić, 2016).

Make an update about the relationship between creativity and the spectrum of schizophrenia is considered important in order to see if the actual designs and methods to research that topic are suitable, and in contrary case to promote future original studies with a more appropriate design to unscramble the ambiguity and heterogeneity of the evidence, such as cohort or case-control design.

To investigate if persons who show a high creative profile could be considerate in risk of developing a psychotic-like disorder could answer if creativity should be considered an early predictor of those disorders. If a shared vulnerability between creativity and the schizophrenia spectrum is confirmed, it could be a basis to focus on highly creative people as a risk population. In that case, it could be justified to propose primary prevention in that population. On the other hand, investigating how cognitive variables relate to different mental disorders supports dimensional diagnostic models.

2 OBJECTIVES

The main objective of this review is to investigate whether creativity can be identified as a predictor of psychotic disorders (schizophrenia, schizoaffective and schizophreniform) and/or those of A cluster personality disorders (schizoid, schizotypal and paranoid).

Other objectives are:

1. Check if the relationship between creativity and psychotic disorders is a frequent research topic and is currently being studied.
2. Determine the design and methodology of the most common studies to study this topic.

3. Provide an updated synthesis on the relationship between the creativity variable and psychotic disorders/traits.
4. Assess the methodological quality of the selected primary studies.
5. Discuss how creativity and psychotic disorders/traits are commonly assessed.

3 METHODS

3.1 CRITERIA FOR CONSIDERING STUDIES IN THE REVIEW

3.1.1 Types of studies

Original studies (empirical investigations) with cohort design (retrospective or prospective), case control and cross-sectional were accepted. Historical / historiometric / biographical studies, autoethnographies, reviews and other formats that do not correspond to empirical, original studies were rejected. Single-case studies (N=1) were also excluded.

Relationships between creativity and psychotic disorders/traits were sought even in those studies that did not have this association as their main or exclusive objective, such as genetic or neural studies, or that sought more general associations with variables such as personality factors, multiple cognitive variables, or psychopathology in general.

The fact that no type of statistical relationship was established between the predictor and the outcomes studied or the statistical information was insufficient was a reason for exclusion of the studies.

Intervention focused studies, like art therapy efficacy articles were also excluded.

The only languages accepted were English and Spanish, and publication date was limited to 1980 to coincide with DSM-III publication and use (see justification in *Types od outcomes to be predicted*).

3.1.2 Targeted population

Studies with clinical and non-clinical population (general population) were included, and participants must be 16 years or older (adult population).

There were no other exclusion criteria for other sociodemographic reasons. Studies with any type of sample or population in terms of origin, sex, gender, and years of education were accepted. The course time of the mental disorder was not a reason for exclusion either.

3.1.3 Type of predictive factor

The predictor variable studied was creativity. Creativity was operationalized in many different ways, but it was required that there be at least one standardized measure of creativity, either through batteries, scales, cognitive tasks, or self-report questionnaires. Variables that are considered components of creativity and general indices of creativity were accepted. Table 5 details the variables and instruments used as a measure of creativity in all the selected studies.

Studies were rejected if creativity was operationalized exclusively through proxy variables such as a supposedly creative occupation, education or hobbies. In case of finding studies in which creativity was operationalized in this way, but in addition there were standardized measures (scales, tasks, questionnaires), these studies were accepted but taking only the standardized measure as a variable and ignoring the results in which the variable with which outcomes are related is the non-standardized measure (e.g., as happened in O'Reilly et al, 2001). Likewise, studies were accepted in which part or all of the participants were considered creative (e.g. artists) but taking them as a general population (not clinical) and considering only the evaluated forms of creativity.

3.1.4 Types of outcomes to be predicted

Eligible health outcomes were major psychotic disorders (schizophrenia, schizoaffective, and schizophreniform) and Cluster A personality disorders

(schizotypal, schizoid, and paranoid). However, the personality trait "schizotypy" was also accepted.

As operative variables, diagnoses of the mentioned disorders carried out with DSM-III (1980), DSM-IV, DSM-5, ICD-9, ICD-10 and ICD-11 were accepted. The outcomes diagnosis were limited to these editions because they are the versions that contain all the disorders of interest in this review (previously some are missing) and because in previous editions the equivalence with the current diagnostic categories begins to blur (e.g. "schizophrenic reaction").

When there was a diagnosis, measures of positive and negative psychotic symptoms assessed with standardized, validated tools were also accepted as operational variables.

Regarding the trait of schizotypy, they were taken as operative variables measures through standardized-validated tools regarding the trait in general and/or its positive (Perceptual Aberration, Magical Ideation) and negative (Physical and Social Anhedonia) dimensions. Other dimensions of schizotypy (disorganized cognition, nonconformist impulsiveness or others) were not taken into account to observe their relationship with creativity.

Table 6 details the outcome assessment tools used by each of the selected studies.

Articles were **rejected** in the following cases:

- a) it was not specified whether the diagnosis had been performed with DSM or ICD, the version was not specified, and it could not be inferred from the information provided (e.g., specify codes, talk about Axis, etc.)
- b) the health condition was a generic, unspecified, ambiguous or obsolete label disorder (e.g. "psychotic disorder", "schizophrenic reaction", or "psychosis").
- c) The outcome was specifically "Delusional disorder" or "Brief psychotic disorder". This was decided to avoid excessive unrelated results in

- the study identification process due to confusion with other concepts that generate the terms “brief” or “delusional”.
- d) self-reported mental health states were taken as indicators of mental disorders, without confirming diagnosis or symptoms through diagnostic manuals or standardized tests.
 - e) the outcome was a measure of psychoticism.
 - f) the participants had other comorbid disorders that could affect cognitive functions and generate interaction effects with the predictor factor or the outcomes studied, whether they were:
 - i. Other psychological disorders: such as mood disorders, drug or alcohol addiction, etc.
 - ii. Neurodegenerative disorders and other medical conditions with neural involvement, such as dementia, neurosyphilis, lead poisoning, epilepsy, etc.
 - g) The participants were under the effect of substances (e.g. hallucinogens or experimental drugs), except for the medications prescribed in diagnostic cases.

3.2 SEARCH METHODS FOR IDENTIFICATION OF STUDIES

3.2.1 Electronic searches

The identification of potentially relevant studies was performed using 3 electronic databases: Web of Science (1980-present), Scopus (1980-present) and PubMed (1980-present). Search terms used were *creativ**, *divergent think** OR *genius* AND *psychotic disorder**, *schizo**, *paranoid*, *madness* OR *insan**. The language of the articles was limited to English and Spanish only. The publication date was limited to 1980 because it is the date on which the publication of the DSM-III coincides (see justification in selection criteria for the outcomes). The full search strategy as well as the results of each search and each database is available in Appendix A. Search strategy.

3.3 DATA COLLECTION

3.3.1 Selection of studies

All findings were exported to a reference manager (EndNote 20; desktop version; Windows 10). A total of 2,743 nonduplicate articles were identified and screened for eligibility based on title and abstract. Because the review has a single author and reviewer, the screening consisted of three rounds from most conservative to most restrictive, in order to limit bias. Initially, even articles that did not show abstract, DOI or other metadata in the reference manager were kept. Unavailable free full-text articles were requested to the authors. In the full-text search for eligibility, 108 articles identification data (title, authors, year, DOI, Accession Number, Type of work and reference) was exported from EndNote to a spreadsheet (Google Sheets) in a self-created template. The reasons for exclusion were registered. A total of 64 articles were selected to be included in the analysis (Figure 1).

3.3.2 Data extraction and management

Data was extracted to the same spreadsheet to which the studies for eligibility had been exported

All the data was extracted in the same spreadsheet where the 46 selected articles were listed. The data columns were previously prepared to systematically extract the same information from each article. Every article had as many rows as creativity variables measured, to extract from every study the specific relation between all creativity variables and the outcomes.

The following data was extracted from each of the selected articles and full text reviewed:

- Study design: Cross-sectional, Cohort prospective or retrospective, Case-Control.
- Sample characteristics: type and number of participants for every group, number of groups, total sample (N), mean age and country of the study.

- Measurements:
 - Outcomes measurements: Type (test or diagnosis), Variable (Schizotypy, Schizophrenia, Personality disorders or traits) and Instrument used for every outcome variable.
 - Creativity measurements: Variable (divergent thinking, creative achievement, etc.) and Instrument used for every variable.
- Creativity and outcomes relations: for every outcome identified it was extracted if it had a positive, neutral, or negative correlation with every creativity variable from every study.
- Other data not systematically extracted but only if was available and/or considered relevant, such as other variables measured (relevant for the methodological quality assessment) or potential moderators identified.

Creativity and outcomes associations were extracted if there was enough and clear statistical data, such as correlations, main effects, and differences between clinical and control groups.

It was decided to extract the association between every variable of creativity and every outcome in every study in order to respect the multidimensional nature of creativity and the schizophrenia spectrum disorders and traits.

3.3.3 Assessment of risk of bias in included studies

The assessment of the methodological quality and risk of bias in selected studies was conducted by the guidelines described in Hayden (2006) and the QUIPS tool (evolution of the guidelines) described in Hayden, et al 2013.

The 6 domains proposed by Hayden (2006; 2013) were evaluated, answering the recommended items for each of the domains. The items served as specific questions to assess each of the domains. Items were answered according to whether they were considered to pose a low, moderate, high or unsure risk, and domains were answered as low, moderate or high risk by averaging the answers in the items or considering key items.

Specifically, the domains evaluated were 1) Study Participation , 2) Study Attrition, 3) Prognostic Factor Measurement, 4) Outcome Measurement, 5) Study Confounding, 6) Statistical Analysis and Reporting.

The evaluation was carried out with a self-created tool in a spreadsheet based on the QUIPS tool, with predefined columns to record the answers in each domain and in each item of each domain.

