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6 Creativity in the Visual Arts

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Abstract

In this chapter, we review research on creativity with visual art, and, specifically, how this has been addressed within the psychology of art. We begin with a brief review of the history of psychology of art and the unique challenges associated with studying artistic creativity and expression. We then review current creativity studies that touch on art making and that focus on techniques and methods that provide the foundation for current research. We conclude with a consideration of important questions that hold particular intrigue for future research, such as questions related to artistic development, approaches to assessing art making, and the artistic brain.

Introduction

Arguably, no domain so closely connects humans to creativity as art. Researchers suggest that art making – or visual artistic expression – dates back at least 40,000 to 75,000 years, and if one considers evidence from pigments, symbolic beads, etc., possibly much farther (Zaidel, Nadal, Flexas, & Munar, 2013). Researchers also argue that the intentional creation of art is both one of the major points of evolutionary distinction from other animals and a defining feature of modern humans. Art is ubiquitously produced in human societies, with a seemingly endless variety of expression, and thus is a major point of inter-social and cultural comparison (Dissanayake, 2000; Dutton, 2009). Art is therefore one of the more intriguing avenues for considering the development and action underlying creativity, as well as a main topic for psychology, because: (1) art is spontaneously created by almost every individual at some point in his or her lifetime; (2) art is considered a window reflecting our perception and thinking (Zaidel, 2010); and (3) art making is a unique skill involving a range of proficiencies.

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1 A brief Note on the Unique Challenge of Studying Creativity in Art

One only has to consider the rich history of art and the evolving range of artists and modes of visual expression to realize its importance as well as the unique challenge inherent in its study. Since the dawn of human ability to create visual images, those with a special ability in this domain have probably always held a special place of reverence. Prototypical genius creators that often come to mind when thinking about creativity are often artists. A visit to an elementary school – or a studio or museum – will also confirm that we have a special respect, and sometimes fear (Mitchell, 1987), for visual creative ability. Technically speaking, the large number of overlapping abilities that must be utilized in visual art making – perception, memory, motor control, language, spatial reasoning, not to mention imagination – also makes art one of our most complex human activities. Naturally, the question is asked: How is it possible that we can see something, or have an idea, and translate that conception through physical manipulation of materials (or our bodies) into a unique and pleasing representational, symbolic, *or even abstract* image?

Such questions related to artistic creativity comprise, in fact, some of the oldest topics of psychology. While the consideration of painting and drawing had long before been a topic of philosophy, studies on art making also emerged as a branch of psychology in the late nineteenth century during a time when the field was distinguishing itself as a scientific discipline. The field's founding is often attributed to Fechner (e.g., 1876), who, among other approaches, stressed the “method of production” as a driving element in his search for general laws guiding aesthetic preferences (Westphal-Fitch, Oh, & Fitch, 2013). Art making was also subsequently taken up as a topic in the United States as well as Europe in the 1920–30s, during which there was a demand for measures of people's abilities, aptitudes, and personalities – combined with a general discourse on “creativity” – and which led to the development of several standardized drawing assessments (Holert, 2009). This was also coupled with standardized assessments of human visual memory and use of perspective or spatial arrangements (e.g., Meyers & Meyers, 1995; McManus, Chamberlain, Loo, Rankin, Riley & Brunswick, 2010). The next 100 years after Fechner also saw a slow, steady rise in research on art viewing, including landmark works by Arnheim (1956) and Berlyne (1974). This continues to the present day, when there is an obvious burgeoning of psychology of art with new empirical procedures, development of new physiological and neuroimaging measures, and robust cognitive models of art processing (Chatterjee; 2003; Leder, Belke, Oeberst & Ausgustin, 2004; Pelowski & Akiba, 2011) and dynamics between art making and viewing (Tinio, 2013).

Aesthetic reception and artistic production are at two ends of the art spectrum, with the latter being linked to the artist creating an artwork and the former to the viewer encountering the artwork. While studies on the aesthetic reception of art have been increasing, since Fechner there has been a disproportionate scarcity of studies on creativity as expressed within the visual arts as well as artistic production. There are several reasons for the challenging nature of such research. Amongst these is the

ineffable nature of art making (Chatterjee, 2010; Lundy, 2012). Even during Fechner's time, it was already recognized that the sheer breadth of decisions and factors that go into art making, as well as its open-ended nature, make it particularly difficult to study empirically (Leder, 2014; Westphal-Fitch et al., 2013). This was coupled with a predominant focus in psychology (tied to its roots in philosophy) on top-down discussions of aesthetic judgments and reception of viewers, rather than bottom-up processes related to the making of art (Leder, 2013).

Researchers must also deal with a shifting definition of art itself. Art history has witnessed a constant evolution of conceptualizations of what it means for an object to be considered art (Becker, 1982). These include ideas, at various periods, that art might be beautiful, realistic, technically superior, contain specific styles, or even express the individuality of an artist, or challenge the prevalent conceptions held among others who make and value art (Dutton, 2009). As a consequence, it has become difficult to conceptualize what creativity in art should look like. Each of these definitions is characterized by a particular art making approach, utilizing different channels of information, and resulting in "creative" works as different as the impressionist paintings of Monet and the conceptual pieces of Rauschenberg, or the readymades of Duchamp. Approaches to art and creativity may also differ between cultures (e.g., Li, 1997, see also Section 3 below), thus introducing the danger of normalization and further challenging our understanding.

Finally, there has been minimal collaboration between scientists and artists. As put by Arrell (1997, "Teaching Aesthetics to Artists," para. 1), many individuals involved with art "are suspicious that too much analyzing of their art will harm their creativity," or "that thinking about art in this way is simply useless . . . that the issues discussed are not ones that they face as artists."

2 How Is Artistic Creativity Measured?

Even with the above challenges, there have been notable studies on creativity in art. Most of these studies are based on explorations of visual creativity in general, which is typically defined as the production of both novel and useful forms within a given context (Dake, 1991; Sternberg & Lubart, 1999). This is also considered a main counterpoint to verbal creative ability, and thus is often combined with such research. This skill is additionally considered as a primary component of drawing, painting, photography, etc. At the same time, many of the studies that we will review also directly involve the making or consideration of "art". In general, approaches can be split into four main areas (Lemons, 2011): the creative person, product, process, and environment. These will be reviewed below.

2.1 The Creative Person

One approach to studying creativity in art focuses on the creator. This involves the search for aspects of personality or behavior that might correlate to present creative achievement or future proficiency as an artist (or a visually creative person). A good

body of research has shown that creative people tend to share certain characteristics, many of which have also been connected to individual skills in art (e.g., Feist, 1999 for a review). Such individuals tend to be independent, resourceful, and spontaneous (Cassandro & Simonton, 2010; Eysenck, 1997; Lemons, 2011), with tolerance for risks, conflict, or ambiguity (Feldman, 1999). They are also often confident in their abilities and have low levels of cognitive or behavioral inhibition (Eysenck, 1997; Feist, 1999). These features may be assessed through standardized personality scales or observation.

