Improving the creativity of organizational work groups

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Executive Overview

In the rapidly changing, more competitive new economy, teams need to engage in divergent thinking in which they put aside typical assumptions. However, the deck seems to be stacked against teams as the agents of creativity. Indeed, teams excel at convergent thinking, but it is individuals who excel at divergent thinking. In this article, the four key obstacles to creative teamwork are identified and described. Then, ten techniques for enhancing creative teamwork are outlined that most teams or workgroups can put into place. These techniques have all been proven effective in enhancing creativity and are extremely cost-effective.

Creativity—how to ignite it and how to regenerate it—is a key question that managers and executives pose to management educators and consultants. Several organizational changes and developments make creativity a valuable necessity for the new economy and the organizations that inhabit it. First, flatter organizational structures require companies, divisions, and managers to act in a more entrepreneurial and inventive fashion. The absence of hierarchy and bureaucracy creates fertile opportunity for creative knowledge and action. Second, by nearly all counts, businesses are growing more competitive. Strictly speaking, this means that companies continually need to reinvent themselves. Frank and Cook's book *The Winner-Take-All Society* provides compelling data on how companies are becoming more competitive, resulting in "winners" who gain more and more market share.[1] Third, blurred lines between traditional notions of who's "inside" and who's "outside" the company allow teams to form new relationships with suppliers, complementary businesses, and shadow industries. In *Co-opetition*, Brandenburger and Nalebuff argue that cooperation and competition can co-exist in business relationships.[2] Finally, the focus on customer service is more important than ever, and the quest to satisfy and delight the customer or client requires creativity.

Just because the challenges facing a team call for creativity, however, is no guarantee that the team members will be creative. In fact, several factors that seem to foster creativity might actually thwart it.

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Creative Realism

Most people think that creative ideas are wild ideas; on the contrary, creativity is the production of novel and useful ideas. Creativity is important for innovation. If creativity pertains to ideas, then innovation pertains to the services and products that result from creative ideas. According to the famous psychologist James Guilford, creative thinking occurs when a problem solver invents a novel solution to a problem.[3] Creative ideas and creative acts are original and valuable. Figure 1 shows a 2×2 grid defining, on the horizontal continuum, creative and conservative ideas.[4] According to the model, teams should strive to achieve creative ideas, which represent highly original and novel ideas, as opposed to conservative, traditional ideas.

The vertical continuum is the one that is too often overlooked. It distinguishes new ideas that are *realistic* (connected to current ideas and knowledge) from ideas that are *idealistic* (disconnected from current knowledge). If new ideas are not connected to current ideas and knowledge, they are often unimplementable.

REALISTIC

CREATIVE REALISM   **CONSERVATIVE REALISM**

CREATIVE ← → CONSERVATIVE

CREATIVE IDEALISM   **CONSERVATIVE IDEALISM**

IDEALISTIC
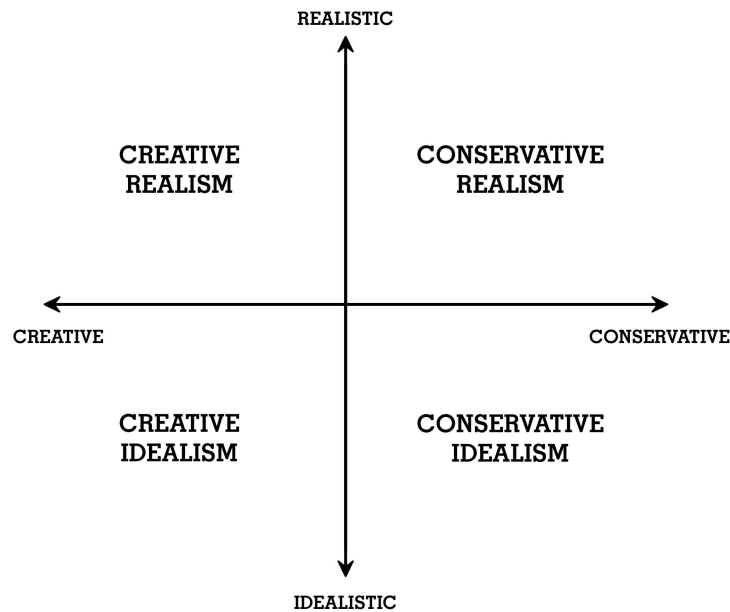
Source: Finke, R. A. 1995. Creative realism. In S. M. Smith, T. B. Ward, & R. A. Finke (Eds.), _The creative cognition approach:_ 303–326. Cambridge, MA: MIT Press. Used with permission.

FIGURE 1
Four General, Conceptual Domains into Which New Ideas Can Be Classified

The best of all possible worlds is to get ideas in the upper left quadrant. This domain is called _Creative Realism_ because these ideas are highly imaginative and highly connected to current structures and ideas. _Conservative Realism_ represents ideas that are highly traditional and highly connected to current knowledge and practices. This realm contains little ambiguity and little uncertainty. _Conservative Idealism_ is perhaps the worst type of thinking for a company: an extension of a common idea that is unrealistic to begin with. Such ideas exhibit little or no imagination and are not connected to existing knowledge. _Creative Idealism_ represents highly original, yet highly unrealistic, ideas.

The key question is how teams can maximize the probability of landing in the upper left (Creative Realism) quadrant. The ideas that flow from this type of thinking are highly original and very useful. An excellent example of Creative Realism was Edison's development of the electric light system.[5] After Edison invented the incandescent light, his next project was to develop an entire system whereby the invention could be made commercially successful. At the time, there were two in-place lighting systems (neither developed by Edison): gas lights and electrical arc lights. Gas lights could be directly controlled for brightness; gas fuel was produced off-site and sent through buried gas mains. Arc lighting was produced by an electrical spark between carbon rods, was very hot, and pro-

duced fumes. The generating plant was located at the user's site. Edison's electric lighting system was based on the principles of gas lighting. Edison wrote in his workbooks that he completely imitated the gas system, replacing the gas with electricity. In Edison's electric system, the source of power was remote from the user, and the wires that brought the power were underground. Further, the individual lights were turned on and off by the user. The light bulb in Edison's system was called a burner and was designed to produce the same amount of light as a gas burner.

As we shall see, the efforts that people make to generate ideas in the Creative Realism quadrant sometimes ensure that they won't end up there. As it turns out, the route to creative, useful ideas is often indirect and non-obvious.

Measuring Creativity

In my MBA and executive education courses, I challenge participants to assess their own creativity using a standard creativity measure: Guilford's cardboard-box task.[6] The procedure is very simple: all participants spend ten minutes writing down all of the uses that they can think of for a cardboard box. (The same can be done for a brick, etc.). I am always surprised by the variation in the number, originality, and quality of ideas within the class.

The next step is to instruct participants in how to

evaluate creativity, using this very simple task as a model. To do so, I introduce Guilford's three-factor model of creativity: fluency, flexibility, and originality.[7] *Fluency* is simply a measure of *how many* different ideas a person is able to generate. As we will see, Alex Osborn (the father of modern brainstorming) was right: quantity often does breed quality.[8] The typical range that I get in my MBA and executive classes is 5–40.

Quantity often does breed quality.