4 RESULTS

4.1 RESULTS OF THE SEARCH

From the 3 databases selected 2,743 nonduplicate articles were identified. After the screening process based on title/abstract, 2,630 were rejected and 108 accepted for full-text review. From the 2,630 articles rejected, the main reason to rejection was that they were clearly unrelated to the inclusion criteria (2,420). After this the rejection reasons were not being an empirical research (177), ineligible format (e.g., ineligible language not properly filtered in the database search), not having enough information available (not finding abstract, DOI or full text in the reference manager or searching online) and 3 duplicated data not detected by reference manager. 5 full-text articles selected for eligibility were unavailable. Of the 108 articles reviewed in full text, 62 were rejected due to stricter criteria such as ineligible operative variables, population not accepted or not providing enough statistical information. Finally, 46 studies were selected to extract the pertinent information and evaluate their methodological quality. Figure 1 shows the described process.

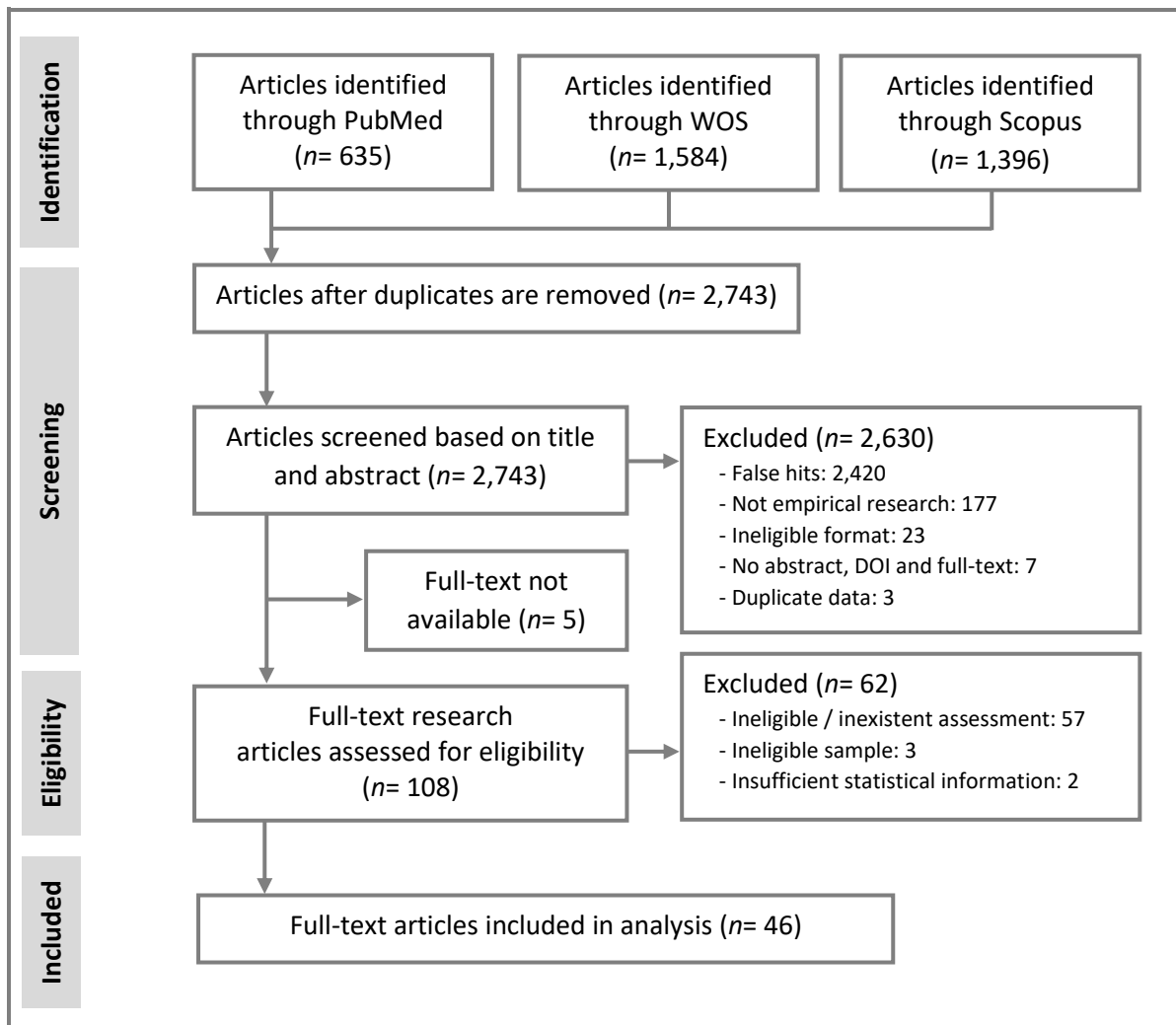


Figure 1. Flow diagram of study selection.

All selected studies were cross-sectional (transversal). There wasn't found any longitudinal (prospective or retrospective) study according to selection criteria.

Table 1 describes some main characteristics of the selected studies. *Sample type* refers to whether the samples were general population ("population") or a clinical group without a control group ("non-comparative"). The "comparative" label refers to the fact that the groups were divided between a clinical sample vs. healthy controls, or between non-clinical participants with high vs. low schizotypy. The oldest article was from 1988, the maximum number of groups was 4 (only in one case). General population used to be university students (psychology students many times) which explains why so many studies have a mean age around

20. Total N sample and country of the study were varied between the studies.

Table 1. Selected studies characteristics

	Sample type	Groups	N total sample	Mean age	Country of the study
<i>Abraham and Windmann (2008)</i>	Comparative	2	31	24.19	Germany
<i>Abraham, et al. (2007)</i>	Comparative	2	46	41.09	UK
<i>Aguilera and Rodriguez-Ferreiro (2021)</i>	Population	1	154	23.1	Spain
<i>Ahmetoglu, et al. (2016)</i>	Population	1	1659	N/A	UK
<i>Armstrong (2012)</i>	Population	1	114	22	Canada
<i>Baas, et al. (2020)</i>	Population	1	826	20.12	Netherlands
<i>Batey and Furnham (2008)</i>	Population	1	140	18.96	UK
<i>Batey and Furnham (2009)</i>	Population	1	85	19.2	UK
<i>Claridge and Blakey (2009)</i>	Population	1	152	19.79	USA
<i>Claridge and McDonald (2009)</i>	Population	1	78	22.3	UK
<i>Cox and Leon (1999)</i>	Population	1	77	20.7	UK
<i>Folley and Park (2005)</i>	Population	1	116	18.74	USA
<i>Furnham (2015)</i>	Comparative	3	51	32.5	USA
<i>Green and Williams (1999)</i>	Population	1	5337	40.07	UK
<i>Gross, et al. (2019)</i>	Population	1	72	26	Australia
<i>Jacquet, et al. (2020)</i>	Population	1	96	19.1	USA

<i>Jaracz, et al. (2012)</i>	Comparative	2	411	21.17	France
<i>Jones, et al. (2011)</i>	Comparative	2	88	35.5	Poland
<i>Kinney, et al. (2000)</i>	Comparative	2	64	25.14	UK
<i>LeBoutillier, et al. (2014)</i>	Comparative	2	78	33.8	Denmark
<i>LeBoutillier, et al. (2016)</i>	Population	1	133	21	UK
<i>MacPherson and Kelly (2011)</i>	Population	1	203	22.44	UK
<i>Mavrogiorgou, et al. (2021)</i>	Comparative	2	415	28.85	Multiple (online)
<i>Michalica and Hunt (2013)</i>	Comparative	3	50	44.7	Germany
<i>Nelson and Rawlings (2010)</i>	Comparative	4	174	43.1	Canada
<i>Nemoto, et al. (2005)</i>	Population	1	100	34.69	Australia
<i>Nemoto, et al. (2007)</i>	Comparative	2	52	29.6	Japan
<i>O'Reilly, et al. (2001)</i>	Comparative	2	72	30.02	Japan
<i>Poreh, et al. (1993)</i>	Comparative	2	100	22.5	UK
<i>Rodrigue and Perkins (2012)</i>	Comparative	2	85	19.3	Michigan
<i>Rubinstein (2008)</i>	Comparative	3	82	27.8	USA
<i>Rust, et al. (1989)</i>	Comparative	3	170	29	Israel
<i>Sampedro, et al. (2020a)</i>	Population	1	80	21.4	UK
<i>Sampedro, et al. (2020b)</i>	Comparative	2	90	41.58	Spain
<i>Schuldberg (1990)</i>	Non-comparative	1	119	41.55	Spain
<i>Schuldberg, et al. (1988)</i>	Population	1	625	21.4	USA
<i>Son, et al. (2015)</i>	Comparative	2	117	21.8	USA
<i>Stanciu and Papasteri (2018)</i>	Comparative	2	79	37.37	Japan

<i>Wang, et al. (2017)</i>	Population	1	229	21.07	Romania
<i>Wang, et al. (2018)</i>	Population	1	180	26.48	UK
<i>Winston, et al. (2014)</i>	Comparative	3	117	20.5	China
<i>Yamaoka and Yukawa (2020)</i>	Comparative	2	78	21.6	China
<i>Zabelina, et al. (2014)</i>	Population	1	130	33.42	India
<i>Zanes, et al. (1998)</i>	Population	1	865	18.99	Japan

One last note on the characteristics of the studies is that it was observed that the number of studies identified under the selection criteria had followed an increasing trend over time since 1980, as can be seen in Figure 3. Anecdotally, it was noted that the studies published before 1995 were reduced in those in which the schizotypy trait was used as a variable, which was related to the fact that the O-LIFE test (the most used test to measure schizotypy) was published that same year.

