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Using Constraints to Generate and Sustain Novelty

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This article presents a constraint-based model of novelty in which constraints contribute far more than performance criteria. Based on Reitman's classic analysis of the composition of a fugue, the model features paired constraints. One of each pair precludes or limits search for novelty among a specific set of existing responses; the other promotes or directs search among its opposites. The model shows how precluding specific aspects of Abstract Expressionism and promoting their opposites produced the novelty known as Pop Art. It then demonstrates how the same process—applied to an artist's own successive sets of responses—can maintain novelty. The evidence supports the argument that constraint selection is critical to generating and sustaining novelty.

Keywords: novelty, variability, constraints

Imagine being back in school taking a class called *Creative Writing*. The syllabus shows that a two-page theme "on anything, in any style" is due tomorrow. Sounds simple, but there's a snag: complete freedom makes writing a piece of novel prose difficult, if not impossible. Why? Any introductory psychology text can supply the answers: choices are confounding; responses rewarded in the past are repeated. Without constraints, composition takes place in a cul-de-sac of the customary (a familiar subject) and the successful (a style worth an "A" in the past, in this class). Alternatively, think about an assignment with constraints on both subject and style: a conversation, say, in which the contributions are separated and the speakers identified without using standard punctuation.[1] Novelty (not necessarily in the domain, but for the individual) is now not only possible, it is inevitable. This paradox, that constraints help generate and sustain novelty, is the theme of this article and the basis of the constraint model of novelty that it presents.

Novelty, Variability, and Constraints

Novel behaviors or products can be characterized as original, innovative, or creative. Originality connotes unusual or rare responding (Baer, 1993; Guilford, 1950; Runco, 1999). Innovative implies usefulness and appropriateness, in other words, effective novelty (Cropley, 1999). Creativity has been construed in distinct ways. For some, it is synonymous with innovation, that is, novel and expedient (Amabile, 1996; Sternberg & Lubert, 1999; Weisberg, 2006). For others, it stipulates that a novel response is also generative, leading to other ideas or things, or influential, changing the way that others view, or do, things like it (Boden, 1994; Csikszentmihalyi, 1996; Simonton, 2004; Stokes, 2005).

Variability is a measure of how differently something is done. As shown in Figure 1, it can be seen as a continuum with low variability at one end and high variability at the other (Stokes, 1999a). Most responses are reliable, involving often-repeated actions that have been associated with past success and would be located close to the low end. In behavioral terms, these are called operants (Skinner, 1953); in problem-solving terms, default rules (Holland, Holyoak, Nisbett & Thagard, 1987). Because increasing the frequency of any response decreases variability, success often leaves experts "stuck" in their successful solutions (Stokes, 2005). Getting "stuck" underlies the process by which reliable responses emerge before unusual, more original ones (Christensen, Guilford, & Wilson, 1957; Maltzman, 1960; Mednick, 1962; Runco, 1986) and often preclude or interfere with the production of more effective, innovative ones (Duncker, 1945; Luchins & Luchins, 1970; Ward, 1994).

Experimental examples of reliability preceding novelty appear in tests of divergent thinking: familiar word associations and conventional uses for common objects precede unusual ones (Guilford, 1950; Runco, 1999). An observation from my years at art school shows the same process at work. Given weekend breaks from life-drawing classes, Pratt students—at the start of each week—drew in their "usual" styles; as each week progressed, our drawings became more variable, morphing in novel ways, but returning to the most familiar at the start of the next week.

Detrimental effects of successful low-variability solutions on novel ones have been investigated under the rubrics "functional fixedness" (Adamson, 1952; Duncker, 1945; Maier, 1945; Weisberg & Suls, 1973), "fixation" (Dodds & Smith, 1999), "mental set" (Atwood & Polson, 1976; Luchins & Luchins, 1970), and "path-of-least-resistance" (Ward, Dodds, Saunders, & Sifonis, 2000). Functional fixedness refers to typical uses of objects (e.g., a box as a container) interfering with unusual, novel uses (e.g., a box as a platform). Fixation and mental set involve stereotyped solutions (e.g., an algorithm for determining amounts of water) interfering with the acquisition of novel, more effective solutions.