Flexibility is a measure of *how many different types* of ideas a person generates. For example, suppose that one person who completes this exercise, Sandy, generates three ideas: using the box for a cage as a hamster, a container for a turtle, and a kennel for a dog. Sandy would receive three points for fluency, because there are three different ideas, but only one point for flexibility, because the ideas are of the same category (i.e., homes for animals). Conversely, Pat suggests using the cardboard box as a god, a telephone (via two boxes and some string), and trading it as currency.[9] Pat would receive a score of three points for fluency (same as Sandy), but score three points for flexibility, because there are three separate categories of ideas—one involving religion, another communication, and the third economics. Clearly, some of Pat's ideas do not meet the requirements for structural connectedness, but as we will see, Pat and her team are in a much better position to set the stage for creative realism than Sandy. Think of flexibility as a kind of mental gymnastics—the ability to entertain different types of ideas, all in a short amount of time. Most people, and in particular most teams, tend to get stuck in one or two types of categories of thought, a kind of cognitive arthritis. The typical range that I get in my MBA and executive classes is 4–17 categories.

Originality is a measure of the *uniqueness* or originality of the idea. (This is what is meant by creativity on the conservative-creative continuum in Figure 1.) Statistically, original ideas are ideas that are generated by less than 5 percent of a given sample. Thus, in my investigations, if there are 50 executives in a given class, an originality point is given to an idea only if two or fewer people come up with that particular idea. The typical range that I get for originality scores in my MBA and executive classes is 0–14.

There is always a striking correlation among the three measures, such that the people who get the highest scores on originality also get high scores on flexibility and fluency. Thus, there is a strong association between quantity, diversity, and novelty of ideas. According to Guilford, flexibility is the driver. This runs counter to most business notions of creativity, in which diversity of ideas is often not rewarded, quantity is not valued, and *quality* is viewed as the single most important goal. If flexibility is indeed the driver, how do we set the stage for it?

Convergent versus Divergent Thinking

Convergent thinking is thinking that proceeds toward or converges on a single answer. For example, consider a gambling problem: The EV, or expected value, of a 70 percent chance of earning $1,000 is obtained through a simple algorithm, such that $1000 is multiplied by .7 to obtain $700. In contrast, divergent thinking moves outwards from a problem in many directions and involves thinking without boundaries. Divergent thinking is somewhat like Janusian thinking. Janus was the Roman deity who had two faces looking in opposite directions. In this context, Janusian thinking refers to the ability to cope with conflicting ideas, paradoxes, ambiguity, and doubt. To stimulate Janusian thinking, Tom Verberne suggests asking, "What if the world turned into your worst nightmare or your nicest dream?"[10] Open-ended questions stimulate divergent thinking. After participants answer such questions, have them identify factors that influence the opposing scenarios. This kind of thinking can prevent people from jumping to the most obvious (and often the most expensive) solution. Verberne gives the example of hotel guests complaining to a hotel manager that they have to wait too long for the elevators. The manager refers the problem to an engineer, who suggests installing another elevator. The manager is not convinced to adopt the costly solution, so she asks a psychologist for advice. The psychologist recommends giving people something to do while they wait—e.g., putting mirrors and a magazine rack near the elevators. The manager chooses the low-cost option, and the complaints stop. Verberne also suggests role switching, where participants ask what important opportunity or problem faces their organization, take each other's roles within the organization, and ask what's important from the perspective of their new, assumed roles.

Impossibilities can also stimulate divergent thinking. Participants think of ideas that are at present impossible to execute (e.g., living on the moon, traveling by satellite, etc.) and then identify conditions that might lead to the idea's fruition.

Many of the factors that make up creative problem solving are related to divergent thinking. Most

teams do require some convergent thinking. As we shall see, however, teams tend to focus on convergent thinking at the expense of divergent thinking. Thus, one paradox for teams, when it comes to creativity, is that teams excel at convergent thinking, but individuals excel at divergent thinking. This is paradoxical because intuitively, most people strongly believe that teams are more creative than individuals, when in fact they aren't.

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A large body of research in social and organizational psychology reveals that when teams are pitted against individuals, it is teams who excel at tasks requiring convergent thinking. For example, in a classic decision-making game that has a proven best answer, groups of people generate superior decisions with greater frequency than do individuals. Moreover, business and social institutions seem to know this and capitalize on it. Presumably, one reason for having a jury of 12 peers is that the resulting judgment will be more balanced and accurate than if only one person weighs the evidence.

The most difficult task for most teams is divergent thinking, often referred to as "Thinking Outside the Box." As a general observation, the ideas that groups and teams come up with are more clichéd and traditional than the ideas that individuals generate when working on their own. It is as if teams act as a norming device, thereby making group members more likely to conform to one another. In several organizational situations, this is highly desirable, such as when teams want to build cohesion and identity. However, by its very definition, creativity requires diversity of thought and ideas. Marshall Fisher, a co-founder of Century 21 Real Estate, realized that most people, left to their own devices, engage in conformist, convergent thinking. The idea behind his IdeaFisher program is that alternatives need to be freed up. The IdeaFisher program uses keywords and phrases and cross-references them with other like words and phrases to put together diverse and different ideas that normally don't come together in a highly organized fashion.[11] Diversity also means conflict, among other things; and most teams want to avoid conflict at any cost. Conflict avoidance can actually cost a lot.

Brainstorming

Alex Osborn, an advertising executive in the 1950s, wanted to increase the creativity of teams in organizations. He believed that one of the main blocks to organizational creativity was the premature evaluation of ideas. He was convinced that two heads were better than one when it came to generating ideas, but only if people could be trained to *defer judgment of* their own and others' ideas during the idea generation process. Osborn then developed the most widespread business practice used by companies to encourage creative thinking: brainstorming.

In his influential book *Applied Imagination*, Osborn suggested that brainstorming could considerably increase the quality and quantity of ideas produced by group members.[12] Osborn therefore believed that the group product could be greater than the sum of the individual parts if certain conditions were met. Hence, he developed rules to govern the conduct of brainstorming. Contrary to popular corporate lore that brainstorming sessions are wild and crazy free-for-alls where anything goes, Osborn's rules were specific: (1) criticism is ruled out; (2) freewheeling is welcome; (3) quantity

Table 1
Rules for Brainstorming

No Criticism:	Do not criticize ideas. Group members should not evaluate ideas in any way during the generation phase; all ideas should be considered valuable.
Freewheeling Welcome:	Group members should express any idea that comes to mind, no matter how strange, weird, or fanciful. Group members are encouraged not to be constrained nor timid. They should freewheel whenever possible.
Quantity Desired:	Group members should generate as many ideas as possible. Groups should strive for quantity, as the more ideas, the better. A high quantity of ideas increases the probability of finding excellent solutions.
Combining/Improving Ideas Encouraged:	Because all of the ideas belong to the group, members should try to modify and extend the ideas suggested by other members whenever possible.

Source: Adapted from A. F. Osborn. 1957. *Applied imagination* (revised edition). New York: Scribner.

is desired; and (4) combination and improvement of ideas are encouraged (see Table 1).

Osborn aptly noted that quantity is a good catalyst for quality: A team is more likely to discover a really good idea if it has a lot of ideas to choose from. But there is even more to brainstorming than mere quantity. Osborn believed that the ideas generated by one person in a team could stimulate ideas in other people in a synergistic fashion.

