

Techniques for Creative Thinking

First of all, you should read the introduction which discusses the question: "What can I do to increase my creativity?"

Random Input

Problem Reversal

Ask Questions

Applied Imagination - Question Summary

Lateral Thinking

Six Thinking Hats

The Discontinuity Principle

Checklists

Brainstorming

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Morphological Analysis

Imitation

Mindmapping

Storyboarding

Synectics

Metaphorical thinking

Lotus Blossum Technique

In the realm of the senses

Use of drawing (from Robert McKim's **Experiences in Visual Thinking**)

IdeaToons (by Michael Michalko) **New!**

NLP (Neuro-Linguistic Programming) Techniques

Assumption Smashing

DO IT! method of Roger Olsen

LARC Method

Unconscious Problem Solving

Simplex - a "complete" process with three stages (finding problems, solving problems, implementing solutions) and eight discrete steps represented as a wheel to reflect the circular, perennial nature of problem solving. The full name is the Basadur Simplex process. Its eight steps include: problem finding, fact finding, problem defining, idea finding, evaluating and selecting, action planning, gaining acceptance, and taking action. The t

Fuzzy Thinking

Some further examples of creativity techniques and guidelines linked with historical examples.

Breakthrough Thinking - The seven steps of uniqueness, purpose, solution after next, systems, needed information collection, people design, and betterment timeline.

Catalogues or Encyclopaedias of Techniques?

You may be wondering if there are books or an encyclopaedia of these techniques to use as a reference. I'm aware of a creativity encyclopaedia being currently developed, but two books containing many techniques are:-

Michael Michalko's **Thinkertoys**

James Higgin's **101 Creative Problem Solving Techniques**

I intend to produce a meta-index of the techniques found in the creativity books in my personal library. Write to me for more information.

Last updated: 7th November 1997

..\index.htmlCreativity Web Home Page

Random Input

Creativity Technique

From "Teach your child to think" - Edward de Bono:

The "random-word" method is a powerful lateral-thinking technique that is very easy to use. It is by far the simplest of all creative techniques and is widely used by people who need to create new ideas (for example, for new products).

Chance events allow us to enter the existing patterns of our thinking at a different point. The associations of a word applied to the new "out of context" situation generates new connections in our mind, often producing an instant "Eureka" effect, insight or intuition. It is said that Newton got the idea of gravity when he was hit on the head with an apple while sitting under an apple tree. It is not necessary to sit under trees and wait for an apple to fall - we can get up and shake the tree. We can produce our own chance events.

Random inputs can be words or images. Some techniques for getting random words (and the words should be nouns) are:

Have a bag full of thousands of words written on small pieces of paper, cardboard, poker chips, etc. Close your eyes, put in your hand and pull out a word.

Open the dictionary (or newspaper) at a random page and choose a word.

Use a computer program to give you a random word. I have a Hypercard program suitable for Apple Macintosh which uses this list of words (236 of them!)

Make up your own list of 60 words. Look at your watch and take note of the seconds.

Use this number to get the word.

It is important to use the first word you find.

Once you have chosen the word, list its attributions or associations with the word. Then apply each of the items on your list and see how it applies to the problem at hand.

How does it work? Because the brain is a self-organising system, and very good at making connections. Almost any random word will stimulate ideas on the subject. Follow the associations and functions of the stimulus word, as well as using aspects of the word as a metaphor.

You may want to mind-map the random word.

Exercise.

1. You are tired of getting unsolicited email and you are searching for a solution. Your random word is **BANANA**.
2. You need to tell a story to your children at bedtime. Your random word is **EGG**.

Roger von Oech **writes in *ÒA Kick in the Seat of the PantsÓ***:

A good way to turn your mental attic of experiences into a treasure room is to use *Òtrigger conceptsÓ* - words that will spark a fresh association of ideas in your mind. Like pebbles dropping in a pond, they stimulate other associations, some of which may help you find something new.

He writes in *ÒA Whack on the Side of the HeadÓ* about various cultures having oracles. The ancient Greeks used the ambiguous predictions of the Delphic Oracle, the Chinese used the I Ching, the Egyptians consulted the Tarot, the Scandinavian people used Runes and the North American Indians used Medicine Wheels. The purpose of these oracles was not so much to foretell the future but to help the user delve deeper into their own minds.

You can create your own oracle by doing three things:

Ask a question. This focuses your thinking. Perhaps you should write your question to focus attention.

Generate a random piece of information. Random selection is important, as the unpredictability of this new input will force you to look at the problem in a new way.

Interpret the resulting random piece of information as the answer to your question. The important thing is to have an open, receptive mind.

LET A RANDOM PIECE OF INFORMATION STIMULATE YOUR THINKING!

Here is a method I (Charles Cave) have been developing recently:

I make my own random picture cards by cutting out pictures from the various pieces of advertising material and magazines that appear in my letter box. A card can be picked at random and used as the random word. Choose pictures without text to allow a more right-brain approach. My cards include pictures of felt pens, furniture, kitchen items, art works, people, buildings, scenes and abstract designs. The cards can be shuffled and a card chosen at random.

Last updated: 3rd June 1997

Comments? Send them to Charles Cave

Problem Reversal

From "What a Great Idea" by Charles Thompson.

The world is full of opposites. Of course, any attribute, concept or idea is meaningless without its opposite.

Lao-tzu wrote *Tao-te Ching* which stresses the need for the successful leader to see opposites all around:

The wise leader knows how to be creative. In order to lead, the leader learns to follow. In order to prosper, the leader learns to live simply. In both cases, it is the interaction that is creative.

All behaviour consists of opposites...Learn to see things backwards, inside out, and upside down.

The method

State your problem in reverse. Change a positive statement into a negative one.

Try to define what something is *not*.

Figure out what everybody else is *not* doing.

Use the "What If" Compass

Change the direction or location of your perspective

Flip-flop results

Turn defeat into victory or victory into defeat

1. Make the statement negative

For example, if you are dealing with Customer Service issues, list all the ways you could make customer service *bad*. You will be pleasantly surprised at some of the ideas you will come up with.

2. Doing What Everybody Else Doesn't

For example, Apple Computer did what IBM didn't, Japan made small, fuel-efficient cars.

3. The "What-If Compass"

The author has a list of pairs of opposing actions which can be applied to the problem.

Just ask yourself "What if I" and plug in each one of the opposites. A small sample:-

Stretch it/Shrink It

Freeze it/Melt it

Personalise it/De-personalise it

...

4. Change the direction or location of your perspective

Physical change of perspective, Manage by Walking around, or doing something different.

5. Flip-flop results

If you want to increase sales, think about decreasing them. What would you have to do?

6. Turn defeat into victory or victory into defeat

If something turns out bad, think about the positive aspects of the situation. If I lost all of the files off this computer, what good would come out of it? Maybe I would spend more time with my family?! Who knows!

Last updated 5th October 1996

Ask Questions

I keep six honest serving men
 They taught me all I knew:
 Their names are **What** and **Why** and **When**
 And **How** and **Where** and **Who**
Rudyard Kipling (from "Just So Stories)
 Click [here](#) to read more of this
 poem

Ask "Why" Five Times

From "What a Great Idea" by Chic Thompson.

Ask "Why" a problem is occurring and then ask "Why" four more times.

For example...

1. Why has the machine stopped?
A fuse blew because of an overload
 2. Why was there an overload?
There wasn't enough lubrication for the bearings
 3. Why wasn't there enough lubrication?
The pump wasn't pumping enough
 4. Why wasn't lubricant being pumped?
The pump shaft was vibrating as a result of abrasion
 5.

Why was there abrasion?
There was no filter, allowing chips of material into the pump
 Installation of a filter solves the problem.

The Six Universal Questions

Idea Generators should be aware of a simple universal truth. There are only six questions that one human can ask another:

What?

Where?

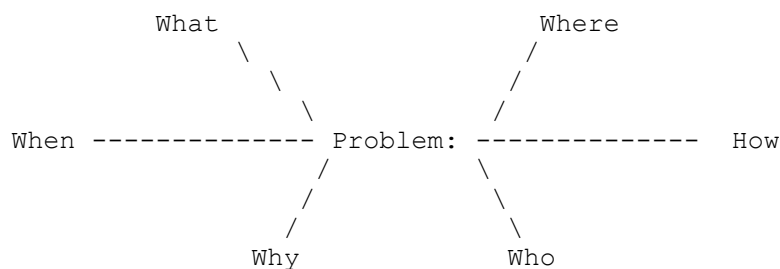
When?

How?

Why?

Who?

You may want to draw a mind map of the problem with these six words as nodes on the map.



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Last updated: 1st November 1997

Question Summary

"Applied Imagination"

Alex Osborn - 1957

Make an idea-prompting poster by printing this page and placing it in a prominent position.

Put to other uses? New ways to use as is? Other uses if modified? **Adapt?** What else is like this? What other idea does this suggest? Does the past offer parallel? What could I copy? Whom could I emulate? **Modify?** New twist? Change meaning, color, motion, sound, odor, form, shape? Other shapes? **Magnify?** What to add? More time? Greater frequency? Stronger? Higher? Longer? Thicker? Extra Value? Plus ingredient? Duplicate? Multiply? Exaggerate? **Minify?** What to subtract? Smaller? Condensed? Miniature? Lower? Shorter? Lighter? Omit? Streamline? Split up? Understate? **Substitute?** Who else instead? What else instead? Other ingredient? Other material? Other process? Other power? Other place? Other approach? Other tone of voice? **Rearrange?** Interchange components? Other pattern? Other layout? Other sequence? Transpose cause and effect? Change pace? Change schedule? **Reverse?** Transpose positive and negative? How about opposites? Turn it backward? Turn it upside down? Reverse roles? Change shoes? Turn tables? Turn other cheek? **Combine?** How about a blend, an alloy, an assortment, an ensemble? Combine units? Combine purposes? Combine appeals? Combine ideas?