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[1] One approach would be adapting the style of Jose Saramago. In his books, conversations are continuous and contained within paragraphs: the contributions of each speaker are separated only by commas; the speakers are identifiable because each has a distinct "voice."

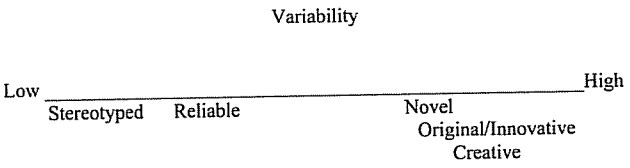

Figure 1. Variability continuum.

Path of least resistance reflects a tendency to structure novel ideas in conventional ways, for example, basing features of imagined extraterrestrial animals on features common to familiar (earthly) animals (Ward, 1994).

One way to get "unstuck" is, counterintuitively, by using constraints (Stokes, 1999b, 2001b). Experimental (Mumford, Reiter-Palmer, & Redmond, 1994; Ward, Patterson, & Sifonis, 2004; Yokochi & Okada, 2005) and biographical work (Cunningham, 1999; Lesschaeve, 1985) support this contention. A series of experiments closely related to the current constraint model focused on inventions: students could choose either parts (e.g., tube, wheels, ring), or categories (e.g., vehicles, appliances, toys) to be used, or both. The predictions—that more choice would promote conventional thinking, whereas less choice would preclude it—were supported. Inventions produced by the most constrained students (those with no choice of either category or parts) were judged more creative than those generated by the least constrained, that is, those who selected both parts and category (Finke, 1990; Finke, Ward, & Smith, 1992). An intervention requiring that a professional Chinese brush-painter use paper inscribed with random lines drawn by the experimenters produced paintings that differed noticeably from his usual (i.e., successful, systematic) style. The random lines precluded his typically empty, serene spaces, promoting busier, livelier ones in their place. The painter himself preferred these paintings, saying that they were "unique and nicer than those created in a traditional way" (Yokochi & Okada, 2005, p. 247).

Biographical evidence includes the working method of choreographer Merce Cunningham. Cunningham uses chance both to preclude his "personal feelings about order and . . . memory of physical combinations" (Cunningham, 1999, p. 44), and to promote the possibility of any and all combinations within a particular movement vocabulary. For example, *Torse* (1975) focuses on five positions of the back and backbone, along with related leg and arm positions. From these, Cunningham designed 64 dance phrases (the movement chart) to be done at any of 64 stage locations (the space chart). The actual sequence of movements and locations in a particular performance (each performance is different) is then determined by chance, casting die to combine trigrams from the *I Ching* (the ancient Chinese *Book of Changes*) into hexagrams. Trigrams are three-sided; hexagrams are six-sided. The first toss gives the number of the trigram that forms the top half of the hexagram; the second, the number for the bottom half. Cage uses the results to form sequences rather than hexagrams. Thus, if the results are "13 over 15, that means phrase 13 along with phrase 15" (Lesschave, p. 21).[2]

These examples demonstrate that constraints can generate novelty. Not surprisingly, precluding some things and promoting others are important to how this happens. Before presenting the constraint model of novelty (along with art historical evidence of its efficacy) two of its components, problem-spaces and constraints, are discussed. Both the model and its components are derived from the seminal work of Newell and Simon, which provided an architecture for problem-solving and established the (to be discussed) connection between creativity and ill-structured problems (Newell, Shaw, & Simon, 1962).[3]

Problem Spaces and Constraints

According to Newell and Simon (1972), problem-solving takes place in a problem space, defined as how a solver represents or structures a given problem. A problem space has three parts: an initial state, a goal state, and a set of operators (strategies, rules, moves) that are applied in some sequence or other to get from the initial state (the problem) to the goal state (its solution). The goal state includes a criterion for knowing whether the goal has been reached.

Well-Structured Problems

In a well-structured problem, all the information necessary for solution is provided. A jigsaw puzzle is a good example. The initial state is some number of unconnected puzzle pieces. The goal is connecting the pieces to produce a picture; the goal criterion specifies that the picture match the one shown on the puzzle box cover. A sequence of operators (condition-action rules of the form, "If the situation is X, then do Y") provides a solution path from the initial to the goal state. If completely written out, the first operator would read "If the situation is starting the puzzle, then the action is sorting the puzzle pieces by color."

