Synectics®: Its Potential For Education

Current school practices often unintentionally limit children's potential for using connection-making to solve problems creatively, Messrs. Weaver and Prince maintain. They offer a better approach.

BY W. TIMOTHY WEAVER AND GEORGE M. PRINCE

WHAT IS Synectics? It is a creative problem-solving process that carries participants from the analysis of problems to the generation and development of new ideas. The key to understanding the process can be found in its name, which is made up of the Greek roots *syn* (bring together) and *ectics* (diverse elements). Synectics operates on the principle that, by using the mind's remarkable capacity to connect seemingly irrelevant elements of thought, we can spark surprising new ideas that may later be developed into feasible solutions to problems.

Synectics was originally designed to exploit the diverse resources of groups, but an individual working alone can also use the process successfully. Synectics works by allowing participants to indulge in activities that are sometimes discouraged in school: guessing, wishing, taking mental "excursions," using distant and loosely coupled analogies, improvising highly speculative and approximate connections, and freely employing any thought from any source that can be imagined – no matter how irrelevant it seems. In our work with the program, we have discovered over and over again that connections that seem irrelevant often signal new and unusual lines of thought.

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The research that led to the development of the Synectics process began in 1955, when the future founders of Synectics, Inc., were working in the Invention Design Group of the Arthur D. Little Company in Cambridge, Massachusetts. The group recorded its own invention meetings to determine what actions helped it come up with new ideas. Group members were surprised to learn that, when the group was disorderly, confused, and uncertain, it was the most effective in generating new lines of thought. If the leader tried to impose more order and direction, the group became less effective.

These discoveries and many more were the foundation of the Synectics process, which began to take formal shape in 1960 with the start-up of the company. By the early 1980s, more than 10,000 groups had been taped and debriefed using an evolving Synectics process whose aim was to help groups invent. Two full-length books and numerous articles have been written describing the process.[1]

Among the company's first educational clients was the Early Learning Center in New Haven, Connecticut. Various forms of Synectics have been used by teachers, including the well-known analogical thinking exercises mentioned by Bruce Joyce and Marsha Weil in *Models of Teaching*.[2] Much of this material has been developed over the years by William Gordon and Tony Poze of Porpoise Press in Cambridge, Massachusetts. In addition, the videotape series "Teaching Strategies Library II," produced by the Association for Supervision and Curriculum Development, has recently added a "Synectics" tape. In this article, we will emphasize what we have learned since the early years of Synectics, when the use of analogies and metaphors was first popularized in the literature of education.

CREATIVITY

During the last several years we have been working with teachers and administrators to extend and test our own thinking about creativity. We have come to some surprising conclusions, among them the realization that there is not a separate form of thinking that we can isolate and call "creative." Through our studies, we have found that the process of inventing new ideas is indistinguishable from the process of learning. Both rely on what we call "connection-making." When we are learning something, we use the mental process of the inventor: we make connections, at first crude and approximate, between the understood and the not understood. The good inventor, like the good learner, will use connection-making to develop the useful parts of an idea and will not be deterred by flaws and errors.

It is a mistake to think in terms of a dichotomy between good "critical" thinkers and good "creative" thinkers. Effective thinkers – what we call "generative" thinkers – are both. They use critical thinking to guide an essentially creative process: an open, speculative search for connections — even ones that at first seem irrelevant — that will eventually lead to useful and original lines of thought. Limited thinkers have difficulty being open and speculative and are easily sidetracked by the flaws that come with most emerging ideas. Thus limited thinkers foreclose on many promising lines of thought. Theirs is a way of thinking that seems to be reinforced by an emphasis on precision, on right and wrong answers, and on punishment for mistakes. Current school practices often unintentionally limit children's potential for using connection-making to solve problems creatively.

We view creativity as a general human attribute, not one that is restricted to those deemed "gifted and talented." Our definition of creative thinking is simple: it is everyday thinking that results in something new, either to the person doing the thinking or to the world. Whether the discoverer or inventor is the first or the hundredth matters little. The process is the same. It is the act of connecting something observed or apprehended with the understanding of it that is stored in our mind. (This same mental process continues even when there is no precise understanding stored in our mind.)

The relentless drive of every human being to make connections is at the heart of the creative process. Each of us is motivated by a powerful need to make what we observe meaningful, to connect the new with the understood. The result is a remarkable venture into a thinking operation that is subtle and confused, "approximately precise," and full of mistake-making that eventually results in learning something new. In this venture we use our everyday connection-making capacity to generate new understandings. To do so effectively, we must ignore several conventions that are presumed to be essential to good thinking.

TYPES OF THINKING

In our research, we have examined thousands of problem sessions (both live and videotaped) dedicated to producing new ideas. It became clear that a very large majority of participants were using the same thinking processes, yet there were vast differences in the originality and usefulness of the ideas produced. This observation suggested that, while each of us has the same basic thinking tools, some of us have learned to use them more skillfully than others. We began to discern a spectrum of thinking — not a hierarchy of thinking skills ranked from "low" to "high," but a range of approaches that goes from making literal and logical trial connections on one end to making highly speculative, illogical, and nonliteral connections on the other. People vary in their ability to move with ease back and forth along this spectrum. To put it another way, they have different degrees of tolerance for ambiguity.

Suppose a child is asked, "What might you turn that flower into?" The child thinks of things that flowers eventually turn into and says, "A bouquet." This perfectly good connection falls at the literal end of the thinking spectrum. Another child answers, "Feather duster." She is making a nonliteral connection, much like the little girl who, on seeing a petal fall from a flower, said to her mother, "Look, Mommy, it lost a feather." This connection reflects an almost lyrical connection between flower and bird.

Young children make nonliteral connections willingly and pleasurably. For example, when 3-year-old Max was visiting the New England Aquarium in Boston, he looked into the big tank and saw a scuba diver feeding the fish. He said,

Illustration by Susanna Spann

"Look, Mommy, there is a fireman." Max had never seen a scuba diver with all of his gear and tanks, but several months before the visit to the aquarium he had become very interested in a large fire extinguisher. When Max saw the tank on the scuba diver's back, he made a daring connection to the fire extinguisher. He did not limit his inventory of possibilities to the literal. He used everything he knew to create for himself a new understanding, approximate but viable. We are concerned about how quickly this wonderful advantage of childhood fades.

