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# THE BIDIRECTIONAL RELATIONSHIP BETWEEN RISK AND CREATIVITY: A SYSTEMATIC REVIEW

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Alongside the concept of risk-taking (RT), the construct of creativity often appears in scientific literature. However, the study of their relationship has been conducted unsystematically, with both theoretical (definition of the constructs) and methodological (different assessment methods) difficulties. Some studies consider risk as a predictor of creativity, while others consider the opposite direction, which often leads to contrasting results. The present systematic review was conducted using the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines to systematize results on this topic and investigate reasons for these conflicting results. Fifteen studies were included from an initial *N* = 1009 (from three scientific databases). Theoretical and methodological considerations that may explain the mixed results have been investigated in depth. They can be summarized as follows: 1) the difficulty in clearly defining the multidimensional constructs of creativity and risk, 2) the heterogeneity of the instruments used in the studies, and 3) the possible effect of cultural differences. Despite this, much of the evidence in the literature has supported the hypothesis that people with lower creative ability tend to avoid risky situations and decisions, preferring the status quo, while people with higher creative skills tend not to flinch from challenging situations. Theoretical, methodological future directions and the practical application of these main findings are discussed.

Keywords: Risk-taking; Decision-making; Creativity; Divergent thinking; Convergent thinking.

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Risk is a measure of uncertainty about an outcome (Kahneman & Tversky, 1984) and is a fundamental component in the decision-making (DM) process. Over the years, risk has been considered a personality trait and general domain (Beghetto et al., 2021; Charyton, Snelbecker, Elliot, et al., 2013; Charyton, Snelbecker, Rahman, et al., 2013; Glover, 1977; Glover & Sautter, 1977; Jose, 1970; Pankove & Kogan, 1968), while other studies have introduced the hypothesis that risk is context-specific and domain-specific (Dewett, 2006; Harada, 2020; MacCrimmon & Wehrung, 1986, 1990; Pascual-Leone et al., 2010; Tyagi et al., 2017). Although risk is a multifaceted construct, including various dimensions (e.g., risk perception, risk tolerance, risk attitude), risk-taking constitutes a behavioral outcome influenced by the combined effect of risk perception, tolerance, and attitude (Weber et al., 2002). Thus, risk-taking is the most often considered measure of risk in cognitive research. In the last decades, several researches have demonstrated that how

people approach risk-taking depends on individual and contextual differences. Individual differences depend on how people may consider multiple alternatives when making choices in different contexts — gambling, financial investments, business decisions or personal (health, social, ethical) decisions (Blais & Weber, 2006; MacCrimmon & Wehrung, 1986, 1990; Weber et al., 2005). This is both in terms of gains (risk as something desirable) and losses (risk as something to be avoided) (Lubart & Thornhill-Mller, 2019). Several studies have investigated the influence of different variables on risk-taking, such as personality traits and cognitive styles (Zuckerman & Kuhlman, 2000) or creative abilities (Shen et al., 2018).

In particular, concerning cognitive styles, literature has proposed a model built up of two cognitive poles — analytical (rational) and intuitive (holistic and feeling-based approach) (Allinson & Hayes, 2012; Kozhevnikov, 2007) — while more recent models have introduced different facets of cognitive styles. For instance, Cools and Van den Broeck (2007) proposed a 3-style model which comprehended the "knowing," "planning," and "creating" styles. The first takes up the analytical style and refers to individuals who prefer logical, analytical, and impersonal information processing. The second style refers to individuals seeking certainty who prefer a well-organized context. Finally, the "creating" style refers to the intuitive style, typical of people who make decisions based on intuition and instinct. This style introduces creativity as a cognitive style related to how people deal with everyday decisions by implementing flexibility and openness strategies (Miceli et al., 2018). However, the results of the studies assessing the relationship between creative styles and abilities and the component of risk are often inconsistent.

Creativity is a multidimensional construct of which it is difficult to find a comprehensive definition; however, it can generally be defined as creating a new product and implementing unusual and new behaviors that satisfy both the criteria of originality and adequacy concerning the context and use (Barron, 1988). For this reason, creativity includes both the components of creative potential (psychological and cognitive attributes that allow originality) and expressed/applied creativity (or creative behavior/creative product) (Sternberg, 2001). Furthermore, according to some authors, it is involved in making decisions in uncertain or open situations (Collins & Koechlin, 2012) and in the willingness to take risks (Tyagi et al., 2017): creativity is also described as a human capacity that enables people to find original, alternative, and valuable solutions and requires the individuals to tolerate certain degrees of risk (Allwood & Selart, 2001).

Finally, a crucial aspect linking creativity to different modes of thinking is the distinction between divergent (DT) and convergent (CT) thinking. DT focuses on generating multiple solutions and alternative ideas in response to a stimulus or an open-ended problem (Guilford, 1956). On the contrary, CT is the ability to discover a single correct solution to a specific problem (Eysenck, 1995). However, several studies have sometimes confused the concept of DT, that is now considered an index of creative potential, with the multidimensional construct of creativity (Fusi et al., 2021; Piffer, 2012), leading to controversial results in studies investigating the relationships of creative thinking and other aspects of cognition and behavior.

A clear example of confusion in the study of the relationship of this complex construct with other psychological constructs concerns the field of study regarding the relationship between creativity and risk. Indeed, although many studies have investigated the relationship between creativity (mainly creative process and ability) and risk-taking (RT), the results are still controversial and often contradictory. Interestingly, some researchers consider risk as a prerequisite for creativity: being creative often involves tolerating a certain degree of risk, allowing people to promote creative inventions or make entrepreneurial profits (Baas et al., 2015; Sternberg & Lubart, 1992). Additionally, creative people often exhibit risky behaviors (Lubart & Sternberg, 1998; Ucar, 2018) and prefer challenging and risky situations (Harada, 2020). On the contrary, others consider the opposite hypothesis: creativity might be a crucial aspect of risk, as in the investment

theory or considering the willingness to take a risk (Dewett, 2006; Sternberg, 2006; Sternberg & Lubart, 1992; Williams, 1980; Zhou & George, 2001).

Considering these premises, the purpose of this review is twofold:

(1) Analyzing the theoretical and methodological factors that could account for the creativity/risk relation's conflicting results.

(2) Suggesting methodological and practical future directions in this field of studies.

We wish to emphasize the importance of a clear theoretical background, as this could suggest perspectives for future studies: can creativity support risk-taking or, on the contrary, is it an obstacle and does it encourage nonfunctional behaviors? Moreover, is risk-taking beneficial or detrimental to creative thinking and behavior?

## METHOD

The review was conducted following the Preferred Reporting Items for Systematic reviews and Meta-Analyses guidelines (PRISMA; Liberati et al., 2009). Two authors, Maura Crepaldi and Giulia Fusi, performed it through three electronic databases (PubMed, Scopus, and PsychINFO) from October 2020 to January 2021. Therefore, the discussion is limited to articles focusing on the relationship between creativity and risk.

### Search Strategy

The search was conducted in the three databases using the following keywords: "creativity AND risk-taking," "divergent thinking AND risk-taking", and "convergent thinking AND risk-taking." Furthermore, for the search in Scopus database, we selected some specific subject areas: "Article, English"; while in PsychINFO, we selected "Academic Journals" and "English." Finally, cross-references of the selected studies were also considered to identify possible supplementary significant articles. The selection process flow is presented in Figure 1.

### Inclusion and Exclusion Criteria

The inclusion criteria were "articles," "English language," "human," and "healthy subjects." The exclusion criteria were studies that considered data by neuroimaging and stimulation techniques, genetic studies, and articles that considered a pathological sample or training and stimulation. In line with the aim of this review, only the articles that consider direct measures of creativity and risk are reported; those that use indirect measures have been excluded.