Return to the page of techniques.

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Send your comments to Charles Cave

Lateral Thinking

Edward de Bono writes in "Serious Creativity", how he became interested in the sort of thinking that computers could not do: creative and perceptual thinking. The entry in the Concise Oxford Dictionary reads: "seeking to solve problems by unorthodox or apparently illogical methods."

Lateral thinking is about moving sideways when working on a problem to try different perceptions, different concepts and different points of entry. The term covers a variety of methods including provocations to get us out of the usual line of thought. Lateral thinking is cutting across patterns in a self-organising system, and has very much to do with perception.

For example: Granny is sitting knitting and three year old Susan is upsetting Granny by playing with the wool. One parent suggests putting Susan into the playpen. The other parent suggests it might be a better idea to put Granny in the playpen to protect her from Susan. A lateral answer!

The term "Lateral thinking" can be used in two senses:

Specific: A set of systematic techniques used for changing concepts and perceptions,

and generating new ones.

General: Exploring multiple possibilities and approaches instead of pursuing a single approach.

Coming soon to this page will be a summary of de Bono's fundamental principles, and a nutshell guide of techniques.

Last updated: 5th October 1996

Six Thinking Hats

A summary by Sylvie Labelle

Early in the 1980s Dr. de Bono invented the Six Thinking Hats method. The method is a framework for thinking and can incorporate lateral thinking. Valuable judgmental thinking has its place in the system but is not allowed to dominate as in normal thinking. Dr. de Bono organized a network of authorized trainers to introduce the Six Thinking Hats. Advanced Practical Thinking (APTT), of Des Moines, Iowa USA, licenses the training in all parts of the world except Canada (and now, Europe). APTT organizes the trainers and supplies the only training materials written and authorized by Dr. de Bono. Organizations such as Prudential Insurance, IBM, Federal Express, British Airways, Polaroid, Pepsico, DuPont, and Nippon Telephone and Telegraph, possibly the world's largest company, use Six Thinking Hats.

The six hats represent six modes of thinking and are directions to think rather than labels for thinking. That is, the hats are used proactively rather than reactively.

The method promotes fuller input from more people. In de Bono's words it "separates ego from performance". Everyone is able to contribute to the exploration without denting egos as they are just using the yellow hat or whatever hat. The six hats system encourages performance rather than ego defense. People can contribute under any hat even though they initially support the opposite view.

The key point is that a hat is a direction to think rather than a label for thinking. The key theoretical reasons to use the Six Thinking Hats are to:

encourage Parallel Thinking

encourage full-spectrum thinking

separate ego from performance

The published book *Six Thinking Hats* (de Bono, 1985) is readily available and explains the system, although there have been some additions and changes to the execution of the method.

The following is an excerpt from John Culvenor and Dennis Else *Engineering Creative Design*, 1995)

White Hat on the Hats

There are six metaphorical hats and the thinker can put on or take off one of these hats

to indicate the type of thinking being used. This putting on and taking off is essential. The hats must never be used to categorize individuals, even though their behavior may seem to invite this. When done in group, everybody wear the same hat at the same time.

White Hat thinking

This covers facts, figures, information needs and gaps. "I think we need some white hat thinking at this point..." means Let's drop the arguments and proposals, and look at the data base."

Red Hat thinking

This covers intuition, feelings and emotions. The red hat allows the thinker to put forward an intuition without any need to justify it. "Putting on my red hat, I think this is a terrible proposal." Usually feelings and intuition can only be introduced into a discussion if they are supported by logic. Usually the feeling is genuine but the logic is spurious. The red hat gives full permission to a thinker to put forward his or her feelings on the subject at the moment.

Black Hat thinking

This is the hat of judgment and caution. It is a most valuable hat. It is not in any sense an inferior or negative hat. The black hat is used to point out why a suggestion does not fit the facts, the available experience, the system in use, or the policy that is being followed. The black hat must always be logical.

Yellow Hat thinking

This is the logical positive. Why something will work and why it will offer benefits. It can be used in looking forward to the results of some proposed action, but can also be used to find something of value in what has already happened.

Green Hat thinking

This is the hat of creativity, alternatives, proposals, what is interesting, provocations and changes.

Blue Hat thinking

This is the overview or process control hat. It looks not at the subject itself but at the 'thinking' about the subject. "Putting on my blue hat, I feel we should do some more green hat thinking at this point." In technical terms, the blue hat is concerned with meta-cognition.

This was an excerpt from Edward de Bono's "Why Do Quality Efforts Lose Their Fizz?" Quality is No Longer Enough, The Journal for Quality and Participation, September 1991

This page supplied by Sylvie Labelle who can be contacted at labellsy@ERE.UMontreal.CA

Last updated: 18th October 1996

The Discontinuity Principle

The more you are used to something, the less stimulating it is for our thinking. When you disrupt your thought patterns, those ideas that create the greatest stimulus to our thinking do so because they force us to make new connections in order to

comprehend the situation. Roger van Oech calls this a "Whack on the Side of the Head", and Edward de Bono coined a new word, *po*, which stands for "Provocative Operation".

Try programming *interruptions* into your day. Change working hours, get to work a different way, listen to a different radio station, read some magazines or books you wouldn't normally read, try a different recipe, watch a TV program or film you wouldn't normally watch.

Provocative ideas are often stepping stones that get us thinking about other ideas. Abutting ideas next to each other, such that their friction creates new thought-paths a technique that flourishes in the east (haiku poetry and Zen koans) but causes discomfort in Western thinking.

Last updated: 5th October 1996

Checklists

Alex Osborn in his pioneering book **Applied Imagination** talks about "Questions as spurs to ideation", and outlines about 75 idea-spurring questions in his book.

The simplest set of questions comes from the six basic questions described in the Ask Questions section of the Creativity Web.

Why is it necessary?

Where should it be done?

When should it be done?

Who should do it?

What should be done?

How should it be done?

The **What other uses?** is a good question for by adding uses we can often add value.

By piling up alternatives by way of other uses, a still **better** use is likely to come to light.

Osborn went on with the following questions:

Adapt?

Modify?

Substitute?

Magnify/Maximise?

Minimise/Eliminate?

Rearrange?

Reversal?

Combine?

Thinkertoys

Michael Michalko, in his book **Thinkertoys** describes the rearrangement of the above questions (by Bob Eberle) into the mnemonic SCAMPER (Substitute, Combine Adapt, Modify, Put to other uses, Eliminate, Reverse).

Start applying these questions to your problems and see what ideas come forth.

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Send your comments to Charles Cave

Brainstorming

The term **Brainstorming** has become a commonly used word in the English language as a generic term for creative thinking. The basis of brainstorming is a generating ideas in a group situation based on the principle of suspending judgment - a principle which scientific research has proved to be highly productive in individual effort as well as group effort. The **generation** phase is separate from the **judgment** phase of thinking. In Michael Morgan's book **Creative Workforce Innovation** he gives the following guidelines:

Brainstorming is a process that works best with a group of people when you follow the following four rules.

Have a well-defined and clearly stated problem

Have someone assigned to write down all the ideas as they occur

Have the right number of people in the group

Have someone in charge to help enforce the following guidelines:

- Suspend judgment

- Every idea is accepted and recorded

- Encourage people to build on the ideas of others

- Encourage way-out and odd ideas

In **Serious Creativity**, Edward de Bono describes brainstorming as a traditional approach to do deliberate creative thinking with the consequence that people think creative thinking can only be done in groups. The whole idea of brainstorming is that other people's remarks would act to stimulate your own ideas in a sort of chain reaction of ideas.

Groups are not at all necessary for deliberate creative thinking, and **Serious Creativity** describes techniques for individuals to use to produce ideas. In a group you have to listen to others and you may spend time repeating your own ideas so they get sufficient attention. Thinking as a group using brainstorming can certainly produce ideas, but individual thinking using techniques such as those described by de Bono should be employed.

de Bono believes that individuals are much better at generating ideas and fresh directions. Once the idea has been born then a group may be better able to develop the idea and take it in more directions than can the originator.

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Send comments to Charles Cave

Forced Analogy

Forced analogy is a very useful and fun-filled method of generating ideas. The idea is to compare the problem with something else that has little or nothing in common and

gaining new insights as a result.

You can force a relationship between almost anything, and get new insights - companies and whales, management systems and telephone networks, or your relationship and a pencil.

Forcing relationships is one of the most powerful ways to develop new insights and new solutions. A useful way of developing the relationships is to have a selection of objects or cards with pictures to help you generate ideas. Choose an object or card at random and see what relationships you can force.

Use mind-mapping or a matrix to record the attributes and then explore aspects of the problem at hand.

Corporation as a matchbox

Robert Olson in his book **The Art of Creative Thinking** describes the problem of examining a corporate organisation structure by comparing it to a matchbox.

Matchbox Attributes Corporation Striking surface on two sides The protection an organisation needs against strikes Six Sides Six essential organisational divisions Sliding centre section The heart of the organisation should be slidable or flexible Made of cardboard Inexpensive method of structure - disposable

Marriage as a pencil

Betty Edwards in her book **Drawing on the Artist Within** shows the example of a pencil used to examine aspects of a marriage.

Pencil Marriage Gold Ring Remember promises Blue Ring Clean the tub. I share depression too often with family Yellow Too timid. Harold needs to know my true feelings Flat side Dull daily routine. Change activities Six sides 6 things to do: Budget, Take a class, Improve discipline, be more assertive, start now!, improve communications Eraser Rub him out! Forgive and forget past mistakes Money Spend too much. Need a budget. Take a job Superior I feel inferior to my husband Wood shaft Feel closed in. Need other interests. Am I getting shafted? Lead Get the lead out! Do It! if I press any harder I will break. Write Send a note telling Harold that I love him.

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Send comments to Charles Cave

Attribute Listing

Notes from "Creating Workforce Innovation" by Michael Morgan - published by Business and Professional Publishing 1993

Attribute listing is a great technique for ensuring all possible aspects of a problem have been examined. Attribute listing is breaking the problem down into smaller and smaller bits and seeing what you discover when you do.