More specifically to the art domain, elements of personality such as “openness to experience” have been linked to art making and art viewing. This element of the Big Five Personality Inventory (Costa & McCrae, 1992) involves a willingness to seek out unfamiliar or novel encounters, and has been shown to correlate with an individual’s ability to select “aesthetically superior” pictures (Myszkowski et al., 2014), as well as to positive ratings of both abstract and representational art (see Feist & Brady, 2004). Openness to experience has also been shown to predict creative achievement in both the arts and the sciences (Feist, 1998). Silvia, Nusbaum, Berg, Martin and O’Connor (2009) further note that openness can often be combined with “extraversion,” another Big Five factor, to create a broader category of “placticity,” or the ability to engage flexibly with novelty in behavior and cognition (see also DeYoung, 2006). Together, these two aspects predict scores on several creativity measures. However, see Roy, 1996, who found introversion as a key personality factor in fine artists.

2.1.1 Scales Assessing the Creative Person That Are Relevant to Art

Previous research has also used scales to identify creative persons, which can also reference or predict ability in art (see Cropley, 2000). For example, the Group Inventory for Finding Creative Talent (GIFT; Rimm & Davis, 1980) and the Group Inventory for Finding Interests (GIFFII and GIFFIII; Davis & Rimm, 1982) measure respondents’ (children of different age levels) agreement to a number of Yes/No statements, which include examples such as, “I am very aware of artistic considerations.” Answers are combined to yield scores for traits such as self-confidence, adventurousness, risk-taking, curiosity, humor, and artistic interest. This scale has shown moderate correlation with teacher-judged creativity of drawings (Cropley, 2000).

Similarly, the Creativity Scale for Diverse Domains (CSDD; Kaufman & Baer, 2004; see Silvia, Kaufman & Pretz, 2009 for a review) measures creative self-concepts, or people’s view of themselves as creative. The scale uses nine items covering areas from mathematics and interpersonal relations to art making, and yields scores in specific domains of “math/science,” “empathy/interpersonal,” “hands-on creativity,” as well as one global self-concept question (“How creative would you say you are in general?”). Rawlings and Locarnini (2007), for example, administered the scale to small groups of professional artists and scientists and showed that artists scored higher both on items measuring creativity in art as well as general creativity, while professional scientists scored higher only on items

measuring creativity in science and mathematics, but not general creativity (Kaufman & Baer, 2004). A recent update of the scale, the Kaufman Domains of Creativity Scale (K-DOCS: Kaufman, 2012), also added visual art/aesthetic creativity as one of its five dimensions. The Rating the Behavioral Characteristics of Superior Students (SRBCSS: Renzulli, Smith, White, Callahan, & Hartman, 1976), especially its nine-item *Creative Characteristics Rating* (CCRS) subscale, also touch on art. This scale is intended for grades K–12, and is often used with teachers to rate giftedness in creativity, art, music, drama, and communication, using creative achievements or activities (however, see Chan and Zhao, 2010).

The richness of people's personal visual imagination is also argued to relate to the ability to produce artistic/creative images (Pérez-Fabello & Campos, 2007). This has been assessed by, for example, the Vividness of Visual Imagery Questionnaire (VVIQ: Marks, 1973; see McKelvie, 1995 for review), which asks participants to read a description of a scene and then rate the vividness of their resulting mental image. Kottlow, Praeg, Luethy and Jancke (2011) suggested that artists scored higher than non-artists, although not to the level of statistical significance.

2.1.2 Biographical Inventories

Art is also included as a factor in several batteries that assess life history as a means of identifying creative talent. Examples include Schaefer and Anastasi's (1968) Biographical Inventory for Identifying Creativity in Adolescents, and Taylor and Ellison's (1968) Alpha Biographical Inventory (ABI), both of which use scales that touch on a number of areas potentially connected to creative achievement (see Cropley, 2000 for a review). Schaefer and Anastasi's inventory measures, for example, family background, motivation (possession of special equipment, willingness to skip meals to work on a project), intellectual and cultural orientation (hobbies, frequency of visits to museums or art galleries), breadth of interests, and drive towards novelty/diversity (including level of interest in unusual forms of art). This inventory was shown to correlate to teacher creativity ratings of art produced by high school students (Cropley, 2000). Correlation with this inventory was also higher for art than scientific creativity, with the test correctly identifying 96 percent of students whose products were rated by teachers as artistically creative.

Similarly, the Khatena–Torrance Creative Perceptions Inventory (KTCPI: Khatena & Torrance, 1976; see Lemons, 2011 for review), intended for ages 10 and up, includes a self-rating scale assessing tendency to function creatively, based on items requiring a choice between pairs of characteristics representing high and low creativity behaviors, as well as a fifty-item self-rating scale assessing autobiographical aspects ("I have composed a dance, song, or musical piece"). The Creative Activities Checklist (Runco, 1987), developed for use with children in grades 5 to 8, also asks participants to report how frequently they recently participated in six areas of activity – literature, music, drama, crafts, science, and art. Finally, the Creative Achievement Questionnaire (CAQ: Carson, Peterson & Higgins, 2005) asks individuals to rate their own creativity in ten domains, including music, architectural design, entrepreneurial ventures, humor, inventions, theater, film, and visual art.

It also has the unique feature of asking individuals to rate specific instances of ability, which, the authors argue, may give a more objective and outwardly observable basis for measuring creative output. With visual art, this ranges from having no training to taking lessons, showing works in galleries, and being in national publications.

2.2 The Creative Art Product

Approaches to studying creativity in art have also focused on the art product. Here as well, rather than directly testing creativity, most studies have focused on assessing general creative ability using tasks such as creating figures or images that are conceptually similar to art making. In a collection of 225 creativity tests by Torrance and Goff (1989), figural image-making type tasks made up about 9 percent of the total items. Although comparatively less common than other verbal measures, the use of figural creation is valued for two reasons. First, as noted above, art is a domain in which individuals, especially children, can act in a primarily creative fashion. Thus, art making is considered a particularly ecologically valid means of inducing creative action. Second, with its emphasis on visual problem solving, art offers an alternative to verbal tests of creativity, which may also not always overlap. Considered more broadly, however, these studies could also shed light on the unique ability of artists.