Table 1 presents a simplified problem space for a jigsaw puzzle. In this example, the choice of operators is goal, stimulus, and pattern driven (Simon, 1978). Goal-driven involves matching the picture on the cover; stimulus-driven means using visual cues, colors, and shapes; pattern-driven implies drawing on stored rules, like "start with the straight edges." All completely structured problems—like a jigsaw puzzle—have single, correct, predetermined goal states. Consequently, they preclude novel solutions. Novelty is only possible with incompletely or ill-structured problems.

Ill-Structured Problems

Ill-structured problems do not supply all the information necessary for solution (Simon, 1973; Voss & Post, 1988). Central to our concerns, the goal criterion is both complex and indefinite (Simon, 1978). Thus, any problem requiring a novel response (i.e., a novelty problem) has three characteristics: (1) it is ill-structured or incompletely specified, (2) its solution requires the strategic selection of paired constraints, and (3) these constraints structure the problem space to preclude search among reliable, expected responses, and promote search among risky, surprising, ones.

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[2] Notice that Cage's constraints not only produce novelty in choreography, they also sustain it in performance: the chance of any two performances of *Torse* being exactly alike is very unlikely.

[3] For an extensive review and critique of work on problem-solving and creativity, see Weisberg (2006).

Table 1
Problem Space for a Jigsaw Puzzle

Problem Stages	Description
Initial state	Unconnected puzzle pieces
Operators	1. If starting, then sort the pieces by color. 2. If the pieces are color-sorted, then separate out those with straight edges. 3. If the straight-edge pieces are separated, then connect to form the outline. 4. If the outline is complete, then connect the remaining pieces by color and shape.
Goal state	Match the picture on the cover of the jigsaw puzzle box.

Table 2 presents a problem space for Pop Art, the reaction of one group of artists to the extravagance and romanticism of the then-predominant painting style, Abstract Expressionism. In the history of art, a primary catalyst for the development of novel styles is the desire of young artists, their eyes on fame and fortune, to differentiate their output in noticeable ways from a dominant style. Indeed, the to-be-Pop artists had been trained and were painting in this style; thus, the initial state for each painter was Abstract Expressionism. The questions of interest here are two: first, how did the Pop group pick their operators and goal criterion; second, how did each develop an individual signature style. The answers involve identifying constraints to restructure an existing problem space.

Constraints

Constraints define domains, well-developed areas of expertise with consensual performance criteria (Abuhamedeh & Csikszentmihalyi, 2004). These criteria involve goal, source, subject, and task constraints (Stokes & Fisher, 2005). Goal constraints are overall criteria. If accepted by a domain, they become stylistic conventions, approved, recognizable ways to paint (Abstract Expressionism, Pop), compose (Baroque, 12-Tone), or perform (ballet, tap). They are primary, because all other constraints are strategically selected to reach an existing goal (in which case the problem is well structured) or to preclude an existing goal and specify (via a series of approximations) the criterion for a novel one. Source constraints are existing stylistic elements available for recombination and improvisation. Availability depends on the individual's knowledge of, and expertise in, one or more related domains. Many artists have written about such sources. Paul Klee (1910/1964) referred to them as "the contents of the paint box," meaning both how paints are used (mixed, applied) and how they have been used (stylistically) by past painters. Larry Rivers (1987), a jazz musician as well as a painter, said that the history of painting provides the "first chorus" on which the artist improvises. Subject constraints specify content and attitudes toward it. For example, a formal portrait by Ingres (19th century) is a paean to position and prosperity, a Pop version by Rivers is both an homage to, and an ironic comment, on Ingres' classicizing style. Finally, task constraints involve materials and their application.

The Constraint Model of Novelty

How Do Constraints Generate Novelty?

According to the current model, which is modeled after Reitman's (1965) classic analysis of musical composition, constraints generate novelty by directing and limiting search for solutions in a problem space. This means that (contrary to common misconceptions) constraints do not only preclude something or (contrary to other creativity models) simply provide performance criteria (Chi, 1997; Johnson-Laird, 1988; Simonton, 2004).