Let's say you are in the business of making torches. You are under pressure from your competition and need to improve the quality of your product. By breaking the torch down into its component parts - casing, switch, battery, bulb and the weight - the attributes of each one - you can develop a list of ideas to improve each one.

Attribute Listing - Improving a torch

Feature Attribute Ideas Casing Plastic Metal Switch On/Off On/Off low beam Battery Power Rechargeable Bulb Glass Plastic Weight Heavy Light

Attribute listing is a very useful technique for quality improvement of complicated products, procedures for services. It is a good technique to use in conjunction with some other creative techniques, especially idea-generating ones like brainstorming. This allows you to focus on one specific part of a product or process before generating a whole lot of ideas.

A related technique is that of morphological analysis.

Last updated: 17th October 1996

Morphological Forced Connections

This application of attribute listing is contained in **The Universal Traveler** which authors Koebert and Bagnall call "Morphological Forced Connections". They give the following rules for their "foolproof invention-finding scheme" along with an example showing how their scheme works. Here it is:

List the attributes of the situation.

Below each attribute, place as many alternates as you can think of

When completed, make many random runs through the alternates, picking up a different one from each column and assembling the combinations into entirely new forms of your original subject.

After all, inventions are often new ways of combining old bits and pieces.

Example: Improve a ball-point pen

Cylindrical Material Cap Ink source Faceted Metal Attached Cap No Cartridge
Square Glass No Cap Permanent Beaded **Wood** Retracts **Paper Cartridge** Sculptured
 Paper Cleaning Cap Cartridge Made of Ink

Invention: A Cube Pen; once corner writes, leaving six faces for ads, calendars, photos, etc.

Another use of attribute listing, credited to Fritz Zwicky, is called **Morphological Analysis** and is an automatic method of combining parameters into new combinations for the later review of the problem solver. A selection of parameters or attributes is chosen and combinations explored. You could imagine three attributes as X, Y and Z axes.

An excellent way of implementing this method is with a computer program to enumerate the combinations and prompt the user with random combinations. Often the combinations are useful idea prompters and stepping stones to other solutions. I have

such a program written in Hypercard, but the technique is not difficult. Of additional value is to have a collection of attribute lists for plugging into your morphological analysis. Here are some of mine:

Human Ages Baby, Toddler, Pre-Schooler, Child, Adolescent, Adult, Retired Time Units Milli-seconds, Seconds, Minutes, Hours, Morning/Afternoon/Evening, Days, Weeks, Fortnight, Month, Quarters, Years, Decades, Century Colours Red, Orange, Yellow, Green, Blue, Indigo, Violet, Black, White, Brown, Pink, Crimson Meals Breakfast, Snack, Lunch, Dinner, Supper, Snack Six Questions Who, What, When, Where, How, Why

Think of the very popular books produced by Rick Smolan (photographer) which included **A Day in the Life of Australia** and his more recent **A Day in the Life of Cyberspace**. My using morphological analysis, you could replace **A Day** with the list of time units, **Life** could be replaced with Birth/Death/Growth/Decay and the last word could be replaced with a list of your areas of interest, eg My Family, My Country, My Dog.

As you evaluate the combinations, you will encounter such combinations as: "A Year in the Death of my employer" which could prompt you to examine the decline of your employer following your retrenchment. (I speak from experience!).

Last updated: 18th October 1996

Send your comments to Charles Cave

Imitation

How many ideas are really original?

It is quite valid to imitate other ideas as a preparatory step to original thinking. Try what all the "great" creators have done: *imitate, imitate, imitate*. After you have imitated enough, you will find your preferences shape what you are doing into a distinct style.

Originality is a natural result of sincere creative pursuit.

Isaac Newton said:

"If I have seen farther it is by standing on the shoulder of giants".

Just as the Beatles started out playing cover tunes, J.S. Bach went blind in his old age copying scores of other musicians (for personal study), Beethoven played on the themes of his time, and Jazz musicians insert popular melodies into the middle of bizarre atonal solos. Ideas are constantly on the move, much to the annoyance of patent & copyright lawyers! Certainly, ideas may be exploited by the materially minded, just like anything else. But if you truly comprehend an idea, it is yours.

Dean William R. Inge said:

"What is originality? Undetected plagiarism."

T. S. Eliot said:

The immature poet imitates; the mature poet plagiarizes.

Last updated: 26th October 1996

Mind Maps

Introduction

Learn Mind Mapping from Vanda North (Co-founder with Tony Buzan of the Brain Trust & Brain Clubs) Sydney and Melbourne, Australia - March 2001 Contact MindWerx International - Phone (03) 9482 9018

The human brain is very different from a computer. Whereas a computer works in a linear fashion, the brain works *associatively* as well as linearly - comparing, integrating and synthesising as it goes.

Association plays a dominant role in nearly every mental function, and words themselves are no exception. Every single word, and idea has numerous links attaching it to other ideas and concepts.

A good example of a mind map is this index to a set of interviews at www.aikido.com.
(Clicking this link opens a new window)

Mind maps, developed by Tony Buzan are an effective method of note-taking and useful for the generation of ideas by associations. To make a mind map, one starts in the centre of the page with the main idea, and works outward in all directions, producing a growing and organised structure composed of key words and key images. Key features are:

Organisation

Key Words

Association

Clustering

Visual Memory - Print the key words, use color, symbols, icons, 3D-effects, arrows and outlining groups of words

Outstandingness - every Mind Map needs a unique centre

Conscious involvement

Mindmaps are beginning to take on the same structure as memory itself. Once a mind map is drawn, it seldom needs to be referred to again. Mind Maps help organise information.

Because of the large amount of association involved, they can be very creative, tending to generate new ideas and associations that have not been thought of before. Every item in a map is in effect, a centre of another map.

The creative potential of a mind map is useful in *brainstorming* sessions. You only need to start with the basic problem as the centre, and generate associations and ideas from it in order to arrive at a large number of different possible approaches. By presenting your thoughts and perceptions in a spatial manner and by using colour and pictures, a better overview is gained and new connections can be made visible.

Mind maps are a way of representing associated thoughts with symbols rather than with extraneous words something like organic chemistry. The mind forms associations almost instantaneously, and "mapping" allows you to write your ideas quicker than expressing them using only words or phrases.

More information is available in a Mind Mapping FAQ (Frequently Asked Questions) Document.

Notes from Books by Tony Buzan

"Use Both Sides of your Brain" Plume 1989

Chapter 6 - Mind Maps Introduction

Chapter 7 - Mind Maps - The Laws

Chapter 8 - Mind Maps - advanced methods and uses

Chapter 9 - The Mind Map organic study technique (MMOST)

The Mind Map Book - How to Use Radiant Thinking to Maximise Your Brain's Untapped Potential

The Mind Map Book

The disadvantages of standard notes

Mind maps use pictures.

Harnessing the full range of your cortical skills

Summary of the Mind Map Laws

The mnemonic mind map as a mirror of creativity.

Creative Thinking Mind Maps

Computer Mind Mapping

The Book of Genius (Details coming soon)

Mind Mapping Software

The Software section of this web site contains details of several programs for Mindmapping. Programs for mind-mapping include...

MindMan - The Creative MindManager - software authorised by Tony Buzan

Axon Idea Processor

Inspiration (Mac and Windows)

Mindmap from emagic

Mind Map Web Sites

Tony Buzan's Web Site

Joyce Wycoff's page on MindMapping

Concept Mapping

Mind Mapping Site in Germany (the contents are in German) by Maria Beyer - Mind Mapping trainer, and seminar leader.

Information at Google.com

Mind Map Authors

Tony Buzan

Dilip Mukerjea

Joyce Wycoff

Nancy Margulies - "Mapping Inner Space"

Some templates developed by Charles Cave to use as starting points for mind mapping a problem.

The six questions

The five senses

Life planning - spiritual, physical, etc...

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Storyboarding

Storyboards go back to the very beginnings of cinema, with Sergei Eisenstein using the technique. In the world of animation, Walt Disney and his staff developed a Story Board system in 1928. Disney wanted to achieve full animation and for this, he needed to produce an enormous number of drawings. Managing the thousands of drawings and the progress of a project was nearly impossible, so Disney had his artists pin up their drawings on the studio walls. This way, progress could be checked, and scenes added and discarded with ease.

Story-Boarding is a popular management tool to facilitate the creative-thinking process and can be likened to taking your thoughts and the thoughts of others and spreading them out on a wall as you work on a project or solve a problem.

When you put ideas up on Story Boards, you begin to see interconnections, how one idea relates to another, and how all the pieces come together. Once the ideas start flowing, those working with the Story Board will become immersed in the problem.

People will "hitch-hike" onto other ideas. To implement a Story Board solution you can use a cork board or similar surface to allow pinning up index cards. Software programs are now available such as Corkboard (Macintosh).

Start with a topic card, and under the topic card, place header cards containing general points, categories, considerations, etc that will come up. Under the header cards you will put sub-heading cards ("subbers") containing the ideas that fall under each header; they're the details ideas generated in the creative-thinking session, ideas that develop or support the headers.

Story Boarding works well in group sessions and there are four major types of Story Boards (according to Mike Vance in his "Creative Thinking" cassette program):

Planning, Ideas, Communication and Organisation boards. During a story-boarding session, consider all ideas relevant, no matter how impractical they appear. Think positively, hold all criticism until later, and hitchhike on other's ideas. Creative Thinking sessions are held separately from Critical Thinking sessions.

Leonardo da Vinci used to put ideas up on the wall and examine the layout.

Story-Boards give total immersion in a problem as you can see how everything fits together.

Last updated: 26th October 1996

The term Synectics from the Greek word *synectikos* which means "bringing forth together" or "bringing different things into unified connection."

Since creativity involves the coordination of things into new structures, every creative thought or action draws on synectic thinking.