2.2.1 Figure Completion

One such task that has seen widespread use is figure completion. This involves participants drawing from visual cues pre-printed on paper. This approach can be traced from early twentieth-century experimental psychology approaches, which sought to explore drawing ability (see Holert, 2009 for a review), later used for assessing creativity in general. Modern examples could be said to stem from the Franck Figure Completion Test of Franck and Rosen (1949; see Runco, Millar, Acar & Cramond, 2010 for updates and a review). This test provides participants with thirty-six rectangular fields, each with a simple geometric or curved figure. Participants are then asked to complete the drawing. Originally intended to test masculinity–femininity differences, it was employed by Baron (reported in Ludington, 1965) to test creativity and personality, with the completed drawings scored for novelty in terms of the extent to which they build on the cues. Similar approaches were also used by the various tests of creative thinking developed by Guilford (1967; later Meeker & Meeker, 1985). These included a drawing task, among various verbal measures, with small fields in which participants are asked to “make something different,” and with drawings scored for fluency, flexibility, transformation (ability to revise something into a new form), and originality (see Lemons, 2011 for a review).

This approach was also the inspiration for the Torrance Test of Creative Thinking (TTCT: Torrance, 1966; recently re-normed in 2008; see also Cropley, 2000 and Runco et al., 2010 for reviews). This is the most widely used method for assessing

creativity (Cramond, Matthews-Morgan, Torrance, & Zuo, 1999) and is comprised of both a verbal and a figural section – “thinking creatively with pictures.” This latter section has three activities including picture completion using a blank paper divided into ten squares, each containing a different stimulus figure. Participants are asked to sketch a novel object or design by adding lines to the figures. This is paired with a picture construction task in which participants complete a drawing and assign a title, and a lines/circles task in which participants draw as many uses for a simple image as possible. These activities yield scores for fluency (ability to create many images), originality, elaboration, abstractness of titles, and resistance to premature closure (tendency not to quickly close off line cues). The figural tests can also be scored for thirteen creative strengths (Ball & Torrance, 1984; Kim, 2006), including: storytelling, movement and action, unusual visualization, richness of imagery, etc.

As noted by Baer (1993), the TTCT was used in 75 percent of all published creativity studies with elementary schoolchildren, and 40 percent of studies with adults or college students. This prevalence may be because the TTCT expands past verbal divergent thinking studies to integrate visual creativity and personality (Cromptley, 2000). The TTCT has shown good validity for predicting creativity (Lemons, 2011). For example, a twelve-year longitudinal study of 400 primary students (originally assessed between 1958 and 1964, Torrance, 1969) comparing the TTCT, along with follow-up questionnaires on quantity/quality of creative aspirations and achievement, showed a correlation of .27–.45. The TTCT format has also been adapted for more direct assessment of drawing (e.g., Yamamoto, 1964).

Similar assessments to the TTCT include the Creativity Assessment Packet (CAP: Williams, 1980), which focuses on assessing the creativity of younger students (grades 3–12). This test includes a “divergent thinking” task that asks students to work on twelve incomplete drawings and create a title, with the end product being scored for fluency, originality, flexibility, and elaboration. The Wallach–Kogan Creativity Test (WKCT: Wallach & Kogan, 1965) also focuses on divergent thinking and assesses both visual and verbal content, including two figural subtests involving interpretation of abstract lines and patterns. It is scored for fluency (number of ideas) and uniqueness of ideas.

A more recently developed assessment, also based on art production, is the Test for Creative Thinking-Drawing Production (TCT-DP: Urban & Jellen, 1996; Urban, 2004; see Cromptley, 2000 for a review). This test provides participants with two blank sheets of paper with pre-printed cues, in this case a large square with several lines inside and outside. Participants are then asked to complete a drawing, which are rated according to dimensions from a Gestalt-psychology creativity theory and which uses a standardized scoring sheet assessing factors such as continuation, completion, connections, boundary-breaking (drawing outside the large square frame), use of perspective, new elements, humor, and affectivity. Studies in a number of countries have indicated inter-rater reliability of above .90, and test-retest reliability of about .70 to .75 (Cromptley, 2000). The test manual also reports correlations of up to .82 with teacher ratings of creativity.

2.2.2 Free Drawing from Imagination

Studies have also used more open-ended drawing tasks in which individuals are asked to complete a drawing from imagination. One of the most common is Clark's Drawing Abilities Test (CDAT: Clark & Zimmerman, 2004). This asks participants to make four drawings – a house, a running person, a playground, and participants' "fantasy." This test has been used with over 5,000 upper elementary, middle, and high school students in the United States and other countries, and has proven to be a reliable, standardized screening and identification measure for artistically talented students. CDAT scores have also been shown to correlate significantly with teacher rankings of student success in classes for artistically talented students (Clark & Zimmerman, 2004). As noted below, the fantasy drawing aspect has been utilized in several studies because of its ability to elicit original, free expression (Chan & Chan, 2007; Chan & Zhao, 2010).

2.2.3 Selection of Still-Life Objects, Collage

Researchers have also used paradigms in which individuals complete collages or still-life drawings based on the arrangement of predefined shapes or objects. One of the most notable was used by Getzels and Csikszentmihalyi (1976) in their study of adult art students. They presented participants with twenty-three objects and asked them to use at least two objects in an arrangement, which was then drawn. This was first developed to explore the aspect of problem finding or "ideation," referring to the initial generation and graphic representation of visual ideas (Rostan, 2010). The activity, which could be video-recorded (see Rostan, 2005), is typically scored by noting total time spent drawing, total time spent completing basic shapes, and percentage of time given to finding a problem, as well as time exploring and choosing objects, and number of erasures, as a means of exploring the creation process. Assessments can also be made of the final produced art. Similar approaches include the Test of Figural Combination (Finke, 1990), which provides participants with three images that they are asked to combine into a creative object that is then sketched, (see e.g., Palmiero et al., 2010 for recent use in a study of art making).

Amabile (1982) also offered an oft-duplicated approach in which participants create collages from predefined shapes, and which offers a more standardized, yet open-ended means of assessing creativity. Collages can be rated on several artistic dimensions including creativity, technical goodness, and aesthetic appeal, and have shown good inter-rater reliability and separation between creativity judgments and judgments of technical goodness or aesthetic appeal. This too has been used in recent studies assessing interpersonal differences (Niu & Sternberg, 2001, see also Section 3).

2.2.4 Methods for Rating Creative Art Products

The above aspect of art making also touches on the complementary approach of individuals' artistic creations being rated by peers, teachers, or experts. This approach

follows from the argument that many other creativity approaches – such as those involving personality or self-introspection – tend to lack validity or reliability (Baer & McKool, 2009). In contrast, simply asking people to rate the creativity of produced art should reveal something meaningful about creativity or production, especially if there is agreement in people's ratings. The validity may be further enhanced if experts serve as raters (e.g., Cropley, 2000; Getzels & Csikszentmihalyi, 1976).

One of the most dominant approaches is the Consensual Assessment Technique (CAT: Amabile, 1982, 1983, 1996; Baer, 1993). With this method, raters (most often experts), working independently, are given a full set of created products or artworks and are asked to place the products into a number of groups representing points on a scale from non- to highly creative. Individual ratings are checked for correspondence and averaged to create a score for each product. This technique has been shown to have high inter-rater agreement (Amabile, 1983), temporal stability (Baer, 1994), and generally increasing reliability as one increases the number of raters (Baer & McKool, 2009).