Many companies still use the original brainstorming rules suggested by Osborn over 40 years ago. Silicon Valley's IDEO design firm lives by these rules. Douglas Dayton of IDEO says that five rules govern every brainstorming session at IDEO: "Have one conversation at a time. Build upon the ideas of others. Defer judgment. Encourage wild ideas (not wild behavior). Stay focused on the subject."[13]

Osborn claimed to have (but did not provide) research evidence that a team which adopted these rules could generate twice as many ideas as similar numbers of individuals working alone. Thus, the comparison Osborn had in mind was a real group working face-to-face and a control group of sorts, known in the literature as a nominal group.

Does It Work?

This is the question organizational theorists asked about the brainstorming technique. Nearly all laboratory studies have found that group brainstorming leads to the generation of fewer ideas than comparable numbers of solitary brainstormers in both laboratory and organizational settings (i.e., nominal groups).[14] Thus, 40 or so years of research on brainstorming has found that brainstorming is significantly *worse* in terms of fostering creativity than just having the same number of individuals work independently. In fact, virtually all of the empirical investigations of group brainstorming are strongly (not just mildly) negative about its effectiveness compared to solitary brainstorming.

As a typical example, look at the statistics in Table 2, which are actual performance data of brainstorming groups and solitary groups in terms of quantity and quality of ideas. On the basis of these results, which have been replicated several hundred times with a variety of teams brainstorming about all kinds of things, the same pattern emerges again and again. According to Mullen, et al., "It appears particularly difficult to justify brainstorming techniques in terms of any performance outcomes, and the long-lived popularity of brainstorming techniques is unequivocally and substantially misguided."[15]

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However, companies who use brainstorming don't like to hear this. Despite the empirical evidence for its ineffectiveness, group brainstorming remains popular in business and industry.[16]

Major Threats to Team Creativity

Four major problems stifle the effectiveness of brainstorming in teams. The basic problem is not teamwork itself, but rather the social-cognitive processes that operate in teamwork and how teams are managed. I refer to these problems as social loafing, conformity, production blocking, and downward norm setting.

Social Loafing

Social loafing is the tendency for people in a group to slack off—i.e., not work as hard either mentally or physically in a group as they would alone. Indeed, when organizational members perceive their own contributions to be unidentifiable and dispensable, they are likely to loaf.[17] If loafing is

Table 2
Performance Data of Group and Solitary Brainstorming

	Face-to-face brainstorming group	The same number of people working independently (solitary brainstorming)
Quantity: The number of ideas generated	28	74.5
Quality: Percentage of "good ideas" (judged anonymously by independent experts)	8.9%	12.7%

Source: Adapted from Diehl, M., & Stroebe, W. 1987. Productivity loss in brainstorming groups: Toward a solution of a riddle. *Journal of Personality and Social Psychology,* 53: 497–509.

extreme disinterest in a task, then "flow" is extreme involvement and interest. According to psychologist Mihaly Csikszentmihalyi, people who really enjoy a task often experience a state of "flow." The idea of flow is that an activity is challenging enough to be interesting and rewarding, but not so challenging that the player is threatened or inhibited. Flow is the experience of enjoying an activity so much that it becomes worth doing even though it may have no consequences beyond its own context.[18] Thus, the process is more important than the outcome for people in a flow state.

Conformity

A basic human principle is the desire to be liked and accepted by others, particularly others in one's groups. Several theories of social behavior (e.g., social identity theory) provide compelling evidence that people seek to identify with groups and sometimes will engage in bizarre behaviors to ensure their acceptance by a group.[19] In brainstorming teams this means, for example, that managers may be cautious about their presentation of ideas and suggestions because they fear that others may negatively evaluate the ideas.[20] This, of course, will lead members to respond with "appropriate," traditional, conservative, and highly similar ideas—exactly the kind of behavior that most organizations would like to avoid. For example, word association studies reveal that people make more conventional and clichéd responses when they are in a group than when they are alone. Some companies have liberated teams by using free-association exercises. For example, at Campbell's Soup Company, a group of product developers began brainstorming by randomly selecting the word "handle" from a dictionary. Through free association, someone suggested the word "utensil." This led to "fork." One participant joked about a soup that could be eaten with a fork. The group reasoned (in a convergent fashion) that soup could not be eaten with a fork unless it was thick with vegetables and meat—and Campbell's Chunky Soups, an extraordinarily successful product line, were born.[21]

Conformity can occur when group members are concerned that others in the group will be critical of their suggestions, despite instructions designed to minimize such concerns.[22] Many social conventions in companies suggest that people should stay "on topic" and not present ideas that diverge greatly from those being discussed. This type of conformity is usually not a good idea when it comes to creative thinking.

Production Blocking

A person working alone on a problem can enjoy an uninterrupted flow of thought. In contrast, brainstorming group members cannot speak at the same time; they have to wait for their turns to speak. Consequently, people may forget their ideas or decide during the waiting period not to present them.[23] Their idea production is blocked. Waiting can certainly be frustrating, especially if the meeting is not managed well. Production blocking works both ways too: It is difficult for group members to listen to and process ideas generated by other group members while they are generating their own ideas.

Downward Norm Setting

It is commonly observed that the performance of people working within a group tends to converge over time. For example, at CDW (Computer Discount Warehouse), salespeople working in the same area in the building report monthly sales figures more similar to one another than to those working in other buildings and areas.[24] So far, no problem. However, there is a pervasive tendency for the lowest performers in a group to pull down the average. Indeed, individuals working in brainstorming groups tend to match their performance to that of the least productive member, also known as downward norm setting.[25] It is most likely to occur when there are no strong internal or external incentives for high performance in teams.[26] This low performance level may set the benchmark for the team, in that it is seen as an appropriate or typical level of performance. For example, participants in interactive dyads or groups of four tend to be more similar in their rate of idea generation than non-interacting groups.[27] Unfortunately, the least productive members of the team are often more influential in determining overall team performance than the high performers.

Individuals working in brainstorming groups tend to match their performance to that of the least productive member.

What Goes on During a Typical Brainstorming Session?

What exactly might we expect to observe in a typical company brainstorming session? Video- and tape-recorded interactions reveal an interesting set of events. The four problems noted above com-

bine to cause people in most brainstorming groups to:

- Experience inhibitions, anxiety, and self-presentational concerns
- Reduce their production
- Participate in social rituals, such as telling stories, repeating ideas, and giving positive feedback (a natural pattern of conversation that works well at cocktail parties but kills creativity)
- Set their performance benchmarks too low
- Conform in terms of ideas
- Conform in terms of rate of idea generation

The Faulty-Performance Illusion

Most brainstorming teams have no idea that these behaviors are occurring; most interactive brainstorming teams feel quite confident about their productivity. Thus, though the group's esteem has been soothed via the social rituals, the esteem has a faulty basis. Brainstorming groups, and the companies who use them, are their own worst enemy: They fall prey to the illusion that they function very effectively. They suffer from illusions of invulnerability, collective rationalization, belief in the morality of the group, and stereotyping of outgroups. In fact, the illusion of performance is so self-serving that people often take credit for the ideas generated by others.[28]

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Building Team Creativity

Fortunately, teams can take actions to ward off the typical problems that brainstorming produces. The ten strategies outlined below all have a strong scientific research basis, are practical, and are reasonable in cost:

1. Diversify the Team

Team members that have different backgrounds, training, and perspectives are naturally going to offer different categories of thought and ways of looking at a problem compared to homogenous teams. The more heterogeneous a team is, the more likely that the team will excel in all measures of creativity. Indeed, teams in which members are diverse with regard to background and perspective outperform teams with homogeneous members on tasks requiring creative problem solving and innovation.[29] Teams with heterogeneous members generate more arguments, apply a greater number of strategies, detect more novel solutions, and are better at integrating multiple perspectives than teams without conflicting perspectives. For example, IDEO design firm deliberately hires people with diverse backgrounds.