Creative behaviour occurs in the process of becoming aware of problems, deficiencies, gaps in knowledge, missing elements, disharmonies, bringing together in new relationships available information; identifying the missing elements; searching for solutions, making guesses, or formulating hypotheses. - E Paul Torrance

Creativity is the marvellous capacity to grasp mutually distinct realities and draw a spark from their juxtaposition - Max Ernst

A man becomes creative, whether he is an artist or scientist, when he finds a new unity in the variety of nature. He does so by finding a likeness between things which were not thought alike before - Jacob Bronowski

Buckminster Fuller summed up the essence of Synectics when he said all things regardless of their dissimilarity can somehow be linked together, either in a physical, psychological or symbolic way.

Synectic thinking is the process of discovering the links that unite seemingly disconnected elements. It is a way of mentally taking things apart and putting them together to furnish new insight for all types of problems.

William Gordon set forth three fundamental precepts of synectic theory:

Creative output increases when people become aware of the psychological processes that control their behaviour

the emotional component of creative behaviour is more important than the intellectual component; the irrational is more important than the intellectual component

the emotional and irrational components must be understood and used as "precision: tools in order to increase creative output.

Three Lessons

1. The Synectic Attitude

Synectics encourages the ability to live with complexity and apparent contradiction

Synectics stimulates creative thinking

Synectics mobilises both sides of the brain, the right brain (the dreamer), and the left brain (the reasoner)

Synectics provides a free-thinking state of consciousness

In a free-thinking state, analogies between perceptions, concepts, or even systems and abstractions tend to occur repeatedly. - Silvano Arieti

Creativity demands flexibility and imaginativeness but also tightly organised thought processes, matched by a high degree of emotional and psychological freedom. - R. L. Razik

2. The Synectic Trigger Mechanisms

Synectic Trigger mechanisms catalyse new thoughts, ideas and inventions

Synectic Theory is based on disruptive thinking - similar to the PO operation of Edward de Bono

The creative process is a matter of continually separating and bringing together, bringing together and separating, in many dimensions - affective, conceptual, perceptual, volitional and physical - Albert Rothenberg

3. The Synectic Ways of Working

Synectics is based on the fusion of opposites

Synectics is based on analogical thinking

Synectics is Synergistic. Its action produces a result which is greater than the sum of its parts.

The world is totally connected. Whatever explanation we invent at any moment is a partial connection, and its richness derives from the richness of such connections as we are able to make. - Jacob Bronowski

The Synectic Pinball Machine

Synectic thinking is like a mental pinball game. Stimulus input bounced against the scoring bumpers (the Trigger Questions) is transformed. Ordinary perceptions are turned into extraordinary ones; the familiar or prosaic is made strange. Synectic play is the creative mind at work.

Let's get started!

Ideas are not born in a vacuum. First of all, you must identify the problem you have and write it down. Next, you must gather information about it to mix in with the information already stored in the brain.

Now do something. Take creative action by using the Trigger Questions to transform your ideas and information into something new. These questions are tools for transformational thinking and may lead you to some great discoveries.

Books

Design Synectics - Stimulating Creativity in Design Nicholas Roukes, Published by Davis Publications 1988. **Synectics** by W.J.Gordon (possibly out of print) **The Practice of Creativity** by Gordon Prince.

Software

The Axon Idea processor contains a set of Synectics questions as part of its checklist system.

MacSynectics is a Hypercard stack (for Apple Macintosh) of trigger questions allowing the user to be presented with questions at random, and to record the ideas generated during the session. Go to the Hypercard Software section.

Last updated: 5th April 1997

Metaphorical thinking

People tend to think of the mind as analogous to current technology. Over the last few centuries, the mind has been likened to a steam engine, telephone exchange, and recently, a computer. The mind is more than a computer!

A metaphor is a soft thinking technique connecting two different universes of meaning. Examples: Food chain, flow of time, fiscal watchdog. The key to metaphorical thinking is

similarity. The human mind tends to look for similarities. A road map is a model or metaphor of reality and useful for explaining things, the Dolby Sound system is like a sonic laundry.

Excessive logical thinking can stifle the creative process, so use metaphors as a way of thinking differently about something. Make and look for metaphors in your thinking, and be aware of the metaphors you use. Metaphors are wonderful, so long as we remember that they don't constitute a means of proof, as by definition a metaphor must break down at some point.

Imaging within another sensory or conceptual frame can help, eg. the visual images of spring which inspired Vivaldi's "Prima Vera", the dream that led to Berlioz's "Symphonie Fantastique," the art exhibition which Mussorgsky illustrated in "Pictures at an Exhibition," and so on.

Last updated: 5th October 1996

Lotus Blossom Technique

lotus2.htmlotus2.htm

Extracted from Thinkpak by Michael Michalko Published by Ten Speed Press © 1994 Michael Michalko Reproduced with permission of the author

This exercise involves starting with a central theme or problem and working outward, using ever-widening circles or "petals." Central themes lead to ideas that themselves become central themes, and so forth. The unfolding themes trigger new ideas and new themes.

1. Copy the diagram above [by clicking on the image above for a larger image, or downloading an Excel 4 spreadsheet]

2. Write your central theme or problem in the diagram's center.

Think of related ideas or applications and write them in the surrounding circles (those labelled A through H). For instance, one company's central theme was "establishing a creative climate." They surrounded this statement in the central box with: "offer idea contests," "create a stimulating environment," "have creative-thinking meetings," "generate ways to 'get out of your box'," "create a positive attitude," "establish a creative-idea committee," "make work fun," and "expand the meaning of work."

4. Use the ideas written in circles ADH as central themes for the surrounding boxes. So, if you had written "create a stimulating environment" in circle A, you would copy it into the circle labeled A directly below, where it would become the central theme for a new box, and so on.

5. Try to think of eight new ideas involving the new central theme, and write them in the squares surrounding it. Use the idea stimulators to help you generate ideas. Fill out as many boxes as you can.

6. Continue the process until you've completed as much of the diagram as you can.

7. Evaluate your ideas. One of the ideas a company adopted was to provide a special room for creative thinking. They stocked it with books on creativity, videos, educational toys and games, beanbags, modeling clay, and so on. It was decorated with pictures of

the employees as babies, as a reminder that we are all born innocent and creative. An unemployed marketing executive used the lotus exercise to generate ideas he needed to land a job. His central theme was "job". One of the ideas surrounding this central box was "create a resume." "Resume" then became a new central theme and, using the idea stimulators, he came up with a number of variations on the idea of a resume. For example, he took out ads in several papers with the bold headline, "\$50,000 Reward." The fine print underneath explained that an employer could save \$50,000 by not paying a headhunter to find a person with his marketing talents. When interested employers called the number listed in the ad, they heard a recording of his resume. He received forty-five job offers

Last updated: 26th October, 1996

In the Realm of the Senses

This technique focuses on the five senses as an area of focus, attribute listing or idea prompter. I took the name from a film by Nagisa Oshima, and it evokes the idea of each sense evoking different sets of responses.

Think about various experiences you have had, such as hiking, running, dining out, falling in love and doing your job. Jot down your ideas about the different sensory components of each. An excellent way of using this technique is drawing a five senses mind map.

Mike Vance in his book **Think Out of the Box** describes the term "sensation" coined during his time working for Walt Disney. Sensation means simultaneously thinking in the five senses of sight, sound, taste, touch and smell. Sensation gives us a wider range for thinking, and must be cued or triggered by some mental device to engage the creative process. Mike Vance's book gives some lists of associations for each of these senses, but you of course can make your own. Use a dictionary and a thesaurus to get started.

Last updated: 27th April 1997

Send your comments to Charles Cave

Drawing and Visual Thinking

So much of our thinking is word based which is very much a left-brained activity. To utilise the right brain in visualising and solving problems, a new method is needed... thinking in a visual language.

This is the premise of Betty Edward's book **Drawing on the Artist Within** (the sequel to **Drawing on the Right Side of the Brain**).

The seminal book on the subject of visual thinking would have to be Robert McKim's book **Experiences in Visual Thinking** which he developed from his experiences in teaching a visual-thinking course at Stanford University.

Last updated: 18th October 1996

from "Thinkertoys" by Michael Michalko - Published by Ten Speed Press (c) 1991

"Therefore, when I have won a victory I do not repeat my tactics but rearrange them to circumstances in an infinite variety of ways." - Sun Tzu: The Art of War

We think in different ways and two complementary modes are **visual thinking** and **verbal thinking**.

The method liberates your thinking from the world of words by utilising the power of patterns, shapes and pictures. Pattern language is a visual thinking technique, and its visual, flexible nature makes it a useful creative device for seeing **new and different relationships between attributes**.

This language consists of a number of abstract visual symbols which you create to substitute for words. Do not dwell on drawing like an expert - your drawing skills are not crucial. The only consideration is what the graphic representations mean to you.

Ideatoons Blueprint

1. **Divide your challenge into attributes.**
2. **Describe each attribute by drawing an abstract graphic symbol.** Each drawing should represent a specific attribute and be on a separate index card. Draw whatever feels right for you. Allow the image of the attribute to emerge in its own way - to state what it wants to say. On the back of the card, write the attribute.
3. **Place all of the file cards on a table with the graphic symbols facing up.** Group and regroup the symbols randomly into various relationships. Try letting the cards arrange themselves without conscious direction, as if they were telling you where they wanted to be. Mix and match the symbols to provoke ideas.
4. **Look for ideas and thoughts that you can link to your challenge.** Try to force relationships. Try free-associating, Record the most idea-provoking arrangements.
5. **When stalemated, you may want to add other Ideatoons** or even start an entirely new set. A New Hampshire banker who wanted to solve the problem of stolen checks used several different sets of Ideatoons to search for a solution. Finally the act of using pictures *itself* prompted him to think of the answer.
The idea: He invented a system that lets banks print customer's pictures on their checks.