This approach has had interesting use with art. Amabile (1983) reported a series of twenty-one studies of visual art making (collage), with inter-rater reliabilities ranging from .72 to .93. Amabile (1982, 1983) also found that while experts tended to agree regarding creativity, ratings often did not correlate with other attributes such as technical goodness, neatness, and expression (although it did correlate with aesthetic appeal), potentially suggesting that creativity is distinct, and that raters appear to be using the same domain specific factors for their judgments. Hennessey (1994) used this approach to assess Picasso drawings and to analyze videos of Picasso's art making process, and showed consistent ratings even among untrained undergraduates, further suggesting that even non-art-experts can agree on what they consider creative (see also Section 3 below).

The Creative Product Analysis Matrix (CPAM: Besemer & O'Quin, 1987) is another scale developed to assess creative products across disciplines, including art. This proposes three main dimensions: novelty, resolution (valuable, useful, solves a need), and synthesis or elaboration (well crafted, attractive, elegant). Raters assess the dimensions using a forty-three-item, semantic-differential scale. Besemer (1998), for example, tested the CPAM with chairs, exhibited as art, revealing that the hypothesized factors accounted for 70–80 percent of the total variance.

2.3 Perspectives on the Creative Process

Researchers have also considered the process whereby creative products are generated. This focus predominantly refers to the modeling of stages of the creative process in general. However, many of the aspects mentioned can be, and also have been, connected to creativity in art. Wallas (1926; cited in Torrance, 1988; see Niu & Sternberg, 2001 for a review), for example, proposed a four-step process of preparation, incubation, illumination, and revision, which is helpful for considering art. The work of Getzels and Csikszentmihalyi (1976) also considered the initial planning and execution of an idea during the process of drawing. Similarly, Bogousslavsky (2005) proposed three stages: perception processing, extraction

and abstraction (in which major features are delineated), and final execution. Recently, Tinio (2013) proposed a model of art making, which included the three stages of initialization, expansion and adaptation, and finalizing, connecting this as well to similar stages in art viewing (see below). As noted by Acosta (2014), most of these approaches share the idea that art making must begin with a baseline knowledge of materials, techniques, and approaches. This provides a fertile setting for new insight, which must then be “codified” or recognized by the artist, and only subsequently can it be brought to fruition through art making. Models often also make explicit distinction between the roughing-out of visual ideas (e.g., initialization) and later revision/refinement, which has been argued as a way of building from the initial foundation and providing a general linear progression of art making (e.g. Tinio, 2013).

2.3.1 Ideation

A related aspect of the artwork creation process that is often considered involves “ideation,” or the process of creating an initial idea or goal for the creative act, and, more specifically, the ability to compose ideas that are novel or surprising (Jackson & Messick, 1965; Kay, 1991). This type of problem solving has been cited as an essential component of the creative process in various disciplines (Mednick, 1962; Wallach & Kogan, 1965), but is also specifically important for creating new and interesting visual art. Runco and Chand (1995) offered a model stressing the interaction of processing components, motivation, and knowledge. Their first tier posited three primary controlling components – problem-finding skills and processes, ideational skills and processes, and evaluation. They suggested that it is both the ability to come up with new insight, but perhaps more importantly, the time given to problem finding and solution generation, which leads to creative products.

Empirical studies have also examined the related measure of “ideational fluency” – the propensity to generate multiple or unusual answers to problems (Barron & Harrington, 1981; Sawyers & Canestaro, 1989) – which is often a significant aspect of art. This is most often assessed through measures of original problem solving (e.g., Wallach & Kogan, 1965). Notably, the Multidimensional Stimulus Fluency Measure (Moran, Milgram, Sawyers, & Fu, 1983) combines several previous approaches, and was shown by Sawyers and Canestaro (1989) to correlate to the degree of creativity (as assessed by teachers) of university design students’ projects. This ability may also relate to the unique ability of creative people to “see past” stereotypical schema or ways of depiction, or to otherwise assume the “innocent eye” of the artist (Gombrich, 1960).

Research has shown differences amongst artists in their ability to initially construct an idea visually. This was emphasized in the work of Getzels and Csikszentmihalyi (1976), who showed that time spent thinking of an idea before drawing, as well as time required to rough-out main aspects of a composition, correlated with the assessed creativity of final products. More recently, Jaarsveld and van Leeuwen (2005; see also Verstijnen, van Leeuwen, Goldschmidt, Hamel, & Hennessey, 1998) analyzed the strategies used by designers when developing visual

graphics or objects. By evaluating early and intermediate sketches, the authors found that participants whose final designs received the highest ratings by art critics introduced a global structure in earlier sketches. They argued that by creating this more solid foundation, designers might have constructed a stable basis for refining their drawings during later stages. In an observational and eye-tracking study of professional artists, Miall and Tchalenko (2001) also showed that time spent looking and not drawing was significantly longer than for nonartists' (see also Cohen, 2005 for similar findings).

Studies conducted by Kozbelt and Serafin (2009), and especially Serafin, Kozbelt, Seidel and Dolese (2011), had expert and lay artists evaluate the quality of drawings at multiple points during the art-making process. Results showed that artists were able to quickly determine the quality of the emerging art, perhaps because they had in mind a gist idea, a sense of the overall structure of the work. The authors also found that for artworks rated as less creative, there was a linear, additive relationship between time and quality. In contrast, for artworks rated as highly creative, there were irregular patterns in their assessed quality during the art-making process, which suggests that ideation may only be one component in producing highly creative art.

2.4 Artistic Development and the Environment

Research has also considered artistic development, and the specific interaction of biology, culture and/or environment (see Rostan, 1997 for a review). This is often approached via componential models that posit elements that control and influence creative individuals. Notable among these, Amabile (1983) described creativity, including creativity in art, as the result of domain-relevant skills, relating to expertise developed through education and life experience, as well as basic motivation, intelligence or talent. Urban (1991) proposed a model organized around divergent thinking, general and specific knowledge bases, task commitment, tolerance of ambiguity, and motivation. Runco and Chand (1995) proposed a two-tier model, composed of controlling components such as problem-finding skills and processes, ideational skills, and evaluation as well as contributing components such as environment and motivation.

The above models have also been coupled with empirical findings, using many of the procedures reviewed above. This has shown, for example, age-related differences in art making, often involving developments in aesthetic sensitivity, repleteness, expressivity with materials, composition, and technical ability (Gardner, 1982; Goodman, 1968; Rostan, 1997). Carothers and Gardner (1979), for example, found that children's perception of aesthetic properties increases with age, as does technical ability. Children also show a universal and increasing attraction to representing objects through graphical means (Winner, 1989), and a temporal progression from structurally simpler to more complex art (Golomb, 1992). Studies have also shown interpersonal differences regarding unique advantages of skilled artists. Milbrath (1998) analyzed and compared artworks of artistically talented and less talented children (as identified by parents and teachers). The latter acquired drawing skills at

a more rapid rate, and also showed spontaneous compositional differences, such as incorporating their personal viewing position in drawings rather than general or stereotypical depictions.