Let us try to illustrate why it is important to cultivate and use this powerful mode of thinking throughout life. Imagine that a group of teachers is attempting to devise a disciplinary system that is more effective than the system of escalating punishment that they are currently using. One teacher says, "Let's make the discipline more constructive. Rather than using detention and other forms of punishment, let's have the troublemakers do some of the maintenance that is a constant problem for us."

A second says, "I like the idea of constructive discipline. When you think about it, our system is based, however distantly, on the criminal justice system, which has been a monumental failure. Can we think of a successful system we can borrow from? One that comes to mind is the old-fashioned apprentice system."

A third teacher says, "What if we built the apprentice idea into our present system of counseling? Pair a troublemaker with a straight thinker and have them do problem-solving discussions together."

If we look at these ideas without worrying about their practical implications – if we consider them solely as examples of initial thinking about a problem – we can see that they differ noticeably in terms of their originality. All three ideas are the product of connecting. The first teacher is still connecting to the school's problem and looking for ways to change the form of punishment. The second first connects the problem with the prison system but then shifts her point of view and looks for connections to a successful system. The third connects that new direction with an existing program.

There need not be a tradeoff between critical and creative thinking.

TYPES OF THINKERS

In the session just described, we can recognize three basic types of thinkers. Each type is capable, well-educated, intelligent, and interested in solving problems. When "type one" thinkers consider a problem, they tend to limit their trial connections to material that is closely relevant to the problem. We call such people *apposite* thinkers. They have a low tolerance for anything that does not seem pertinent. "Type two" thinkers may consider relevant material, but they often discard it and look for widely different, even seemingly irrelevant, connection-making material. These people we call *divergent* thinkers. Their divergence frees them to leap at will across the full spectrum of thinking. A "type three" thinker is open to divergent beginnings but eagerly searches for connections to make ideas more workable. These "type three" people we call *generative* thinkers.

In the situation described above, apposite thinkers are not handicapped by any lack of connection-making material: they are aware of the failings of the criminal justice system, and they are familiar with apprenticeships and the school's counseling program. Their tendency toward banal thinking seems to stem from self-imposed caution – what we will later describe as "self-censoring" (often reinforced by the climate around them). For example, in a continuation of the discussion about discipline, a divergent thinker might enjoy making a connection with the home laundry system as one that has great success. An apposite thinker would find this bizarre and distasteful, too far-fetched to be useful at all, a waste of time, even an embarrassment. But divergent and generative thinkers would plunge in:

> *Divergent*: Just think about it as if the misbehaving student has gotten a little dirty and needs some cleaning up. We furnish the parents with something like a home laundry to clean the student up.
>
> *Generative*: Right! It would be nice if the family already had the equipment but were using it for something else – like the TV or the telephone.
>
> *Divergent*: There's a thought! Use the telephone to connect the child with a computer program designed to develop more realistic behavior. . . .

Our studies of thinkers have made it clear to us that there are an infinite number of ways to generate good connection-making material and then to construct an idea that is original and useful. Many skillful thinkers have their own unique ways. Over time we have become persuaded that the basic thinking operations are the same, though individuals differ widely with respect to their willingness and ability to apply the basic operations across the spectrum from precisely literal to wildly irrelevant. A few seem to have no limitations when it comes to speculating and pursuing a seemingly nonsensical line of thought; most have trouble shedding their caution.

In our experiments with adults and children we have tried a great many procedures and strategies. We have sought to teach people to imitate the outstanding thinkers we have encountered and to avoid the practices of limited thinkers. We have exaggerated the characteristics of the kind of thinking called "creative" and have devised step-by-step procedures to elicit that kind of thinking. Several examples of these techniques are described later in this article.

CRITICAL THINKING

One of the constructive developments in education is the growing appreciation that there need not be a tradeoff between critical and creative thinking. Both are essential operations that we all use to solve problems, to learn, and to invent. We need to determine how each can best serve the learner and the inventor.

For the apposite thinker, critical thinking paradoxically acts like a cell-invading virus that switches off the kind of thinking that can reach out for something that seems to be irrelevant and transform it into a working idea. The apposite thinker begins prematurely to test for reality, to apply logic, and to search for shortcomings. This search for closure can cause the apposite thinker to overlook parts of a beginning idea that lead the generative thinker to useful originality. The thought process is preempted before speculation can come into play.

Generative thinkers employ critical thinking to guide the mental pursuit of guesses, approximations, absurdities, hunches, feelings, and intuitions. Each time their scanners detect a shortcoming, they direct the resultant tension and energy toward finding a solution, all the time combining critical and speculative faculties to reconstruct the idea and to make it more workable. Apposite thinkers instead use their energy and critical faculties to pursue the deficiency, often rehearsing detailed reasons to defend their position against the flawed idea.

Perhaps we can clarify these different approaches with an example. Let us continue with the earlier discussion of discipline, in which one of the ideas was to use the telephone to connect a child with a computer program. The skillful thinker instantly visualizes her version of how this might work. She imagines a home terminal with a phone connection and a child interacting with a program. Both apposite and generative thinkers will quickly make connections with experience to guess about the troubles that will arise with this concept: the cost of terminals, training the children to use them, breakage, tying up the phone for hours, the difficulty of developing a program that will have any impact on discipline, and so on. However, for the generative thinker, the more wide-ranging production of connection-making material allows for a more complete and insightful critical evaluation. A generative thinker might speculate on the possible effects on teachers of removing the daily burden of discipline and on the implications of using computers for other kinds of teaching in the home. The apposite thinker would already have stopped using connection-making to generate new thinking about the problem.