Rather, constraints come in pairs. In solving a novelty problem, one of the pair precludes or limits search among unsurprising, tried-and-true responses, whereas the second promotes or directs search among surprising, untried ones (Stokes, 2001a, 2001b, 2005; Stokes & Fisher, 2005). However, by itself, "do something surprising or new" is not a feasible goal. The goal state is itself constrained: a specific initial state is precluded in order to promote an alternative that is gradually realized as the problem space is structured.

To illustrate the constraint generation process, Table 3 expands the problem space for Pop Art, replacing the Operators from Table 2 with the Constraint Pairs that generated them. I like to think that this type of table captures what Boden (1991) called "a territory of structural possibilities" (p. 82).

Table 2
Simplified Problem Space for Pop Art

Problem Stages	Description
Initial state	Dominant style: Abstract Expressionism
Operators	1. If working in a "cool" style, then exclude the emotional. 2. If composing, then completely plan the painting. 3. If selecting motifs, then choose the ordinary and familiar. 4. If drawing, then produce hard-edged, simple forms. 5. If selecting colors, then pick unmixed primaries. 6. If applying paint, then put down flatly.
Goal state	New style: Pop Art

Table 3
Paired Constraints for Pop Art

Problem Stages	Description
Initial state	Current "hot" painting style, Abstract Expressionism
Constraint pairs	1. Preclude emotional impact → Promote intellectual distance (irony)
	2. Preclude improvisation → Promote pre-planning
	3. Preclude abstraction as motif → Promote ordinary, real objects as motifs
	4. Preclude complex forms → Promote simplified forms (hard-edged)
	5. Preclude modulated colors → Promote primary, unmixed hues
	6. Preclude virtuoso brushwork → Promote flat paint application
Goal state:	New "cool" painting style, Pop Art

A little art history will show from whence the constraints actually came. According to Roy Lichtenstein (personal communication, March 11, 1985), Pop was deliberately developed by a group of artists, all ambitious, all faced with a calculated career choice. The choice involved an economic or "fame" constraint pair. The group could continue as second-generation Abstract Expressionists (and not become rich or famous) or develop a new style, one directly opposed to Abstract Expressionism. In Lichtenstein's version, the group sat down and compiled a list of Abstract Expressionism's major qualities; things to be precluded, worked against, things like abstract, complex, emotional, painterly—the last includes virtuoso handling of mixed, modulated colors. A second list included the opposites of the first; things to be promoted, worked with, things like realistic, simple, slick.

In Table 3, subject and task constraints used by the Abstract Expressionists are precluded; their opposites, which restructured the problem space, were promoted, practiced by the Pop group. To visualize the differences, imagine a canvas by Robert Motherwell, *Elegy to the Spanish Republic No. 172 (with Blood),* painted between 1988 and 1990. Black vertical ellipses impinge on black rectangles that hang from the top of the canvas; the ellipses touch either side of the canvas, but neither top nor bottom. The black shapes, huge and hovering, process to the left across the almost white field, a few touches of pure red seep out from under their great weight. The effect is brooding, tragic; words one would never use in relation to a work by Lichtenstein.

Lichtenstein's signature Pop style was based on cartoons, blown-up, outlined in black, and filled with day-glo colors and the dot pattern of the news-printing process. The artist even parodied Abstract Expressionism: *Yellow and Green Brushstrokes* (1966) features two large sweeping cartoon-style brushstrokes "dripping" their flatly applied colors (olive green and yellow) on a (gray) dot patterned background. It is a very "cool" (ironic), sophisticated (you need to know what he's parodying) painting. Like Lichtenstein, each member of the Pop group developed a signature style that met the group's criteria. These styles emerged from and reflected the source constraints—easy-to-grasp (popular or "pop") formats—which individual artists worked with and elaborated on. For example, Andy Warhol, who had worked in advertising, appropriated packaging (think of Brillo boxes and Campbell soup cans); James Rosenquist, who painted billboards, used the oversized format of the billboard (Osterwold, 2003; Rose, 1986).

The Pop Art example shows how constraints help generate novelty. The next section expands the constraint model, using the developing oeuvre of the artists Christo and Jeanne-Claude to demonstrate how constraints sustain novelty.

How Do Constraints Sustain Novelty?