### Study Selection and Data Collection

The search identified 1009 hypothetically related articles (the sum of the results returned by all databases). After the first selection of titles (duplicates and articles that did not match the inclusion criteria were deleted) and abstracts (not in line with the review's aim), we considered 30 full texts.

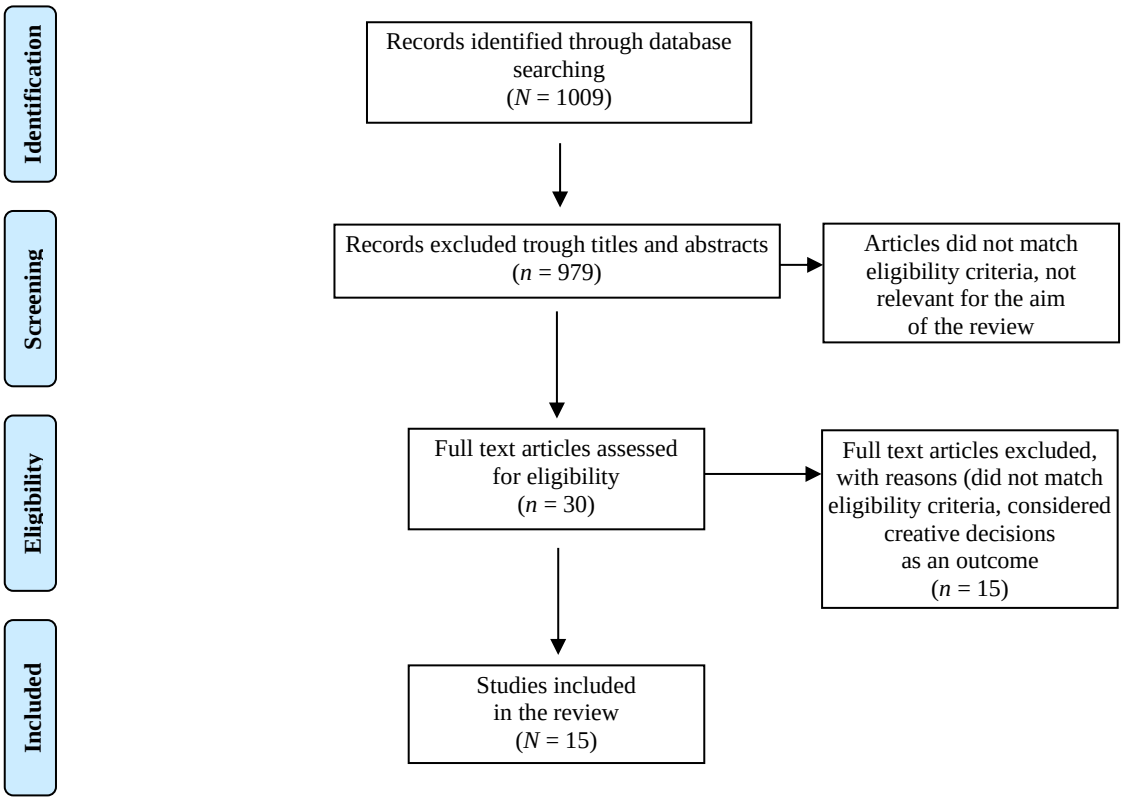


FIGURE 1
PRISMA flow diagram

Initially, Crepaldi and Fusi independently examined the titles and abstracts of the database outputs, identifying which ones were not relevant to the research aim (i.e., investigating the link between RT and creativity and which direction this relationship goes). As a result, all the articles that considered creativity a product of choice and not a process were excluded. Afterward, the full texts of the selected articles were read and examined to check the inclusion criteria (Figure 1). Finally, 15 articles were selected (Table 1).

## RESULTS

### Study Design and Sample Characteristics

The studies' main characteristics are described in Table 1 (i.e., authors, year of publication, title, sample, evaluation tools, and findings). This table also shows whether the articles considered (1) risk as a general or specific domain considering performance, or self-report measures; (2) creativity as disposition, performance (DT or CT), or achievement/behavior. The selected articles were published from 1961 (Merrifield et al., 1961) to 2020/2021 (Beghetto et al., 2021; Harada et al., 2020). No articles were found before this date.

TABLE 1
Description of the 15 selected articles after reading the abstract and full texts (see PRISMA flow diagram, Figure 1)

| ID | Authors, year | Titles | Sample | Instruments | Risk | Creativity | Findings |
|---|---|---|---|---|---|---|---|
| 1 | Beghetto et al., 2021 | Intellectual risk taking: a moderating link between creative confidence and creative behavior? | Young and adults | *Risky measures* = IRT (Beghetto, 2009) *Creativity measures* = global CC, Short Scale of Creative Self (SSCS; Karwowski et al., 2018), Creative Achievement (Carson et al., 2005), Creative Activity (ICAA; Diedrich et al., 2018) | Performance; general domain | Achievement/behaviors | Not stronger relationships: intelectual risk seems to moderate the relationship between CC and ICAA; positive relationship between adaptive risk taking, CC, and CB |
| 2 | Charyton, Snelbecker, Elliott, et al., 2013 | College students' general creativity as a predictor of cognitive risk tolerance | Young | *Risky measures* = Cognitive Risk Tolerance scale (CRT) *Creativity measures* = Creative Personality Scale (CPS), Creative Temperament scale | Self-report; personality/trait or preference; general domain | Disposition | Creative personality and creative temperament predicted higher cognitive risk tolerance |
| 3 | Charyton Snelbecker, Rahman, et al., 2013 | College students' creative attributes as a predictor of cognitive risk tolerance | Young | *Risky measures* = Cognitive Risk Tolerance (CRT) scale *Creativity measures* = Creative Personality Scale (CPS) | Self-report; personality/trait or preference; general domain | Disposition | Procreative attributes predicted higher cognitive risk tolerance. Students who self-identify as insightful, inventive, interests wide, and reflective tended to report higher cognitive risk tolerance |
| 4 | Dewett, 2006 | Exploring the role of risk in employee creativity | Adult | *Risky measures* = Willing Risk-Taking (WTR); risk propensity is a 5-item scale adapted from Sitkin and Weingart (1995). *Creativity measures* = adaptation from George and Zhou (2001) and Scott and Bruce (1994) | Self report; personality/trait or preference; specific domain | Achievement/behavior; performance | WTR was positively and significantly related to employee creativity; the relationship between encouragement and employee creativity was completely mediated by WTR; risk propensity positively affected WTR, this variable had no effect on creativity |

(table 1 continues)

Table 1 (continued)

| ID | Authors, year | Titles | Sample | Instruments | Risk | Creativity | Findings |
|---|---|---|---|---|---|---|---|
| 5 | Eisenman, 1987 | Creativity, birth order, and risk-taking | Adult | Personal opinion survey (Eisenman, 1969)<br>Unusual-uses test; preference for complexity; WAIS vocabulary; risk-taking | Self report; personality/trait or preference; general domain | Disposition and performance | Risk taking correlated significantly with creativity measures: personal opinion survey, unusual-uses originality scores, preference for complexity |
| 6 | Glover, 1977 | Risky shift and creativity | Young | *Risky measures* = six items Stoner's (1968)<br>*Creativity measures* = TTCT, verbal form b ("unusual uses" and "ask and guess") | General domain | Performance (divergent thinking) | In risky shift group (risky preferences): increase flexibility, originality, decrease elaboration |
| 7 | Glover & Sautter, 1977 | Relation of four components of creativity to risk-taking preferences | Young | *Risky measures* = The Choice Dilemma Questionnaire (Kogan & Wallach, 1964)<br>*Creativity measures* = verbal forms of the Torrance Tests of Creative Thinking (TTCT; Torrance, 1974) | Performance; general domain | Performance (divergent thinking) | *Higher risks* = higher on the flexibility and originality measures<br>*low risk-takers* = scored significantly higher on the elaboration. No significant difference on the fluency measure |
| 8 | Harada, 2020 | The effects of risk-taking, exploitation, and exploration on creativity | Young | *Risky measures* = IGT, BFS, RL (reinforcement learning)<br>*Creativity measures* = AUT, S-A, RAT, reading span, operation span, matrix span | Performance; specific domain | Performance (divergent thinking) | Divergent thinking related to risk seeking; convergent thinking was not associated with risk attitudes or exploitation/exploration |
| 9 | Jose, 1970 | Convergent-divergent thinking abilities and risk-taking in children | Adolescents | *Risky measures* = ring toss/fortune wheel (gambling)/clues. The third measure of risk-taking is called "clues"<br>*Creativity measures* = verbal and figural forms of the TTCT; Kuhlmann-Anderson test (Form I) (Kuhlmann, 1928) = convergent thinking | Performance; general domain | Performance (divergent thinking) | No correlation between DT and RT |