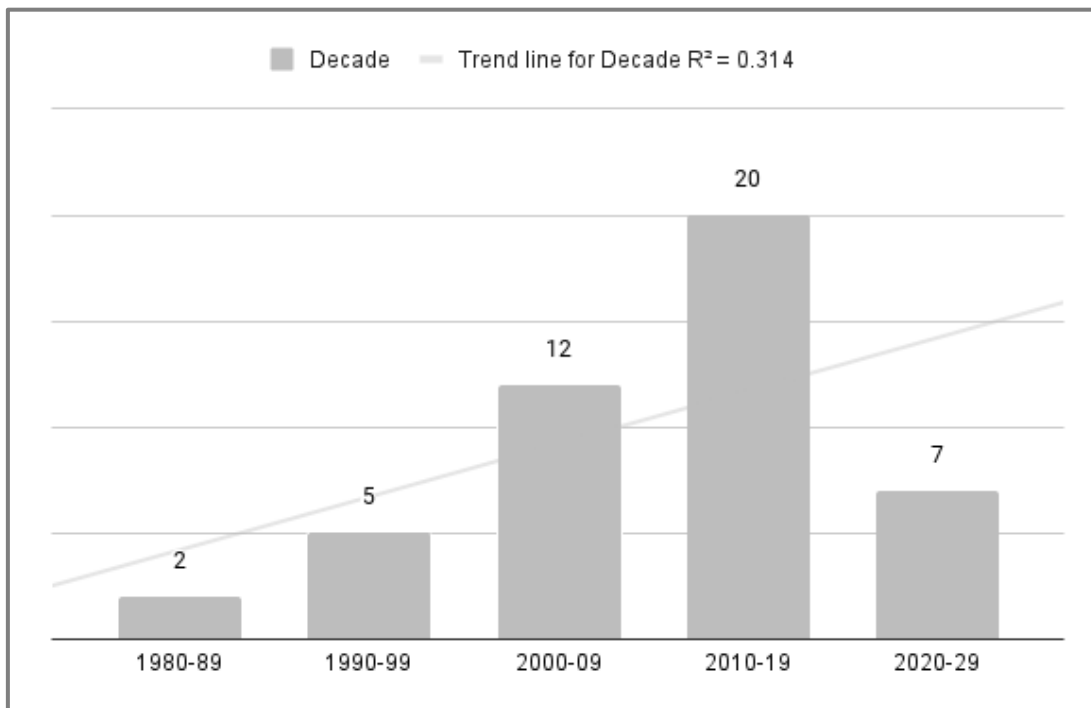


Figure 2. Number of selected studies according to publication decade

4.2 RISK OF BIAS ASSESSMENT OF INCLUDED STUDIES

The main reasons to consider risk of bias in "study participation" was that not enough descriptions of their characteristics or their selection process were provided, or that no type of selection criteria was established. The risk of bias domain "study attrition" was low for all the selected articles, but this is considered to be mainly because there were no longitudinal studies, they were all cross-sectional. It was decided to keep this bias assessment domain because some of these studies, despite being considered cross-sectional, had several phases that took place at different times, so attrition was a possibility. Risk of bias in "prognostic factor measurement" and "outcome measurement" it was considered mainly for using few or partial measures of the variables, and the biases in "statistical analysis and reporting" were judged mainly by showing selective data or scarce statistical information (although enough not to rule it out by exclusion criteria). "Study confounding" was the domain in which the most biases were judged, mainly due to the fact that few or no potentially modulating variables of the association between predictor and outcomes were considered (e.g. cognitive variables such as executive functions or differences in the time of evolution and onset of schizophrenia).

Figure 4 shows the overall risk of bias judgement according to QUIPS tool (Hayden et al, 2013) and Table 4 shows the judgment of every selected study.

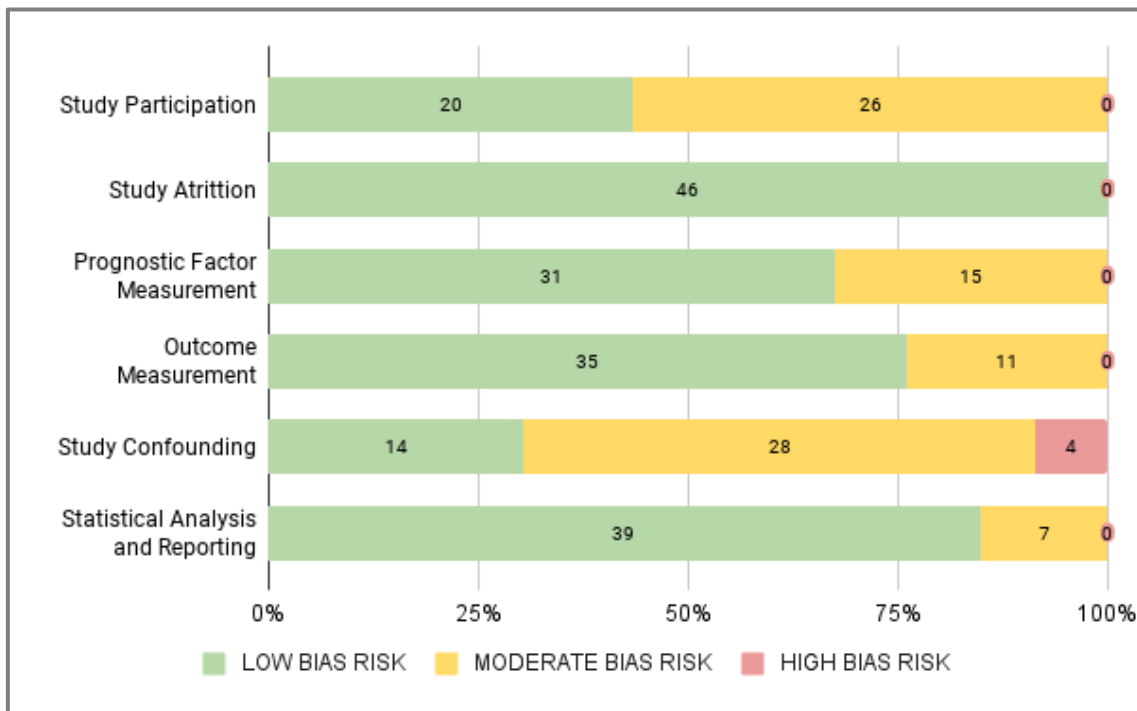


Figure 3. Overall risk of bias according to QUIPS.

Table 2. Risk of bias according to QUIPS tool

	Bias domains						Overall Risk of Bias
	Study Participation	Study Attrition	Prognostic Factor Measurement	Outcome Measurement	Study Confounding	Statistical Analysis and Reporting	
<i>Abraham and Windmann (2008)</i>	?	+	+	+	?	?	?
<i>Abraham, et al. (2007)</i>	+	+	+	+	+	+	+
<i>Aguilera and Rodriguez-Ferreiro (2021)</i>	?	+	?	+	x	+	?
<i>Ahmetoglu, et al. (2016)</i>	?	+	+	?	?	+	?
<i>Armstrong (2012)</i>	?	+	+	+	?	+	+
<i>Baas, et al. (2020)</i>	?	+	?	+	?	+	?

<i>Batey and Furnham (2008)</i>	?	+	+	+	?	+	+
<i>Batey and Furnham (2009)</i>	?	+	+	+	?	+	+
<i>Carter, et al. (2019)</i>	?	+	+	+	?	+	+
<i>Claridge and Blakey (2009)</i>	?	+	+	+	?	+	+
<i>Claridge and McDonald (2009)</i>	?	+	+	+	?	+	+
<i>Cox and Leon (1999)</i>	?	+	+	?	×	+	?
<i>Folley and Park (2005)</i>	+	+	?	+	+	?	+
<i>Furnham (2015)</i>	+	+	+	?	?	+	+
<i>Green and Williams (1999)</i>	?	+	+	+	?	+	+
<i>Gross, et al. (2019)</i>	?	+	+	?	?	+	?
<i>Jacquet, et al. (2020)</i>	?	+	+	+	?	?	?
<i>Jaracz, et al. (2012)</i>	+	+	+	+	+	?	+
<i>Jones, et al. (2011)</i>	+	+	+	+	?	?	+
<i>Kinney, et al. (2000)</i>	+	+	?	+	+	+	+
<i>LeBoutillier, et al. (2014)</i>	?	+	+	+	×	+	?
<i>LeBoutillier, et al. (2016)</i>	?	+	?	+	?	+	?
<i>MacPherson and Kelly (2011)</i>	+	+	?	+	?	+	+
<i>Mavrogiorgou, et al. (2021)</i>	+	+	?	+	?	+	+
<i>Michalica and Hunt (2013)</i>	?	+	?	+	?	?	?
<i>Nelson and Rawlings (2010)</i>	+	+	?	+	?	+	+
<i>Nemoto, et al. (2005)</i>	+	+	+	+	+	+	+
<i>Nemoto, et al. (2007)</i>	+	+	+	+	+	+	+
<i>O'Reilly, et al. (2001)</i>	?	+	+	+	?	+	+

<i>Poreh, et al. (1993)</i>	+	+	+	?	?	?	?
<i>Rodrigue and Perkins (2012)</i>	+	+	?	?	?	+	?
<i>Rubinstein (2008)</i>	?	+	?	?	?	?	?
<i>Rust, et al. (1989)</i>	?	+	+	?	?	+	?
<i>Sampedro, et al. (2020a)</i>	+	+	+	+	+	+	+
<i>Sampedro, et al. (2020b)</i>	?	+	+	+	+	+	+
<i>Schuldberg (1990)</i>	?	+	?	+	+	+	+
<i>Schuldberg, et al. (1988)</i>	+	+	+	?	?	+	+
<i>Son, et al. (2015)</i>	+	+	+	+	?	+	+
<i>Stanciu and Papasteri (2018)</i>	?	+	?	+	?	+	?
<i>von Stumm and Scott (2019)</i>	?	+	+	+	+	+	+
<i>Wang, et al. (2017)</i>	+	+	+	?	+	+	+
<i>Wang, et al. (2018)</i>	+	+	+	+	+	+	+
<i>Winston, et al. (2014)</i>	?	+	+	+	+	+	+
<i>Yamaoka and Yukawa (2020)</i>	+	+	?	+	+	+	+
<i>Zabelina, et al. (2014)</i>	+	+	+	+	?	+	+
<i>Zanes, et al. (1998)</i>	?	+	?	?	×	+	?

Judgement: + = Low risk of bias, ? = Moderate risk of bias, × = High risk of bias

4.3 FINDINGS

4.3.1 Relationships between creativity and psychotic disorders/traits

Table 3 shows the main findings extracted from the selected studies. It is shown the number of studies that found at least one positive, neutral or negative relation between a measure of creativity and one of the found outcomes.

Of the 46 studies analyzed, 34 measured the relationship between some variable of creativity and schizotypy, 14 with schizophrenia and 3 with personality disorders from cluster A. It should be considered that some studies measured more than one outcome and more than one creativity variable. No studies were found that measured other psychotic disorders according to the selection criteria.

Table 3. Traits/Disorders and number of studies that found positive, neutral, or negative relationships with creativity.