Our experiments with client groups at Synectics, which are repeated hundreds of times each year, have yielded evidence about the kind of thinking that produces originality. There is no doubt that, in the early stages of developing new ideas, criticism, precision, logic, and an emphasis on the shortcomings of every idea militate against original, adventurous thinking. When our critical skills are allowed to repress our generative thinking, we greatly limit our potential to be creative and to learn. Furthermore, when we criticize others' ideas without having made an effort ourselves to see beyond their defects, it is psychologically destructive, because no one wants to risk rejection. Criticism that is not accompanied by an explicit acknowledgment of the good thinking that led to an idea is almost always perceived as punishment and as an order to abandon a particular way of thinking. These findings apply equally well to children: too much criticism too early in the thinking process teaches them to avoid the very kind of thinking that produces originality.

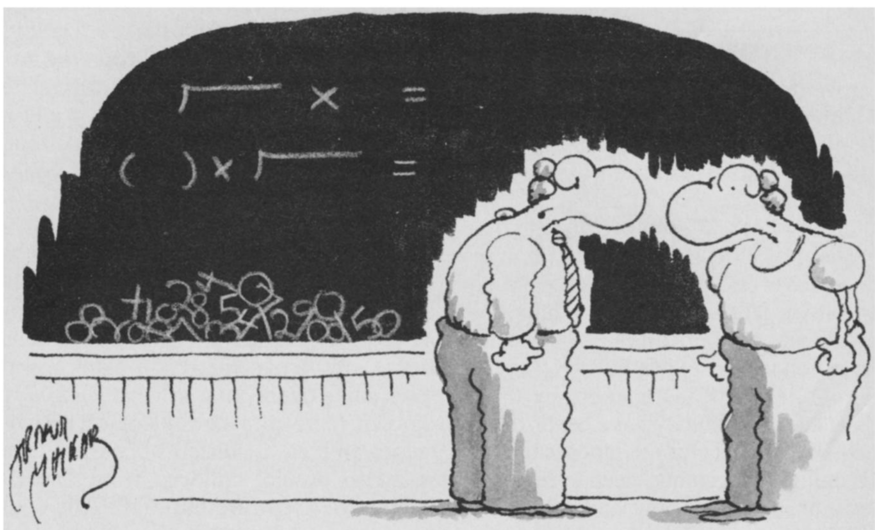
We can learn a great deal about creative thinking by watching young children learn.

OBSERVING CHILDREN

We can learn a great deal about creative thinking by watching young children learn about their world. To children the world is a giant and fascinating unknown. They do not attempt to impose order too early. They are comfortable with not understanding instantly. Learning, which comes easily and rapidly, is a source of pleasurable satisfaction and self-esteem. Children have no difficulty pretending that an ashtray is a car. Focusing on details, feasibility, and real constraints will come later.

Let us return for a moment to Max and the fireman. A lot rests on how Max's idea is treated, by himself and by anyone around him – especially by his parents, teachers, and friends. He has done a splendid job of connection-making. His store of experience is limited (although vastly greater at age 3 than we probably imagine), and his discovery is a wonderful approximation. The inner consequence of this successful generation of an idea is enormous for him. Not to understand his world reduces his feeling of self-worth. His ability to observe, imagine, and connect in order to build and then retrieve an idea that reduces his lack of understanding enhances his sense of competence, independence, and self-worth.

If his courageous act is accompanied by affirmation ("That's a wonderful connection, Max; tell me more about the fireman you see . . ."), he will continue to make more connections and develop more ideas. If he is discounted, even mildly ("That's funny, Max . . ."), all of these benefits are canceled out. If Max is told, "No, Max, that is not a fireman; it is a scuba diver," the discount will be



"Gesundheit!"

even more harmful. We believe that *all* discounts are harmful to adventurous thinking.

When we say to a 3-year-old, "No, Mary, that is not Santa; it is Santa's helper," we are correcting her thinking when she was already doing excellent thinking. We might have said, "Tell me how you see him as Santa." Otherwise, the message repeated several hundred times daily is: "Don't bother making connections. Just ask me, and I will tell you." This is one of the early steps in cutting a child off from the kind of thinking that is usually thought of as "creative." Unfortunately, a significant amount of early communication with children focuses on this kind of limiting "instruction." One of the outcomes is that children become fearful of offering ideas that might be less than perfect.

We believe that the consequences of limiting thinking in this way are so complete and far-reaching that we do not even recognize them. We are disturbed by the widespread conviction that any work of art, discovery of a new material, or invention of a new machine is reserved for people who have a gift or a talent or an ability most of us lack – namely, creativity. Most of us believe we are simply not creative. It doesn't take long for children to arrive at the same self-limiting conclusion. These self-imposed limitations cause us to give up on problems that take us beyond routine thinking into the unfamiliar world of speculating and experimenting. We are convinced that such limiting of speculative thinking also limits the child's capacity in critical and analytical thinking and in learning.

EXPERIMENTING

How do children develop an understanding of and assign meaning to our complex world? We believe that the key is fearless testing, constant experimenting, and a philosophy of acting first and evaluating later. We believe that children intuitively follow the rule, "Test it in order to learn it." This is exactly the approach we learn to avoid as adults. We parents and teachers often justify our intervention to stop experiments by saying that children will learn to act by themselves later, when they have better-developed skills. This attitude ignores the fact that children constantly need to reinforce their capacity for doing and to develop their self-esteem. Children need to engage in these "meaning-making" activities, as Robert Kegan refers to them.[3]

Max, the learner, and Pilkington, the inventor, have a lot in common.

When a child gains an insight, when something that has resisted understanding makes sense, that child feels a special elation. The not-understood becomes the understood. For a child, connection-making is not a cool, cerebral exercise. The split second in which a connection is made is highly charged with excitement and satisfaction. Archimedes, it is said, was so overwhelmed by his discovery of the principle of fluid displacement that he leaped from his bath and ran down the street naked, shouting, "Eureka!" A child who has learned something new, such as tying a bow, feels much the same excitement.

The irony is that the *process* we venerate for having produced the famous discovery of Archimedes is the same process we punish for being mistaken thinking in our everyday lives. Three-year-old Winthrop sees his first horse. "Daddy! Look at that big cat!" Winthrop, like Archimedes, has made an approximate connection between an unknown and a known in order to understand something puzzling. However, we dismiss Winthrop's connection as a mistake.