(table 1 continues)

Table 1 (continued)

| ID | Authors, year | Titles | Sample | Instruments | Risk | Creativity | Findings |
|---|---|---|---|---|---|---|---|
| 10 | Kurtzman, 1967 | A study of school attitudes, peer acceptance, and personality of creative adolescents | Adolescents | *Risky measures* = High School Personality Questionnaire (HSPQ)<br>*Creativity measures* = Kit of Reference Tests for Cognitive Factors (French et al., 1963) | Self-report; personality/trait or preference; general domain | Performance | Creativity is linked with tolerance of ambiguity |
| 11 | Merrifield et al., 1961 | Interrelationships between certain abilities and certain traits of motivation and temperament | Adult | Aptitude test for risk and nonaptitude test for creativity | Aptitude test, self-report; personality/trait or preference (adventure) | Nonaptitude test, performance test (fluency, originality, flexibility) | Correlation between creativity (associational fluency) and risk-taking, measured as a score on adventure |
| 12 | Pankove & Kogan, 1968 | Creative ability and risk-taking in elementary school children | Children | *Risky measures* = draw and circle, clues and shuffleboard<br>*Creativity measures* = Guilford tests of creativity | Performance; general domain | Performance | No correlation, shuffleboard correlated with creativity only in boys |
| 13 | Pascual-Leone et al., 2010 | Affective and cognitive correlates of gambling behavior in university students | Young | *Risky measures* = South Oaks Gambling Screen-Revised (SOGS; Lesieur & Blume, 1993)<br>*Creativity measures* = box test, verbal subtest of the Torrance Tests of Creative Thinking (TTCT; Torrance, 1974) | Performance; specific domain | Performance (divergent thinking) | *Self-critical and creative/original* = likely to gamble<br>*creative originality* = predicts gambling up to a certain level of risk; positive relationship between gambling behavior and creative originality held only for the middle range of gambling behavior |
| 14 | Shen et al., 2018 | Risk-taking and creativity: convergent, but not divergent thinking is better in low-risk takers | Young and adults | *Risky measures* = risk-taking preference index (RPI; Hsee & Weber, 1997, 1999)<br>*Creativity measures* = convergent thinking RAT AUT | Self-report; personality/trait or preference; general domain | Performance (divergent thinking) | Inverse relationship between risk-taking and convergent thinking, *low risk-taking* = better convergent thinking not significantly correlated with divergent thinking |
| 15 | Tyagi et al., 2017 | The risky side of creativity: domain specific risk taking in creative individuals | Young and adults | *Risky measures* = roulette betting task; DOSPERT<br>*Creativity measures* = AUT; c-RAT; CAQ; RIBSs; CPS | Performance; specific domain | Achievement/behavior; performance | Strong link between risk taking in the social domain and personality and biographical inventory-based measures of creativity |

Some studies present a comparison between different ages, for example, adolescents and adults (Charyton, Snelbecker, Elliot, et al., 2013; Charyton, Snelbecker, Rahman, et al, 2013; Glover, 1977; Glover & Sautter, 1977; Harada, 2020; Jose, 1970; Kurtzman, 1967; Pankove & Kogan, 1968; Pascual-Leone et al., 2010); others present data for a single sample, for example, adults (Beghetto et al., 2021; Dewett, 2006; Eisenman, 1987; Merrifield et al., 1961; Shen et al., 2018; Tyagi et al., 2017). Since no particular differences emerged when considering different age groups in the selected studies, it was decided to comment on the studies independently of this aspect.

Most of the studies considered in this review show a positive, significant, and direct relationship between risk and creativity (Beghetto et al., 2021; Charyton, Snelbecker, Elliot, et al., 2013; Charyton, Snelbecker, Rahman, et al., 2013; Dewett, 2006; Eisenmann et al., 1987; Glover, 1977; Glover & Sautter, 1977; Harada, 2020; Pascual-Leone et al., 2010; Shen et al., 2018). However, there are also some conflicting results, and the direction of this relationship is not always clear (i.e., Jose, 1970; Pankove & Kogan, 1968; Tyagi et al., 2017). The contrasting results that emerged seem to be due to the plurality of definitions of the two constructs (construct definition) and the variety of instruments used to investigate them (methodological contributions).

## Constructs Definition (Theoretical Aspect)

The first major difficulty that emerges from reading the selected articles is the definition of the two constructs. Some authors consider risk as a general domain (Beghetto et al., 2021; Charyton, Snelbecker, Elliot, et al., 2013; Charyton, Snelbecker, Rahman, et al., 2013; Eisenman, 1987; Glover, 1977; Glover & Sautter, 1977; Jose, 1970; Kurtzman, 1967; Merrifield et al., 1961; Pankove & Kogan, 1968; Shen et al., 2018). Others studied risk as a domain-specific construct and identified different aspects of risk (Dewett, 2006; Harada, 2020; Pascual-Leone et al., 2010; Tyagi et al., 2017), such as gambling, social, investment, and so forth.

Furthermore, some authors view risk as performance (Beghetto et al., 2021; Harada, 2020; Glover, 1977; Glover & Sautter, 1977; Jose, 1970; Pankove & Kogan, 1968; Pascual-Leone et al., 2010; Tyagi et al., 2017) while others view risk as a disposition or personality trait (Charyton, Snelbecker, Elliot, et al., 2013; Charyton, Snelbecker, Rahman, et al., 2013; Dewett, 2006; Eisenman, 1987; Kurtzman, 1967; Merrifield et al., 1961; Shen et al., 2018). So, risk-taking was measured differently by behavioral tasks or self-report measures.

The same difficulty in definition can be found in the concept of creativity. Defining and measuring creativity has been an exceptionally challenging task throughout the history of psychological research. This is also evident in studies that have attempted to investigate the relationship between this construct and risk.

Some authors identify creativity as an individual disposition (Charyton, Snelbecker, Elliot, et al., 2013; Charyton, Snelbecker, Rahman, et al., 2013; Dewett, 2006; Eisenman, 1987), while others with creative performance (Glover, 1977; Glover & Sautter, 1977; Harada, 2020; Jose, 1970; Kurtzman, 1967; Merrifield et al., 1961; Pankove & Kogan, 1968; Pascual-Leone et al., 2010; Shen et al., 2018), and others with achievement (Beghetto et al., 2021; Tyagi et al., 2017).

## Measures Used (Methodological Aspects)

From the definitions given by the various authors and as a consequence of the theoretical difficulties addressed above, it can be seen that very different tools and methods have been used to measure both

constructs and the relationship between creativity and risk. This may have contributed to the inconsistency of the results. The several instruments used for assessing creativity and risk are described in Table 1.