Physically rearranging your cards will invent new relationships and provoke new ideas. Try turning your symbols upside down and sideways to generate new patterns. Juggle the symbols and test the limits of your imagination.

Ideatoons is a device that allows you to express, see and think about your business challenge in a different and unique way by seasoning your challenge with the sauce of pictures.

Pattern language increases your capacity to divide whole into parts and regroup the parts into a variety of new patterns. Symbols also help you develop a deeper insight into

any situation.

Pictures stimulate your imagination and provide a pleasant change after being deluged with words. Pictures permit you to look at challenges with a fresh pair of eyes. You may see the idea bouncing around on your desk like a chicken trying to avoid becoming Sunday dinner.

Exercises

1. A delegation of Martians has just landed in the middle of your home town. They do not understand any Earth languages - only graphic symbols. Prepare a short speech composed of graphic symbols to welcome them and tell them just what kind of place you live in. (Feel free to send me copies of what you draw - contact the address shown below).
2. Draw Ideatoons for all the attributes of your professional situation. Devise some pictures for the different people you deal with...the products, things, tools and concepts associated with your work.
3. Invent a card game using your Ideatoons. Perhaps you could develop a family pack of cards? With the festive season approaching, how about making your own **Ideatoon Christmas / New Year/ Seasons Greeting** cards?

Return to the list of Techniques

Last updated: 6th November 1997

Send your comments and ideas to Charles Cave.

NLP Techniques

Practitioners of Neuro-Linguistic Programming (NLP), a.k.a. the "science of subjective experience", have produced a number of techniques that can be used to describe the strategies used by highly effective people.

Essentially, experts are carefully studied and analyzed (or modeled in NLP parlance) as a way to make conscious and unpack the mental strategies they used to get expert results. Once the strategies are decoded, they are the available for others to enhance their own expertise. Milton Erickson, the well known hypnotherapist, and Virginia Satir, one of the world's best known family therapist were among those who were modeled by NLP practitioners.

Interestingly, it appears that people can be modeled even after they have died! A case in point: Robert Dilts (one of the creators of NLP) recently modeled Walt Disney. He studied his writings, observed films of him doing his work and interviewed people that worked with him. From this he extracted the Disney Creativity Model, which will be briefly described below.

The basis strategy for modeling people is to either observe them while performing or to have them mentally go back to a time when they were performing extremely well, and to have them describe (while reliving a particular moment of great human performance) the thought patterns, physiology and context that supported the performance

The modeler might also choose to elicit a strategy that lead to poor performance or a failure to get the same results as a "counter model." This is done to provide a contrast that clearly points out the distinctions between the two states of "success" and "failure".

NLP provides a set of linguistic and observational tools that ensure useful descriptions and models.

Walt Disney

Dilts concluded that Walt Disney moved through three distinct states when he produce his work. Dilt's called them Dreamer, Realist and Critic. Each of these three stages have a distinct physiology and thought patterns and can be consciously employed by individuals who want to improve their creative performance.

It is beyond the scope and mandate of this FAQ to elaborate any further on Dilt's work. If you want more information, consult his books: "Tools for Dreamers" and "Skills for the Future". Details are in FAQ Part 1.

Anchoring

NLP techniques are also useful to help you remember, at an instant, what psychological state you must be in to be creative. NLP practitioners can "anchor" a particular state in which you are most creative. In fact, you anchor these state yourself. Many people have to be in a certain room, or standing or walking, or in some particular context in order to be creative. The context is the anchor that reminds you mind/body to be creative.

A Demo on using NLP As An Aid to Creativity

The next time you find yourself creative, e.g. you are noticing it easy to generate a lot of ideas or you finding it easy to elaborate on an idea, notice the position of your body and observe the context in which you are operating Record as much as you can about how you "made yourself" creative. You can then use that information (the more details the better) to set the state for being creative in the future, i.e. put yourself in a matching body posture and in a similar particular context as before.

Another technique is to make a tape recording of everything that is going on in your mind and body when you are being creative. If you're with someone else, have them tell you everything they noticed you doing. (Tell them to focus on behaviors, not interpretations of the behavior, e.g. the observation "you were smiling" is not as useful as "the corners of you mouth were turning upwards"). Then, listen carefully to their report and use that information to recreate the context the next time you want to be creative.

A Caution And An Invitation

Keep in mind, the suggested activities outlined in the last two paragraphs do not, in any way, do justice to the sophistication of NLP techniques. If you're interested in NLP as a way to enhance your creative potential, read, talk with those who know a lot about NLP, and find a good trainer.

Other NLP Resources

<http://www.capmedia.fr/nlp> Web site.

NLP FAQ and Resources The home of the alt.psychology.nlp newsgroup.

. NLP and DHE Neuro-linguistic programming and design human engineering.

Last updated: 25th October 1996

Assumption Smashing

A useful technique of generating ideas is to list the assumptions of the problem, and then explore what happens as you drop each of these assumptions individually or in combination.

For example, I used to work in the Customer Service division of a software company. When customers purchase software, they are encouraged to purchase support agreements for a cost of 15% of the software value. The revenue from this maintenance funds the support personnel who answer telephones.

The assumptions of this situation are:

Customers purchase maintenance agreements

Customers pay 15% of the software's worth for support

Support is a product and should therefore be sold

The software vendor provides helpful, timely support

Now think about the situations as each attribute is dropped.

What happens if support is free? - Maybe the software price should be increased and the support given away, creating the impression of free support. **Don't support the product** - Don't offer support. The vendor doesn't have to support it, so doesn't have to employ support staff. If anyone rings for help, tell them to buzz off! This could lead to customers forming their own support groups (user groups) or turning to other areas such as the Internet, bulletin boards, newsletters, independent support specialists and so on.

Even more assumptions could be dropped. What if the vendor **gave away** the software. You are most likely reading this file with Netscape Navigator or Microsoft Explorer. Did you buy that software? How do you think Netscape makes money if most people don't pay for the browser?

Free form assumption dropping

Assumption dropping is a great way to relax and think of crazy ideas. How would you answer these questions?

What if gravity stopped for one minute every day?

What would you do if you didn't have to sleep?

Describe your working week if you only had to go to work (or school) for one day a week? Or one month of the year?

More examples can be found in a document on [Escape Thinking](#).

Last updated: 18th October 1996

Send your comments to Charles Cave

DO IT

This technique is fully described in the book **The Art of Creative Thinking** by Robert W. Olson and published by Perennial Library (ISBN 0-06-097051-0) 1980.

The name is based on the following abbreviation:

Define

Open

Identify

Transform

The pattern of the DO IT process emphasises the need to **Define** problems, **Open** yourself to many possible solutions, **Identify** the best solution and then **Transform** it into action effectively.

The ten DO IT catalysts, designed to help us creatively define, open, identify and transform, are...

Define

Mind Focus
Mind Grip
Mind Stretch

Open

Mind Prompt
Mind Surprise
Mind Free
Mind Synthesise

Identify

Mind Integrate
Mind Strengthen
Mind Synergise

Transform

The DO IT Process and Catalysts

The DO IT catalysts may be used effectively separately for quick problem solving, or together as a process when very important or difficult problems are to be solved. They are designed to accelerate and strengthen your natural creative problem-solving ability and to stimulate a large number of good, diverse ideas for solutions to your problems.

Write down a statement of the problem!

Define the problem carefully to make sure you are solving the real problem and to help engage your unconscious and conscious minds to the problem.

Mind Focus 1) Ask why the problem exists. This may lead to a broader statement of the problem. 2) Try to subdivide the problem into smaller problems. This may lead to a narrower restatement of the problem. Mind Grip Write down at least three two-word statements of the problem objective. Select the combination of words which best represents the precise problem you want to solve. Use this to write a new, more optimal and effective restatement of the problem. Mind Stretch List the goals, objectives and/or criteria which the solution of the problem is to satisfy. (Think of the obstacles which must be overcome.) Then stretch each goal, objective or criterion and write down any ideas which are stimulated.

Write down the most optimal statement of the problem

Open yourself to consider many diverse solution ideas. Delay judgment on ideas generated until the Identify step. First, list any ideas which are on your mind. Then....

Mind Prompt Ask other people with diverse backgrounds, knowledge and intelligence for solutions to your problem. Use their solutions as prompters for your own ideas. Mind Surprise List ridiculous, laughable ideas. Use them to trigger more reasonably, possible usable solutions to your problem. Mind Free Stimulate fresh ideas by forcing similarities between your problem and things which aren't logically related to your problem. 1 - Write down the name of a physical object, picture, plant or animal. 2 - List its characteristics in detail. 3 - Use the listed characteristics to stimulate insights into and ideas for the solution to your problem. Mind Synthesise

Circle the best of ideas generated so far during the Define and Open steps

Identify the best solution to your problem and modify it until you are ready to transform your idea into action.

Mind Integrate Review your goals, objectives and/or criteria then trust your own gut-level feeling to select the best idea from the already circled ideas. Mind Strengthen List the negative aspects of your idea. Be vicious! Try to positive the negatives. Then **modify** the **solution** to reduce the negative aspects. Mind Energise Exaggerate the worst and best potential consequence which might result from the implementation of your solution. Modify your solution to minimise bad consequences and maximise good consequences. Proceed to the transformation step if you are sufficiently energised.

Carefully write down a statement of your final solution idea

Transform your solution idea into action. Use the DO IT process and catalysts again to help creatively solve the problem which you now have of "How to transform your solution idea into action."

Important Note: When time allows, take advantage of incubation (unconscious thinking) and research processes (find out what ideas have already been tried).

Most of our everyday personal and professional problems are solved in a few minutes or instantly. Therefore you will probably find it advantageous to use only one or a few of the catalysts at a time.

Last updated: 18th October 1996

Send comments to Charles Cave

LARC - Left and Right Creativity

The LARC method is step by step process that brings the right (creative) side of your brain into play with the left (logical) side. Each phase of the program suggest specific, easy-to-follow techniques.