	Schizotypy traits n = 34			Schizophrenia n = 14			A Cluster PD n = 3		
	General	(+) traits	(-) traits	General	(+) SY	(-) SY	Schizotypal	Schizoid	Paranoid
<i>Population studies</i>									
Positive	3 (8.6%)	9 (25.7%)	2 (5.7%)	-	-	-	1 (33.3%)	-	-
Neutral	4 (11.4%)	13 (37.1%)	12 (34.3%)	-	-	-	-	1 (33.3%)	1 (33.3%)
Negative	1 (2.9%)	1 (2.9%)	8 (22.9%)	-	-	-	1 (33.3%)	1 (33.3%)	1 (33.3%)
<i>Comparative studies</i>									
Positive	8 (22.9%)	14 (40%)	-	-	-	-	1 (33.3%)	1 (33.3%)	-
Neutral	5 (14.3%)	3 (8.6%)	3 (8.6%)	9 (64.3%)	1 (7.1%)	1 (7.1%)	-	-	-
Negative	1 (2.9%)	-	-	10 (71.4%)	-	1 (7.1%)	-	-	-
<i>Noncomparative studies</i>									
Positive	-	-	-	-	-	-	-	-	-
Neutral	-	-	-	1 (7.1%)	1 (7.1%)	-	-	-	-
Negative	-	-	-	-	-	1 (7.1%)	-	-	-
<i>Total</i>									
Positive	11 (31.4%)	23 (65.7%)	2 (5.7%)	-	-	-	2 (66.7%)	1 (33.3%)	-
Neutral	9 (25.7%)	16 (45.7%)	15 (42.9%)	10 (71.4%)	2 (14.3%)	1 (7.1%)	-	1 (33.3%)	1 (33.3%)
Negative	2 (5.7%)	1 (2.9%)	8 (22.9%)	10 (71.4%)	-	2 (14.3%)	1 (33.3%)	1 (33.3%)	1 (33.3%)

SY = symptoms, PD = Personality Disorders

It has been found that most of the relationships found between variables of creativity and general schizotypy are positive (31.4%) or neutral (25.75%). The same pattern has been found with positive schizotypy, but in the case of negative schizotypy the relations are usually neutral (42.9%) or negative (22.9%).

No positive relationship has been found between schizophrenia and creativity. The same number of studies (71.4%) have been found reporting neutral and negative relationships with general schizophrenia (diagnosis). The studies that measured schizophrenia positive and symptoms were insufficient to describe a pattern, although in none of the cases the relationship with creativity is positive.

The number of studies that measure personality disorder as outcomes are also insufficient to describe any pattern.

For a more detailed view of the findings and in order to attend the multidimensional nature of creativity, Table 4 shows the findings of all the associations (positive, neutral or negative) of the 62 studies that observed the relationship between variables of creativity and schizotypy (n=34) or schizophrenia (n=14). The data must be considered taking into account that most studies measured and related with the outcomes several variables of creativity.

Table 4. Schizotypy/Schizophrenia and number of results that found positive, neutral or negative correlation with different creativity variables.

	Schizotypy traits			Schizophrenia		
	General	(+) traits	(-) traits	General	(+) SY	(-) SY
Divergent thinking (DT)						
Positive	9	8	1	-	-	-
Neutral	5	18	12	8	3	1
Negative	1	-	5	11	-	2
Constraining examples						
Positive	1	-	-	-	-	-
Neutral	-	-	-	1	-	-
Negative	-	-	-	-	-	-
Conceptual expansion						
Positive	1	-	-	-	-	-
Neutral	1	-	-	-	-	-
Negative	-	-	-	1	-	-
Creative imagery						
Positive	-	1	1	-	-	-
Neutral	1	1	1	-	-	-
Negative	-	-	-	1	-	-
Convergent thinking (CT)						
Positive	-	-	-	-	-	-
Neutral	2	5	3	-	-	-
Negative	1	1	2	3	-	-
Verbal fluency						
Positive	-	-	-	-	-	-
Neutral	-	2	-	-	1	-
Negative	-	-	1	1	-	1
Other cognitive						
Positive	-	-	-	-	-	-

Neutral	1	1	2	1	-	-
Negative	-	-	-	1	-	-
Personality / Traits						
Positive	1	6	-	-	-	-
Neutral	-	6	4	-	-	-
Negative	-	-	3	-	-	-
Achievement / Behavior						
Positive	1	5	-	-	-	-
Neutral	1	2	4	1	-	-
Negative	-	-	2	1	-	-
Phenomenological						
Positive	-	1	-	-	-	-
Neutral	-	-	-	-	-	-
Negative	-	-	-	-	-	-
Total						
Positive	13	22	2	-	-	-
Neutral	11	35	26	11	4	1
Negative	2	1	13	19	-	3

SY = symptoms

The associations between schizotypy and divergent thinking are heterogeneous, although it can be said that in most cases the relationship is neutral or positive with general schizotypy and positive schizotypy and is neutral or negative with negative schizotypy. In case of schizophrenia associations are generally negative or neutral.

Creative personality and creative achievement shows a similar pattern of associations with schizotypy, this is mostly neutral or positive relationships with general and positive schizotypy, and neutral or negative links with negative schizotypy. Those creativity variables have been scarcely studied in relation to schizophrenia.

Convergent thinking generally has a non-significant correlation with schizotypy and in the rest of the results the relationship is negative. With schizophrenia it has only been related in 3 cases and in a negative way.

The rest of the creativity variables have diffuse and few individual results to consider patterns.

4.3.2 Creativity and outcomes assessing tools

The most evaluated operational variable of creativity is divergent thinking. The problem is that this variable is actually a category of variables, within which one can distinguish (and not always do) verbal or figural forms, novelty, usefulness, originality and other variations. Another important part of studies use instruments that focus on creative achievement and personality. Test batteries tend to measure divergent thinking or general indices of creativity. Other variables of creativity are measured in a minority, such as conceptual expansion. In general, the measures are very heterogeneous and many times it cannot be ensured that they measure the same, since the same terms are not always used to refer to the variables (e.g., sometimes DT is measured in general and other times a subdomain is specified, but not always those specifications use the same terms).

Table 5. Creativity measurements used in analyzed studies

Category	Test type	References	
Cognitive creativity	Battery tests	TTCT (Torrance Test of Creative Thinking)	Armstrong (2012) Gross, et al. (2019) Mavrogiorgou, et al. (2021) O'Reilly, et al. (2001) Poreh, et al. (1993) Sampedro, et al. (2020) Wang, et al. (2017)
		WKCT (Wallach-Kogan Creativity Tests)	Carter, et al. (2019) Claridge and Blakey (2009) Claridge and McDonald (2009) Green and Williams (1999) Winston, et al. (2014)
		ATTA (Abbreviated Torrance test for adults)	Rodrigue and Perkins (2012) Zabelina, et al. (2014)
		RISC (Rust Inventory of Schizotypal Cognitions)	Rust, et al. (1989)
	Divergent thinking (DT)	Alternate Uses	Abraham, et al. (2007) Baas, et al. (2020)

		Batey and Furnham (2009)
		Claridge and Blakey (2009)
		Cox and Leon (1999)
		Folley and Park (2005)
		Jones, et al. (2011)
		LeBoutillier, et al. (2016)
		Rubinstein (2008)
		Schuldberg (1990)
		Schuldberg, et al. (1988)
		von Stumm and Scott (2019)
		Wang, et al. (2017)
		Wang, et al. (2018)
		Yamaoka and Yukawa (2020)
	Idea Fluency	Ahmetoglu, et al. (2016)
		Batey and Furnham (2009)
		Furnham (2015)
		Nemoto, et al. (2005)
		Nemoto, et al. (2005)
		Nemoto, et al. (2007)
		Son, et al. (2015)
	Design Fluency	Nemoto, et al. (2005)
		Nemoto, et al. (2007)
		Son, et al. (2015)
	CAT (Consensual Assessment Technique)	Batey and Furnham (2009)
Verbal Creativity	Word Fluency	Batey and Furnham (2009)
		Nemoto, et al. (2007)
	Verbal Fluency	Son, et al. (2015)
Convergent thinking (CT) / Insight / Associational	CPS (Creative Problem Solving)	Abraham, et al. (2007)
		Armstrong (2012)
		Claridge and McDonald (2009)
		Stanciu and Papasteri (2018)
		Wang, et al. (2017)
	RAT (Remote Associates Test)	Armstrong (2012)

Self-Reported			Folley and Park (2005) Jones, et al. (2011) Schuldberg (1990) Zanes, et al. (1998)
	Other cognitive	Creative imagery	Abraham and Windmann (2008) Abraham, et al. (2007) LeBoutillier, et al. (2014) LeBoutillier, et al. (2016)
		Conceptual expansion	Abraham and Windmann (2008) Abraham, et al. (2007) Wang, et al. (2018)
		Constraints of examples	Abraham and Windmann (2008) Abraham, et al. (2007)
		BWAS (Barron-Welsh Art Scale)	Jaracz, et al. (2012)
		RAS (Revised Art Scale)	Schuldberg, et al. (1988) Cox and Leon (1999) Schuldberg (1990)
		CPAC (Cognitive Processes Associated with Creativity)	Jacquet, et al. (2020)
		Inventiveness from BIS (Berlin Intelligence Structure Test)	Jaracz, et al. (2012)
		Symbolic Equivalence Test (SET) (Barron, 1988)	LeBoutillier, et al. (2014)
		Creative achievement / behavior	Baas, et al. (2020)
		CAQ (Creative achievement questionnaire)	Carter, et al. (2019) Zabelina, et al. (2014)
		CBI (Creative Behavior Inventory)	Aguilera and Rodriguez-Ferreiro (2021)
		CBI (Creative Behavior Inventory)	Gross, et al. (2019)
		Janssen Creativity Scale	Baas, et al. (2020)
	BICB (Biographical Inventory of Creative Behaviours)	Batey and Furnham (2008)	
	LCS (Lifetime Creativity Scales)	Kinney, et al. (2000)	
	Others	Michalica and Hunt (2013)	

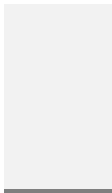
Creative personality / traits	ACL: CPS (Creative personality scale from the Adjective Check List)	Aguilera and Rodriguez-Ferreiro (2021) Batey and Furnham (2008) MacPherson and Kelly (2011) Schuldberg (1990) Schuldberg, et al. (1988) Schuldberg, et al. (1988)
	How Do You Think	Cox and Leon (1999) Schuldberg (1990) Schuldberg, et al. (1988)
	10-point Likerttype scale (Batey, 2007).	Batey and Furnham (2008)
	CSQ (Creativity Styles Questionnaire)	Claridge and Blakey (2009)
	CPI (Creative Personality Inventory)	Gross, et al. (2019)
	ECCII (Epstein Creativity Competencies Inventory for Individuals)	Jacquet, et al. (2020)
	RIBS (Runco Ideation Behavior Scale)	von Stumm and Scott (2019)
Phenomenological	Experience of Creativity Questionnaire.	Nelson and Rawlings (2010)

Outcome measures do not appear to be as biased by the problems with the creativity measures, at least not when exclusion criteria are specified to limit these biases. In the selected studies, the main measures of schizophrenia are diagnoses using DSM or ICD with categories considered equivalent (1980 onwards). Schizotypy is usually measured with the O-LIFE test, and its general measurements or those of the positive and negative dimensions are usually considered equivalent between the different tests. However, not all tests coincide in measuring the same other dimensions (such as impulsive nonconformity or disorganized cognition). A final problem to comment on is that terms and instruments for schizotypy and schizotypal personality disorder are often confused or used interchangeably.