Theories also consider the role of culture in creative development (Rostan, Pariser & Gruber, 2002 for review). Notably, Csikszentmihalyi (1999) proposed a model with three shaping factors: (1) a more or less stable symbol system of a culture (e.g., “art”), which can be employed by artists; (2) social institutions that both select creative products, and that could promote or develop artists; and (3) the individual artist, who is a product of training and experiences. Simonton (1984, 1996) also considered contextual effects – cultural, economic, social – on creativity in art. He used a historiometric method to study the creativity of eminent people in multiple cultures and periods, arguing that social environment can have nurturing (or inhibitory) effects on development. Lubart and Sternberg (1998) went further to propose that the effects of culture can manifest itself in four areas: the creative process; training; the extent to which people focus their creativity towards certain domains; and the “creativity” concept itself. Amabile (1996) also added specific emphasis on the role of the educational system and family structure as important facilitating/motivating or inhibiting aspects. These theories are also supported by a number of studies (Cox, Koyasu, Hiranuma & Perara, 2001; Li, 1997; Huntsinger, Schoeneman & Ching, 1994; Toku, 2001; see Niu & Sternberg, 2001 for a review). Studies have also considered more longitudinal perspectives of creative talent over lifespans (Simonton, 1996; Csikszentmihalyi, 1988, 1999; Helson, 1999).

3 Findings and Topics for Future Research

The above approaches have provided the building blocks for a number of discussions that define important currents in research on creativity in art. They also raise intriguing questions, which we expect will help to define future research. While not an exhaustive review, in this section we will consider some topics that we expect will define the future of research in this area.

3.1 How Is Creativity in Art Developed, and Why Do Many Become Progressively Worse at Art?

A number of issues arise from ongoing studies on artistic development, involving questions as basic as how people develop and maintain creativity in the arts. As noted above, while findings do routinely show general improvements in creativity, there is also evidence that *creativity in art* may actually peak, and then decrease, as children move from elementary to adolescence to adulthood (Barbot & Tinio, 2015). Only artistically gifted adolescents, in turn, retain or regain their artistic creativity at later stages, resulting in a “U-shaped” trajectory (Gardner & Winner, 1982; Davis, 1993). This finding is directly at the heart of artistic expression, and raises the question of whether the underlying reason has more to do with nature or culture and training.

There have also been several other explanations, such as those related to natural abilities that may emerge as children develop (Milbrath, 1998), or related to a link between decreasing creativity and an “inhibiting” focus on realism or practiced stereotypical popular images, as opposed to expressive drawing, both of which may reduce artistic creativity in older individuals. This latter explanation could imply either a natural “literal stage” (e.g., Rostan, 1997) in most people’s development, or a social/normative impact on art making. Decreasing creativity may also be a function of the task or motivation, which may be higher in individuals interested in art (Chan & Zhao, 2010; Rostan, 1997), or even non-existent in others. It may even have to do with the judge or art perceiver and use of changing evaluation metrics for different individuals or ages (e.g., Pariser & van den Berg, 1995, 1997; Rostan et al., 2002). A better understanding of these aspects could obviously inform understanding of the unique abilities of artists, and how art making can be fostered.

Questions also arise regarding the role of training, which may play an important role in helping some individuals to smoothly develop their creativity with art. As noted above, several authors (Amabile, 1996; Csikszentmihalyi, 1999; Lubart & Sternberg, 1998) argue for the importance of supporting factors that could overcome the typical tendency to lose artistic creativity with age. Rostan et al. (2002) suggested that training might facilitate creative expression through technical ability or skill in imbuing artworks with aesthetic properties. Training could also lead to more technical improvements in finished products, such as the use of personal perspective (described above), which could increase judged creativity. This needs to be further considered.

3.1.1 What Is the Relationship Between Creativity in Art and Technical Ability with Art Media?

Another topic involves the link between creativity and the technical skill of artists. Chan and Zhao (2010) noted that technical skill and creativity are two components that have played prominent roles in the assessment of artistic quality, and how these two components interact is a major question. Such an interaction is important for two reasons. First, from a practical standpoint, assessed skill may often overlap or largely determine the judged creativity of art. For example, Rostan (1997) revealed the importance of expressivity and composition in predicting assessed novelty of drawings (see also Kozbelt, 2004; Rostan et al., 2002). Rostan (2010, p. 262) attributed this to the implicit assumptions held by many viewers, including judges, that artistically talented people are characterized by a natural technical competence, which may lead to higher assessment of creativity when they see such competence displayed in art. Kozbelt (2004) attempted to tease apart drawing skill and creativity by asking judges to rate drawings on twenty-five factors related to quality, technical skill, and originality. All three items were correlated, and skill and originality loaded highly on the same “quality” dimension (accounting for 90 percent of the variance).

Creativity may actually be facilitated via technical skill with media. Chan and Zhao (2010) suggested that skill may facilitate artistic (and creative) performance.

This was also suggested by, for example, Vinacke (1952, p. 253), who noted that “no matter how original” an idea, “it cannot result in a work of art . . . unless its originator has the requisite skills to convert it into tangible form.” Gallo, Golomb, and Barroso (2002; see also Rostan, 2010 for review) also studied the drawing development of children (aged 5–9) and argued that most children’s intentions exceeded their ability to express them in drawing. Rostan et al. (2002) found that the combination of skill mastery and opportunities for self-expression distinguished art students – whose artworks were also more likely to be judged as creative – from non-art students. Combining the above-discussed factors, Rostan (2005) also found differences in technical skill, creativity, and processing of visual information as a function of different amounts of art training. Rostan (1998) also showed that technical skill could nurture an artistic identity and predict aesthetic success, as well as creativity. This area needs much more research. Technical ability may also plateau as most children develop, also raising the related question of whether training would impact artistic creativity itself (e.g., Chan & Zhao, 2010).

3.1.2 Creativity and Motivation

Another interesting question involves motivation. Lemons (2011, p. 756) noted that in addition to most other context or personal abilities, there is “an often overlooked” factor – “passion” for art – which may drive creativity development and the results of many studies. This may occur to the extent that some researchers (e.g., Amabile, 2001) argue motivation to be the variable that distinguishes creative from noncreative individuals.

By merely participating in the arts – or by continuing to participate – one might further develop his or her artistic creativity beyond that accomplished by others (e.g., Eisner, 2002; Rostan, 2010). This factor may also interact with skill level. Students who initially show a certain amount of skill in art may be motivated internally, or externally by teachers/parents, to pursue more training, or may come to think of themselves as “artists,” thus leading to higher levels of creativity. They may also be given more resources (e.g., attention, adult motivation), which could lead to both higher creative and technical development.