A wonderful working illustration of the diverse-team concept is in place at some microbiology labs. Dunbar undertook a massive and exhaustive study of microbiology laboratories over an extended period of time.[30] He attended all meetings and painstakingly recorded all interactions, both formal and informal, in his search for the conditions that might generate creativity. Over time, some labs distinguished themselves in terms of having more breakthrough discoveries, as evidenced by the number of patents. These successful laboratories did not have larger staff, nor were their scientists better paid or smarter. The key difference involved diversity in training within the lab groups. Lab teams that were more heterogeneous in composition were more likely to engage in divergent thinking, learned from their failures, and freely drew from other domains to address their problems.

2. Analogical Reasoning

Analogical reasoning is the act of applying a concept or idea from a particular domain to another domain. The simplest analogy might be something like this: Green is to go as red is to stop. A much more complex analogy is Kepler's application of concepts from light to develop a theory of orbital motion of planets.[31] Similarly, chemist Friedrich Kekulé discovered the closed hexagonal structure of the benzene ring by imagining a snake biting its own tail. To the extent that teams can recognize when a particular known concept might be useful for solving a new problem, creativity can be enhanced. The problem is that it is not easy to transfer relevant information from one domain to another; people almost always tend to solve problems based on their surface-level similarity to other situations, rather than on their deep, or structural, similarity.

This tendency points to a serious problem with creative teamwork: People usually have the knowledge they need to solve problems, but they fail to access it because it comes from a different context. For example, when people are given the "tumor problem" (concerning how to use a ray to destroy a patient's tumor, the problem being that a ray of sufficient strength will destroy healthy tissue en

route to the tumor), an elegant (but not obvious) solution involves using a series of low-intensity rays from different angles that all converge on the tumor spot as their destination.[32] Only about 10 percent of people solve this problem. Gick and Holyoak asked whether performance would improve if the participants were given an analogous problem beforehand involving a general who is trying to capture a fortress but is prevented from making a frontal attack with his entire army. An elegant (and analogous) solution is to divide the army into small groups of ground troops that each approach the fortress from a different road at the same time. Even when the tumor problem was presented immediately after the fortress problem, only 41 percent of people spontaneously transferred the "first divide and then converge" solution. In the research done in our laboratory, we have demonstrated similar lack of transfer with managers and executives.[33] Thus, applying previously learned knowledge to new situations is surprisingly difficult for most managers. This is known as the "inert knowledge" problem.

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Many companies are recognizing the box-breaking potential of analogical reasoning as a way of using ideas that people have about other, seemingly unrelated things to solve pressing business problems. Alan Heeks, a Harvard MBA who worked at Procter & Gamble, uses an organic farm as a model for business life. Heeks goes so far as to run workshops at a 132-acre farm where analogies run rampant—participants think about harvesting for their future development, recycling, fertility, and sustainability. Heeks helps participants draw analogies between soil and a company's staff.[34]

The Pennsylvania Chamber of Business in downtown Harrisburg is a broad-based business association representing more than 6,500 companies in Pennsylvania that make use of the private work force. The organization chose the novel *River Horse* by William Least Heat-Moon as an analogy for the changes and transformation their organization is going through.[35] Chamber president Floyd Warner selected the book for his group to read and discuss on a regular basis.

Another use of analogy: When NASA found it necessary to design a satellite that would be tethered to a space station by a thin wire 60 miles long, designers realized that the motion of reeling in the satellite would cause it to act like a pendulum with an ever-widening arc. Stanford scientist Thomas Kane, using the analogy of a yo-yo, determined that a small electric motor on the satellite would allow it to crawl back up the tether to the space station.[36]

As another example, a manufacturer of potato chips faced a frequently encountered problem: Potato chips took up too much shelf space when they were packed loosely, but they crumbled when packed in smaller packages. The manufacturer found a solution by using a direct analogy: Dried leaves are highly similar to potato chips. They crumble very easily and they are bulky. Pressed leaves are flat. Could potato chips be shipped flat? As it turned out, they could not. However, the team realized that leaves are not pressed when they are dry but when they are moist. So, they packed potato chips in stacks, moist enough not to crumble, but dry enough to be nearly flat. The result was Pringles™.[37]

Prem Kamath, head of management resources for Hindustan Lever, described how his firm uses analogies from the movie *Tora! Tora! Tora!* to guard itself against complacency.[38] And Barry Schuler, Marriott International's senior vice president of strategy and planning for information resources, has helped to technically season Marriott's executives by speaking in analogies. Schuler, a former race car driver, sold a new network with the following analogy: "Bill Marriott, Jr. (CEO and chairman of the board) owns several exotic cars. He loves talking about cars. I tell him that the infrastructure—the hardware and system software connecting the network—[is] like the road. Then I ask him, 'Why would you want a thousand roads coming to the same place, when you can have one?' I compare our applications to trucks and cars driving on the road. And Information Resources people are the pit crew."[39] Analogical reasoning involves the application of diverse categories to a company's present problem or challenge. Another example: The D'Arcy advertising firm often holds "kidnappings" in which employees are suddenly whisked away to museums and then asked to think about a certain artist or exhibit as an analogy to their current product or service.[40]

3. Brainwriting

Brainwriting works like this: At various key points in time during a brainstorming session, group members will cease all talking and write down their own ideas silently.[41] Writing ideas instead of speaking them eliminates the problem of production blocking, since group members don't have to

wait their turn to generate ideas. It may also reduce conformity, since the written format eliminates the need for public speaking and is typically more anonymous than oral brainstorming. The written ideas can be subsequently shared by the group in a round-robin fashion and summarized on a blackboard or flipchart. For example, investigations of brainstorming groups of four people revealed that brainwriting, followed by a round-robin exchange, eliminated production blocking and social loafing as compared to standard brainwriting.[42] I personally have employed this technique in the executive classroom and have gotten strange reactions: Managers feel uncomfortable sitting in silence; they claim that it breaks their rhythm. But the proof is in the pudding: Brainwriting groups consistently generate more and better ideas than groups who follow their natural instincts. It is worthwhile noting that even if the facilitator does not use brainwriting per se, merely taking breaks can be almost as effective. Even if group members don't write anything down, taking brief breaks can serve a function similar to brainwriting.[43] The more silences and pauses that occur, the more likely it is that a divergent cycle can be created.

Brainwriting groups consistently generate more and better ideas than groups who follow their natural instincts.

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4. Nominal Group Technique

The nominal group technique, or NGT, is a variation of the standard brainwriting technique.[44] It begins with a session of brainwriting (independent writing of ideas). These ideas are subsequently shared by the group in a round-robin fashion and summarized on a blackboard. Then the group discusses the ideas for clarification and evaluation. Finally, each person rank-orders the ideas. This technique was compared with an interactive brainstorming process, and the NGT technique overwhelmingly outperformed the standard brainstorming group.[45] Also, nominal groups that perform in the same room generate more ideas than those in separate rooms.[46] One variant of the NGT is the anonymous nominal group technique. Members first write down their ideas on individual sheets of paper or note cards. The meeting facilitator (or a group member) then collects the note cards, shuffles them, and redistributes them randomly to individuals, who read the cards aloud or discuss them in small groups. This variation creates greater acceptance of others' ideas because the ideas are semi-anonymous and prevents individual members from championing only their own ideas.