Table 6. Outcomes assessing tools used in selected studies.

Type	Target	Instrument	Reference
Diagnosis	Mental disorders	DSM-5	Wang, et al. (2017)
		DSM-IV	Abraham, et al. (2007) Folley and Park (2005) Jaracz, et al. (2012) Mavrogiorgou, et al. (2021) Rodrigue and Perkins (2012) Rubinstein (2008) Sampedro, et al. (2020)
		DSM-III	Kinney, et al. (2000)
		ICD-10	Nemoto, et al. (2005) Nemoto, et al. (2007)
		ICD-11	Mavrogiorgou, et al. (2021)
Psychometric	PD traits	FFM PD (Five-Factor Model to assess personality disorders) HDS (Hogan Development Survey)	Ahmetoglu, et al. (2016) Furnham (2015)
	Psychotic symptoms	PANSS (Positive and Negative Syndrome Scale)	Sampedro, et al. (2020) Wang, et al. (2017)
		CASH (Comprehensive Assessment of Symptoms and History)	Abraham, et al. (2007) Folley and Park (2005)
		BNSS (Brief Negative Symptom Scale)	Sampedro, et al. (2020)
Schizotypal traits	O-LIFE (Oxford-Liverpool Inventory of Feelings and Experiences)	Baas, et al. (2020) Batey and Furnham (2008) Batey and Furnham (2009) Claridge and Blakey (2009) Claridge and McDonald (2009) LeBoutillier, et al. (2014) MacPherson and Kelly (2011) Michalica and Hunt (2013)	

	Nelson and Rawlings (2010)
	O'Reilly, et al. (2001)
	Stanciu and Papasteri (2018)
	von Stumm and Scott (2019)
Shortened O-LIFE (Oxford-Liverpool Inventory of Feelings and Experiences)	LeBoutillier, et al. (2016)
	Winston, et al. (2014)
SPQ (Schizotypal Personality Questionnaire)	Abraham and Windmann (2008)
	Carter, et al. (2019)
	Jones, et al. (2011)
	Wang, et al. (2017)
	Wang, et al. (2018)
SPQ-B (Schizotypal Personality Questionnaire-Brief)	Jacquet, et al. (2020)
	Yamaoka and Yukawa (2020)
STA (Schizotypal Personality Scale)	Folley and Park (2005)
	Green and Williams (1999)
	Poreh, et al. (1993)
	Zabelina, et al. (2014)
	Zanes, et al. (1998)
Schizotypal Scale (S scale) of the Millon Clinical Multiaxial Inventory-III (MCMII-III).	Rodrigue and Perkins (2012)
ESQUIZO-Q (The Oviedo Schizotypy Assessment Questionnaire-Abbreviated)	Aguilera and Rodriguez-Ferreiro (2021)
MI (Magical Ideation) Scale	Armstrong (2012)
	Gross, et al. (2019)
	Poreh, et al. (1993)
	Schuldberg (1990)
PA (Perceptual Aberration) Scale	Armstrong (2012)
	Poreh, et al. (1993)
	Schuldberg (1990)
PhA (Physical Anhedonia) Scale	Armstrong (2012)
	Schuldberg (1990)
	Schuldberg, et al. (1988)
	Son, et al. (2015)



RSAS (Revised Social Anhedonia Scale)

Armstrong (2012)

Cox and Leon (1999)

Rust Inventory of Schizotypal Cognitions

Rust, et al. (1989)

5 DISCUSSION

5.1 SUMMARY AND CONCLUSIONS

The main objective of this review was to investigate whether creativity was identifiable as a predictor of schizophrenia spectrum disorders. Given that all the studies that were selected were of observational and cross-sectional design, it is not possible to make statements about causal relationships, nor to outline in which direction the variables are related. It is only considered possible to offer descriptive and qualitative evidence.

Although many of the observed relationships are null, positive relationships with creativity tend to be concentrated in general schizotypy and positive schizotypy, while negative correlations tend to be concentrated in negative schizotypy and any measure of schizophrenia. These findings are consistent with Holt (2016) and Acar et al., (2018).

When looking at relationships specifically with divergent thinking, many null relationships are seen, but the pattern persists: more positive relationships with general schizotypy and positive schizotypy, and more negative relationships with negative schizotypy and any measure of schizophrenia.

The fact that trends are observed that are in line with what is suggested by the theorized inverted U distribution raises the question as to why the relationship is neutral vs. positive in some cases, and neutral vs. negative in other cases. The answer could lie in relationships with specific subdomains of divergent thinking, as suggested by Taylor (2017).

In other words, significant relationships (positive or negative) may occur specifically with very specific forms of creativity, such as verbal creativity, or with the components of originality or design.

Another possible explanation is that what determines the significance of the relationships are modulating variables that are closely related or necessary in creative performance, as suggested by Acar et al. (2017).

In this sense, it should be noted that convergent thinking, a variable that is not an indicator of creativity by itself, but is usually considered necessary in the creative process, shows generally neutral relationships with general and positive schizotypy, half-half neutral and negative relationships with negative schizotypy, and only negative with schizophrenia. Although there are few measures of this variable across the studies, it is not misguided with respect to what was proposed by Holt (2016). In other words, it may be one of the variables for which a minimum level (a normative one) is required, but a lower level could partially explain the deficits in creativity variables, such as divergent thinking. Suggested in another way, if divergent thinking does not find minimal support from convergent thinking, what could be considered ends up being expressed as chaos and eccentricity.

Regarding the measures of creative achievement and personality, the results are very diffuse. It should be noted that different instruments were also used for each of these variables, which probably reveals the previously mentioned aspect of inequivalence of the measures, in addition to the effects of moderating variables, such as the severity of the traits / disorder or the preservation of executive functions (Acar et al., 2017; Holt, 2016)

Regarding the rest of creativity variables, there are few individual measures.

Through the identification and selection of articles for this systematic review, it has been possible to verify that the study of the relationship between creativity and the spectrum of schizophrenia is a frequent topic of research, although it should be noted that most of it corresponds to studies on schizotypy and secondly schizophrenia. The relationship with cluster A personality disorders is less studied and is overshadowed, replaced and confused with the study of schizotypy. As illustrated in Figure 3, the number of studies on this research topic of this review has been gradually increasing and seems to currently maintain an increasing trend.

As already mentioned, the most common study design is the cross-sectional one, and regarding the type of population, it is usually a non-clinical general population. Although most studies use standardized or behavioral measures of creativity, other forms of research on this topic are gaining ground, such as studies linking creativity to psychopathology through genetic and neural measures (Crabtree and Newton-John, 2019; Li et al., 2020).

It is considered that it has been possible to provide an updated synthesis about the relationship between creativity and psychotic disorders / traits, and this relationship also seems to support the inverted U distribution, since the findings show that creativity is usually unaffected or favored (but not impaired) in the range of schizotypy, whereas in schizophrenia it tends to be unaffected or reduced (but not enhanced), consistent with other findings, like Acar et al., (2018).

Assessing the methodological quality of the selected primary studies has also been possible, identifying that the most judged source of bias is "study confounding", since although it has been suggested that the relationship between creativity and psychopathology depends on moderating cognitive variables (Holt, 2016), there are still many primary studies that do not control enough potential moderating variables.

Finally, how creativity and psychotic disorders/traits are commonly assessed can be shown in Table 5 for creativity and Table 6 for the outcomes. In creativity case, it can be seen that it has been measured in many ways in the 46 selected studies across many different variables that cannot be claimed to be equivalent (Sampedro et al, 2020c). However, despite the heterogeneity of the results, a similar pattern was observed in the main variables measured (divergent thinking, creative personality, and creative behavior), with a tendency to support the inverted U model and to correlate more positively with positive schizotypy and more negatively with negative schizotypy (Holt, 2016).

Thus, all the objectives planned at the beginning of this revision have been answered.

5.2 STRENGTHS AND WEAKNESSES OF THE REVIEW

5.2.1 Strengths

Are considered main strengths of this systematic review:

- a) the establishment and application of criteria for the selection of studies that has allowed limiting the presence of bias in the selected studies (considering the controversial research topic) as can be seen in Figure 4.
- b) the extraction and synthesis of the data, focused from the beginning on extracting the correlations between each outcome and all the variables measured in each study, with the aim of being able to show evidence for different variables of creativity, as can be seen in Table 6. This is considered a strength because is a topic of debate if the nature of creativity is general or domain-specific (Parnas et al, 2019a) and “general creativity” considered with a single instrument is often a source of research bias (Sampedro et al, 2020c).
- c) offer detailed evidence on the positive and negative dimensions of schizotypy, as well as the positive and negative symptoms of schizophrenia, in relation to creativity. In this way, it has been possible to observe the pattern previously mentioned and supported by Holt (2016).