In the same ways that they generate it, by restructuring an existing problem space. In any artistic career, the first problem space to be restructured will, as in the Pop Art example, come from one's domain. After this, novelty is sustained by restructuring one's own problem space(s).

The top set of constraint pairs in Table 4 illustrate how Christo's first wrapped package (c. 1958) was produced. Both Christo and the Pop artists were concerned with changing perception, how people saw the world. Pop Art made its audience look closely at, rather than simply recognize, ordinary objects. To differentiate himself from Pop, Christo made his audience puzzle over unrecognizable, albeit ordinary objects. The Pop artists used traditional art materials—pristine canvas, poster board, paint—to produce easy-to-perceive, primary-colored objects (like Warhol's Brillo boxes), as well as paintings. Christo wrapped (occluded) an empty paint can with canvas and twine before coating the package with brown varnish and sand (found, marginal materials) to prevent seeing the no-longer ordinary object. The final (task) constraint pair, distance versus emotion, highlights Christo's continuing focus on the transitory, on "passing through" (Chernow, 2002). Ordinary packages are temporary, they are meant to be unwrapped. Christo's packages were enigmatic, meant to remain in their "transitory," unwrapped state.

Precluding the early, never-unwrapped packages, subsequent projects became de facto transitory, wrapped or draped for a short, set period of time and then dismantled. The first set (#2 in Table 4), a series of temporarily wrapped very large existing objects, included the *Pont-Neuf* bridge in Paris (1985) and the *Reichstag* building in Berlin (1995). The original overall goal criterion (focus on the transitory) was unchanged, although differently realized via changed subject (large, permanent structures) and task constraints that restructured Christo's initial problem space. Among task constraints, materials were produced rather than found; their colors were lighter and brighter (wrappings for the *Pont-Neuf* were an intense yellow); their application involved unwrapping as well as unwrapping. Because the projects involved temporary use of public spaces, a finite amount of time was available for their construction and removal (Baal-Teshuva, 2001).

The third, ongoing, set of projects involves temporary construction and draping of large environmental-sized objects that, in Christo's words, "manipulate space by making a gentle distur-

Table 4
Christo and Jeanne-Claude's Constraint Pairs

Initial state	Subject constraints	Task constraints
1. Pop Art	Preclude recognizable objects → promote permanent wrapping of small ones	Preclude primary colors → promote earth colors Preclude "art" materials → promote "found" materials Preclude intellectual distance → promote emotional impact
2. Own permanently occluded objects	Preclude permanently wrapped small objects → promote temporary wrapping of large structures	Preclude found materials → promote specifically produced wraps and ties Preclude earth colors → promote light, bright hues Preclude permanency → promote limited time
3. Own temporarily occluded structures	Preclude wrapping and extant structures → promote draping of temporary constructions	(Same as 2)

bance, by creating a new border" (Chernow, 2002, p. 201). The project most recently realized by this third restructuring was *The Gates* in Central Park.

Figure 2 presents schematic drawings representative of the three constraint phases. The drawings are mine. The top right presents a permanently wrapped package secured with string that is knotted in several places; the top left shows the temporarily wrapped (in bright yellow) *Pont Neuf* in Paris; the bottom drawing illustrates four temporary *Gates* along a path in Central Park. Both the structures and the pleated fabric panels billowing from the top of each were bright orange.