Concerning risk measure, results will be presented following three categories: i) risk as a general domain and personality trait; ii) risk as a general domain in performance tasks; iii) risk in a specific situation or specific domain risk.

i) *Risk as a general domain and personality trait.* Several authors consider risk as a general domain and an aspect of personality and temperament (Charyton, Snelbecker, Elliot, et al., 2013; Charyton, Snelbecker, Rahman, et al., 2013; Dewett, 2006; Eisenman, 1987; Kurtzman, 1967; Merrifield et al., 1961; Shen et al., 2018). Merrifield and colleagues (1961) used an aptitude self-report test to measure risk: need for freedom, need for variety, adventure, impulsiveness, and tolerance of ambiguity. Kurtzman (1967) administered the High School Personality Questionnaire (HSPQ; Cattell & Beloff, 1962), a modification of the Cattell 16PF scale that measures 14 dimensions of personality. Together with the Classroom Social Distance Scale (Cunningham et al., 1951) and the Student Opinion Poll (Getzels & Jackson, 1960), the authors used this task to measure risk in the specific school context. Eisenman (1987) also considered risk as a preference for complexity and investigated it through a personal opinion survey (Eisenman, 1969). Finally, Shen et al. (2018) considered the risk-taking preference index (RPI; Hsee & Weber, 1997, 1999). This tool consists of 14 questions and measures risk: the score is calculated relying on the answers given on a scale from 1 (*most risk-averse*) to 8 (*most risk-seeking*).

ii) *Risk as a general domain in performance tasks.* Pankove and Kogan (1968) considered, as a measure of risk, three different tasks: draw a circle, clues, and shuffleboard. The "draw a circle" test, a pencil and paper task (McClelland, 1961), aims to measure risk-taking, especially in the entrepreneurial field. The assignment is presented twice. First, the subject is asked to draw a circle on one side of the sheet (lined) previously folded in half and presented by the experimenter. Then he/she is asked to flip the paper and draw a cross in the circle's centre, asking where he/she thinks the circle's centre would be if he/she could see the circle. The hypothesis is that RT is assumed to increase as the diameter of the drawn circle decreases. The second task used to measure risk is "clues," taken from Kogan and Wallach (1964). In the following task, 23 valuable clues about the identity of two elements (baseball bat and goat) are presented, one at a time, and the subject can choose when to answer. Each correct answer increases the score, and, in the end, there is a $ 1.00 prize for the person who gets the most points. This task was also used by Jose (1970). The last task used in this study was "shuffleboard," where the apparatus was very similar to the one previously employed by Kogan and Wallach (1964) to evaluate RT strategies. In addition to the task clues, Jose (1970) used ad hoc questionnaires as a risk measure. Ring toss is inspired by the "ring throwing experiment" (Atkinson & Litwin, 1960), in which participants are asked to throw a certain number of rings at a peg (in this case, 10). The ring's launch distance indicates the more significant risk a subject can take, while the shorter the distance, the minimum risk is taken. The second task used is a gambling task named "fortune wheel," which measures one of the risk dimensions, explicitly gambling, although it is considered a general risk. The tool was designed in such a way that the game involves losses and gains based on the assumption of RT; the areas of the wheel are, in fact, of different sizes, and the assumptions are that if the person "bets" on small areas he/she assumes more risks, instead if he/she bets on larger areas he/she can take less risk. After these initial studies, the most recent ones used standardized tasks. For example, Glover and Sautter (1977) administered The Choice Dilemma Questionnaire (Kogan & Wallach, 1964), which measures RT tendencies. Furthermore, Charyton and colleagues (2013) investigated risk with the Cognitive Risk Tolerance (CRT; Snelbecker et al., 2001) scale, which consists of 35 self-reported items on a 10-point Likert scale, ranging from 0 = *strongly disagree* to 9 = *strongly agree*, aimed to assess an individual's ability to formulate and express their ideas despite potential opposition. Finally, Beghetto and colleagues (2021) proposed, as a measure of risk, the

intellectual risk-taking (IRT; Beghetto, 2009) task on a 5-point Likert scale, ranging from 1 = *definitely not* to 5 = *definitely yes*, that measures people's general tendency to engage in situations that involve risk-taking.

iii) *Risk in a specific situation or specific domain risk.* The last group of studies includes articles that considered risk as a domain-specific construct (Dewett, 2006; Harada, 2020; Pascual-Leone et al., 2010; Tyagi et al., 2017;). For example, Dewett (2006) explored a specific risk measure, the Willing RT measure and the Sitkin and Weingart (1995) scale. The first is an ad hoc scale composed of eight elements, each designed to investigate two aspects of the willingness to risk construct, the willingness to take a risk and the awareness of possible negative consequences. The second (Sitkin & Weingart, 1995) is a risk propensity scale with five items, intending to investigate the characteristic levels of RT that an individual might exhibit in different situations/contexts.

In their study, Pascual-Leone and colleagues (2010) used the South Oaks Gambling Screen-Revised (SOGS; Lesieur & Blume, 1993) scale, which consists of 20 items used to screen the population's gambling behavior. Furthermore, Tyagi and colleagues (2017) used the Roulette Betting Task (RBT) and a Domain-Specific Risk-Taking (DOSPERT) scale to evaluate risk in different domains. The first task is a behavioral risk measure that uses a wheel with 10 segments (pockets), red (losses), or blue (winnings). Participants are asked for 100 trials to select a bet from three boxes indicating the available bet options (low, medium, and high). The blue-to-red-colored pockets ratio determines the probability of winning. The task provides two measures of risk: financial gambling and gambling risk adjustment. The second task, DOSPERT, is a standardized questionnaire of 30 questions investigating the five domains of risky behaviors: ethical, financial, health/safety, recreational, and social. Harada (2020) specifically investigated the risk in a gambling situation with the Iowa Gambling Task (IGT), in which the participants are asked to make some choices between four decks of cards, two of which are advantageous (small losses and small gains), and two are not (significant wins and large losses) to maximize the profit.

## Creativity Measures

As regards creativity measures, the authors employed different tasks. However, it is possible to distinguish them into three categories related to the theoretical concept presented before: 1) dispositional and perceived creativity, 2) creative performance tasks, and 3) creative achievement/behavior and self-beliefs. Although this distinction is valid, some authors consider more than one measure of creativity, for example, Beghetto and colleagues (2021) and Tyagi and colleagues (2017) consider tasks of creative performance as well as tasks of creative achievement or creative behavior.

1) *Dispositional/trait creativity*. Eisenman (1987) and Charyton and colleagues (2013) used different instruments but all aimed at measuring creativity in dispositional terms, although sometimes combined with performance tasks (e.g., Eisenman, 1987). The two main scales used are: the Creativity Personality Scale (CPS) taken from the Adjective Chec-klist (ACL; Gough, 1979; see also Charyton, Snelbecker, Elliot, et al., 2013; Charyton, Snelbecker, Rahman, et al., 2013) which considers creativity from personality theory and personality attributes and the Creative Temperament Scale (Gough, 1992; see also Charyton, Snelbecker, Elliot, et al., 2013). The latter is an adaptation of the California Psychological Inventory (CPI) and aims to investigate and predict creative performance in various domains.

2) *Creative performance tasks (divergent and convergent thinking).* Some authors used The Torrance Test of Creative Thinking (TTCT; Torrance, 1987, 1998; see also Glover, 1977; Glover & Sautter, 1977; Pascual-Leone et al., 2010), which consists of two forms: figural TTCT and verbal TTCT. The figurative form tasks are corrected for fluency, elaboration, originality, resistance to premature closure, and abstractness of titles, while the verbal form tasks are corrected for fluency, flexibility, and originality. Other measures have

been detected with the Kit of Reference Tests for Cognitive Factors (French et al., 1963; see also Kurtzman, 1967) that considers different categories of creative thinking: controlled associations, word arrangements, thing categories, word beginnings and endings, utility, gestalt transformation, and apparatus. For example, Beghetto and colleagues (2021) use a modified 33-item scale that measures creative activity, constructed from the Inventory of Creative Activities and Achievement (ICAA; Diedrich et al., 2018) across the lifespan, assesses creative activity in different domains such as in literature, music, cooking, arts and crafts, sports, visual arts, performing arts, science and engineering.