Developing creativity may also require intrinsic motivation, which could vary depending on personality or life experiences. Researchers argue that the motivation to get better, hone one’s ability, or practice – with increasingly greater challenges – is necessary for both the emergence of art talent and highly creative performance, and may vary between individuals (Csikszentmihalyi, Abuhamdeh, & Nakamura, 2005; Ericsson, 1996; Feldman, 2003). Csikszentmihalyi’s (1988, 1999) longitudinal study of art students found that some of the most creative children ended up pursuing occupations that had little to do with creativity or art, whereas others who had shown less potential persevered and experienced artistic or creative achievements. Amabile’s (1996; Amabile & Conti, 1997) studies also showed a positive relationship between intrinsic motivation and assessed creativity, and especially argued that when one is intrinsically motivated one experiences more interest and is thus more likely to produce creative output.

Motivation may also be a major factor affecting the results of creativity assessments. Rostan (2010) compared the artistic process and the corresponding finished artworks (free drawings from imagination and life drawings from Getzels & Csikszentmihalyi, 1976) in both younger (ages 9–10) and older art students (ages 11–16). She also used the Need for Cognition assessment, which, along with the number of years spent attending arts programs, was considered a measure of motivation. Analyses revealed that technical skill explained age differences in life-drawing problem identification, creativity, and motivation. Number of years attending the art program and time spent drawing also correlated with creativity.

3.1.4 Culture and Creativity with Art?

Another major issue involves specific differences related to creativity in art that can arise as a function of culture. As noted above, several theorists have emphasized the importance of culture, to the extent that some researchers (Csikszentmihalyi, 1988, 1996; Amabile, 1982; Niu & Sternberg, 2001) have argued that creativity may be more of a cultural phenomenon than an innate/internal process. As a primary example, a series of studies have looked at differences between European/North American and Asian artists. As discussed by Niu and Sternberg (2001), in Western cultures, which is considered more independent, there is often a focus on recognizing the unique capacity of individuals and promoting individual differences. In contrast, Eastern cultures may emphasize relatedness or interdependence. Thus, with Western art, artistic exceptionalism may often be characterized by expressiveness and “formal boldness” of production. Eastern art may be characterized by emphasis on technical ability or learning and using traditional art methods (Li, 1997; Rostan, et al., 2002).

Such differences have been empirically shown by Jellen and Urban (1988), who employed the TCT-DP to assess children from eleven countries, and revealed that children from England, Germany, and the United States showed significantly higher art-related creativity scores than did children from China, India, and Indonesia. Niu and Sternberg (2001) compared the rated creativity of artworks – collages, (Amabile, 1982), and free drawing of an extra-terrestrial alien (Ward, 1994) – by American and Chinese college students with no artistic training. American and Chinese students (postgraduate psychology students, using CAT) served as judges. American students produced higher-rated works on scales of creativity, likeability, appropriateness, and technical quality, regardless of task or culture of rater. American judges also tended to be stricter with ratings. Regarding technical training, Cox et al. (2001) compared children’s human figure drawings in the United Kingdom and Japan, and Toku (2001) compared American and Japanese children. In both cases, Japanese children produced superior drawings, possibly reflecting their school art curriculum and value placed on copying standardized comic book images (however, see Cox et al., 1998).

On the other hand, there is also evidence that interdependency within a culture could actually foster creativity in art. Rudowicz, Lok, and Kitto (1995), using the

TTCT figural circles task, found that children from Hong Kong received significantly higher creativity scores than children from the United States. The authors posited that this may be due to the character-based Chinese language, which may have given the children from Hong Kong a unique advantage. A similar study by Huntsinger et al. (1994) found that Chinese-American children were more advanced in both the technical quality and assessed creativity of their drawings and handwriting as compared to Caucasian-American children. The authors argued that this may be due to the fact that Chinese parents emphasized fine muscle activities, which may have enabled children to be more expressive of their creativity. However, once again, more work is necessary.

3.2 Judging Creativity: To What Extent Can Judges Detect Creativity in Art?

There is also the question of how and to what extent judges can detect creativity in art. This is especially important for creativity in art because of important repercussions from such judgments in regards to economic or educational advancement. A number of studies have found reasonable agreement using both lay and expert or quasi-expert judges (Getzels & Csikszentmihalyi, 1976; Amabile, 1982; Kozbelt, 2004; Hekkert & van Wieringen, 1996; Chan & Chan, 2007; but see Kaufman & Baer, 2012, for a discussion of issues regarding these studies). However, in more directed studies meant to specifically identify future creative talent, the results are less clear. Rostan, Pariser, and Gruber (1998) assessed whether contemporary judges trained in Western modernist art could identify juvenile works of noted artists (e.g. Picasso, Klee, Lautrec) as being exceptional. They tested such drawings mixed in with the works of students' (aged 6–11) in an after-school enrichment program. Judges did not find the masters' drawings to be consistently above average for technical skill, composition, or expressivity. Few of the masters' drawings in fact scored even among the top 25 percent (however, creativity was not directly assessed). Interestingly, a similar study by Rostan, et al. (2002), which did assess creativity, found that parents showed higher interrater reliability than experts, suggesting that artists and art critics with more expert or personal experience may lead to idiosyncratic reactions that may reduce agreement. This raises the possibility that experts themselves may not always be the best judges of creativity. However, expert and lay judges may be using different factors or heuristics, with experts' ratings being less agreed upon but potentially more valid. This topic also relates to other areas of psychology of aesthetics, such as art perception, where the use of "creativity" as a factor in art judgments is often overlooked in favor of basic hedonic preference, pleasure, or liking. Rarely explored is how creativity might relate to such judgments.

3.2.1 Can Art Tests Predict Future Creative Art Achievement?

Another question involves the use of tests of creative output to predict future success in the arts. A typical finding from longitudinal studies (Lemons, 2011 for a review) is

that creative children do not necessarily become highly creative adults, as assessed through their careers and activities. A review of creativity measures involving art tasks by Cropley (2000) found that most tests' ability to predict real-life creative achievements results in coefficients of around .50 (see also Plucker, 1999; Torrance, 2002 for similar findings with the TTCT). In contrast, IQ often correlates at about .70. Thus, researchers (Helson, 1999; Cropley, 2000) have suggested that creativity tests may be best thought of as tests of creative potential, not of creativity itself, with other factors also contributing to creative achievement. This highlights the need for more refined testing.

This also suggests one particular benefit that might be gleaned from creativity testing through art. For example, Cropley (2000, p. 78) suggested that one explanation for many creativity tests' lower predictive validity is that they do not resemble real-life behavior. Art may provide for a more natural activity. This is supported by the finding that personality-based tests often have lower validity than art-related studies (Schraw, 2005; Jarosewich, Pfeiffer & Morris, 2002; Lemons, 2011). However, this also begs further consideration and comparison against other performance-based measures.