The technique comes from the book **Unleashing the Right Side of the Brain** by Robert Williams and John Stockmyer, published by The Stephen Greene Press in 1987.

The right brain can be stimulated using drawing and visual images. There are four versions of LARC and each is a complete system for the stimulation of creative ideas. LARC 1 and LARC 2 are quick sets of exercises that can prompt imaginative solutions

to many problems. LARC 3 and LARC 4 are more complex, take more time, and are to be used for more difficult problems or when it is necessary to find even more inventive ideas than those produced by LARC 1 and LARC 2. Each LARC version builds on the previous version.

LARC Versions

LARC 1

Drawing

Smashing

Creating 1

LARC 2

Drawing

Smashing

Creating 1

Rearranging

Creating II

LARC 3

Drawing

Smashing

Creating 1

Rearranging: Group, Pyramid, Chain, Circle

Creating II

LARC 4

Stating the Problem

Drawing

Smashing

Creating 1

Rearranging: Group, Pyramid, Chain, Circle

Creating II: Relationship Lines

LARC 1

Drawing

Draw pictures of each word or concept you will use in the technique. Draw specific pictures for specific terms (house, school) and symbolic pictures for symbolic terms (destruction, love). Draw several pictures from different angles, perspectives, etc. for each word.

Smashing

Use one of the four following lists - active, passive, simple, complex - to generate fact-bits from your terms. The simple lists of smashing questions are for "easy" problems, the complex for "harder" problems. Passive questions work best when smashing subjects or terms have no independence of action, or cannot act on their own.

Conversely, active lists are for smashing terms that can control their actions - people, animals, organisations. It doesn't really matter too much about the lists, because the questions are designed to stimulate ideas. If you are not sure about simple or complex, use the complex list.

Passive Active Simple Complex Simple Complex

TypesStepsPartsCausesWhenWhyHowThings connected withSight images ofProducts or resultsTypesStepsPartsCausesSynonymsWhoWhatWhenWhereWhyHowThings connected withSight images ofHearing Images ofEmotionsOppositeTouching Images ofCharacteristics Products or resultsModes of operation AbilitiesFear of threatsGoals and hopesStrengthsWeaknessesTypesStepsThings connected withSight images ofCharacteristicsAbilitiesFear or threatsGoals and hopesResponsibilitiesInterestsLikesDislikesStrengthsWeaknessesTypesCausesStepsHow becomeWho isWhereWhenThings connected withSight images ofCharacteristicsProducts or results

Creating I

Harvest time! Scrutinise the responses to the smashing questions and pore over every fact-bit to come up with ideas.

To be continued....

Last updated: 18th October 1996

Send your comments to Charles Cave

Unconscious Problem Solving

This method relies on the unconscious mind to be continually processing the various sensory inputs stored in short-term and long-term memory.

Using your unconscious to solve problems is a process of **listening** and a readiness to **record ideas** as they percolate into your conscious mind.

Some of the greatest thinkers were great **relaxers**. Einstein was a daydreamer and spent much of his relaxation time sailing on a lake. Ralph Waldo Emerson enjoyed fishing.

It's all very well to work hard on a problem under the stressful pressure of deadlines, but the opposite condition of relaxation and **not** working on a problem is very valuable.

A practical application of this technique is to saturate yourself in the problem and then take a break. Write down the problem on a writing pad and leave it by your bedside. The next morning, take that pad and start writing down your ideas. Aim to write three full pages of anything that comes to mind. Explore your dreams.

We all dream, and we all dream a lot more than we think we do. As you get into bed, say out loud: "Tonight I am going to dream about" (including a brief description of the problem). When you wake up, lie and bed and think some more about the problem. The important thing is not to try too hard. Go with the flow. Incubate.

Last updated: 18th October 1996

TRIZ

Systematic Innovation(TRIZ) Web Page covering TRIZ and Ideation Methodology.

[Return to Creativity Techniques page.](#)

Last updated: 9th June 1997

..\index.htmlCreativity Web Home Page

Fuzzy Thinking

Western thinking is based on Aristotle ... around 2000 years old. So much of our logic and decision making depends on True/False or Yes/No Decisions. Are you tall or short? Do you like your Job - Yes or No? Such questions have answers indicating different levels of truth.

Lotfi Zadeh was the pioneer worker in the area of **Fuzzy Logic** (Fuzzy Thinking) and his work has been made accessible to the public in two books:

Fuzzy Thinking by Bart Kosko

Fuzzy Logic - The Revolutionary Computer Technology that is changing the world by Daniel McNeill and Paul Freiburger.

Although the main application of Fuzzy Logic has been in process control (train controllers, air conditioning, control of nuclear reactors, etc), the principles are important to the understanding of how we think. I believe it is as important as Edward de Bono's book "Mechanism of Mind".

How would you decide to change jobs or propose marriage? Answers to questions such as "Is the Salary Good?", "Can we be happy" will have varying degrees of truth. In Aristotelian Logic, there is True and False. With Fuzzy Logic, there is a scale of 0 to 1 where Truth would be 1 and False be 0. Decisions made with Fuzzy Logic take into account these varying degrees of truth for a variety of inputs, and produce an output (action) based on the inputs.

This section of the Creativity Web is being developed so your thoughts on Fuzzy Logic and Fuzzy Thinking are most welcome!

Last updated: 18th October 1996

Send comments to Charles Cave

Creativity, Innovation and Problem Solving

Some Guidelines with Linked Historical Examples

TRUE Creativity and Innovation consists of SEEING what everyone else has seen, THINKING what no one else has thought, and DOING what no one else has dared!"

START WITH THE CUSTOMER OR END USER:

The customer is always your first and most important creative challenge. Listen! Try to see the customer's problems and needs from his point of view.¹⁸ Restate the problem and the customer's needs in his terms and iterate until a consensus is reached. Ask not only what his problems are, but what special methods or tools he is presently using to solve them.⁷ Work together with or in the place of the end user or customer. Use fictitious product descriptions to stimulate ideas and discussion. Remember that effective market research and sales strategy requires just as much creativity, enthusiasm and perfection as does product development.

IMPORTANCE OF ASKING THE RIGHT QUESTIONS AND MAKING A PROPER PROBLEM STATEMENT:

The problem as first stated is rarely the true problem. Ask at least five times. Always restate the problem as many ways as you can; change the wording, take different viewpoints, try it in graphical form. Describe the problem to laymen and also to experts in different fields.¹⁰ Don't try to learn all the details before deciding on a first approach.⁹ Make the second assault on a problem from a different direction.¹² Transforming one problem into another or studying the inverse problem often offers new insights. If you don't understand a problem try explaining it to others and listening to yourself. Test the extremes.¹⁴ If you can't make it better, try making it worse and analyzing what happens. Get a "SuperTech" to help: Imagine how an ideal supertechnician would perform the required function and then try to implement his equivalent in hardware and/or software. "Why are we so much better at answering questions than at answering the right questions? Is it because we are trained at school and university to answer questions that others have asked? If so, should we be trained to ask questions?" [Or trained to ask the complete set of right questions in the right way?] Trevor Kletz (Analog Science Fiction, January 1994, p195)

DEVELOP THE PROPER TOOLS AND PROCEDURES:

Creative problem solving depends on using the right tools, tricks, procedures or methods of analysis. In some cases new tools and methods of analysis must be developed from scratch by the inventor before a problem can be solved and in other cases special tools and procedures must be developed to take the final critical step of enabling successful commercial applications.

GETTING GOOD IDEAS FROM EVERYONE AND EVERYWHERE:

Asking once is rarely effective, you have to ask many times in many ways. Look at all possible sources of good ideas: your customers, your competition, your peers, the literature, patents, and your own subconscious. Give others some examples, this serves both to illustrate what you're talking about and encourages them to suggest improvements to your ideas. Tell them also what [you believe] you don't want and which solutions [you believe] won't work. Remember that breakthrough innovations often come from the outside. Work with high performers in fields related to your own to identify and adopt their relevant methods, tools and "tricks of the trade". Trade ideas with all.

SERENDIPITY:

Serendipity is a very effective process for coming up with useful new ideas, but requires you to keep your eyes open and imagination turned on. Learn from Mother Nature (the originator of serendipity), and study the lessons or investigate any unexplained phenomena she may reveal to you. Find useful solutions by reviewing your backlog of problems while you browse at random in libraries, trade shows, and the real world.

Review your problems before you go to sleep at night and keep a notepad and audio recorder handy. Meditate out under a tree or in an open field. Play with combinations of ideas and concepts. Think about analogies to the problem.

SEARCH FOR MULTIPLE SOLUTIONS:

"Nothing is more dangerous than an idea when it is the only one we have." The first solution found is usually inadequate or non-optimum. There is usually more than one acceptable solution. Suspend judgement and criticism when first collecting ideas (see brainstorming). Studying multiple problems jointly often generate unique solutions. Look for solutions using combinations of ideas from different or evolving technologies. Even if you have one optimum solution it may be necessary to get patent coverage for all other effective solutions so as to protect your market. Team up with others in applying these techniques.

BRAINSTORMING:

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Other Web Pages Relating to Creativity and Patents

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IBM Patent Database A complete searchable database of all US Patents from 1971 to the present. Hypertext links are provided to referenced patents and publications. You can order copies on-line either in paper form or on custom CD-ROM (up to 800 patents on each CD).

Visit the Alliance for American Innovation for general information about innovation in business and Congressional plans to change the patent system in ways that may hurt American innovation and competitiveness.

What a Great IDEA! The book by Chic Thompson about key steps that creative people take. Also learn about "Killer Phrases" and how to prevent them from inhibiting your creativity.

Visit the Creativity Home Page in Australia for an extensive list of books and references on creative problem solving, inventions and patents.

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Return to Quantum Books Home Page.