5.2.2 Limitations

One of the main limitations of this review has been not integrating information on possible moderating variables of the interaction between creativity and outcomes (e.g., executive functions, intelligence, time of evolution/onset of disorders, severity or other cognitive functions). This was limited in part because many studies do not measure potentially moderating variables or do not provide robust data because it is still an underexplored research topic.

Another main limitation has been that there is a lack of consensus on definitions and measures of creativity. Even when they are supposed to measure the same variable (e.g. divergent thinking), different terms are

used to name it or its subcomponents. This generates a tendency to cluster variables even when it cannot be said that they are equivalent (Sampedro et al, 2020c). Although it has been considered a strength of this systematic review to be able to identify relationships between creativity and different operative variables of creativity used in the selected studies, it is considered a limitation, especially in the case of studies that measure divergent thinking, the difficulties mentioned in being able to dis-cluster the subdomains of this variable and observe specific relationships with creativity.

Creative performance as an operative variable of creativity is certainly controversial, due to aspects such as the fact that it depends on participant's age and experience (McDonald, 2021). This is a factor to be taken into account because many studies used samples from a young population (e.g., university students). Cognitive creativity is expected to remain even if the characteristics of the person's environment do not allow him to translate his aptitude into creative products.

This review has also been unable to establish any causal relationship or suggest in which direction the variables are influenced, mainly due to the design of most of the original studies.

5.3 IMPLICATIONS FOR RESEARCH

Further longitudinal design studies are required to suggest more robust predictor-outcome relationships. Perhaps these studies could be achieved if the inclusion criteria allowed occupations or performance to be accepted as operational variables of creativity. However, the risk of bias that this would imply would have to be controlled. Other possibilities for longitudinal studies include retrospective interviews on creative behaviors or personality at different developmental moments of the person or using school or extracurricular materials or reports to estimate creativity during childhood and/or adolescence. Again, this could lead to serious research biases that should be considered.

Another way to compensate for the scarcity of longitudinal studies could be to focus on studies that relate predictor and outcomes at the genetic and neural levels.

Because the most judged biases was "study confounding", is a suggestion that more studies are required integrating different variables to observe potential interaction effects. Specifically, it would be interesting to focus on those variables that have already been suggested to have a modulating effect but have few studies or even contradictory findings, such as spatial working memory (Crabtree et al., 2021), IQ, cognitive flexibility, general working memory (Carson, 2011), handedness (Jones et al., 2011), severity of schizophrenia (Fisher et al., 2013), or executive functions (Wang et al., 2017; Jaracz et al., 2012; Holt, 2016).

The second most judged bias domain was "study participation", and in fact the reasons for the judgment were related to "study confounding", since the most identified source of bias in this domain was not providing enough descriptive information on the study samples, which also translates into the absence of control for potential modulator variables. Likewise, were also detected studies that did not establish selection criteria or exercise eligibility within the sample (generally with student populations or "snowball recruitments"). It would be preferable that future studies try to limit this source of bias, either by surveying and providing potentially relevant information (whether sociodemographic or of its baseline in relation to potential modulating variables) and describing in greater detail the recruitment and evaluation processes. Precisely in student samples, which are usually those for which less information is provided and fewer selection criteria are established, it would be interesting to consider aspects such as whether they have any disorder or condition, whether chronic or temporary. For example, a possible source of bias in students is that they submit themselves to evaluation during exam periods (possibly under stress) and/or under the inducement of obtaining money or credits for their participation.

As discussed in limitations, an important source of heterogeneity in the findings could come from the problem of using so many measures of creativity without a consensus about the terms and categories of the operative variables and not being able to ensure that the variables that measure different tests are equivalents. In this sense, the establishment of a consensus about the variables (operational and theoretical) and creativity instruments is recommended, at least within the community dedicated to this research topic. Specifically, it would be advisable to approach the subdomains of the "divergent thinking" variable and future studies are urged not to cluster these subdomains under a macrocategory as much as possible.

Many times, the levels of schizotypy in studies are limited to "high" and "low". Studying the relationship between creativity and more segmented levels of schizotypy could provide evidence on whether the distribution of inverted U is sustained.

Finally, conducting a meta-analysis with the type of information extracted in this review could generate more robust, reliable, and well-founded conclusions.

6 DECLARATIONS OF INTEREST

None known.

REFERENCES

1. Abraham, A., & Windmann, S. (2008). Selective information processing advantages in creative cognition as a function of schizotypy [Article]. *Creativity Research Journal*, 20(1), 1-6. <https://doi.org/10.1080/10400410701839819>
2. Abraham, A., Windmann, S., McKenna, P., & Gunturkun, O. (2007). Creative thinking in schizophrenia: the role of executive dysfunction

- and symptom severity. *Cogn Neuropsychiatry*, 12(3), 235-258. <https://doi.org/10.1080/13546800601046714>
3. Acar, S., Chen, X., & Cayirdag, N. (2018). Schizophrenia and creativity: A meta-analytic review. *Schizophr Res*, 195, 23-31. <https://doi.org/10.1016/j.schres.2017.08.036>
 4. Aguilera, M., & Rodriguez-Ferreiro, J. (2021). Differential Effects of Schizotypy Dimensions on Creative Personality and Creative Products [Article]. *Creativity Research Journal*, 33(2), 202-208. <https://doi.org/10.1080/10400419.2020.1866895>
 5. Ahmetoglu, G., Dobbs, S., Furnham, A., Crump, J., Chamorro-Premuzic, T., & Bakhshalian, E. (2016). Dark side of personality, intelligence, creativity, and managerial level [Article]. *Journal of Managerial Psychology*, 31(2), 391-404. <https://doi.org/10.1108/jmp-03-2013-0096>
 6. Armstrong, D. (2012). The Contributions of Creative Cognition and Schizotypal Symptoms to Creative Achievement [Article]. *Creativity Research Journal*, 24(2-3), 177-190. <https://doi.org/10.1080/10400419.2012.677329>
 7. Baas, M., Nijstad, B. A., Koen, J., Boot, N. C., & De Dreu, C. K. W. (2020). Vulnerability to Psychopathology and Creativity: The Role of Approach-Avoidance Motivation and Novelty Seeking [Article]. *Psychology of Aesthetics Creativity and the Arts*, 14(3), 334-352. <https://doi.org/10.1037/aca0000223>
 8. Batey, M., & Furnham, A. (2008). The relationship between measures of creativity and schizotypy [Article]. *Personality and Individual Differences*, 45(8), 816-821. <https://doi.org/10.1016/j.paid.2008.08.014>
 9. Batey, M., & Furnham, A. (2009). The relationship between creativity, schizotypy and intelligence [Article]. *Individual Differences Research*, 7(4), 272-284. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-74549203232&partnerID=40&md5=6ddde58419b01f836e3de353a734d114>
 10. Bertalan, P., & Szabolcs, K. (2015). Individual differences in creative thinking: Psychotic-like features in an adaptive context?

- [Article]. *Magyar Pszichologiai Szemle*, 70(3), 537-555. <https://doi.org/10.1556/0016.2015.70.3.3>
11. Biedermann, Falko; Fleischhacker, W. Wolfgang (2016). Psychotic disorders in DSM-5 and ICD-11. *CNS Spectrums*, 1–6. doi:10.1017/S1092852916000316
 12. Carson S. H. (2011). Creativity and psychopathology: a shared vulnerability model. *Canadian journal of psychiatry. Revue canadienne de psychiatrie*, 56(3), 144–153. <https://doi.org/10.1177/0706743711105600304>
 13. Carter, C., Hass, R. W., Charfadi, M., & Dinzeo, T. J. (2019). Probing Linear and Nonlinear Relations Among Schizotypy, Hypomania, Cognitive Inhibition, and Creativity [Article]. *Creativity Research Journal*, 31(1), 83-92. <https://doi.org/10.1080/10400419.2019.1580091>
 14. Claridge, G., & Blakey, S. (2009). Schizotypy and affective temperament: Relationships with divergent thinking and creativity styles [Article]. *Personality and Individual Differences*, 46(8), 820-826. <https://doi.org/10.1016/j.paid.2009.01.015>
 15. Claridge, G., & McDonald, A. (2009). An investigation into the relationships between convergent and divergent thinking, schizotypy, and autistic traits [Article]. *Personality and Individual Differences*, 46(8), 794-799. <https://doi.org/10.1016/j.paid.2009.01.018>
 16. Cox, A. J., & Leon, J. L. (1999). Negative schizotypal traits in the relation of creativity to psychopathology [Article; Proceedings Paper]. *Creativity Research Journal*, 12(1), 25-36. https://doi.org/10.1207/s15326934crj1201_4
 17. Crabtree, J., & Green, M. J. (2016). Creative Cognition and Psychosis Vulnerability: What's the Difference? [Article]. *Creativity Research Journal*, 28(1), 24-32. <https://doi.org/10.1080/10400419.2015.1030305>
 18. Crabtree, J., Hudson, J. L., Brockman, R., & Newton-John, T. (2021). Spatial working memory, not IQ or executive function, discriminates early psychosis and clinically vulnerable creative individuals

- [Article]. *Early Intervention in Psychiatry*, 15(1), 47-56. <https://doi.org/10.1111/eip.12909>
19. Crabtree, J., & Newton-John, T. R. O. (2019). Comparisons and associations between personality, creative potential and achievement in creative, non-creative and early psychosis participants [Article]. *Psychosis-Psychological Social and Integrative Approaches*, 11(2), 138-150. <https://doi.org/10.1080/17522439.2018.1542021>
20. Fisher, J. E., Heller, W., & Miller, G. A. (2013). Neuropsychological differentiation of adaptive creativity and schizotypal cognition. *Pers Individ Dif*, 54(1), 70-75. <https://doi.org/10.1016/j.paid.2012.08.003>
21. Folley, B. S., & Park, S. (2005). Verbal creativity and schizotypal personality in relation to prefrontal hemispheric laterality: a behavioral and near-infrared optical imaging study. *Schizophr Res*, 80(2-3), 271-282. <https://doi.org/10.1016/j.schres.2005.06.016>
22. Furnham, A. (2015). The Bright and Dark Side Correlates of Creativity: Demographic, Ability, Personality Traits and Personality Disorders Associated with Divergent Thinking [Article]. *Creativity Research Journal*, 27(1), 39-46. <https://doi.org/10.1080/10400419.2015.992676>
23. Geng, F. L., Xu, T., Wang, Y., Shi, H. S., Yan, C., Neumann, D. L., Shum, D. H. K., Lui, S. S. Y., Cheung, E. F. C., & Chan, R. C. K. (2013). Developmental trajectories of schizotypal personality disorder-like behavioural manifestations: a two-year longitudinal prospective study of college students [Article]. *BMC Psychiatry*, 13, 10, Article 323. <https://doi.org/10.1186/1471-244x-13-323>
24. Green, M. J., & Williams, L. M. (1999). Schizotypy and creativity as effects of reduced cognitive inhibition [Article]. *Personality and Individual Differences*, 27(2), 263-276. [https://doi.org/10.1016/s0191-8869\(98\)00238-4](https://doi.org/10.1016/s0191-8869(98)00238-4)
25. Gross, M. E., Araujo, D. B., Zedelius, C. M., & Schooler, J. W. (2019). Is perception the missing link between creativity, curiosity and schizotypy? Evidence from spontaneous eye-movements and