Another variant of the nominal group technique is the Delphi technique. In this technique, group members do not interact in a face-to-face fashion at any point. This technique is ideally suited for groups whose members are geographically dispersed, making meetings difficult to attend, and for teams whose members experience such great conflict that it is difficult to get through a meeting. This technique requires a leader or facilitator who is trusted by team members. The entire process proceeds through questionnaires followed by feedback, which can be computerized. The leader distributes a topic or question to members and asks for responses from each team member. The leader then aggregates the responses, sends them back out to the team, and solicits feedback. This process is repeated until the issue in question is resolved.

The Delphi technique provides maximum structure, ensures equal input, and avoids production blocking; it is pretty easy to avoid coordination loss when team members never interact directly! The technique is a good alternative for teams who are physically separated but nevertheless need to make decisions. Because members respond independently, conformity pressures and evaluation apprehension are limited. One problem associated with this technique but not associated with regular or nominal brainstorming is that it can be quite time-consuming. "Sessions" can last several days, even weeks.

5. Creating an Organizational Memory

Among the biggest drains on group performance are the repetition of ideas and the forgetting of ideas. Groups can create an organizational memory by recording ideas in full view. Group members more often waste time by repeating ideas when ideas are not physically indexed. Recording all ideas improves brainstorming sessions greatly. For example, Buckman Laboratories Inc., a manufacturer of specialty chemicals for aqueous industrial systems based in Memphis, Tennessee, connects all of its associates worldwide with a proprietary knowledge network, K'Netix.[47] Also, Sun Microsystems' Java migration team created a shared-code library, which serves as a central communication hub from which they can check out whole pieces of software codes rather than recreate them every time.[48]

6. Trained Facilitators

A trained facilitator can better follow the rules of brainstorming, help to create an organizational memory, and keep teams on track, in terms of making sure that downward norming does not occur. Indeed, trained facilitators can bring the level of team performance up to that of nominal groups.[49] Furthermore, there can be long-term benefits to this investment: Teams guided by facilitators in several sessions of productive idea generation demonstrate high levels of productivity in subsequent sessions without facilitators.[50] Facilitators can teach teams to share ideas without extensive social interaction or "filler" talk. At IDEO design firm, group leaders are used to facilitate all brainstorming sessions. According to IDEO managers, the key qualification of the facilitators is that they are "good with groups," not that they are experts in the particular product area.

7. High Benchmarks

Brainstorming groups often underperform because they don't have relevant benchmarks. Information about other members' activity levels may increase performance as long as the benchmark is not too high.[51] Providing brainstormers with high performance standards greatly increases the number of ideas generated.[52] Even when members are working independently, announcing to others how many ideas they are generating every five minutes increases the number of ideas generated by the team.[53] Similarly, a facilitator can periodically call the attention of brainstormers to a graph on the computer screen indicating how the team's performance compares with that of other teams. This feedback significantly enhances the number of ideas generated by the group.[54] Simply forewarning teams that they will see a display of all ideas at the end of the session also increases the number of unique ideas generated.[55] It is also helpful for members to record their own ideas after the brainstorm.

8. Membership Change

Groups do not usually remain completely intact; rather, members enter and exit most groups.[56] My colleague, Hoon-Seok Choi, and I have extensively examined small groups that remain perfectly intact (no turnover) versus groups that experience at least one membership change (holding the total number of group members constant). We find dramatic evidence that groups who experience membership change (i.e., an exit of an old member and the entry of a new member) generate more ideas (higher fluency) and more different kinds of ideas (higher flexibility) than do groups who remain intact.

Here is what we think happens: Groups that stay together without any change in membership develop a sort of cognitive arthritis; they get stuck in their same old ruts when it comes to idea generation. In contrast, groups that experience a change in membership are naturally exposed to more ideas due to greater member diversity in task-relevant skills and information. Moreover, when a group experiences a membership change, old members are in a unique position to look at themselves more thoughtfully. That is, the presence of a newcomer can motivate old-timers to revisit their task strategies and develop new and improved methods for performing group tasks.[57] At that point, we think the group is in a better position not only to think about their working style but also to learn from others. Finally, groups that experience membership change are more task-oriented than are groups that keep the same members, due to the transitory nature of interaction among members of groups whose membership changes.

The presence of a newcomer can motivate old-timers to revisit their task strategies and develop new and improved methods for performing group tasks.

The stepladder technique is a variant of the membership-change technique. In this technique, members are added one by one to a team.[59] Step 1 of the technique involves the creation of a two-person subgroup (the core) that begins preliminary discussion of the group task. After a fixed time interval, another member joins the core group and presents ideas concerning the task. The three-person group then discusses the task in a preliminary manner. The process continues in steps until all members have systematically joined the core group. The complete group then arrives at a final solution. Each group member must have sufficient time to think about the problem before entering into the core group. More important, the entering members must present their preliminary solutions before hearing the core group's preliminary solutions. Self-pacing stepladder groups (which proceed through group activities at a self-determined pace) produce significantly higher quality group decisions than conventional groups.[60] Members with the best individual decisions exert more in-

fluence in stepladder groups than in free interaction groups.

9. Electronic Brainstorming

Also known as EBS, electronic brainstorming makes use of computers to interact and exchange ideas. In a typical EBS session, members are seated around a table that contains individual computer stations. A large screen projects all ideas generated by members. Because members don't have to compete for floor time, production blocking is virtually eliminated. And because ideas are anonymously posted, conformity is virtually eliminated.

Mattel Media uses an interesting variation of electronic brainstorming in their team meetings. A self-proclaimed "technographer" records team members' new-product ideas on a laptop, the entries appearing before the group either on a 35-inch color monitor or on the wall. Bernie DeKoven, whose title at Mattel was "Doctor Fun/Staff Design," did not allow anyone to write, in an attempt to minimize production blocking (based on the belief that if you are writing, you are not thinking). Thus, the note-taker recorded everyone's ideas in front of the group. These ideas could be rated, evaluated, and eventually accepted or dumped. Furthermore, everyone left the meeting with a hard copy of the notes in hand, thus providing the organizational memory.

In addition, DeKoven kept a "boneyard"—a file of ideas that were rejected in the meeting. Some of those dismissed notions became valuable later on in the context of other projects. For example, when Andy Rifkin, senior vice president of creative development for Mattel Media, was touring with toy buyers, he got repeated requests for activity-based toys for boys. Picking through the boneyard of a year-old meeting, he found a Hot Wheels CD-ROM concept for designing and decorating cars and printing licenses and tickets. The Hot Wheels Custom Car Designer became a best-selling item in stores.[61]

10. Build a Playground

One of the most popular approaches for stimulating creativity in the short term as well as instilling long-term passion and motivation is the creation of the work playground. There is no single recipe for the playground. The basic idea is to break with old ideas about what it means to be at work. In the playground, beige walls turn into tent-shaped fabric sails; "chat-zapping" elevators are replaced with conversation-instigating escalators; and the brainstorming areas (called "chill-out zones" at one office) are painted in funky Technicolor hues.[62] Most importantly, functionality guides the fun playground.