If we were to view every one of a child's activities as a step toward learning something new, we would surely broaden the range of experiments available to the child. All learning is in a sense a result of some action (experiment) plus some connecting to what is already known to form a new piece of knowledge, an idea, a concept. Naturally, we want to protect children from experiments we know are harmful. This concern raises some difficult questions for us as teachers, and we will need to do some problem solving of our own in order to satisfy the real needs of both teacher and child. But the goal seems clear: to figure out how to encourage testing and experimenting without endangering the child – or the sanity of the teacher.

We hypothesize that when children are forced by teachers or parents to avoid an experiment, they perceive it as an arbitrary denial of their basic need to know what is happening. Their fundamental drive to understand their environment has been blocked. This interference is interpreted at some level as a "discount." Their need to understand is being dismissed as unimportant, and their self-esteem is thereby diminished. The consequence is that the children take revenge: when their "experimental" selves are called upon, they ignore the call. We conclude that they are not "creative."

INVENTING, CREATING, LEARNING

Most people would differentiate the process of *inventing* a parachute from the process of *learning about* a parachute, but we believe that they involve much the same forms of experimental thinking. We speculate that learning and inventing employ many of the same mental operations. When children see a skydiver about to board a plane, they might connect the parachute pack with a knapsack, something they know about. This connection gives them a temporary, approximate understanding (which is more important than has hitherto been appreciated). When they see the person jump from the plane and float to the ground by means of the parachute, they might make a connection with an umbrella, but the basic idea has been formed by observing and connecting two happenings that are new to them: "That man had an umbrella in his knapsack."

Let us compare a new learning and a new invention. We imagine that, when Max learned about scuba divers, he went through a series of steps. He saw a strange (to him) fish/man swimming underwater in the aquarium. He had an impulse to understand this strange thing, to make sense of it. He had a *need to discover* what was going on. He observed the tank on the diver's back and was *open* to possible connections. He remembered the tank at his grandfather's and that it was used for putting out fires. He had made a *retrieval*: "Tanks are for fires." Max next made what we would call in a Synectics invention session a "force-fit."

He put two things together that forced him to make a new connection: "A fireman is in the fish tank." This is a learning. Max will later learn that the two tanks have a lot in common (both hold gas, both are under pressure, etc.) and that the tank on the diver's back is to provide him with oxygen so he can breathe underwater. Each of these new learnings is based on the first, approximate learning.

Alistair Pilkington, the Englishman who invented the float process for manufacturing plate glass, had been trying for years to figure out how to produce a smooth, distortion-free product. The old manufacturing process used mirror-smooth rollers to shape the molten glass. But even these devices imparted to the glass enough roughness and imperfections that it had to be polished – an expensive operation.

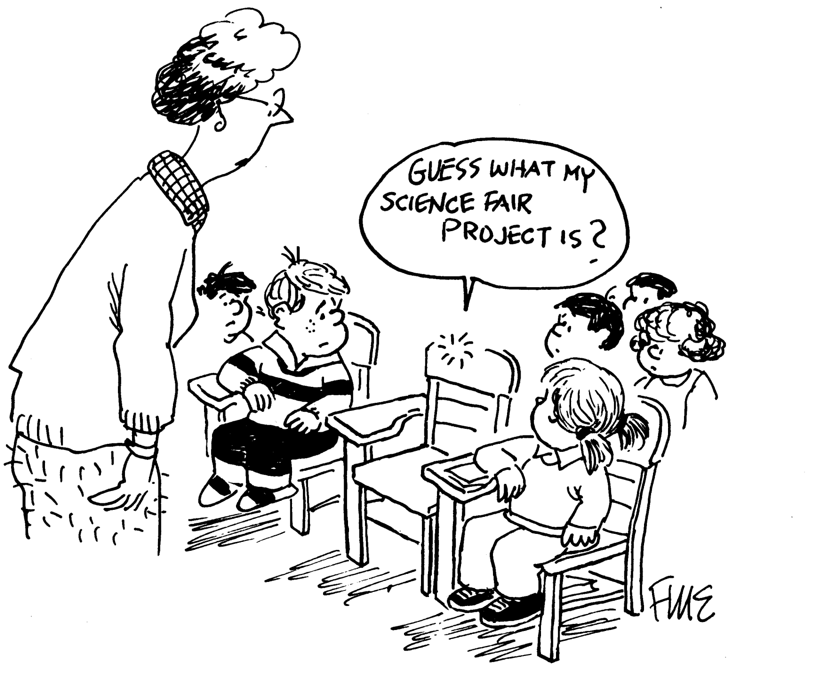
One evening Pilkington was washing dishes and observed a patch of grease floating on the dishwater. Like Max, he had a *need to discover* what was going on. He had not forgotten his problem of making smoother plate glass, but it was not in his conscious mind as he noticed the grease. However, he was *open* to possible connections regarding the grease. He remembered that water seeks its own level, so that both sides of the grease would be perfectly smooth. He had made a *retrieval*: "Water seeks its own level." Pilkington next made a thrilling connection: "Pour glass on water." This is a magnificent insight, nascent and approximate.

Pilkington knew that if molten glass were poured on water, it would explode. An apposite thinker would have begun to use his critical thinking to build a case against the idea. Too expensive. Too much danger. Possible lawsuits. Instead, Pilkington, being a generative thinker, made more trial connections with fluids that might be more practical, and he began to try experiments. The solution, arrived at over a period of years, was to use molten tin as the base on which to float the liquid glass. The solution was based on the first approximate discovery.

If we focus on the process, we see that both Max and Pilkington made a trial connection and jumped to a conclusion. Then they tested that conclusion to discover the "truth" about it.

Max, the learner, and Pilkington, the inventor, have a lot in common. Both were able to suspend judgment about reality and to speculate. By speculating, they made themselves receptive to multiple trial understandings of the new phenomenon. The important point is that neither waited to consult with someone else before drawing his own conclusions. Later, Max will discover that asking questions is the norm in the classroom. Students are rewarded for asking "good" questions. They are not so often rewarded for speculating, guessing, and jumping to conclusions.