The Guilford tests of creativity (Guilford, 1967), that is, the Alternative Uses Task (AUT), are also included in the TTCT (Eisenman, 1987; Pankove & Kogan, 1968; Shen et al., 2018; Tyagi et al., 2017) and S-A creativity test (Harada, 2020). In addition, Jose (1970) used two measures of DT taken from the verbal and figural forms of the Minnesota Tests of Creative Thinking. In the AUT, the subject is asked to list as many unusual uses as possible of everyday objects (e.g., glasses, shoes, bricks). The test can be administered with or without a time limit, and timing also affects comparability data and results. Scores are attributed relying on originality, fluency, and flexibility of responses.

S-A creativity is taken from the TTCT and foresees three different activities: AUT, to imagine useful and desirable but unrealized functions of some objects; imagine the consequences of "unimaginable things" that happen. In this case, the answers are evaluated for fluidity, flexibility, originality, and elaboration (as in the TTCT). In addition to measures of divergent thinking, Harada (2020) and Tyagi and colleagues (2017) also considered measures of convergent thinking.

3) *Creative achievement/behavior and self-beliefs.* Dewett (2006), Beghetto and colleagues (2021), and Tyagi and colleagues (2017) used performance measures in their studies but considered creative achievement and creative behavior. Dewett (2006) used a measure of creativity that is an adaptation of the task of George and Zhou (2001) and Scott and Bruce (1994). The task consists of six items in which creativity-related problem-solving behavior is investigated.

The self-report questionnaire Creative Achievement (CAQ; Carson et al., 2005) investigates 10 domains of creativity: music, visual arts, architecture, scientific discovery, culinary arts, dance, theatre and films, inventions, writing, and humor (Beghetto et al., 2021; Tyagi et al., 2017). Beghetto et al. (2021) measured creativity by considering the global CC, as measured by the Short Scale of Creative Self (SSCS; Karwowski et al., 2018), a 5-point Likert scale, ranging from 1 = *definitely not* to 5 = *definitely yes*, that investigates creative self-efficacy and creative personal identity.

## Discussion

The primary purposes of this review were to analyze and systematize the constructs' definition and methodological factors that could explain the controversial results of the studies investigating the relationship between RT and creativity. Secondly, to suggest new methodological and practical directions in this field of study. The inconsistent results concerning the link between RT and creativity, as highlighted in the Results section, could depend on two main factors: the first is the way risk and creativity constructs are considered from a theoretical point of view, and the second complementary to this aspect, how different assessment methods have been employed to measure the two constructs (Tyagi et al., 2017). However, in addition to these theoretical and methodological considerations, looking back at the results obtained in the review, we can distinguish two ways of investigating the examined constructs. The earliest studies on creativity and RT were mainly based on speculation. If Merrifield and colleagues (1961) found a correlation between creativity (associational fluency) and risk-taking, measured as a score on the adventure, Pankove and Kogan (1968) found very low correlations between the two measures using different tools (only one task, the shuffleboard,

performed only by boys shows a correlation). These results emphasize how much the results can be related to the measure or task used. Another confirmation could be found in the study conducted by Jose (1970), who reported no significant correlations between DT and RT. The turning point came with Torrance's (1971) more systematic studies of the relationship between creativity and risk through standardized tests in which he showed that the most creative people were also those who were able to cope better with frustration as they were able to break free from typical and habitual patterns of behavior. Building on these studies, Glover and Gary (1976) also showed that creative people could tolerate ambiguity and solve problems in unusual ways. However, this breakthrough has not diminished the problems arising from the complexity of the two constructs. Even after this methodological improvement, almost all studies used different assessment tools depending on the author's definition of the constructs of creativity and risk, sometimes considering the relationship in one direction (how creativity affects risk) or in the other (how risk, understood as personality, can affect being creative cognition and/or behavior). For example, some studies show that creativity influences RT (Charyton, Snelbecker, Elliot, et al., 2013; Charyton, Snelbecker, Rahman, et al., 2013; Dewett, 2006; Eisenman, 1987; Glover, 1977; Glover & Sautter, 1977; Pascual-Leone et al., 2010; Tyagi et al., 2017), while others show that RT can influence only some components of creative thinking (Beghetto et al., 2021; Harada, 2020; Jose, 1970; Shen et al., 2018).

Besides these theoretical (definition of constructs) and methodological problems (different measures used) from the analysis of the selected studies, although with conflicting results, it appears that, in general, there is a complex and bidirectional relationship between the two constructs that might be better explained by considering more specifically and thoroughly their facets (i.e., risk as a specific domain or generic domain; creativity understood as potential, as a trait, or as actual achievements). The following sections will then systematize the results following this consideration.

## General Domain RT

Usually, the more creative a person is, the more they tend to risk. This could at first be seen as a weakness because it is not always functional to make risky decisions; indeed, for example, in the financial field, this could be detrimental. Going into detail, however, some studies show that specific components of creativity, such as flexibility, can be a "protective" factor against risky behavior. Furthermore, the ability to reach many novel solutions to a given problem advocates cognitive flexibility, which seems at odds with the rigid nature of some risky behaviors (e.g., gambling; Pascual-Leone et al., 2010). Risk conditions are often characterized by ambiguity, and remarkably creative individuals tolerate ambiguity better, accommodating less structured and unfamiliar situations (Kurtzman, 1967). In general, high levels of creative ability predict higher levels of risk tolerance (Charyton, Snelbecker, Rahman, et al., 2013).

In general, it seems that a higher level of creativity (in particular DT) is linked with higher RT and risk-seeking (i.e., Charyton, Snelbecker, Elliot, et al., 2013; Charyton, Snelbecker, Rahman, et al., 2013; Merrifield et al., 1961); vice versa, RT and willingness to take intellectual risks could influence creative performance in two ways: in the exploration or manipulation of stimuli, or as a moderator in creative behavior (Beghetto et al., 2021; Harada, 2020). People must be willing to take risks for creative confidence to develop into creative behavior (Beghetto et al., 2021). Furthermore, efficient divergent thinkers tend to engage in RT rather than risk-averse behavior (Harada, 2020). Moreover, creative individuals show a higher tolerance for ambiguity than those with low creativity scores and, thus, a greater propensity to take risks. This can be useful in everyday life because they do not experience a high degree of discomfort in tasks of uncertainty and ambiguity and can maintain focus on the problem to be solved and the alternatives to be considered without prematurely closing the search for possible solutions (Allwood & Selart, 2001; Tegano, 1990).

Consistently, individuals characterized by rigid and absolutist reasoning, such as intolerance of ambiguity, perform worse in creative problem-solving tasks, which may be inefficient in everyday life (e.g., Salvi et al., 2023, 2021). More in detail, in the early studies that investigated the relationship between creativity components and risk, although using different instruments to investigate the constructs, it emerged that higher flexibility and originality scores are more correlated with high RT scores, whereas elaboration goes in the opposite direction and is linked to a low RT score in general (Eisenman, 1987; Glover 1977; Glover & Sautter, 1977). This could be related to the fact that the more details a person tends to add, the more time he/she has to think and find solutions, explore alternatives, and take fewer risks.

## RT in Specific Domains

More recently, studies in this field have focused on certain risk domains considering, for example, risk in the financial field, also highlighting a positive relationship with creativity (Charyton, Snelbecker, Elliot, et al., 2013; Charyton, Snelbecker, Rahman, et al., 2013) and with the originality component (Pascual-Leone et al., 2010). From these studies, it thus appears that creativity may be a predictor of greater risk-taking. Shen and colleagues (2018) also show that higher RT scores correlate with higher DT scores. It has been shown that DT plays an essential role in RT, precisely concerning these two aspects of the process: optimization of the task based on general information and the broader search for a more excellent range of information. The authors also considered RT with two main aspects: RT preference and attitude toward risk, which could be valuable research for future work (Harada, 2020).