- responses to auditory oddball stimuli. *Neuroimage*, 202, 116125. <https://doi.org/10.1016/j.neuroimage.2019.116125>
26. Hayden, J., Côté, P., & Bombardier, C. (2006). Evaluation of the Quality of Prognosis Studies in Systematic Reviews. *Annals of Internal Medicine*, 144, 427-437. <https://doi.org/10.7326/0003-4819-144-6-200603210-00010>
27. Hayden, J., van der Windt, D., Cartwright, J., Côté, P., & Bombardier, C. (2013). Assessing Bias in Studies of Prognostic Factors. *Annals of Internal Medicine*, 158, 280-286. <https://doi.org/10.7326/0003-4819-158-4-201302190-00009>
28. Holt, N. J. (2016). Schizotypy. In *The Curated Reference Collection in Neuroscience and Biobehavioral Psychology*. <https://doi.org/10.1016/B978-0-12-809324-5.23686-9>
29. Hurlow, J., & MacCabe, J. H. (2011). Paradoxes in creativity and psychiatric conditions. In *The Paradoxical Brain* (pp. 289-300). <https://doi.org/10.1017/CBO9780511978098.018>
30. Iancu I, Dannon PN, Ziv R, Lepkifker E. A follow-up study of patients with DSM-IV schizophreniform disorder. *Can J Psychiatry*. 2002;47(1): 56-60.
31. Jacquet, J., Delpech, L., Bronchain, J., & Raynal, P. (2020). Creative Competencies and Cognitive Processes Associated with Creativity are Linked with Positive Schizotypy [Article]. *Creativity Research Journal*, 32(2), 142-150. <https://doi.org/10.1080/10400419.2020.1733895>
32. Jaracz, J., Patrzala, A., & Rybakowski, J. K. (2012). Creative thinking deficits in patients with schizophrenia: neurocognitive correlates. *J Nerv Ment Dis*, 200(7), 588-593. <https://doi.org/10.1097/NMD.0b013e31825bfc49>
33. Jones, T., Caulfield, L., Wilkinson, D., & Weller, L. (2011). The Relationship Between Nonclinical Schizotypy and Handedness on Divergent and Convergent Creative Problem-Solving Tasks [Article]. *Creativity Research Journal*, 23(3), 222-228. <https://doi.org/10.1080/10400419.2011.595964>
34. Jung, R. E., Grazioplene, R., Caprihan, A., Chavez, R. S., & Haier, R. J. (2010). White Matter Integrity, Creativity, and Psychopathology:

- Disentangling Constructs with Diffusion Tensor Imaging
[Article]. *PLoS One*, 5(3), 7, Article e9818. <https://doi.org/10.1371/journal.pone.0009818>
35. Kar, N., & Barreto, S. (2018). Psychosis, creativity and recovery: Exploring the relationship in a patient [Article]. *BMJ Case Reports*, 2018, Article bcr-2017-223101. <https://doi.org/10.1136/bcr-2017-223101>
36. Kinney, D. K., Richards, R., Lowing, P. A., LeBlanc, D., Zimbalist, M. E., & Harlan, P. (2000). Creativity in offspring of schizophrenic and control parents: An adoption study [Article]. *Creativity Research Journal*, 13(1), 17-25. <Go to ISI>://WOS:000166914900003
37. LeBoutillier, N., Barry, R., & Westley, D. (2014). The Role of Schizotypy in Predicting Performance on Figural and Verbal Imagery-Based Measures of Creativity [Article]. *Creativity Research Journal*, 26(4), 461-467. <https://doi.org/10.1080/10400419.2014.961778>
38. LeBoutillier, N., Barry, R., & Westley, D. (2016). Creativity and the Measurement of Subclinical Psychopathology in the General Population: Schizotypy, Psychoticism, and Hypomania [Article]. *Psychology of Aesthetics Creativity and the Arts*, 10(2), 240-247. <https://doi.org/10.1037/aca0000047>
39. Lejuez, Carl W.; Gratz, Kim L. (2020). *The Cambridge Handbook of Personality Disorders. Cluster A Personality Disorders.* , 10.1017/9781108333931(9), 195–211. doi:10.1017/9781108333931.037
40. Li, H., Zhang, C., Cai, X., Wang, L., Luo, F., Ma, Y., Li, M., & Xiao, X. (2020). Genome-wide Association Study of Creativity Reveals Genetic Overlap With Psychiatric Disorders, Risk Tolerance, and Risky Behaviors. *Schizophr Bull.* <https://doi.org/10.1093/schbul/sbaa025>
41. Li, Y., Huang, H., Yang, W., Chen, Q., Qiu, J., & Zhang, Q. (2016). A unified framework of the "Genes-Brain-Environment- Behavior" for the relation between creativity and psychopathology [Article]. *Kexue Tongbao/Chinese Science Bulletin*, 61(11), 1233-1249. <https://doi.org/10.1360/N972015-01250>

42. Ludwig, A. M. (1989). Reflections on creativity and madness. *Am J Psychother*, 43(1), 4-14. <https://doi.org/10.1176/appi.psychotherapy.1989.43.1.4>
43. MacCabe, J. H. J. m. k. a. u., Sariaslan, A., Almqvist, C., Lichtenstein, P., Larsson, H., & Kyaga, S. (2018). Artistic creativity and risk for schizophrenia, bipolar disorder and unipolar depression: A Swedish population-based case-control study and sib-pair analysis [Article]. *British Journal of Psychiatry*, 212(6), 370-376. <https://doi.org/10.1192/bjp.2018.23>
44. MacPherson, J. S., & Kelly, S. W. (2011). Creativity and positive schizotypy influence the conflict between science and religion [Article]. *Personality and Individual Differences*, 50(4), 446-450. <https://doi.org/10.1016/j.paid.2010.11.002>
45. Mavroggiorgou, P., Peitzmeier, N., Enzi, B., Flasbeck, V., & Juckel, G. (2021). Pareidolias and Creativity in Patients with Mental Disorders. *Psychopathology*, 54(2), 59-69. <https://doi.org/10.1159/000512129>
46. Michalica, K., & Hunt, H. (2013). Creativity, Schizotypality, and Mystical Experience: An Empirical Study [Article]. *Creativity Research Journal*, 25(3), 266-279. <https://doi.org/10.1080/10400419.2013.813780>
47. Milas, M., & Šimunić, A. (2016). The relationship of creativity with schizotypy and psychoticism in students of artistic and other domains [Article]. *Suvremena Psihologija*, 19(2), 205-215. <https://doi.org/10.21465/2016-SP-192-06>
48. Nelson, B., & Rawlings, D. (2010). Relating schizotypy and personality to the phenomenology of creativity. *Schizophr Bull*, 36(2), 388-399. <https://doi.org/10.1093/schbul/sbn098>
49. Nemoto, T., Kashima, H., & Mizuno, M. (2007). Contribution of divergent thinking to community functioning in schizophrenia [Article]. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, 31(2), 517-524. <https://doi.org/10.1016/j.pnpbp.2006.12.001>

50. Nemoto, T., Mizuno, M., & Kashima, H. (2005). Qualitative evaluation of divergent thinking in patients with schizophrenia. *Behav Neurol*, 16(4), 217-224. <https://doi.org/10.1155/2005/386932>
51. O'Reilly, T., Dunbar, R., & Bentall, R. (2001). Schizotypy and creativity: an evolutionary connection? [Article]. *Personality and Individual Differences*, 31(7), 1067-1078. [https://doi.org/10.1016/s0191-8869\(00\)00204-x](https://doi.org/10.1016/s0191-8869(00)00204-x)
52. Parnas, J., Sandsten, K. E., Vestergaard, C. H., & Nordgaard, J. (2019). Mental illness among relatives of successful academics: implications for psychopathology-creativity research [Letter]. *World Psychiatry*, 18(3), 362-363. <https://doi.org/10.1002/wps.20682>
53. Parnas, J., Sandsten, K. E., Vestergaard, C. H., & Nordgaard, J. (2019). Schizophrenia and Bipolar Illness in the Relatives of University Scientists: An Epidemiological Report on the Creativity-Psychopathology Relationship. *Front Psychiatry*, 10, 175. <https://doi.org/10.3389/fpsy.2019.00175>
54. Polner, B., Simor, P., & Keri, S. (2018). Insomnia and intellect mask the positive link between schizotypal traits and creativity. *PeerJ*, 6, e5615. <https://doi.org/10.7717/peerj.5615>
55. Poreh, A. M., Whitman, D., & Ross, T. P. (1993). Creative thinking abilities and hemispheric asymmetry in schizotypal college students [Article]. *Current Psychology*, 12(4), 344-352. <https://doi.org/10.1007/BF02686814>
56. Poreh, A. M., Whitman, D. R., & Ross, T. P. (1993). CREATIVE-THINKING ABILITIES AND HEMISPHERIC-ASYMMETRY IN SCHIZOTYPAL COLLEGE-STUDENTS [Article]. *Current Psychology*, 12(4), 344-352. <https://doi.org/10.1007/bf02686814>
57. Ramey, C. H., & Chrysikou, E. G. (2014). "Not in their right mind": the relation of psychopathology to the quantity and quality of creative thought. *Front Psychol*, 5, 835. <https://doi.org/10.3389/fpsyg.2014.00835>
58. Reddy, I., Ukrani, J., Indla, V., & Ukrani, V. (2018). Creativity and psychopathology: Two sides of the same coin? [Review]. *Indian Journal of Psychiatry*, 60(2), 168-174. https://doi.org/10.4103/psychiatry.IndianJPsychiatry_129_18