Max and Pilkington pleasurably experimented in their minds with trial connections that were approximate and full of flaws. But they also employed many logical thinking operations, such as recalling and applying knowledge of science (as their understanding permitted) and searching for problems. Pilkington developed his initial approximate idea into a learning that was new to the world. Max developed his approximate idea into a learning that was new for him.



TEARING DOWN LIMITS TO GENERATIVE THINKING

Perhaps the most complex and frustrating undertaking that educators face is to redefine effective thinking. To do so would mean prizing a child's speculative, nonliteral thinking just as we now prize precisely relevant and literal thinking. We might take a first step in this direction by examining those school practices that unintentionally serve to extinguish or to greatly limit the activities of connection-making whenever speculation or rough approximations come into play.

Several pervasive tendencies continue to limit effective thinking:

• *Maintaining inflexible criteria of what constitutes appropriate thinking.* Even when they have agreed to speculate, the teachers in our innovation sessions are often critical of the very thinking strategies that foster speculation. For example, if we are trying to design a more effective cafeteria service for a school, it might be fruitful to examine how bees and birds handle their problems of fast feeding. In most teachers' meetings, such an excursion from the subject would be criticized as a waste of time. Most of us do not deliberately seek states of confusion, uncertainty, and wrongness – yet we must, if we are to be speculative. Resistance arises because it has been drummed into us that confusion and uncertainty are signs of poor thinking.

• *Insistence on literalness.* Another form of speculative thinking is exploring to get a feeling for what is real and what is not. Five-year-old Max says, "I can fly as fast as Superman," and demonstrates by running. This attempt is not satisfactory. He slashes his hand through the air – still not satisfactory. Finally, he points to an imaginary Max and shows how fast he moves across the sky. The adult impulse is to regard such statements as exaggerations rather than as speculative explorations – physical and mental "tests" to feel out wishes, longings, and dreams.

This is a form of thinking that is valuable throughout life, for it encourages the mental projection of and imaginary testing for consequences without risk.

• *Prematurely eliminating connections.* We usually think that good problem solving requires concentrating on a task and deciding what is and is not relevant. When a thought or observation is not instantly related to the objective, it is ruled a distraction. This approach may be efficient for analytical thinking, but it cripples speculative thinking. The school culture tends to punish approximate thinking as "mistaken thinking."

• *Self-censoring.* Each person growing up learns that there are hundreds of things one mustn't think or talk about. This censoring function is a natural part of development and serves an essential purpose in a civilized society. Unfortunately, when we want to turn the censor off temporarily, we find that it has stopped consulting us. It automatically blocks ideas or thoughts that are too dangerous, and it becomes stricter as we get older. There are ways to outwit our censors. Deliberately turning our attention away from a problem or sleeping on it are well-known techniques. Another strategy, for use in the classroom and in meetings, is called the "excursion," a procedure that allows us to go away from the problem and then to use seemingly irrelevant material to stimulate ideas.

• *Self-punishment.* The practice of self-punishment is mostly hidden from view. It is so well hidden that most of the groups we work with at first deny ever engaging in it. When you made your last mistake, what did you call yourself under your breath? Most of us have our favorite names. The notion of being tough on ourselves seems to be universal in our culture, and it affects the way we treat our own ideas and those of others, especially when the situation calls for experimenting and taking risks with our thinking. All of us are skillful at "giving it a try." We are not so skillful at treating ourselves charitably when an experiment "fails" or when the feedback we receive is negative.

• *Listening for flaws.* This practice is connected to the other habits of mind that appear useful but are actually barriers to creative thinking. We guess that this habit is rooted in the mistake/punishment cycle. We want to avoid not only making our own mistakes but also being associated with the mistakes of others. We examine every new idea for defects and discard any we find. It therefore seems appropriate and helpful to point out these defects to the originator, who will also want to be dissociated from the flawed idea. This process has two consequences. Most beginning ideas, no matter how promising, are discarded because most beginning ideas are flawed. And originators learn to be so cautious that many good ideas never leave the subconscious mind.

Most beginning ideas, no matter how promising, are discarded due to flaws.

APPLYING SYNECTICS IN THE CLASSROOM

One of the stated goals of education is to cultivate purposeful, effective thinking. In order to integrate *creative* thinking into that vision, Synectics, Inc., has translated for schools nearly 30 years of research on the creative process. The purpose of our work with schools is twofold: to provide teachers with classroom strategies for helping children use more of their potential for creative thinking and to build a base for effective cooperation and teamwork throughout the school.

When we work with educators, we concentrate on building an awareness of the consequences of verbal and nonverbal behavior and on developing school practices that can have a positive impact on creative problem solving. We cannot stress too much that unlocking creative potential depends on meticulous attention to the way we treat one another's ideas. To engage in the kind of speculative thinking that lies at the heart of Synectics, everyone must feel a great deal of permission and support – much more than we suspected when we first began this work.

EXCURSIONS: A CLASSROOM STRATEGY FOR GETTING NEW IDEAS

The heart of the Synectics process is the *excursion*, a technique for seeing problems and solutions in new and unusual ways. We will describe the technique and then present several examples of excursions.

There are three simple steps in using excursions. First, put the problem temporarily out of mind. This enables one to get distance from the problem he or she is working on. Second, deliberately focus on apparent irrelevancy. This can generate surprising or unusual connections. Third, force-fit the irrelevant material together with the problem and allow your mind to invent a way of connecting them. Force-fitting is a trick of the mind. Our mind automatically struggles to fit new connections into an existing pattern or, failing that, to create a new pattern. Being open to that new pattern or line of thought will enable us to produce ideas that are both useful and original.

The first step, putting the problem aside temporarily, is a familiar one to most people. Moreover, it is not all that hard to do and has been supported by research.[4]

The second step, turning to seemingly irrelevant material, involves focusing relaxed, concentrated energy on a single object while keeping the problem temporarily at bay. The goal is deliberately to keep the problem out of the foreground. One way to do this when working alone is to select a random object – a pencil, for example. You could write 25 sentences, using the word "pencil" in each sentence.

The final step, "force-fitting," requires pushing our mind past the fear of "not making sense." With deliberate training in this process, we hope to reawaken our childlike capacity to combine elements that are strange to each other without first testing for feasibility and reality.