An apparent exception to this trend is the contribution of Tyagi and colleagues (2017). They found a specific relationship between high-level creativity (biographical measures) and social risk-taking, while a relationship between creativity and RT did not emerge. However, they did find a relationship between RT in the social sphere and creative personality. Again, high RT scores in the social domain were predictors of a creative personality. These conflicting results could probably be related to the different measures of RT and the characteristics of the sample (i.e., cultural identity).

To summarize these last studies, Harada (2020), Shen et al. (2018), and Tyagi et al. (2017) found that creativity was linked with high RT tendencies in the social domain, and, at the same time, social RT was a predictor of a creative personality. Moreover, Beghetto and colleagues (2021) investigated even more in-depth the relationship between RT (willingness to take a risk) and creativity in the component of creative confidence (CC) and creative behavior (CB). The study confirmed that the two constructs are related: the willingness to take risks seems to be a moderator between CC and CB, thus enhancing this link. This could indicate that good levels of creativity influence RT and vice versa and that self-confidence in one's characteristics is crucial.

These results could have two significant application implications. The first could be to develop interventions to enhance creative thinking that could positively influence RT. This could be an advantage in today's society, defined as a "risk society" (Beck, 2002). Secondly, it could make people more and more autonomous in their daily lives, even when they have to make decisions and judgments without knowing the actual result/consequence of the actions (Kahneman, 2003).

Above all, creativity and its DT component seem to play a role in the search for alternative solutions to solve a problem, in contrast to fixation and perseveration, which are not always functional behaviors in society. DT is related to RT as it requires the individual to explore different cognitive pathways and choices that may sometimes involve taking certain risks to generate multiple solutions, especially when the situation is open-ended. The individual does not have the option of relying on known patterns used in the past. CT, on the other hand, although it can be considered an aspect of creativity, leads the individual to focus on finding a single solution,

requiring less risk-taking. However, the literature does not reveal many studies that support this second outcome. Beyond DT and CT, it could be considered that important aspects such as personality or cognitive factors (e.g., having a creative cognitive style) may predict and influence risk-taking and could therefore represent potential moderating factors. However, no studies emerge from the literature that considers these variables together.

Finally, it is worth noting that, as underlined in Harada (2020), the differences in DT or CT scores in several studies (e.g., Harada, 2020; Shen et al., 2018; Tyagi et al., 2017) could also be due to cultural influence: when studying RT preferences and creativity or divergent thinking cultural differences must be considered (Ucar, 2018). Culture could affect RT and risk tolerance differently depending on the geographical area in which the research was conducted (i.e., Shen et al., 2018, conducted the study with native Chinese, while Chermahini and Hommel, 2010, in the Netherlands). Indeed, the literature shows that, for example, Chinese culture defines and values creativity differently from Western culture (Lan & Kaufman, 2012; Niu & Kaufman, 2013), which might explain some differences in the results obtained in the reported studies. For example, Shen and colleagues (2018) pointed out the positive link between DT and decision-making, including risk-taking. However, the same experiment conducted in the Netherlands revealed negative or close to zero correlations (Chermahini & Hommel, 2010), probably influenced by cultural differences. Future studies should carefully consider this factor to disentangle eventual cultural influences that might confound the results.

## Conclusion and Future Directions

The conflicting results reported in this review are mainly due to three factors: a) the difficulty in clearly defining the multidimensional constructs of creativity and risk, b) the heterogeneity of the instruments used in the studies, and c) hypothetically, the role of cultural differences. However, although some results are conflicting or inconsistent, most studies have supported the hypothesis that people with low creativity (in the components of flexibility and originality) tend to avoid risky situations and decisions, preferring the status quo. In contrast, people with high creative abilities (higher test scores in the flexibility and originality components) tend not to flinch from challenging situations (Charyton, Snelbecker, Elliot, et al., 2013; Charyton, Snelbecker, Rahman, et al., 2013; Dewett, 2006; Eisenman, 1987; Glover, 1977; Glover & Sautter, 1977; Pascual-Leone et al., 2010; Tyagi et al., 2017).

For this reason, studying how individual differences, such as creative abilities, impact risk-taking might be pivotal to help people enhance their decision-making skills by supporting functional processes. Moreover, the study of factors related to risk and RT seems particularly important nowadays, as it can help to understand the best ways to manage risk, avoid risky behavior in specific domains and contexts, and enable individuals to benefit from RT by realizing profits (e.g., Platt & Huettel, 2008; Sternberg & Lubart, 1992). Furthermore, studying the role of creativity in risk behavior can also help to understand people's behavior in risk situations, especially in safety-critical or ambiguous and novel environments (Bourgeois-Bougrine, 2020).

By clearly understanding the relationship between the two constructs and how creativity can support and help in risk-taking, and vice versa when it can be a hindrance, it will be possible to favor functional choices. This review suggests the need for a more systematic study of the bidirectional relationship between the two multidimensional constructs of risk and creativity with practical implications concerning the employment of specific assessment methods.

## References

Allinson, C., & Hayes, J. (2012). The cognitive style index: Technical manual and user guide. *Retrieved* January 13, 2014, from https://www.cognitivestyleindex.com/technical-manual

Allwood, C. M., & Selart, M. (2001). Social and creative decision making. In Allwood, C. M., & Selart, M. (Eds.), *Decision making: Social and creative dimensions* (pp. 3-11). Springer. https://doi.org/10.1007/978-94-015-9827-9_1

Atkinson, J. W., & Litwin, G. H. (1960). Achievement motive and test anxiety conceived as motive to approach success and motive to avoid failure. *The Journal of Abnormal and Social Psychology*, *60*(1), 52-63. https://doi.org/10.1037/h0041119

Baas, M., Koch, S., Nijstad, B. A., & De Dreu, C. K. W. (2015). Conceiving creativity: The nature and consequences of laypeople's beliefs about the realization of creativity. *Psychology of Aesthetics, Creativity, and the Arts*, *9*(3), 340-354. https://doi.org/10.1037/a0039420

Barron, F. (1988). Putting creativity to work. In R. J. Sternberg (Ed.), *The nature of creativity: Contemporary psychological perspectives* (pp. 76-98). Cambridge University Press.

Beck, U. (2002). The terrorist threat: World risk society revisited. *Theory, Culture & Society*, *19*(4), 39-55.

Beghetto, R. A. (2009). Correlates of intellectual risk-taking in elementary school science. *Journal of Research in Science Teaching*, *46*(2), 210-223. https://doi.org/10.1002/tea.20270

Beghetto, R. A., Karwowski, M., & Reiter-Palmon, R. (2021). Intellectual risk taking: A moderating link between creative confidence and creative behavior? *Psychology of Aesthetics, Creativity, and the Arts*, *15*(4), 637-644. https://doi.org/10.1037/aca0000323

Blais, A. R., & Weber, E. U. (2006). A domain-specific risk-taking (DOSPERT) scale for adult populations. *Judgment and Decision Making*, *1*(1), 33-47. https://doi.org/10.1037/t13084-000

Bourgeois-Bougrine, S. (2020). What does creativity mean in safety-critical environments?. *Frontiers in Psychology*, *11*, Article 565884. https://doi.org/10.3389/fpsyg.2020.565884

Carson, S. H., Peterson, J. B., & Higgins, D. M. (2005). Reliability, validity, and factor structure of the Creative Achievement Questionnaire. *Creativity Research Journal*, *17*(1), 37-50. https://doi.org/10.1207/s15326934crj1701_4

Cattell, R. B., & Beloff, H. (1962). *Handbook for the IPAT Jr-Sr, High School Personality Questionnaire — the HSPQ*. Institute for Personality and Ability Testing.