Spaces that are designed to foster creativity involve a lot of fun elements. For example, Southern California's Foote, Cone & Belding advertising agency has reinvented the traditional workspace with 156 surfboards on the walls of its boardroom, removal of all doors from offices, and the use of basketball and Italian bocce ball courts for creative brainstorming.[63] In St. Louis, employees at the D'Arcy Masius Benton & Bowles advertising agency rock climb, visit art museums, and go to the movies on company time, and executives at Aurora Foods encourage employees to write on the walls with markers and experiment with Play-Doh and Slinkies.[64]

> ## Spaces that are designed to foster creativity involve a lot of fun elements.

Whereas there is little or no research on whether bocce ball courts increase creativity, a powerful body of research suggests that positive affect—whether it comes from reading a funny cartoon or seeing puppies play—increases creativity.[65] The business of space is serious enough that some companies, like Steelcase, have pioneered the workspaces of the future. "Innovation spaces," custom designed by Steelcase, have transformed the way that British Petroleum searches for oil and the way that ultra high-end fashion designer Prada sells clothes to its customers.[66]

Creativity As Part of the Culture

Teams can be much more creative than they often are. Traditional management practices—such as asking for suggestions, only one person speaking at a time, and evaluating options before exhausting them—hurt rather than facilitate creative teamwork. The ten strategies we have reviewed can be applied to a wide range of groups, from intact, long-term, intensive work teams to ad hoc groups and meetings. Table 3 summarizes the strategies and indicates the particular threat to creativity that each addresses.

Creative teamwork is not only good for the bottom line; it can also be an intensely rewarding experience. The paradox is that most of our instincts about creativity are wrong. Tapping into ideas that are creatively realistic requires that companies support teams that do seemingly

Table 3
How the Key Strategies Deal with the Major Threats to Creative Teamwork

| | Threats to Creativity | | | |
Strategy	Social loafing	Conformity	Production blocking	Downward norm setting
Diversify the team		Diverse teams less likely to have common group norms		
Analogical reasoning		Can lead teams to think about different, non-traditional ideas		
Brainwriting	Especially helpful if the individual group members are accountable	Members are not influenced by others	Everyone can be productive at the same time	Individuals are not aware of others' performance
Nominal group technique	Individuals feel accountable	Members are not influenced by others	Everyone can be productive at the same time	Members less inclined to adjust performance
Creating organizational memory			Group members less likely to repeat ideas	
Trained facilitators	Trained facilitator can keep motivation high	Trained facilitator can use strategies to avoid conformity	Trained facilitator can use strategies to avoid production blocking	
High benchmarks	Clear and high goals reduce loafing			Each member will be reminded of benchmark, which serves as key goal
Membership change	Individuals may be less likely to loaf when newcomers are present	Group norms may be more scrutinized (less conformity)		Teams have exposure to different and potentially higher benchmarks
Electronic brainstorming		Removal of group pressure because of greater (perceived) anonymity	Virtually completed eliminated	
Create a playground	If people are motivated and intrigued, they are less likely to loaf	Non-conformist spaces lead to non-conformist behavior		

purposeless and senseless things, such as striving for quantity rather than quality (at least initially), suggesting deliberately impossible-to-realize ideas, and creating havens for individual thinking. Groups and teams can click creatively, but the four threats to creativity—social loafing, conformity, production blocking, and downward norm setting—can kill a naïve attempt at creativity. The ten strategies for enhancing creativity do not carry high price tags; the main challenge will be to make them part of the creative team's culture.

Endnotes

[1] See Frank, R. H., & Cook, P. J. 1996. *The winner-take-all society: Why the few at the top get so much more than the rest of us* (Reprint edition). New York: Penguin.

[2] See Brandenburger, A. M., & Nalebuff, B. J. 1996. *Co-opetition*. New York: Doubleday.

[3] See Guilford, J. P. 1950. Creativity. *American Psychologist*, 5: 444–454.

[4] See Finke, R. A. 1995. Creative realism. In S. M. Smith, T. B. Ward, & R. A. Finke (Eds.), *The creative cognition approach*: 303–326. Cambridge, MA: MIT Press.

[5] Contrary to popular intuition, Edison's idea was not out of the blue. His lighting system was an extension of current lighting systems. For a description of how he developed the ideas,

see Basalla, G. 1988. *The evolution of technology*. New York: Cambridge University Press; also Weisberg, R. W. 1997. Case studies of creative thinking. In S. M. Smith, T. B. Ward, & R. A. Finke (Eds.), *The creative cognition approach*: 53–72. Cambridge, MA: MIT Press.

[6] See Guilford, J. P. 1959. *Personality*. New York: McGraw-Hill; also Guilford, J. P., 1967. The nature of human intelligence. New York: McGraw-Hill.

[7] Ibid.

[8] One of the most often overlooked contributions of Osborn's pioneering work on brainstorming is his intuition about the positive relationship between quantity and quality. Osborn correctly noted that demands for "great ideas" will often stifle the creative process. However, it is easy for people to strive for quantity. The probability of having one truly excellent idea can be directly predicted from the number of ideas generated. Moreover, the likelihood of building and integrating ideas can be facilitated with quantity as well.

[9] This example was suggested by Professor Terri Kurtzberg, whose dissertation focuses on creativity; she has extensively used the cardboard box task.

[10] See Verberne, T. Creative fitness. *Training and Development*, 1 August 1997, 68–71.

[11] See Camm, M. Learn how to clap with one hand. *Sydney Morning Herald* (Sydney), 24 March 1994, 15.

[12] See Osborn, A. F. 1957. *Applied imagination* (rev. ed.). New York: Scribner.

[13] See Gendron, G. FYI: Growing by design. *Inc.*, May 1998, 9.

[14] Meta-analytic reviews of brainstorming provide compelling data on how individuals outperform groups. A strong example is Mullen, B., Johnson, C., & Salas, E. 1991. Productivity loss in brainstorming groups: A meta-analytic integration. *Basic and Applied Social Psychology*, 12(1): 3–23. Other papers that address this apparent enigma include Diehl, M., & Stroebe, W. 1987. Productivity loss in brainstorming groups: Toward a solution of a riddle. *Journal of Personality and Social Psychology*, 53(3): 497–509; also Paulus, P. B., & Dzindolet, M. T. 1993. Social influence processes in group brainstorming. *Journal of Personality and Social Psychology*, 64(4): 575–586; Jablin, F. M. 1981. Cultivating imagination: Factors that enhance and inhibit creativity in brainstorming groups. *Human Communication Research*, 7(3): 245–258; Paulus, P. B., Larey, T. S., & Ortega, A. H. 1995. Performance and perceptions of brainstormers in an organ-izational setting. *Basic and Applied Social Psychology*, 17(1–2): 249–265; and Taylor, D. W., Berry, P. C., & Block, C. H. 1958. Does group participation when using brainstorming facilitate or inhibit creative thinking? *Administrative Science Quarterly*, 3: 23–47.

[15] See Mullen, Johnson, & Salas, op. cit., 18.