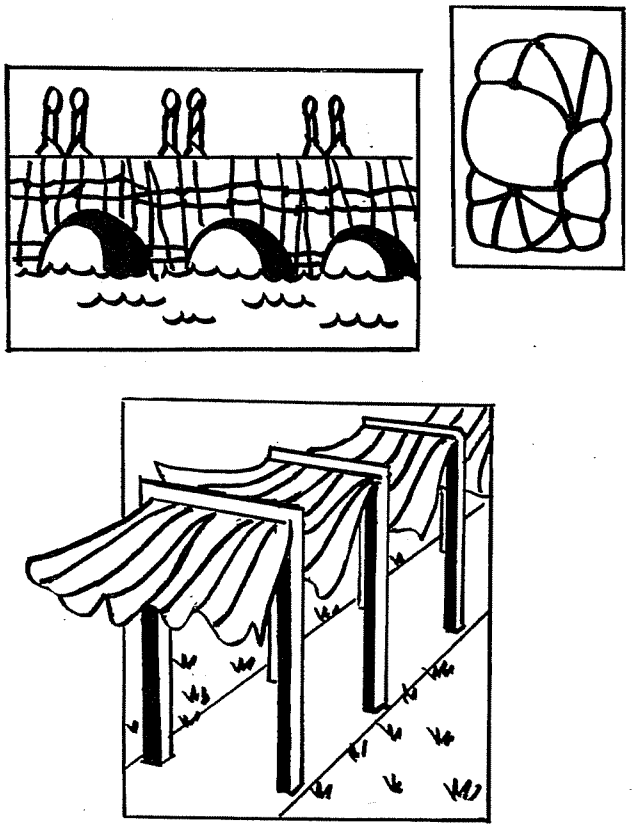

Figure 2. Schematic drawings of a wrapped package, the wrapped Pont Neuf in Paris and a row of Gates in Central Park.

To recap, constraints help sustain novelty in the same way that they help generate it, by restructuring existing problem spaces. Christo's original constraints generated novelty by replacing Pop's; Christo and Jeanne-Claude's subsequent constraints served to sustain novelty by replacing his/their own earlier sets of successful constraints.

Conclusions and a Concluding Question

Previous work suggested that novelty/creativity requires rejecting (Gardner, 1993) and replacing (Boden, 1994) existing ideas and rules. The present Pop and Christo examples show that such rejection/replacement can be accomplished via strategically selecting goal, subject, and task constraints that restructure an existing problem space. Strategically means selecting constraint pairs to initially specify a novel goal and to subsequently refine its criterion. Choosing an existing, well-structured problem to provide the initial state and the preclude half of the constraint pairs is a critical part of the process. I think of it as a kind of problem finding (Csikszentmihalyi & Getzels, 1971) or discovery (Runco & Chad, 1994). As we have seen, the problem can be selected from the domain (think of Abstract Expressionism being precluded by the Pop group) or come from the creator's own previous solution or solutions (think of Christo and Jean-Claude precluding, in order, his permanently wrapped small objects, their temporarily wrapped, large objects). As always, the new emerges from the known.

The concluding question, which is always asked when constraints are discussed, is this: What about artistic freedom? One answer, found in every intro psychology text, was already suggested: free to do anything, we rely on, and often get "stuck" in, successful solutions. The other is based on the constraint model itself. Artistic freedom[4] consists solely in choosing one's own

[4] "Artistic" here, of course, implies "creative" in domains other than the purely aesthetic. To review case studies in advertising, architecture, and fashion design—to name a few—see Stokes, 2005.

constraints. Novices have constraints chosen by their teachers. Expertise involves mastery of existing constraints in a domain. Creativity (of the generative, influential kind) depends on an expert selecting paired subject and task constraints to restructure an existing problem space and realize a novel goal.

References

Abuhamedeh, S., & Csikszentmihalyi, M. (2004). The artistic personality: A systems perspective. In R. J. Sternberg, E. L. Grigorenko, & J. L. Singer (Eds.), *Creativity: From potential to realization* (pp. 31–42). Washington, DC: American Psychological Association.

Adamson, R. E. (1952). Functional fixedness as related to problem solving: A repetition of three experiments. *Journal of Experimental Psychology, 44,* 288–293.

Amabile, T. M. (1996). *Creativity in context.* Boulder, CO: Westview Press.

Atwood, M. E., & Polson, P. G. (1976). A process model for water jar problems. *Cognitive Psychology, 8,* 191–216.

Baal-Teshuva, J. (2001). *Cristo and Jeanne-Claude.* NY: Freeman.

Baer, J. (1993). *Creativity and divergent thinking: A task-specific approach.* Hillsdale, NJ: Erlbaum.

Boden, M. A. (1991). *The creative mind: Myths and mechanisms.* NY: Basic Books.

Boden, M. A. (1994). What is creativity? In M. A. Boden (Ed.), *Dimensions of creativity,* pp. 76–117. Boston: MIT Press.

Chernow, B. (2002). *Christo and Jeanne-Claude: A Biography.* New York: St. Martin's Press.