URL: <http://www.quantumbooks.com/Creativity.html> Revised: October 5, 1997, 25849 bytes

Your comments or contributions of new stories are always welcome. Peter Sylvan <psylvan@world.std.com>

Creativity, Innovation and Problem Solving

Some Guidelines with Linked Historical Examples

TRUE Creativity and Innovation consists of SEEING what everyone else has seen, THINKING what no one else has thought, and DOING what no one else has dared!"

START WITH THE CUSTOMER OR END USER:

The customer is always your first and most important creative challenge. Listen! Try to see the customer's problems and needs from his point of view.¹⁸ Restate the problem and the customer's needs in his terms and iterate until a consensus is reached. Ask not only what his problems are, but what special methods or tools he is presently using to solve them. ⁷ Work together with or in the place of the end user or customer. Use fictitious product descriptions to stimulate ideas and discussion. Remember that effective market research and sales strategy requires just as much creativity, enthusiasm and perfection as does product development.

IMPORTANCE OF ASKING THE RIGHT QUESTIONS AND MAKING A PROPER PROBLEM STATEMENT:

The problem as first stated is rarely the true problem. Ask at least five times. Always restate the problem as many ways as you can; change the wording, take different viewpoints, try it in graphical form. Describe the problem to laymen and also to experts in

different fields.¹⁰ Don't try to learn all the details before deciding on a first approach.⁹ Make the second assault on a problem from a different direction.¹² Transforming one problem into another or studying the inverse problem often offers new insights. If you don't understand a problem try explaining it to others and listening to yourself. Test the extremes.¹⁴ If you can't make it better, try making it worse and analyzing what happens. Get a "SuperTech" to help: Imagine how an ideal supertechnician would perform the required function and then try to implement his equivalent in hardware and/or software. "Why are we so much better at answering questions than at answering the right questions? Is it because we are trained at school and university to answer questions that others have asked? If so, should we be trained to ask questions?" [Or trained to ask the complete set of right questions in the right way?] Trevor Kletz (Analog Science Fiction, January 1994, p195)

DEVELOP THE PROPER TOOLS AND PROCEDURES:

Creative problem solving depends on using the right tools, tricks, procedures or methods of analysis. In some cases new tools and methods of analysis must be developed from scratch by the inventor before a problem can be solved and in other cases special tools and procedures must be developed to take the final critical step of enabling successful commercial applications.

GETTING GOOD IDEAS FROM EVERYONE AND EVERYWHERE:

Asking once is rarely effective, you have to ask many times in many ways. Look at all possible sources of good ideas: your customers, your competition, your peers, the literature, patents, and your own subconscious. Give others some examples, this serves both to illustrate what you're talking about and encourages them to suggest improvements to your ideas. Tell them also what [you believe] you don't want and which solutions [you believe] won't work. Remember that breakthrough innovations often come from the outside. Work with high performers in fields related to your own to identify and adopt their relevant methods, tools and "tricks of the trade". Trade ideas with all.

SERENDIPITY:

Serendipity is a very effective process for coming up with useful new ideas, but requires you to keep your eyes open and imagination turned on. Learn from Mother Nature (the originator of serendipity), and study the lessons or investigate any unexplained phenomena she may reveal to you. Find useful solutions by reviewing your backlog of problems while you browse at random in libraries, trade shows, and the real world. Review your problems before you go to sleep at night and keep a notepad and audio recorder handy. Meditate out under a tree or in an open field. Play with combinations of ideas and concepts. Think about analogies to the problem.

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Your comments or contributions of new stories are always welcome. Peter Sylvan
<psylvan@world.std.com>

Random Input

Creativity Technique

From "Teach your child to think" - Edward de Bono:

The "random-word" method is a powerful lateral-thinking technique that is very easy to use. It is by far the simplest of all creative techniques and is widely used by people who need to create new ideas (for example, for new products).

Chance events allow us to enter the existing patterns of our thinking at a different point. The associations of a word applied to the new "out of context" situation generates new connections in our mind, often producing an instant "Eureka" effect, insight or intuition. It is said that Newton got the idea of gravity when he was hit on the head with an apple while sitting under an apple tree. It is not necessary to sit under trees and wait for an apple to fall - we can get up and shake the tree. We can produce our own chance events.

Random inputs can be words or images. Some techniques for getting random words (and the words should be nouns) are:

Have a bag full of thousands of words written on small pieces of paper, cardboard, poker chips, etc. Close your eyes, put in your hand and pull out a word.

Open the dictionary (or newspaper) at a random page and choose a word.

Use a computer program to give you a random word. I have a Hypercard program suitable for Apple Macintosh which uses this list of words (236 of them!)

Make up your own list of 60 words. Look at your watch and take note of the seconds. Use this number to get the word.

It is important to use the first word you find.

Once you have chosen the word, list its attributions or associations with the word. Then apply each of the items on your list and see how it applies to the problem at hand.

How does it work? Because the brain is a self-organising system, and very good at making connections. Almost any random word will stimulate ideas on the subject. Follow the associations and functions of the stimulus word, as well as using aspects of the word as a metaphor.

You may want to mind-map the random word.

Exercise.

1. You are tired of getting unsolicited email and you are searching for a solution. Your random word is **BANANA**.

2. You need to tell a story to your children at bedtime. Your random word is **EGG**.

Roger von Oech **writes in** **ÒA Kick in the Seat of the PantsÓ**:

A good way to turn your mental attic of experiences into a treasure room is to use Òtrigger conceptsÓ - words that will spark a fresh association of ideas in your mind. Like pebbles dropping in a pond, they stimulate other associations, some of which may help you find something new.

He writes in ÒA Whack on the Side of the HeadÓ about various cultures having oracles. The ancient Greeks used the ambiguous predictions of the Delphic Oracle, the Chinese used the I Ching, the Egyptians consulted the Tarot, the Scandinavian people used Runes and the North American Indians used Medicine Wheels. The purpose of these oracles was not so much to foretell the future but to help the user delve deeper into their own minds.

You can create your own oracle by doing three things:

Ask a question. This focuses your thinking. Perhaps you should write your question to focus attention.

Generate a random piece of information. Random selection is important, as the unpredictability of this new input will force you to look at the problem in a new way.

Interpret the resulting random piece of information as the answer to your question. The important thing is to have an open, receptive mind.

LET A RANDOM PIECE OF INFORMATION STIMULATE YOUR THINKING!

Here is a method I (Charles Cave) have been developing recently:

I make my own random picture cards by cutting out pictures from the various pieces of advertising material and magazines that appear in my letter box. A card can be picked at random and used as the random word. Choose pictures without text to allow a more right-brain approach. My cards include pictures of felt pens, furniture, kitchen items, art works, people, buildings, scenes and abstract designs. The cards can be shuffled and a card chosen at random.

Last updated: 3rd June 1997

Comments? Send them to Charles Cave

READ HOW YOU CAN IMPROVE YOUR CREATIVE THINKING ABILITY

Improving Your Creative Thinking Skills

.....by Melvin D. Saunders

.....Do you think in a restricted or an expanded capacity? Billions of dollars are spent on product advertising each year because advertising works. When you break down a typical ad into its ridiculous components though, you see quickly that it is **NOT** geared to the thinking, conscious individual, because consumer buying is primarily done on emotional impulse. By improving your thinking skills,

you become less susceptible to emotionally directed advertisements.

.....Creative thinking and problem solving go hand in hand. For many years, Dr. Edward de Bono, a psychologist and professor of investigative medicine at Cambridge University, promoted the field of creative thinking under the logo *Lateral Thinking*. Vertical thinking proceeds when you solve a problem by going from one logical step to the next in achieving a solution. Lateral thinking depicts the type of thinking that comes with seeking solutions to problems through unorthodox methods or playing games with the data.

.....Expanding your mental capacity with creative thinking can improve with practice. For instance, lay six stick matches on the table and make four equal sided triangles out of them. After struggling fruitlessly in 2 dimensions, you soon learn that a 3-dimensional tetrahedron is the only way to accomplish the task. Learn to "think wild." Let yourself imagine all kinds of possibilities and alternatives, including those you would ordinarily consider impractical or ridiculous. For instance, try thinking about the exact opposite of what normally comes to mind when posed with a problem, then elaborate on it from there.

..... If you have an opinion and another person has an opposite point of view, visualize yourself in the other person's shoes for a change. List all the reasons why his opinion is valid; then list all the reasons why his opinion is invalid; and finally list all the irrelevant points. Many people become stymied by getting embroiled in describing, complaining and criticizing another person's viewpoint, instead of directing their thinking toward action and deciding what can be done about the situation.

..... More than half of the world's greatest discoveries have been made through 'serendipity' or the finding of one thing while looking for something else; but remember, it takes a creatively aware person to recognize an opportunity when it presents itself. In emergencies, people tend to panic instead of using their head to determine their options.

.....Many people hold opinions or views because they're blocked with emotional or prejudicial reasons. By expanding your scope to include the opposite viewpoint from your position, you often become quickly unblocked. While the U.S. leads the world in crime, drug addiction and indebtedness, Japan has little crime and drug addiction, and is the most solvent and educated nation in the world. Do you think emotional and prejudicial reasons keep U.S. officials blocked from learning from Japan's example or are there other reasons?

.....Now discuss with a partner the opposite of the following assumptions to see where it leads you. Open your mind and think wild.

An Example of an Assumption Proffered by Officials: With the millions of dollars spent on AIDS research, there is still no permanent cure that has yet been found for the disease.

Opposite Considerations and the Reasons Behind Them: The cure that has been found is too inexpensive and permanent and therefore it cannot afford a payback of the expense already outlaid. The disease is actually wanted by world controlling groups to eliminate undesirables and maintain fear in global populations. An expensive, impermanent non-cure is really desired to secure a more continuous flow of revenue off of patients that can afford it. By NOT revealing the cure for AIDS, the disease can be allowed to proliferate to

overwhelming proportions, where only martial law with dictatorial edicts can maintain population control. More money can be made looking for a cure than finding a cure, so all permanent cures must be suppressed.