3.2.2 To What Extent Is Creativity in Art Generalizable to Other Domains?

There is also the open question of what type of creativity or other abilities could be predicted by creativity within art, (see Lemons, 2011 and Silvia et al., 2009 for recent reviews). As referenced in the "Amusement Park Theory" of Kaufman and Baer (2005), some aspects of artistically creative individuals should generalize across domains. These might include many of the personality factors reviewed above (e.g., see Chen et al., 2006; Feldman, 2003; Rostan, 2010), as well as cognitive processes such as problem finding, combining, and abstracting (Palmiero et al., 2010; Simonton, 2009), and which may in fact be even more pronounced in individuals successful at art as compared to individuals showing creativity in such areas as science or math (Kaufman & Baer, 2004).

On the other hand, each domain also involves unique skills (Kaufman, Cole, & Baer, 2009; Plucker, 2005). Notably for art, these may include technical skills or expressivity (see also Han, 2003), as well as spatial skill performance, spatial manipulation, and visual memory, which have shown correlations to e.g., the Vividness of Visual Imagery Questionnaire (see review above). Myszkowski, Storme, Zenasni, and Lubart (2014) also found a relationship between figural creativity and visual aesthetic sensitivity, which was not found for verbal creativity. A study by Silvia, Kaufman, and Pretz (2009), using the CAQ and the Creativity Domain Questionnaire, also showed distinct "creative classes." These included "uncreative," as well as specific smaller classes for visual and performing arts, suggesting that art creativity may be unique. In a review of several other studies, they further noted that if a study focused on the creative product/art, then creativity often appeared domain-specific. In contrast, if a study focused on the person – typically involving divergent thinking – then creativity often appears general.

3.3 How Do People Make Art? The Need for More Nuanced Conceptions

Another area that needs attention regards how people actually create art. As noted in the above sections, there have been specific models put forth concerning basic processes in art making. These typically describe the main stages of planning, ideation, and revision. There have also been studies involving working artists. However, there has not been a significant attempt to move beyond these basic aspects of art making and to the consideration of how individuals really go about constructing art that is particularly creative. Some questions that arise include: How do artists even begin to construct and shape aesthetic objects? What qualities of line, form, and concept go into art making? How do artists respond to the evolving work?

Emerging research, not necessarily dealing with creativity, has noted various elements that should be considered further. These primarily involve the ability to quickly capture the “gist” or essence of an object (e.g., Chamberlain, McManus, Riley, Rankin, & Brunswick, 2013), and the artist’s unique ability to perceive and produce a gestalt or essential form (Tinio, 2013). Research on individuals skilled at realistic drawing also suggests that artists may employ a “local drawing strategy” (Drake & Winner, 2009; Chamberlain et al., 2013) that may begin with, focus on, or jump between depictions of local and global details, and which then allows better appreciation of the distinctiveness of objects. However, studies that have looked to capture such elements have been inconclusive (Drake & Winner, 2009; Mottron et al., 1999). The above research should be expanded, clarified, and paired with creativity assessments. There is also the overlooked aspect of style or expressivity in artistic depiction, and its impact on perception of art (Leder et al., 2004).

3.3.1 A Model of Art Production Tied to Perception?

One recent development, which we will briefly mention, involves new models that attempt to characterize specific stages of art making while simultaneously tying them to stages of art viewing. Notably, a new model by Tinio (2013) builds upon current models of art perception that have emerged in the last decade in the psychology of aesthetics (e.g., Chatterjee, 2003; Leder, et al., 2004; Pelowski & Akiba, 2011). Tinio posited that art making can be considered as mirroring (perceptually and cognitively) the stages involved in art viewing. This model provides a theoretical foundation for considering the making of aesthetically pleasing and creative art. As can be seen in an updated version in Figure 6.1, where we have combined the various models, this provides a basis for theoretically addressing how to optimize the creative aspects of artworks, with such optimization aligning closely with the initial creation of a gestalt or generation of an idea.

We also expect that the same features that individuals attend to in each processing stage should correspond to specific decisions/techniques involved in the art-making process. A recent study of art creativity (Stevenson-Taylor & Mansell, 2012), for example, which was based in part on art viewing models (Pelowski & Akiba, 2011), has shown evidence that this pursuit could be fruitful. Much work is however needed in this regard.