Charyton, C., Snelbecker, G. E., Elliott, J. O., & Rahman, M. A. (2013). College students' general creativity as a predictor of cognitive risk tolerance. *The International Journal of Creativity and Problem Solving*, *23*(2), 79-97.

Charyton, C., Snelbecker, G. E., Rahman, M. A., & Elliott, J. O. (2013). College students' creative attributes as a predictor of cognitive risk tolerance. *Psychology of Aesthetics, Creativity, and the Arts*, *7*(4), 350-357. https://doi.org/10.1037/a0032706

Chermahini, S. A., & Hommel, B. (2010). The (b) link between creativity and dopamine: Spontaneous eye blink rates predict and dissociate divergent and convergent thinking. *Cognition*, *115*(3), 458-465. https://doi.org/10.1016/j.cognition.2010.03.007

Collins, A., & Koechlin, E. (2012). Reasoning, learning, and creativity: Frontal lobe function and human decision-making. *PLoS Biology*, *10*(3), Article e1001293. https://doi.org/10.1371/journal.pbio.1001293

Cools, E., & Van den Broeck, H. (2007). Development and validation of the Cognitive Style Indicator. *The Journal of Psychology*, *141*(4), 359-387. https://doi.org/10.3200/JRLP.141.4.359-388

Cunningham, R., Elzi, A., Hall, J. A., Farrell, M., & Roberts, M. (1951). *Understanding group behavior of boys and girls.* Teachers College. https://doi.org/10.1037/14521-000

Dewett, T. (2006). Exploring the role of risk in employee creativity. *The Journal of Creative Behavior*, *40*(1), 27-45. https://doi.org/10.1002/j.2162-6057.2006.tb01265.x

Diedrich, J., Jauk, E., Silvia, P. J., Gredlein, J. M., Neubauer, A. C., & Benedek, M. (2018). Assessment of real-life creativity: The Inventory of Creative Activities and Achievements (ICAA). *Psychology of Aesthetics, Creativity, and the Arts*, *12*(3), 304-316. https://doi.org/10.1037/aca0000137

Eisenman, R. (1969). Components of creativity, verbal conditioning, and risk taking. *Perceptual & Motor Skills*, *29*(3), 687-700. https://doi.org/10.2466/pms.1969.29.3.687

Eisenman, R. (1987). Creativity, birth order, and risk taking. *Bulletin of the Psychonomic Society*, *25*(2), 87-88. https://doi.org/10.3758/BF03330292

Eysenck, H. J. (1995). Creativity as a product of intelligence and personality. In D. H. Saklofske & M. Zeidner (Eds.), *International handbook of personality and intelligence* (pp. 231-247). Springer.

French, J. W., Ekstrom, Ruth B., & Price, L. A. (1963). *Manual for Kit of reference tests for cognitive factors*. Educational Testing Service.

Fusi, G., Lavolpe, S., Crepaldi, M., & Rusconi, M. L. (2021). The controversial effect of age on divergent thinking abilities: A systematic review. *The Journal of Creative Behavior*, *55*(2), 374-395. https://doi.org/10.1002/jocb.461

George, J. M., & Zhou, J. (2001). When openness to experience and conscientiousness are related to creative behavior: An interactional approach. *Journal of Applied Psychology*, *86*(3), 513-524. https://doi.org/10.1037/0021-9010.86.3.513

Getzels, J. W., & Jackson, P. W. (1960). A study of giftedness: A multidimensional approach. In *The gifted student* (Cooperative research monograph No. 2, pp. 1-18). US Government Printing Office.

Glover, J. A. (1977). Risky shift and creativity. *Social Behavior and Personality: An International Journal*, *5*(2), 317-320. https://doi.org/10.2224/sbp.1977.5.2.317

Glover, J., & Gary, A. L. (1976). Procedures to increase some aspects of creativity. *Journal of Applied Behavior Analysis*, *9*(1), 79-84. https://doi.org/10.1901/jaba.1976.9-79
Glover, J. A., & Sautter, F. (1977). Relation of four components of creativity to risk-taking preferences. *Psychological Reports*, *41*(1), 227-230. https://doi.org/10.2466/pr0.1977.41.1.227
Gough, H. G. (1979). A creative personality scale for the Adjective Check List. *Journal of Personality and Social Psychology*, *37*(8), 1398-1405. https://doi.org/10.1037/0022-3514.37.8.1398
Gough, H. G. (1992). Assessment of creative potential in psychology and the development of a Creative Temperament Scale for the CPI. In J. C. Rosen & P. McReynolds (Eds.), *Advances in psychological assessment* (Vol. 8, pp. 225-257). Plenum Press. https://doi.org/10.1007/978-1-4757-9101-3_8
Guilford, J. P. (1956). The structure of intellect. *Psychological Bulletin*, *53*(4), 267-293. https://doi.org/10.1037/h0040755
Guilford, J. P. (1967). Creativity: Yesterday, today, and tomorrow. *The Journal of Creative Behavior*, *1*(1), 3-14. https://doi.org/10.1002/j.2162-6057.1967.tb00002.x
Harada, T. (2020). The effects of risk-taking, exploitation, and exploration on creativity. *PloS One*, *15*(7), Article e0235698. https://doi.org/10.1371/journal.pone.0235698
Hsee, C. K., & Weber, E. U. (1997). A fundamental prediction error: Self-others discrepancies in risk preference. *Journal of Experimental Psychology: General*, *126*(1), 45-53. https://doi.org/10.1037/0096-3445.126.1.45
Hsee, C. K., & Weber, E. U. (1999). Cross-national differences in risk preference and lay predictions. *Journal of Behavioral Decision Making*, *12*(2), 165-179. https://doi.org/10.3758/BF03212969
Jose, T. (1970). Convergent-divergent thinking abilities and risk-taking in children. *Philippine Journal of Psychology*, *3*(1), 22-35.
Kahneman, D. (2003). A psychological perspective on economics. *American Economic Review*, *93*(2), 162-168.
Kahneman, D., & Tversky. A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, 4(7), 263- 291. https://doi.org/10.2307/1914185
Kahneman, D., & Tversky, A. (1984). Choices, values, and frames. *American Psychologist*, *39*, 341-350. https://doi.org/10.1037/0003-066X.39.4.341
Karwowski, M., Lebuda, I., & Wiśniewska, E. (2018). Measuring creative self-efficacy and creative personal identity. *The International Journal of Creativity & Problem Solving*, *28*(1), 45-57.
Kogan, N., & Wallach, M. A. (1964). *Risk taking: A study in cognition and personality*. Holt, Rinehart & Winston.
Kozhevnikov, M. (2007). Cognitive styles in the context of modern psychology: Toward an integrated framework of cognitive style. *Psychological Bulletin*, *133*(3), 464-481. https://doi.org/10.1037/0033-2909.133.3.464
Kuhlmann, F. (1928). The Kuhlmann-Anderson intelligence tests compared with seven others. *Journal of Applied Psychology*, *12*(6), 545-594. https://doi.org/10.1037/h0073230
Kurtzman, K. A. (1967). A study of school attitudes, peer acceptance, and personality of creative adolescents. *Exceptional Children*, *34*(3), 157-162. https://doi.org/10.1177/001440296703400301
Lan, L., & Kaufman, J. C. (2012). American and Chinese similarities and differences in defining and valuing creative products. *The Journal of Creative Behavior*, *46*(4), 285-306. https://doi.org/10.1002/jocb.19
Lesieur, H. R., & Blume, S. B. (1993). Pathological gambling, eating disorders, and the psychoactive substance use disorders. *Journal of Addictive Diseases*, *12*(3), 89-102. https://doi.org/10.1300/J069v12n03_08
Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *Journal of Clinical Epidemiology*, *62*, e1-e34. https://doi.org/10.1016/j.jclinepi.2009.06.006
Lubart, T. I., & Sternberg, R. J. (1998). Creativity across time and place: Life span and cross-cultural perspectives. *High Ability Studies*, *9*(1), 59-74. https://doi.org/10.1080/1359813980090105
Lubart, T., & Thornhill-Miller, B. (2019). Creativity: An overview of the 7C's of creative thought. In R. J. Sternberg & J. Funke (Eds.), *The psychology of human thought: An introduction* (pp. 277-305). Heidelberg University Publishing. https://doi.org/10.17885/heiup.470.c6678
MacCrimmon, K. R., & Wehrung, D. A. (1986). Assessing risk propensity. In L. Daboni, A. Montesano, & M. Lines (Eds.), *Recent developments in the foundations of utility and risk theory* (pp. 291-309). Springer.
MacCrimmon, K. R., & Wehrung, D. A. (1990). Characteristics of risk-taking executives. *Management Science*, *36*(4), 422-435. https://doi.org/10.1287/mnsc.36.4.422
McClelland, D. C. (1961). *The achieving society*. D. Van Nostrad Company. http://doi.org/10.1037/14359-000
Merrifield, P. R., Guilford, J. P., Christensen, P. R., & Frick, J. W. (1961). Interrelationships between certain abilities and certain traits of motivation and temperament. *Journal of General Psychology*, *65*(1), 57-74. https://doi.org/10.1080/00221309.1961.9920461
Miceli, S., de Palo, V., Monacis, L., Cardaci, M., & Sinatra, M. (2018). The Italian version of the Cognitive Style Indicator and its association with decision-making preferences. *Creativity Research Journal*, *30*(1), 85-94. https://doi.org/10.1080/10400419.2018.1411486
Niu, W., & Kaufman, J. C. (2013). Creativity of Chinese and American cultures: A synthetic analysis. *The Journal of Creative Behavior*, *47*(1), 77-87. https://doi.org/10.1002/jocb.25