Chi, M. T. H. (1997). Creativity: Shifting across ontological categories flexibly. In T. B. Ward, S. M. Smith, & J. Vaud (Eds.), *Creative thought: An investigation of conceptual structures and processes* (pp. 209–234). Washington, DC: American Psychological Association.

Christensen, P. R., Guilford, J. P., & Wilson, R. C. (1957). Relations of creative responses to working time and instructions. *Journal of Experimental Psychology, 53,* 82–88.

Cropley, A. J. (1999). Creativity and cognition: Producing effective novelty. *Roeper Review, 21,* 253–260.

Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of invention.* New York: Harper Collins.

Csikszentmihalyi, M., & Getzels, J. W. (1971). Discovery-oriented behavior and the originality of creative products: A study with artists. *Journal of Personality and Social Psychology, 19,* 47–52.

Cunningham, M. (1999). Choreography and the dance. In G. Celand (Ed.), *Merce Cunningham* (p. 42–49). Barcelona, Spain: Foundation Antoni Tapies.

Dodds, R. A., & Smith, S. M. (1999). Fixation. In M. A. Runco & S. R. Pritzker (Eds.), *Encyclopedia of Creativity* (Vol. 1; pp. 725–728). New York: Academic Press.

Duncker, K. (1945). On problem solving. *Psychological Monographs, 58.* Whole No. 270.

Finke, R. A. (1990). *Creative imagery: Discoveries and inventions in visualization.* Hillsdale, NJ: Erlbaum.

Finke, R. A., Ward, T. B., & Smith, S. M. (1992). *Creative cognition: Theory, research, and applications.* Cambridge, MA: MIT Books.

Gardner, H. (1993). *Creating minds: An anatomy of creativity seen through the lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Ghandi.* New York: Basic Books.

Guilford, J. P. (1950). Creativity. *American Psychologist, 5,* 444–454.

Holland, J. H., Holyoak, K. J., Nisett, R. E., & Thagard, P. R. (1987). *Induction: Processes of inference, learning, and discovery.* Cambridge, MA: The MIT Press.

Johnson-Laird, P. N. (1988). Freedom and constraint in creativity. In R. J. Sternberg (Ed.), *The nature of creativity: Contemporary psychological perspectives* (pp. 202–219). New York: Cambridge University Press.

Klee, F. (Ed.). (1964). *The diaries of Paul Klee, 1898–*1918. Berkeley, CA: University of California Press. (Original work published in 1910.)

Lesschaeve, J. (1985). *The Dancer and the dance: Merce Cunningham in conversation with Jacqueline Lesschave.* New York: Marion Boyars, Inc.

Luchins, A. S., & Luchins, E. H. (1970). *Wertheimer's seminars revisited: Problem solving and thinking* (Vol. 3). Albany, NY: Faculty-Student Association, State University of New York.

Maier, N. R. F. (1945). Reasoning in humans. III. The mechanisms of equivalent stimuli and of reasoning. *Journal of Experimental Psychology, 35,* 349–360.

Maltzman, I. (1960). On the training of originality. *Psychological Record, 67,* 229–242.

Mednick, S. A. (1962). On the associative basis of the creative process. *Psychological Review, 69,* 220–232.

Mumford, M. D., Reiter-Palmer, R., & Redmond, M. R. (1994). Problem construction and cognition: Applying problem representations in ill-structured problems. In M. A. Runco (Ed.), *Problem finding, problem solving, and creativity* (pp. 91–122). Norwood, NJ: Ablex.

Newell, A., Shaw, C., & Simon, H. A. (1962). The processes of creative thinking. In H. E. Gruber, G. Terrell, & M. Wertheimer (Eds.), *Contemporary approaches to creative thinking* (pp. 153–189). New York: Pergamon Press.

Newell, A., & Simon, H. A. (1972). *Human problem solving.* Englewood Cliffs, NJ: Prentice Hall.

Osterwold, T. (2003). *Pop art.* Koln, Germany: Taschen.

Reitman, E. (1965). *Cognition and thought.* New York: Wiley.

Rivers, L. (1987, March). *Improvisation and the creative process in jazz and the visual arts.* Paper presented at the R. M. Levine Distinguished Artists Series, Barnard College, Columbia University, New York.

Rose, B. (1986). *20th century American painting.* NY: Rizzoli.