Here is a brief example of how an excursion works. The problem is to get alcoholics to admit that they have a drinking problem. We put the problem temporarily out of mind and focus on a coffee cup. It has some stains in the bottom. The mind leaps from "stains" and "bottom" to stained diapers! What an entertaining connection! How can stained diapers help with the problem of the alcoholic? Here we come up with a force-fit: toilet training. By recalling toilet-training techniques, we think about placing the alcoholic in the right place at the right time, as we did with the baby. Perhaps we could place alcoholics in hypersupportive environments where they are apt to be able to own up to their need at the exact time that they habitually have the urge to begin drinking.

Or consider the following classroom excursion. Sixteen fourth-graders were trying to solve an unusual but real problem. They were to invent a grizzly bear repellent to prevent bears in British Columbia from attacking and being hurt by electrical transformers. In the beginning, the students came up with several interesting ideas mainly by applying to this new situation things they knew about or had experienced. Later, they would stretch more and generate more speculative and original ideas. The material below is taken from an edited transcript.

Facilitator: Imagine that you have the job of inventing a grizzly bear repellent. Have you ever heard of the word *repellent*?

Several students at once: Yes.

(The facilitator discusses the problem briefly and helps the students define some words, such as *repellent* and *transformer*.)

Facilitator: Okay. We are going to use the Synectics invention process to work on this problem for a little while.

John: Mine has already sort of been invented.

Facilitator: That's okay. Let's have it.

John: Honey!

Facilitator: What are you wishing?

John: Wish we could use honey to . . . wish we could use like liquid honey. Sort of make it a little wetter so that it will blend in and then put it around the transformer, like near trees and stuff; spray it on trees and the bear will go for those.

"Earth science, close up."

Facilitator (writing down exactly what John said): So, attract the bear away from the transformers by spraying the honey on other things . . . am I right?

John: Right.

(The students come up with several more ideas.)

Christine: Put . . . something that makes a ray around the whole electrical thing. And when the bear goes through it there would be a closed circuit.

Jeremy: When the bear goes through . . . what would happen is that it would send out like a small shock and it'll immediately tell the bear that this is no place for the bear.

Elliot: Possibly put the transformer underground.

Lisa: Invent something that you could spray on the transformer so that the bear could smell it, and it would smell bad.

Jeremy: It's not keeping the bears away from the transformers. It's keeping the transformers away from the bears. You could put a styrofoam tree over the transformer, and the bear wouldn't attack a tree.

The facilitator then takes the students on an excursion: "We're going to put the problem out of our minds . . . and just to symbolize that, I'm going to cover up the problem, and, to the extent that you possibly can, I want you to forget about the problem that we are working on. The place you go on your imaginary trip can be anywhere in the world. It doesn't matter where it is."

The students select several places for their imaginary trips and then describe how they picture them. Some select Disney World, while others visit London, Honolulu, and a Kraft cheese factory where one of their mothers works. Here is a portion of the discussion:

Jeremy: I would see the guards at Buckingham Palace.

(The facilitator takes the students back to the problem. Christine immediately has an idea.)

Christine: There would be a circle that would turn around when the bear steps on it [and gets], you know, like dizzy.

Facilitator: Where did you get that idea?

Christine (pointing to the light fixtures in the ceiling): I saw the circles around on the ceiling, so I got the idea.

Facilitator: I love that idea. So the bear would step on this thing, and it would start spinning, and he would get dizzy.

Jeremy: I got this idea from the queen's guards marching back and forth. You would have things to distract the bear by moving around and around. Things moving in front of each other with their arms waving. (Jeremy gestures with his arms.)

Christine's idea of making the bear dizzy is a wonderful example of the connection-making potential of children. During the excursion, she noticed the lights that were recessed into the ceiling and that created a soft, interesting glow. She was open to any image that came into her mind. Under normal circumstances, she might have been scolded for daydreaming. Here she used her natural powers of speculation in exactly the way we had in mind. She picked an apparent irrelevancy and connected it with the problem to generate a new beginning concept. Her teacher told us after the session that Christine normally said nothing in class.

Jeremy's idea shows how well children of this age grasp the process. He had a novel idea and knew exactly how he had manufactured it: he connected the image of the palace guards marching back and forth with the idea of distracting the bears.

It is important to note that these students were from an average fourth-grade class in a large urban school district. They had no training in the Synectics problem-solving process before this experience. They had not heard of the grizzly bear problem. We see in every child the potential to do the same kind of generative thinking as these children.

THE ANATOMY OF COOPERATION

We have seen how a group of fourth-graders used Synectics to invent original ways of solving the grizzly bear problem. In the transcripts of the discussions, there is something hidden from view: the climate in which the group worked. When the students first started working on the problem, there was a great deal of tension, and evaluative comments were occasionally made. For example, when Diego said, "Make a strong barbed wire fence," John immediately said, "That might hurt the bear, though." If such comments had been allowed or even en-

When discussions exceed a certain threshold of criticism, speculation declines.

couraged, then the discussions would have exceeded a threshold of criticism beyond which speculation cannot flourish. The facilitator protected Diego's idea by saying, "We will work around that problem. If it hurts the bear, then we will change it a little bit." John and the rest of the group were encouraged to come up with ways to make barbed wire safe.

The group quickly got the idea that anything they thought about would be deemed acceptable, no matter how incomplete or full of flaws. Every idea or wish that was put forth was recorded by the facilitator on large easel pads, exactly as the child had stated it.

The behavior of this group of children is remarkably like that of an adult group working on a problem. The group plays it safe until it has tested the climate. If the climate is sufficiently supportive, the group shifts to experimental thinking. The reason for the shift, we believe, is that no one is forced to divert psychic energy to the defense of self-esteem. This atmosphere is an essential element in fostering the kind of collaboration a group needs in order to generate new thinking and breakthrough ideas.

A SCHOOL EXAMPLE

In the following example, we will see teachers using the same process to generate new ideas aimed at the solution of a problem. The example was supplied to us by Carolyn Burke, an elementary teacher in Stoneham, Massachusetts, who is also the facilitator of a team of teachers using the Synectics process. The problem is real. The teachers must increase the amount of science instruction offered by their elementary school in order to meet state requirements. We see them cooperating in a way that leads to an outstanding result: a new way of including science in their classrooms. The facilitator is able to maintain a climate that encourages speculative thinking.