Pankove, E., & Kogan, N. (1968). Creative ability and risk-taking in elementary school children. *Journal of Personality*, *36*(3), 420-439. https://doi.org/10.1111/j.1467-6494.1968.tb01483.x

Pascual-Leone, A., Gomes, K., Orr, E. S., Kaploun, K. A., & Abeare, C. A. (2010). Affective and cognitive correlates of gambling behavior in university students. *Journal of Gambling Studies*, *27*(3), 401-408. https://doi.org/10.1007/s10899-010-9226-9

Piffer, D. (2012). Can creativity be measured? An attempt to clarify the notion of creativity and general directions for future research. *Thinking Skills and Creativity*, *7*(3), 258-264. https://doi.org/10.1016/j.tsc.2012.04.009

Platt, M. L., & Huettel, S. A. (2008). Risky business: The neuroeconomics of decision making under uncertainty. *Nature Neuroscience*, *11*(4), 398-403. https://doi.org/10.1038/nn2062

Salvi, C., Iannello, P., Cancer, A., Cooper, S., McClay, M., Rago, S., Antonietti, A., & Dunsmoor, J. E. (2023). *Does social rigidity predict cognitive rigidity? Profiles of socio-cognitive polarization* [Manuscript submitted for publication].

Salvi, C., Iannello, P., Cancer, A., McClay, M., Rago, S., Dunsmoor, J. E., & Antonietti, A. (2021). Going viral: How fear, socio-cognitive polarization and problem-solving influence fake news detection and proliferation during COVID-19 pandemic. *Frontiers in Communication*, *5*. https://doi.org/10.3389/fcomm.2020.562588

Scott, S. G., & Bruce, R. A. (1994). Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of Management Journal*, *37*(3), 580-607. https://doi.org/10.2307/256701

Shen, W., Hommel, B., Yuan, Y., Chang, L., & Zhang, W. (2018). Risk-taking and creativity: Convergent, but not divergent thinking is better in low-risk takers. *Creativity Research Journal*, *30*(2), 224-231. https://doi.org/10.1080/10400419.2018.1446852

Sitkin, S. B., & Weingart, L. R. (1995). Determinants of risky decision-making behavior: A test of the mediating role of risk perceptions and propensity. *Academy of Management Journal*, *38*(6), 1573-1592.

Snelbecker, G. E., McConologue, T., & Feldman, J. M. (2001). *Cognitive risk tolerance survey* [Unpublished manuscript].

Sternberg, R. J. (2001). What is the common thread of creativity? Its dialectical relation to intelligence and wisdom. *American Psychologist*, *56*(4), 360-362. https://doi.org/10.1037/0003-066X.56.4.360

Sternberg, R. J. (2006). The nature of creativity. *Creativity Research Journal*, *18*(1), 87-98. https://doi.org/10.1207/s15326934crj1801_10

Sternberg, R. J., & Lubart, T. I. (1992). Buy low and sell high: An investment approach to creativity. *Current Directions in Psychological Science*, *1*(1), 1-5. https://doi.org/10.1111/1467-8721.ep10767737

Stoner, J. A. F. (1968). Risky and cautious shifts in group decisions: The influence of widely held values. *Journal of Experimental Social Psychology*, *4*(4), 442-459. https://doi.org/10.1016/0022-1031(68)90069-3

Tegano, D. W. (1990). Relationship of tolerance of ambiguity and playfulness to creativity. *Psychological Reports*, *66*(3), 1047-1056. https://doi.org/10.2466/PR0.66.3.1047

Torrance, E. P. (1987). Teaching for creativity. *Frontiers of Creativity Research: Beyond the Basics*, *189*, 215.

Torrance, E. P. (1971). Are the Torrance tests of creative thinking biased against or in favor of "disadvantaged" groups?. *Gifted Child Quarterly*, *15*(2), 75-80.

Torrance E. P. (1974). *Torrance tests of creative thinking*. Ginn.

Torrance, E. P. (1998). *The Torrance tests of creative thinking: Norms-technical manual, figural (streamlined) forms A & B.* Scholastic Testing Service.

Tyagi, V., Hanoch, Y., Hall, S. D., Runco, M., & Denham, S. L. (2017). The risky side of creativity: Domain specific risk taking in creative individuals. *Frontiers in Psychology*, *8*, Article 145. https://doi.org/10.3389/fpsyg.2017.00145

Ucar, E. (2018). Local creative culture and corporate innovation. *Journal of Business Research*, *91*, 60-70. https://doi.org/10.1016/j.jbusres.2018.05.040

Weber, E. U., Ames, D. R., & Blais, A. R. (2005). "How do I choose thee? Let me count the ways": A textual analysis of similarities and differences in modes of decision-making in China and the United States. *Management and Organization Review*, *1*(1), 87-118. https://doi.org/10.1111/j.1740-8784.2004.00005.x

Weber, E. U., Blais, A. R., & Betz, N. E. (2002). A domain-specific risk-attitude scale: Measuring risk perceptions and risk behaviors. *Journal of Behavioral Decision Making*, *15*(4), 263-290. https://doi.org/10.1002/bdm.414

Williams, F. E. (1980). *Creative assessment packet: Manual*. D. O.K. Publishers.

Zenasni, F., Besançon, M., & Lubart, T. (2008). Creativity and tolerance of ambiguity: An empirical study. *The Journal of Creative Behavior*, *42*(1), 61-73. https://doi.org/10.1002/j.2162-6057.2008.tb01080.x

Zhou, J., & George, J. M. (2001). When job dissatisfaction leads to creativity: Encouraging the expression of voice. *Academy of Management Journal*, *44*(4), 682-696. https://doi.org/10.2307/3069410

Zuckerman, M., & Kuhlman, D. M. (2000). Personality and risk-taking: Common bisocial factors. *Journal of Personality*, *68*(6), 999-1029. https://doi.org/10.1111/1467-6494.00124