Runco, M. A. (1986). Flexibility and originality in children's divergent thinking. *Journal of Psychology, 120,* 345–352.

Runco, M. A. (1999). *Divergent and creative thinking.* Cresskill, NJ: Hampton.

Runco, M. A., & Chand, I. (1994). Conclusions concerning problem finding, problem solving, and creativity. In M. A. Runco (Ed.), *Problem finding, problem solving, and creativity* (pp. 217–290). Norwood, NJ: Ablex.

Simon, H. A. (1973). The structure of ill-structured problems. *Artificial Intelligence, 4,* 181–201.

Simon, H. A. (1978). Information-processing theory of human problem solving. In W. Estes (Ed.), *Handbook of learning and cognitive processes* (Vol. 5; pp. 271–295). Hillsdale, NJ: Erlbaum.

Simonton, D. K. (2004). Creativity as a constrained stochastic process. In R. J. Sternberg, E. L. Grigorenko, & J. L. Singer (Eds.), *Creativity: From potential to realization* (pp. 83–101). Washington, DC: American Psychological Association.

Skinner, B. F. (1953). *Science and human behavior.* New York: The Free Press.

Sternberg, R. L., & Lubert, T. I. (1999). The concept of creativity: Prospects and paradigms. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 3–15). New York: Cambridge University Press.

Stokes, P. D. (1999a). Learning variability levels: Implications for creativity. *Creativity Research Journal, 12,* 37–45.

Stokes, P. D. (1999b). Novelty. In M. A. Runco & S. R. Pritzker (Eds.), *Encyclopedia of creativity.* New York: Academic Press.

Stokes, P. D. (2001a). Variability, constraints, and creativity: Shedding light on Claude Monet. *American Psychologist, 56,* 355–359.

Stokes, P. D. (2001b). Constraints and creativity: Experiments in art and psychology. In S. Nagel (Ed.), *The handbook of policy creativity: Volume III* (pp. 33–48). New York: Nova Science.

Stokes, P. D. (2005). *From constraint to creativity: The psychology of breakthrough.* New York: Springer.

Stokes, P. D., & Fisher, D. (2005). Selection, constraints, and creativity case studies: Max Beckmann and Philip Guston. *Creativity Research Journal, 17,* 283–291.

Voss, J. F., & Post, T. A. (1988). On the solving of ill-structured problems. In M. T. H. Chi, R. Glaser, & M. J. Farr (Eds.), *The nature of expertise* (pp. 261–285). Hillsdale, NJ: Erlbaum.

Ward, T. B. (1994). Structured imagination: The role of category structure in exemplar generation. *Cognitive Psychology, 27,* 1–40.

Ward, T. B., Dodds, R. A., Saunders, K. N., & Sifonis, C. M. (2000). Attribute centrality and imaginative thought. *Memory & Cognition, 28,* 1397–1397.

Ward, T. B., Patterson, M. J., & Sifonis, C. M. (2004). The role of specificity and abstraction in creative idea generation. *Creativity Research Journal, 16,* 1–9.

Weisberg, R. W. (2006). *Creativity: Understanding innovation in problem solving, science, invention, and the arts.* Hoboken, NJ: Wiley.

Weisberg, R. W., & Suls, J. M. (1973). An information processing model of Dunker's candle problem. *Cognitive Psychology, 4,* 255–276.

Yokochi, S., & Okada, T. (2005). Creative cognitive process of art making: A field study of a traditional Chinese ink painter. *Creativity Research Journal, 17,* 241–255.

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Welcome to a new era for scholarly communication within the Society for the Psychology of Aesthetics, Creativity, and the Arts, Division 10 of the American Psychological Association! The *Bulletin of Psychology and the Arts*, started through combined efforts of Robert Sternberg, Colin Martindale, and Sarah Benolkin, has evolved into *Psychology of Aesthetics, Creativity, and the Arts*, a fully peer-reviewed scholarly journal of the Division, published by the American Psychological Association.

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For the journal to provide articles that will be of interest and of use to our profession and the wider readership, we will need the assistance of psychologists, students, and others with knowledge and background in psychology and the arts to review manuscripts. If you are interesed in reviewing manuscripts and have the time to review one every few months, please send a list of your areas of expertise and your vita to one of the editors at the email addresses listed below.

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