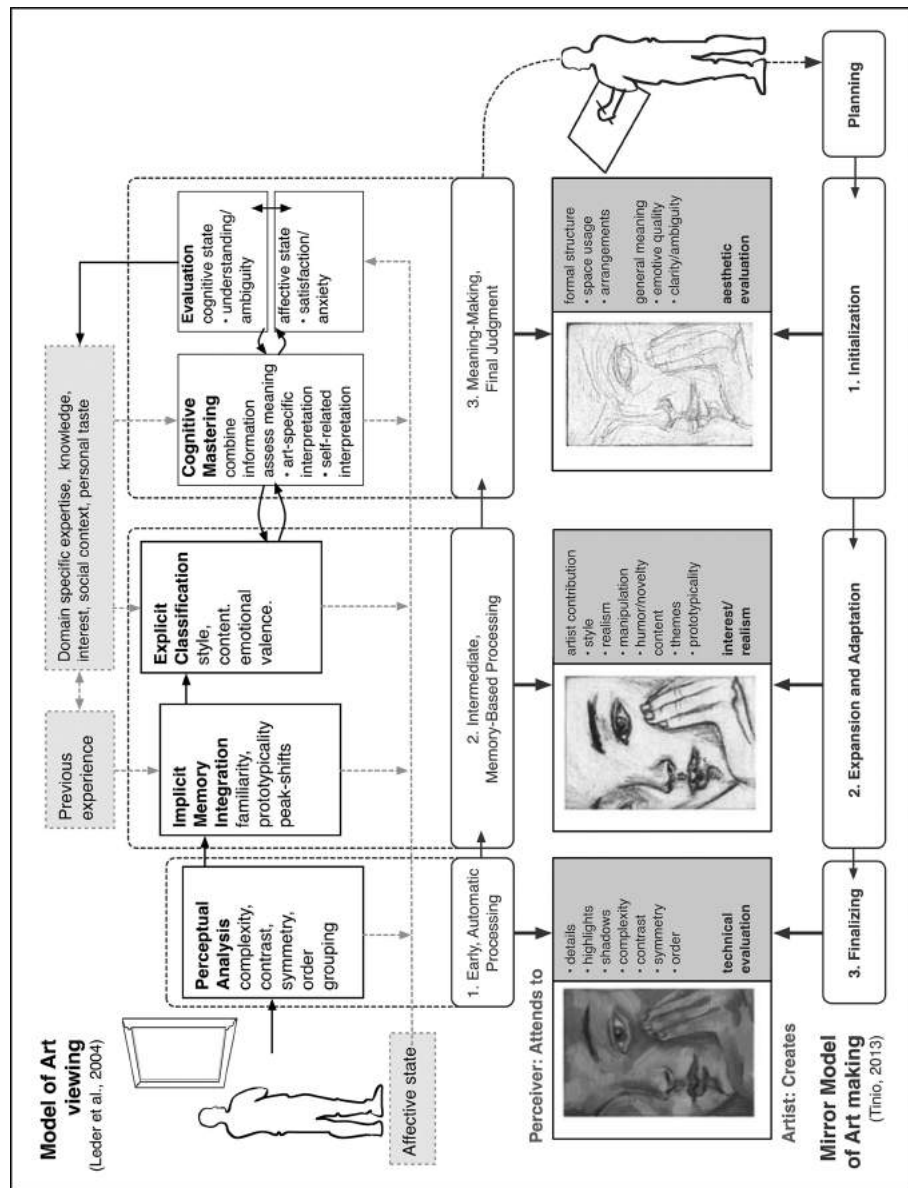


Figure 6.1 Updated mirror model of art making and art perception: Top, model of art viewing (adapted from Leder et al., 2004); Bottom, model of art making (adapted from Tinio, 2013); Middle, posited key factors attended to in each stage. Note that stages are argued to operate in reversed order between the art making and art viewing activities.

3.4 Creativity and the Brain

Last, an area of particular promise involves the role of the brain. This area represents a natural extension of previous empirical and cognitive approaches, connecting creative processes to their biological sources, and has grown with the rise of reliable imaging methods (fMRI, EEG). Recent research has led to the identification of a number of brain areas and neural processes that are closely associated with creative action, or are more active in creative individuals (see Palmiero, Di Giacomo, & Passafiume, 2012; Zaidel, 2014). At the same time, neuroscientific research on creativity in art has also proven to be rather challenging because of difficulty with finding appropriate art-making tasks, which must also be done under restrictive laboratory conditions. Thus, there have only been a handful of neuroscientific studies concerning creativity in art (see Aziz-Zadeh, 2013 for a review).

Nevertheless, there is evidence that such studies could be accomplished. For example, an fMRI study by Kowatari et al. (2009) asked novice and expert designers to mentally imagine designing a novel pen, which they later drew. Experts were shown to utilize a more restricted area of activation, involving only the right prefrontal cortex and parietal regions, potentially related to the processing of global aspects of the problem. Degree of creativity of finished drawings was also correlated with right prefrontal regions. Moreover, using EEG, Bhattacharya and Petsche (2005) asked artists and non-artists to mentally compose drawings while looking at a white wall. Artists had stronger delta synchronization, alpha desynchronization, and right hemispheric synchronization dominance, possibly due to long-term art memories and top-down processing.

Intriguing questions also involve hemispheric specialization, with previous studies (Solso, 2001; Kowatari et al., 2009; Bhattacharya & Petsche, 2005; Kottlow et al., 2011) finding right hemispheric lateralization in accomplished artists. Similarly, artists have also shown greater synchrony in the right (as compared to left) hemisphere during visual imagery tasks compared to non-artists (Bhattacharya & Petsche, 2005). This is potentially related to visuospatial processing, and thus may be of particular importance for creativity in art. Artists may also have less hemispheric connectivity. Moore et al. (2009), using the TTCT and fMRI, showed that higher scores on visual creativity correlated negatively with splenium size of the Corpus Callosum, which connects the two hemispheres. This suggests decreased connectivity and greater (right) hemispheric specialization. Gansler et al. (2011) further found a link between TTCT visual creativity scores and right parietal gray matter volume, which may play a role in global aspects of attention and visuospatial processing.

3.4.1 Lesion Studies, Dementia, and Creativity from the Damaged Brain

Another promising avenue for examining the neurological basis of creativity in art involves looking at the effects of damage to the brain in regard to people's ability to produce art. This too has been a growing area of study (e.g., see Chatterjee, 2004; Gretton & ffytche, 2014; Palmiero et al., 2012 for reviews), with findings showing

intriguing although sometimes conflicting results. For example, Miller et al. (1996) reported several stroke patients who suffered damage to the left temporal hemisphere and dorsolateral prefrontal and parietal regions, and who developed sudden artistic abilities (see also Cela-Conde et al., 2011; Husslein-Arco & Koja, 2010; Midorikawa et al., 2008; Miller & Hou, 2004). Palmiero et al. (2012) similarly found that in fronto-temporal dementia that is restricted to the left anterior temporal regions – thus sparing frontal areas – individuals may show a “new passion” for art as well as alterations of social behaviors, which lead to wilder, freer, creative art making (also Mell, Howard, & Miller, 2003; Serrano et al. 2005).

Alzheimer’s disease, which often affects frontal and temporal areas, can also have the effect of enhanced artistic creativity (Espinell, 1996), leading to surrealist/abstract drawings – for a time – followed by progressively more schematic, less original products (Palmiero et al., 2012; Serrano et al. 2005). Parkinson’s disease, which has been tied to the degeneration of the left inferior frontal cortex, has also been linked to changes in artistic creativity (see Canesi, Rusconi, Isaias, & Pezzoli 2012; Drago et al., 2009; Inzelberg, 2013 for a review), often leading individuals to create more expressive art (however, see e.g., Rankin et al., 2007 for a counterargument). Although interesting and telling, more research on the effects of brain damage or progressive brain degeneration on artistic creativity is needed.

3.4.2. Can We Increase Creativity by Changing Brain Activity?

One final area that we believe will be a major area of research involves interventions – e.g., technological or pharmaceutical – that directly impact brain functioning and thus that could increase (or reduce) creativity itself. Similar to the effects of lesion, techniques that cause disruption or excitation of brain regions, such as by using Transcranial Magnetic Stimulation (TMS) or Transcranial Direct Current Stimulation (TDCS), could impact creativity in art. Similarly, creativity changes could arise from dopamine therapy, often used as treatment for Parkinson’s disease. As noted above, Parkinson’s disease may be related to a malfunctioning of the left frontal regions, and tied to a deficiency in dopamine production, and which could also lead to increased right hemispheric activity. As a treatment, patients may take dopaminergic medications, such as levodopa and dopamine agonists, both of which could shift creativity to a normal level. In fact, researchers note the phenomenon of Dopamine Dysregulation Syndrome (Inzelberg, 2013; Weintraub & Nirenberg, 2012), a drug addiction-like state marked by self-medication with inappropriately high doses, which has been shown to occur among artists or other creative individuals who take the drugs to enhance creative performance, but often at the expense of other aspects of daily life such as family relations (Inzelberg, 2013; Kulisevsky, Pagonabarraga, & Martinez-Corral, 2009; Sessa, 2008).

While the specific effects of dopamine or TMS in creativity are still unclear, the use of these stimulants as possible enhancers of artistic creativity is a controversial issue (Inzelberg, 2013; see also Frecska, More, Vargha, & Luna, 2012) and lies at the crossroads of science, ethics, and art.

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