59. Rodrigue, A. L., & Perkins, D. R. (2012). Divergent Thinking Abilities Across the Schizophrenic Spectrum and Other Psychological Correlates [Article]. *Creativity Research Journal*, 24(2-3), 163-168. <https://doi.org/10.1080/10400419.2012.677315>
60. Rubinstein, G. (2008). Are schizophrenic patients necessarily creative? A comparative study between three groups of psychiatric inpatients [Article]. *Personality and Individual Differences*, 45(8), 806-810. <https://doi.org/10.1016/j.paid.2008.08.012>
61. Rust, J., Golombok, S., & Abram, M. (1989). Creativity and schizotypal thinking. *J Genet Psychol*, 150(2), 225-227. <https://doi.org/10.1080/00221325.1989.9914593>
62. Sampedro, A., Pena, J., Ibarretxe-Bilbao, N., Cabrera-Zubizarreta, A., Sanchez, P., Gomez-Gastiasoro, A., Iriarte-Yoller, N., Pavon, C., & Ojeda, N. (2020). Brain White Matter Correlates of Creativity in Schizophrenia: A Diffusion Tensor Imaging Study. *Front Neurosci*, 14, 572. <https://doi.org/10.3389/fnins.2020.00572>
63. Sampedro, A., Pena, J., Ibarretxe-Bilbao, N., Sanchez, P., Iriarte-Yoller, N., Ledesma-Gonzalez, S., Tous-Espelousin, M., & Ojeda, N. (2020). Mediating role of cognition and social cognition on creativity among patients with schizophrenia and healthy controls: Revisiting the Shared Vulnerability Model. *Psychiatry Clin Neurosci*, 74(2), 149-155. <https://doi.org/10.1111/pcn.12954>
64. Sampedro, A., Pena, J., Ibarretxe-Bilbao, N., Sanchez, P., Iriarte-Yoller, N., Pavon, C., Hervella, I., Tous-Espelousin, M., & Ojeda, N. (2020). Neurocognitive, social cognitive, and clinical predictors of creativity in schizophrenia. *J Psychiatr Res*, 129, 206-213. <https://doi.org/10.1016/j.jpsychires.2020.06.019>
65. Schuldberg, D. (1990). Schizotypal and Hypomanic Traits, Creativity, and Psychological Health [Article]. *Creativity Research Journal*, 3(3), 218-230. <https://doi.org/10.1080/10400419009534354>
66. Schuldberg, D., French, C., Lou Stone, B., & Heberle, J. (1988). Creativity and schizotypal traits: Creativity test scores and perceptual aberration, magical ideation, and impulsive nonconformity [Article]. *Journal of Nervous and Mental Disease*, 176(11), 648-657. <https://doi.org/10.1097/00005053-198811000-00002>

67. Shi, L., Sun, J. Z., Xia, Y. M., Ren, Z. T., Chen, Q. L., Wei, D. T., Yang, W. J., & Qiu, J. (2018). Large-scale brain network connectivity underlying creativity in resting-state and task fMRI: Cooperation between default network and frontal-parietal network [Article]. *Biological Psychology*, 135, 102-111. <https://doi.org/10.1016/j.biopsycho.2018.03.005>
68. Son, S., Kubota, M., Miyata, J., Fukuyama, H., Aso, T., Urayama, S., Murai, T., & Takahashi, H. (2015). Creativity and positive symptoms in schizophrenia revisited: Structural connectivity analysis with diffusion tensor imaging. *Schizophr Res*, 164(1-3), 221-226. <https://doi.org/10.1016/j.schres.2015.03.009>
69. Srinivasan, S., Bettella, F., Hassani, S., Wang, Y., Witoelar, A., Schork, A. J., Thompson, W. K., Collier, D. A., Desikan, R. S., Melle, I., Dale, A. M., Djurovic, S., & Andreassen, O. A. (2017). Probing the association between early evolutionary markers and schizophrenia [Article]. *PLoS One*, 12(1), Article e0169227. <https://doi.org/10.1371/journal.pone.0169227>
70. Stanciu, M. M., & Papasteri, C. (2018). Intelligence, personality and schizotypy as predictors of insight [Article]. *Personality and Individual Differences*, 134, 43-48. <https://doi.org/10.1016/j.paid.2018.05.043>
71. Taylor C. L. (2017). Creativity and Mood Disorder: A Systematic Review and Meta-Analysis. *Perspectives on psychological science : a journal of the Association for Psychological Science*, 12(6), 1040-1076. <https://doi.org/10.1177/1745691617699653>
72. Thaler, S. L. (2016). Cycles of insanity and creativity within contemplative neural systems. *Med Hypotheses*, 94, 138-147. <https://doi.org/10.1016/j.mehy.2016.07.010>
73. Thys, E., Sabbe, B., & De Hert, M. (2014). Creativity and psychopathology: a systematic review. *Psychopathology*, 47(3), 141-147. <https://doi.org/10.1159/000357822>
74. von Stumm, S., & Scott, H. (2019). Imagination links with schizotypal beliefs, not with creativity or learning [Article]. *British Journal of Psychology*, 110(4), 707-726. <https://doi.org/10.1111/bjop.12369>

75. Wang, L., Long, H., Plucker, J. A., Wang, Q., Xu, X., & Pang, W. (2018). High schizotypal individuals are more creative? The mediation roles of overinclusive thinking and cognitive inhibition [Article]. *Frontiers in Psychology*, 9(SEP), Article 1766. <https://doi.org/10.3389/fpsyg.2018.01766>
76. Wang, L., Xu, X., Wang, Q., Healey, G., Su, L., & Pang, W. (2017). Are Individuals with Schizophrenia or Schizotypy More Creative? Evidence from Multiple Tests of Creative Potential [Article]. *Creativity Research Journal*, 29(2), 145-156. <https://doi.org/10.1080/10400419.2017.1302777>
77. Webb, M. E., Little, D. R., Cropper, S. J., & Roze, K. (2017). The contributions of convergent thinking, divergent thinking, and schizotypy to solving insight and non-insight problems [Article]. *Thinking & Reasoning*, 23(3), 235-258. <https://doi.org/10.1080/13546783.2017.1295105>
78. Winston, C. N., Tarkas, N. J., & Maher, H. (2014). Eccentric or Egocentric? Preoperational Features in Schizotypic and Creative Adults [Article]. *Psychology of Aesthetics Creativity and the Arts*, 8(4), 413-422. <https://doi.org/10.1037/a0037442>
79. Yamaoka, A., & Yukawa, S. (2020). Mind wandering in creative problem-solving: Relationships with divergent thinking and mental health [Article]. *PLoS One*, 15(4), 11, Article e0231946. <https://doi.org/10.1371/journal.pone.0231946>
80. Zabelina, D. L., Condon, D., & Beeman, M. (2014). Do dimensional psychopathology measures relate to creative achievement or divergent thinking? [Article]. *Frontiers in Psychology*, 5, 11, Article 1029. <https://doi.org/10.3389/fpsyg.2014.01029>
81. Zanes, J., Ross, S., Hatfield, R., Houtler, B., & Whitman, D. (1998). The relationship between creativity and psychosis-proneness [Article]. *Personality and Individual Differences*, 24(6), 879-881. [https://doi.org/10.1016/s0191-8869\(97\)00199-2](https://doi.org/10.1016/s0191-8869(97)00199-2)

APPENDIX A. SEARCH STRATEGY

Table 7. Full search strategy

Database	Filters	Search text (all fields)	Results	ND	
PUBMED	1980-2022	<i>creativ*+ psychotic disorder*</i>	184	814	
		<i>Creativ* + schizo*</i>	385		
		<i>Creativ* + paranoid</i>	33		
		<i>Creativ* + madness</i>	62		
		<i>Creativ* + insan*</i>	22		
		<i>genius + psychotic disorder*</i>	21		
		<i>genius + schizo*</i>	28		
		<i>genius + paranoid</i>	3		
		<i>genius + madness</i>	28		
		<i>genius + insan*</i>	16		
		<i>divergent think* + psychotic disorder*</i>	5		
		<i>divergent think* + schizo*</i>	23		
		<i>divergent think* + paranoid</i>	3		
		<i>divergent think* madness</i>	1		
		<i>divergent think* + insan*</i>	0		
WEB OF SCIENCE	1980-2022	<i>creativ*+ psychotic disorder*</i>	101	3615	2743
		<i>creativ + schizo*</i>	1.078		
		<i>creativ + paranoid</i>	43		
		<i>creativ + madness</i>	247		
		<i>creaiv + insan*</i>	77		
		<i>genius + psychotic disorder*</i>	11		
		<i>genius + schizo*</i>	73		
		<i>genius + paranoid</i>	4		
		<i>genius + madness</i>	119		
		<i>genius + insan*</i>	57		
		<i>"divergent think*" + psychotic disorder*</i>	4		
		<i>"divergent think*" + schizo*</i>	117		
		<i>"divergent think*" + paranoid</i>	1		
		<i>"divergent think*" madness</i>	4		
		<i>"divergent think*" + insan*</i>	0		
Scopus	1980-2022	<i>creativ*+ psychotic disorder*</i>	213	1783	
		<i>creativ + schizo*</i>	827		
		<i>creativ + paranoid</i>	85		
		<i>creativ + madness</i>	257		
		<i>creaiv + insan*</i>	94		
		<i>genius + psychotic disorder*</i>	23		
		<i>genius + schizo*</i>	45		

<i>genius + paranoid</i>	8
<i>genius + madness</i>	128
<i>genius + insan*</i>	35
<i>"divergent think*" + psychotic disorder*</i>	5
<i>"divergent think*" + schizo*</i>	60
<i>"divergent think*" + paranoid</i>	1
<i>"divergent think*" madness</i>	2
<i>"divergent think*" + insan*</i>	0

ND= nonduplicates