The facilitator begins by asking the group member designated as the "client," Ms. B., "Can you tell us about the problem as you see it? Include any particular remedies that you have tried and any information you feel would influence our thinking."

Ms. B. provides some background and then concludes, "I guess what I would want from this group is a way to teach the science and still not end up with exhausted children and a stressed-out teacher."

The group goes to work offering "wishes." Ms. B. picks two that intrigue her: "I like the one where the children teach themselves science and the one where there is a science specialist."

> *Facilitator*: Why do these wishes appeal to you? What do you like about the ideas?
>
> *Ms. B.*: There is a minimum of classroom teacher involvement, the responsibility is on someone else, and the science is still being covered.
>
> *Facilitator*: Do you mean it is like getting the job done without having to do it?
>
> *Ms. B.*: Exactly.
>
> *Mr. P.*: Effortless teaching!
>
> *Ms. B.*: Wouldn't that be perfect?

The facilitator takes the group on an excursion. She says, "Will you take a few minutes to dream about the world of dance and give me some examples from the world of dance where things happen effortlessly?" The group generates several examples, and then one sparks a new line of thought.

> *Ms. C.*: Peter Pan flying through the air.
>
> *Facilitator*: What are you thinking of, Ms. C.?
>
> *Ms. C.*: Well, Mary Martin is flying across the stage. She makes it look effortless, but there are really wires there supporting her.
>
> *Facilitator*: It looks effortless, but it's not?
>
> *Mr. P.*: That's like in ice dancing at the Olympics, where one partner meshes in with the other and glides around the ice. It looks effortless, but it is not. Both dancers are very well-trained.
>
> *Ms. J.*: The male leads in the ice dancing. It's his job to show off the woman. One partner follows the lead of the other. Both are trained, but one is responsible for the dance. He really is in charge of the dance.

There are some further elaborations on the dependence/independence of the dancers. Then the facilitator moves the group toward a force-fit. She asks, "I know you might find this strange at first, but can we go back to our problem now and see if there is anything from the world of dance that we can apply to our problem?" After some hesitation, Mr. B. says, "Well . . . in dancing both partners are trained, but she follows his lead. Really she doesn't have to be nearly as good a dancer."

> *Facilitator*: How do you think this may relate to our problem? What are you thinking?
>
> *Mr. B.*: Well, the science teacher can be trained, and then the children can follow his lead – like "dance" on their own.
>
> *Ms. S.*: Yeah, if we could get a teacher to come in and give them directions and then the kids could go home and do the science on their own!
>
> *Ms. J.*: Independent science work with a supervisor or something.
>
> *Ms. S.*: Maybe a learning center where all the stuff is out on a table, self-explanatory, directions and all for experiments . . . and the kids just go and do it in their free time.
>
> (The teachers come up with the idea of

OVERLY PERSONAL COMPUTERS

involving parent volunteers and setting up science tables in each classroom every two weeks or so. The facilitator then asks Ms. B. to pick one or two ideas and talk about what she likes about them.)

Ms. B.: Well, I love the idea of the children having the list of experiments and materials at home. This will get the children and the parents involved. Children love science. I like the idea of science tables and kits and supplies set out for independent work. It frees up the teacher and uses peer teaching. I like the idea of the parent coming in to work in the classroom, because I've always felt parents should be included in the schools, and it helps the teacher. (Other teachers mention features of the emerging concept that they like.)

Facilitator: We seem to have the beginnings of a solution here. We need to see where some of our concerns lie so that we can incorporate them into our ideas. Ms. B., are there any areas that may need to be modified or that might cause problems with our ideas? You should state them as "how to's." For example, "I am concerned with how to. . . ."

Ms. B. begins to state some concerns as the time runs out. At a second meeting two days later, the concerns are addressed. This meeting produces more ideas that build toward the possible solution, including the suggestion of videotaping the science experiments for use throughout the school. The group decides to send out a newsletter to parents outlining their plan and inviting parents to get involved.

The search for solutions to the lack of science instruction at this elementary school evolved into a full-scale effort to establish media links between the school, the home, and the community. The problem-solving sessions led the teachers to an idea they had not thought about before: using videocassettes to record experiments and science lessons and then using cable television to link the homes with the school and to involve the parents in the science projects. The idea – and subsequent experimentation – led to a major innovation. A number of cassettes have already been made and may be checked out from the school library for home use. The school is planning to air the lessons on the community-access cable channel to encourage the parents to become involved in their children's schoolwork.

The teachers have also decided to develop a cassette library covering all subject areas for all grade levels and containing remedial, basic, and enrichment lessons. The parent council has offered to purchase blank cassettes for the school, and requests and ideas for specific lessons are pouring in. The school improvement council bought a video camera and two VCRs for the school.

It is difficult to remember that, when this problem-solving effort began, Ms. B. felt overwhelmed and unable to solve her problem. Here is what she said at the beginning of the first meeting:

> There are so many subjects that we are required to teach on the elementary level that it is just not realistic to expect us to spend up to two hours a week on science. The state is testing the children in language; the achievement tests are coming up, and they emphasize reading and math. Mr. G. [the language supervisor on the elementary level] expects us all to produce a literature book by June. It's just too much to expect it all.

Such a meeting usually ends with everyone feeling depressed about the impossibility of solving these kinds of problems. But the problem-solving process allowed the teachers to escape the negative route. It took them step by step on an engaging path toward making connections and producing new, fresh thinking that is the stuff of optimism and accomplishment.

A CLIMATE FOR INNOVATION

The facilitator of the teachers' meetings above used a number of techniques to expand the thinking potential of her group. She began by asking Ms. B. to give a brief background statement and then quickly solicited "springboards." The springboards were to be stated in the form, "I wish. . . ." By keeping the opening of the meeting brief and by encouraging speculative ideas right from the start, the facilitator eliminated the usual strategy of asking probing questions and then fighting over definitions of the problem. The springboards allow each person in the meeting to provide any number of definitions of the problem. Beginning with "I wish" makes it unnecessary for anyone to defend a statement.