[16] Several scholars who have worked directly with teams in companies report that most companies claim to use brainstorming. However, the question of whether it is used effectively is a matter of debate. For examples of how companies use brainstorming, see Hackman, J. R. 1990. Work teams in organizations: An oriented framework. In J. Hackman (Ed.), *Groups that work and those that don't*. San Francisco: Jossey-Bass; also Sutton, R. I., & Hargadon, A. 1996. Brainstorming groups in context: Effectiveness in a product design firm. *Administrative Science Quarterly*, 41(4): 685–718; Swezey, R. W., & Salas, E. (Eds.) 1992. *Teams: Their training and performance*. Norwood, NJ: Ablex Publishing Corp.; and Woodman, R. W., Sawyer, J. E., & Griffin, R. W. 1993. Toward a theory of organizational creativity, *Academy of Management Review*, 18(2): 293–321.

[17] A large research literature has examined several factors that might mitigate the powerful social loafing effect. For ex-amples of these methods, see Bouchard, T. J. 1972. Training, motivation, and personality as determinants of the effectiveness of brainstorming groups and individuals. *Journal of Applied Psychology*, 56(4): 324–331; also Diehl & Stroebe, op. cit.; Harkins, S. G., & Petty, R. E. 1982. Effects of task difficulty and task uniqueness on social loafing. *Journal of Personality and Social Psychology*, 43(6): 1214–1229; and Shepperd, J. A. 1993. Productivity loss in performance groups: A motivation analysis, *Psychological Bulletin*, 113(1): 67–81.

[18] See Csikszentmihaly, M. 1997. *Finding flow: The psychology of engagement with everyday life*. New York: Basicbooks.

[19] See Tajfel's work on social identity theory; specifically: Tajfel, H. 1978. *Differentiation between social groups: Studies in the social psychology of intergroup relations*. New York: Academic Press.

[20] See Camacho, L. M., & Paulus, P. B. 1995. The role of social anxiousness in group brainstorming. *Journal of Personality and Social Psychology*, 68(6): 1071–1080.

[21] See Higgins, J. 1994. Creating creativity. *Training and Development*, 48(11): 11–15.

[22] People pay attention to status cues in a group and, as a general principle, lower-status members conform to what they perceive to be the views of high-status members. For examinations of the conformity effect, see Collaros, P. A., & Anderson, L. R. 1969. Effect of perceived expertness upon creativity of members of brainstorming groups. *Journal of Applied Psychology*, 53(2, Pt. 1): 159–163; also Diehl & Stroebe, op. cit.; and Harari, O., & Graham, W. K. 1975. Tasks and task consequences as factors in individual and group brainstorming. *Journal of Social Psychology*, 95(1): 61–65.

[23] Production blocking refers to both the difficulty in speaking and processing information simultaneously as well as the difficulty in several people competing for the floor. Diehl & Stroebe, op. cit., offer a direct examination of production blocking; see also Diehl, M., & Stroebe, W. 1991. Productivity loss in idea-generating groups: Tracking down the blocking effect. *Journal of Personality and Social Psychology*, 61(3): 392–403; and Stroebe, W., & Diehl, M. 1994. Why are groups less effective than their members? On productivity losses in idea generating groups. *European Review of Social Psychology*, 5: 271–301.

[24] This observation was shared by a high-level manager in the company.

[25] See Camacho & Paulus, op. cit.; and Paulus & Dzindolet, op. cit.

[26] See Shepperd, op. cit.

[27] See Camacho & Paulus, op. cit.; Paulus & Dzindolet, op. cit.

[28] See Stroebe, W., Diehl, M., & Abakoumkin, G. 1992. The illusion of group effectivity. *Personality and Social Psychology Bulletin*, 18(5): 643–650.

[29] See Jackson, S. E. 1992. Team composition in organizational settings: Issues in managing an increasingly diverse work force. In S. Worchel, W. Wood, & J. A. Simpson (Eds.), *Group process and productivity*: 138–173. Newbury Park: Sage.

[30] See Dunbar, K. 1997. How scientists think: Online creativity and conceptual change in science. In T. B. Ward, S. M. Smith, and J. Vaid (Eds.), *Creative thought: An investigation of conceptual structures and processes*: 461–493. Washington, DC: American Psychological Association.

[31] See Gentner, D., Brem, S., Ferguson, R., & Wolff, P. 1997. Analogy and creativity in the works of Johannes Kepler. In T. B. Ward & S. M. Smith (Eds.), *Creative thought: An investigation of conceptual structures and processes*: 403–459. Washington, DC: American Psychological Association.

[32] This example, first experimentally used by Gick and Holyoak in 1980, points to the vexing problem concerning the general inability of people to transfer knowledge learned in one domain to another.

[33] See Thompson, L., Loewenstein, J., & Gentner, D. 2000. Avoiding missed opportunities in managerial life: Analogical training more powerful than individual case training. *Organizational Behavior and Human Decision Processes,* 82(1): 60–75. This paper provides data from managers indicating that analogical reasoning is more powerful than the simple case method. Another article by Loewenstein and Thompson provides our view on how managers should be taught; see Loewenstein, J., & Thompson, L. 2000. The challenge of learning. *Negotiation Journal,* October: 399–408.

[34] See Cox, A. Where there's muck there's brass: Can a few days on the farm really improve your performance at work? *The Guardian* (London), 2 August 2000.

[35] See Jaffe, A. Chamber gleans words of wisdom from novel's plot. *The Sunday Patriot News* (Harrisburg, PA), November 2000, D01.

[36] See Higgins, op. cit.

[37] Ibid.

[38] See *The Economic Times*. The human touch. 7 November 2000.

[39] See Radcliff, D. Marriott: Want to see the benefits of IT and business alignment? *Computer World,* 10 April 2000, 58.

[40] See Lee, T. Get those creative juices flowing. Business Plus section. *St. Louis Post-Dispatch,* 7 January 2002, 8B.

[41] Brainwriting has proved to be an effective technique in enhancing the performance of real groups. For direct, empirical examinations, see Geschka, H., Schaude, G. R., & Schlicksupp, H. 1973. Modern techniques for solving problems. *Chemical Engineering,* August: 91–97; also Paulus, P. B., & Yang, H. 2000. Idea generation in groups: A basis for creativity in organizations. *Organizational Behavior and Human Decision Processes,* 82(1): 76–87.

[42] See Paulus & Yang, op. cit.

[43] See Horn, E. M. 1993. The influence of modality order and break period on a brainstorming task. Honors thesis. University of Texas at Arlington.

[44] See Van de Ven, A. H., & Delbecq, A. L. 1974. The effectiveness of nominal, Delphi, and interacting group decision making processes. *Academy of Management Journal,* 17(4): 605–621.

[45] For a clear demonstration of how NGT is more effective than traditional brainstorming, see Gustafson, D. H., Shukla, R., Delbecq, A., & Walster, W. 1973. A comparative study in subjective likelihood estimates made by individuals, interacting groups, Delphi groups, and nominal groups. *Organizational Behavior and Human Performance,* 9(2): 280–291.

[46] See Mullen, Johnson, & Salas, op. cit.

[47] See Wah, L. Making knowledge stick. *Management Review,* 1 May 1999, 24–29.

[48] Ibid.

[49] Trained facilitators are able to address many of the process-loss problems encountered by brainstorming groups. For studies that have empirically examined the effectiveness of trained facilitators, see Offner, A. K., Kramer, T. J., & Winter, J. P. 1996. The effects of facilitation, recording, and pauses on group brainstorming. *Small Group Research,* 27(2): 283–298; also Oxley, N. L., Dzindolet, M. T., & Paulus, P. B. 1996. The effects of facilitators on the performance of brainstorming groups. *Journal of Social Behavior and Personality,* 11(4): 633–646.

[50] See Paulus, P. B., Putman, V. L., Coskun, H., Leggett, K. L., & Roland, E. J. 1996. Training groups for effective brainstorming. Paper presented at the Fourth Annual Advanced Concepts Conference on Work Teams—Team Implementation Issues, Dallas, TX.

[51] See Seta, J. J. 1982. The impact of comparison processes on coactors' task performance. *Journal of Personality and Social Psychology,* 42(2): 281–291.

[52] See Paulus & Dzindolet, op. cit.

[53] See Paulus, P. B., Larey, T. S., Putman, V. L., Leggett, K. L., & Roland, E. J. 1996. Social influence processes in computer brainstorming. *Basic and Applied Social Psychology,* 18(1): 3–14.

[54] See Shepherd, M. M., Briggs, R. O., Reinig, B. A., Yen, J., & Nunamaker, J. F. Jr. 1995–1996. Invoking social comparison to improve electronic brainstorming: Beyond anonymity. *Journal of Management Information Systems,* 12(3): 155–170.

[55] See Roy, M. C., Gauvin, S., & Limayem, M. 1996. Electronic group brainstorming: The role of feedback on productivity. *Small Group Research,* 27(2): 215–247.

[56] This is based on research by Hoon-Seok Choi and myself conducted over the past year. A paper that reviews our research can be obtained from either myself or Professor Hoon-Seok Choi, Management & Organizations Department, Kellogg School of Management, Northwestern University, Evanston, IL 60208.

[57] See Sutton, R. L., & Louis, M. R. 1987. How selecting and socializing newcomers influences insiders. *Human Resource Management,* 26(3): 347–361.

[58] See Ziller, R. C. 1965. Toward a theory of open and closed groups. *Psychological Bulletin,* 64(3): 164–182.

[59] See Rogelberg, S. G., Barnes-Farrell, J. L., & Lowe, C. A. 1992. The stepladder technique: An alternative group structure facilitating effective group decision making. *Journal of Applied Psychology,* 77(5): 730–737.

[60] See Rogelberg, S. G., & O'Connor, M. S. 1998. Extending the stepladder technique: An examination of self-paced stepladder groups. *Group Dynamics: Theory, Research, and Practice,* 2(2): 82–91.

[61] See Grossmann, J. We've got to start meeting like this. *Inc.,* 1 April 1998.

[62] See Long, S. This CEO handles complaints himself. *The Straits Times,* 12 April 2002.

[63] See *P. R. Newswire.* Surfboards in the boardroom and bocce ball out back. 25 September 2001.

[64] See Lee, op. cit.

[65] For an extensive review of the effects of positive affect on creativity, see Isen, A. M., Daubman, K. A., & Nowicki, G. P. 1987. Positive affect facilitates creative problem solving. *Journal of Personality and Social Psychology,* 52(6): 1122–1131.

[66] For a look at how the fashion company Prada is rethinking creativity, see Brown, J. Prada gets personal. *BusinessWeek,* 18 March 2002, EB8. For an in-depth treatment of how BP is searching for oil in the depths of the sea, see Verrengia, J. B. Finding footprints under Arctic ice. *Associated Press,* 8 April 2002, via *www.msnbc.com.*

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Executive Commentary

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In a poignant scene from the film *Apollo 13,* a group of NASA engineers must find a way to reduce the CO_2 levels in a damaged spacecraft or three astronauts will perish. The ad hoc leader says to his ad hoc team that they must find a way to get "this" (a square filter) to fit into "this" (a round filter case), using nothing but "this" (he proceeds to dump onto a table an unwieldy mass of miscellaneous equipment and materials available on board the spacecraft).

Although not often faced with a life or death situation like the one NASA faced in 1970, businesses today are confronted with ever more technical complexities and ever shorter timelines. I have run into many of the problems Professor Thompson identifies when facilitating or training client teams, or working in groups to write proposals or develop new products and services. I've often thought that we need a way to maximize divergence at the beginning and then throw a switch to reverse the team's polarity and maximize convergence. This is tough to do in reality.

I agree wholeheartedly with the definition of creativity as "the production of novel and useful ideas." Getting from the novel to the useful is the trick. Teams in organizations help to ensure discussion of the useful, but as Professor Thompson points out, those dynamics that support the useful often impede the creative.

Professor Thompson suggests several approaches to improve team creativity, including "brainwriting" and the nominal group technique (NGT). I have found that starting the process off electronically works well in practice. In this modification of the NGT, I send an email stating the central purpose of the team, along with any relevant material, to each team member ahead of time. Each member is instructed to prepare for an upcoming brainstorm session by sending me their initial ideas via email. I then summarize all the ideas back to the group in a face-to-face meeting, where we continue the process. This usually produces good quantity, diversity, and novelty of ideas. The group is then in place to move the ideas along, usually to a few useful options that can be considered for implementation.

Need for Creative Speed

Finding ways like this for groups to be more creative is increasingly important to managers at all levels in an organization, as they have to do more with less, and speed and agility become increasingly important to business success. It is not only important to increase creativity but to speed it up as well. Busy people have precious few moments to "think outside the box" and must make that time count. Increasing global competition in many industries means there is simply less time for a good idea to matter. Based on my experience, the real problem is that if good ideas don't surface in the time allotted, bad ones will get through. Companies and their creative teams must make more effective use of limited time.

It is not only important to increase creativity but to speed it up as well.

Creative Dyads

One area that I would liked to have seen explored more thoroughly in the article was the collaboration process and its effect on creative output. Specifically, I am thinking of collaboration between two people. In my experience, this type of collaboration is different from that of larger groups, although Professor Thompson does refer to research on dyads as well as groups regarding downward norm setting. Along with Alex Osborn, I have found that two heads are often better than one for generating ideas. The right two heads can bring substantial divergence of thought into focus through the lens of their collaboration, thereby creating a clearly defined and actionable idea. We have seen so many famous dyads (e.g., Rodgers & Hammerstein, Lennon & McCartney, Black & Scholes, and Penzias & Wilson) in every field of endeavor that I cannot help but think that making use of carefully structured teams of two represents a swift and flexible method for channeling creative effort.

Having two collaborators might avoid the enemies of creativity outlined by Professor Thompson. Few of the group-level social dynamics that inhibit creativity are manifested in dyads, while some of the convergent aspects of larger teams are preserved. Social loafing, conformity, production blocking, and even downward norming, to some extent, are less likely in a brainstorming collaboration of two people.

Good Feelings and Good Thoughts

Professor Thompson's discussion of play and her observation that positive affect potentially increases creativity are perhaps the most intriguing aspects of this article. One implication here could be that as a creative partnership evolves and develops (and this could perhaps apply to a team as well), a bond could develop and strengthen, increasing positive affect ties, thereby enhancing the duo's creativity. One can monitor a duo's performance and, if they lose productivity, work with them or break them up.

Professor Thompson's article reveals many of the causes of diminished creativity in groups and provides simple and solid advice for how to minimize them. In practice, deciding when to use one, two, or several people to come up with a creative idea may be equally important to the creative outcome.

This article's discussion of individuals and teams reminds me of the old coach's chant, with a new twist: There is no "I" in team, but there are two in creativity.

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