There is typically a struggle over who will control the process and content of meetings. Synectics, Inc., devised the idea of clientship as a way of dealing with this issue. In the meetings we have been discussing, the roles were separated, with the facilitator being responsible for process but staying out of content. The client, Ms. B., was in charge of content. She was responsible for defining the beginning problem and would later be in charge of following up on the ideas that emerged from the meeting. She also selected directions for the group during the meeting. We find that clarifying these roles in the beginning eliminates the need to resolve conflicts over them later on.

The facilitator intervenes whenever one participant tries to dismiss another's idea.

The facilitator in these meetings protected each person's ideas by listening to and writing down every idea verbatim on easel pads. In addition, she intervened whenever one participant tried to dismiss another's suggestion. Here is how she dealt with the situation when Ms. S. offered her thought about the independent learning center and Ms. O. saw a flaw in it:

> *Ms. O.*: That wouldn't work for the primary grades.
>
> *Facilitator*: Ms. O., are you saying that the idea is a good one but that you have some concerns about adapting it for primary children? We are going to get as many ideas here as we can; then we will have time set aside to look at any concerns we might have.

By paraphrasing Ms. O.'s concern, the facilitator acknowledged that she was listening and understood the thought. Ms. O.'s concern was addressed, while Ms. S. did not have to defend her idea. Ms. O. and Ms. S. both felt supported, and the group benefited from their thinking. The meeting did not break down into a fight over whether young children can handle

Misdirected psychic energy is an important factor in unproductive meetings.

science experiments. The next offer suggested a way around the problem:

> *Ms. S.* (interrupting): Have older children read the directions to them. For that matter, have older children set up the experiments for the younger children.

With appropriate training and experience, just about any group can improve the quantity and quality of its original ideas. The difficult part is developing them into solutions. Experience shows us that many potential breakthroughs die because the developer could not see a way around a flaw. In this meeting, the facilitator separated the sessions into idea generating and idea evaluating. She used a technique we call the "itemized response." The group first itemized the useful aspects of the concept they were developing, then listed the concerns. Here the facilitator instructed the group to use a Synectics convention called the "how to." This is a simple but powerful device to convert a negative into a positive. Instead of focusing on the impossibility of scheduling parents, the problem is defined as "how to schedule parents." This approach emphasizes seeking solutions rather than finding problems.

DISCOUNT/REVENGE CYCLE

Untrained groups devote a large amount of energy to the discount/revenge cycle. Discounts are any verbal or nonverbal acts that produce the need to defend self-esteem. We commonly call them put-downs. The almost inevitable reaction to a put-down is to seek revenge against the perpetrator.

In the sessions described above, the facilitators dealt with discounts before they could have negative consequences. In most meeting situations, however, there is no one trained to direct the group toward a positive outcome. There are many kinds of put-downs in the typical meeting and in the typical classroom. For example, we know a superintendent who begins almost every response to a subordinate's idea with, "I don't mean to be critical, but. . . ." What follows is inevitably a criticism.

Consider the following actual classroom incident, which was observed by Douglas Delaney, a consultant with Synectics, Inc. It is the beginning of an eighth-grade English class. The teacher is taking care of some housekeeping details such as future assignments, exams, and so on. She has an interaction with John and Susan concerning a book sale in a couple of days. The interaction sets the tone for the rest of the class.

> *Teacher*: On Thursday we will go to the school's book sale. If you are bringing a check from your parents, be sure that it is made out to the school.
>
> *Susan*: We're always the last class to do anything.
>
> *Teacher*: There are plenty of books left for this class.
>
> *Susan*: Why do we always have to be the last?
>
> *John*: There is no fifth period.
>
> *Teacher*: Of course, there is a fifth period.
>
> *John*: No sir!

The teacher continues the class without responding to John's last comment. For the rest of the class, when John and the teacher interact, it is in a sarcastic and adversarial manner. Other students join in this bantering dialogue.

In this real case, none of the parties acknowledged that they were engaged in discounting. From observing meetings with adults and children, we know that this is not unusual.

Groups that have not been trained in problem solving waste nearly all of their energy defending individual members' self-esteem. The interactions within such groups are predictable. Members ask lots of probing questions (thereby transferring the burden of generating ideas to others). They tend to evaluate every idea immediately for flaws or reasons why it won't work (thus setting up the offerer to defend the idea and other participants to choose sides). They generate few ideas beyond the routine (thus depriving the group of truly new thinking). Members of untrained groups seldom risk inventing ways to get around the flaws they identify in someone else's idea (thus missing opportunities to award meaning to the originator of the idea). The tendency is to set up win/lose situations by using loaded words that every person in our culture knows signal the intent to fight (e.g., "I disagree," "Let me challenge that," "Let me play devil's advocate," "No," "The only way to . . . ," "I don't think so," "Stop right there").

Our analysis suggests that people do not do their best thinking when they are defending themselves against discounts. People who are discounted are more likely to spend their time getting even than inventing or experimenting. In other words, misdirected psychic energy is an important factor in unproductive meetings. Alfie Kohn's review of the literature reinforces our conclusions.[5] Kohn presents the findings of dozens of studies that show that discounting, competitiveness, and put-downs do not lead to greater achievement in school or in the workplace. Rather, they have just the opposite effect.

Our nearly 30 years of experience in running innovation sessions for clients all over the world have convinced us that skilled facilitators can temporarily create discount-free "cultures" in meeting situations. Under these conditions, people use their imaginations freely to create ideas rather than to defend self-esteem.

The work we are doing with schools is an effort to extend to the classroom the supportive world that a trained facilitator creates in meetings. In our vision, the *entire* school culture can become one in which generative thinking flourishes.

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2. Bruce Joyce and Marsha Weil, *Models of Teaching*, 3rd ed. (Englewood Cliffs, N.J.: Prentice-Hall, 1986).
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4. See, for example, William G. Kirkwood, "Effects of Incubation Sequences on Communication and Problem Solving in Small Groups," *Journal of Creative Behavior*, vol. 18, 1984, pp. 45-61.
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