Now find your own opposite considerations for the following assumptions: Give yourself 5 minutes on each of the following Assumptions Proffered By Officials: Pesticides ingested with your fruits and vegetables are too negligible to cause you any health problem. Better education in public schools will take another 10 years or more to put into effect. The unhealthy pollutants in the drinking water of many U.S. cities will simply cost too much to correct. U.S. officials are attempting to curtail the flow of narcotics in the nation.

..... Learn to define your aims, goals and objectives in life's situations. Make a list of all your reasons for doing a particular thing. Even though you assume that you know what your goals are, often hidden or unconsidered goals get in the way. Without a clarity of purpose, all actions are either reactions to a situation or matters of habit or imitation. For example, a tennis player that keeps delivering kill shots into the net might think his goal was to win the game, but in reality it might be just an undetected desire to look terrific.

.....In England & Venezuela, Dr. de Bono has made great headway in initiating lateral thinking courses in public schools. Why is the U.S. so disinterested in such education? Could it be that less money could be made off of thinking citizens than gut oriented citizens? Think about it!

.....One man though has made some headway within the U.S. school systems -- Dr. C. Samuel Micklus. With his wife Carole, they have developed a program called *Odyssey of the Mind (OM)*. The Odyssey of the Mind Program, under the auspices of OM Association, Inc., a not-for-profit corporation, promotes divergent thinking in students from kindergarten through college. It is a program that offers students a unique opportunity to participate in challenging and creative activities both inside and outside their regular classroom curriculum. In OM teams, students develop self-confidence in creating solutions, evaluating their ideas and making final decisions. It makes learning fun. Now going into its eleventh year, over 350,000 students from the U.S., Canada, Mexico, China and Australia compete internationally on specially designed Odyssey of the Mind problems. To learn how to get your child's school involved in the OM program, write: *Odyssey of the Mind*, P.O. Box 27, Glassboro, NJ 08028

<http://omega.cc.umb.edu/~cct/campus.html>

Graduate Program in Critical and Creative Thinking

developing reflective practice and changing our schools, workplaces, and lives

Course Offerings---Outreach Activities---Other Information and Searching

Overview: The primary mission of the Critical and Creative Thinking (CCT) program, based in the College of Education at the University of Massachusetts, Boston is professional development for mid-career teachers and other educators and for leaders or change-agents in other kinds of organizations. CCT approaches this mission by providing its students with an understanding of the processes of critical thinking and

creativity, and with ways of helping others develop these processes in a variety of educational, professional, and social situations.

The Program appeals to mature students who are motivated to transform their work and lives and are interested to learn from other students whose interests and backgrounds are diverse. Many are educators: teachers and college professors, curriculum specialists, teacher educators, museum educators, or school administrators. Others are policy makers or personnel trainers in government, corporate, or non-profit settings. Some are artists, musicians, or writers.

CCT students are encouraged in their course projects, independent studies, and capstone projects to translate what they learn into strategies, materials and interventions for use in their own settings. Students graduate from the Program better equipped for ongoing learning, fulfilling the needs of their schools, workplaces, and communities, adapting to social changes, and collaborating with others to these ends (see exit self-assessment)

CCT is a unique and clearly interdisciplinary graduate program. Its faculty members are drawn from several fields, including education, philosophy, psychology, mathematics, and the life sciences. Traditionally, the field of Critical and Creative Thinking has covered psychological studies of the scope, limits, and techniques of critical and creative thought, information processing, and conceptual learning in children and young adults; philosophical studies of techniques in reasoning, argument, logical thinking, valuing, and judging; and work with cognitive structures and metacognitive techniques for stimulating creativity and critical thought. More recently, CCT has delved further into inter- and intra-personal dimensions of critical and creative thinking and reflective practice, into the areas of empathy, listening, dialogue, and facilitation of other group processes. An interest in contributing to constructive social change has also led CCT faculty and students to address anti-racist and multicultural education and to promote the involvement of teachers and other citizens in debates about science in its social context.

Most students in CCT seek a Master of Arts (M.A.) degree, but others study for a Graduate Certificate. Starting in the summer of 2001 (pending approval), a Certificate of Advanced Graduate Studies (CAGS) with a Concentration in Facilitating Reflective Practice is available through a partnership with the Educational Administration Program. CCT courses also allow students from other GCOE programs to fulfill requirements for courses in critical and creative thinking and in teaching in the different subject areas, especially in mathematics and science. Special, non-degree students can also take CCT courses; this opportunity, together with workshops, summer institutes, forums, and other outreach activities further extend the range of educational experiences offered by the Program.

M.A. students complete four foundation courses, three electives, and three more required courses including a capstone thesis or synthesis. The elective courses offered specifically address four areas in which students apply critical and creative thinking skills: moral education; literature and arts; mathematics, science, and technology (including sub-specialities in science in society, and environment, science, and society); and workplace and organizational change. The program provides for other student specialization through cooperation with other UMass Boston graduate programs, such as instructional design, special education, educational administration, and dispute

resolution.

Outreach Activities---Other Information and Searching--- **denotes**

Course Offerings

Winter and Spring 2001 courses

Constructivist Listening, Winter session, taught by Emmett Schaefer Register through Continuing Education.

CCT Certificates with Special Themes offered in 2001:

Science, Education, and Society

Dialogue and Collaboration in Organizational Change

Moral Education (CrCrTh620), Topics to be covered by new instructor, Ted Klein

Certificate of Advanced Graduate Studies in Educational Administration with a

Concentration in Facilitating Reflective Practice (pending approval)

Summer Institute 2001 (preliminary announcement)

Past years' courses and Future years' proposed offerings

CCT Outreach Activities

Thinking for Change Outreach unit of the CCT Program

Think Tank for College Teachers of Critical Thinking

Critical & Creative Thinking in Practice (Tuesday evening presentations and mini-workshops by students, faculty, alums, and others)

Science, Education, and Society initiatives

Other information and Searching

CCT Handbook -- Joining CCT, moving through the program, and information about the wider CCT community [click & hold for Word file]

Admissions Information Service 617.287.6000 [application forms (PDF files)]

Graduate Bulletin entry for CCT [click & hold for Word file, print out at 77%]

Publicity Brochure [click & hold for Word file; Please print out and distribute]

Compilation of Email Bulletins of News from CCT

Abstracts of completed theses and syntheses

Future plans of the CCT Program (June 2000 Planning Document)

Links to allied organizations and projects

Academic calendar

Directions to get to the CCT Program.

Program Office cct@umb.edu, 617.287.6520, Wheatley Hall, Second Floor, Room

157University of Massachusetts Boston, 100 Morrissey Boulevard, Boston, MA 02125 -3393.

Faculty advisor, Dr. Peter Taylor, 617.287.7636

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10 Steps for Boosting Creativity

Try out BrainStormer, our new creative thinking software. Johann

Sebastian

1 . Listen to music by Johann Sebastian Bach. If Bach doesn't make you more creative, you should probably see your doctor - or your brain surgeon if you are also troubled by headaches, hallucinations or strange urges in the middle of the night.

2 . Brainstorm. If properly carried out, brainstorming can help you not only come up with sacks full of new ideas, but can help you decide which is best. Click [here](#) for more information on brainstorming and download our BrainStormer programme.

3 . Always carry a small notebook and a pen or pencil around with you. That way, if you are struck by an idea, you can quickly note it down. Upon rereading your notes, you may discover about 90% of your ideas are daft. Don't worry, that's normal. What's important are the 10% that are brilliant.

4 . If you're stuck for an idea, open a dictionary, randomly select a word and then try to formulate ideas incorporating this word. You'd be surprised how well this works. The concept is based on a simple but little known truth: freedom

inhibits creativity. There are nothing like restrictions to get you thinking.

5 ■ Define your problem. Grab a sheet of paper, electronic notebook, computer or whatever you use to make notes, and define your problem in detail. You'll probably find ideas positively spewing out once you've done this.

6 ■ If you can't think, go for a walk. A change of atmosphere is good for you and gentle exercise helps shake up the brain cells.

7 ■ Don't watch TV. Experiments performed by the *JPB Creative Laboratory* show that watching TV causes your brain to slowly trickle out your ears and/or nose. It's not pretty, but it happens.

8 ■ Don't do drugs. People on drugs think they are creative. To everyone else, they seem like people on drugs.

9 ■ Read as much as you can about everything possible. Books exercise your brain, provide inspiration and fill you with information that allows you to make creative connections easily.

10 ■ Exercise your brain. Brains, like bodies, need exercise to keep fit. If you don't exercise your brain, it will get flabby and useless. Exercise your brain by reading a lot (see above), talking to clever people and disagreeing with people - arguing can be a terrific way to give your brain cells a workout. But note, **arguing about politics or film directors is good for you; bickering over who should clean the dishes is not.** **NEW!!!** Want to talk about creativity and innovation in business? If so, join Valpocella, our new discussion forum focusing on applied creativity and innovation in business.

"I'm not returning until you fix it," bandleader Count Basie told a club owner whose piano was always out of tune. A month later Basie got a call that everything was fine. When he returned, the piano was still out of tune. "You said you fixed it!" an irate Basie shouted. "I did," came the reply. "I had it painted." Are you solving the right problem? Is there a more significant problem you could be addressing?

Introduction to Creative Thinking

Robert Harris Vanguard University of Southern California Version Date: July 1, 1998

Much of the thinking done in formal education emphasizes the skills of analysis-- teaching students how to understand claims, follow or create a logical argument, figure out the answer, eliminate the incorrect paths and focus on the correct one. However, there is another kind of thinking, one that focuses on exploring ideas, generating possibilities, looking for many right answers rather than just one. Both of these kinds of thinking are vital to a successful working life, yet the latter one tends to be ignored until after college. We might differentiate these two kinds of thinking like this:

Critical Thinking Creative

Thinking analytic generative convergent divergent vertical lateral probability possibility judgment suspended judgment focused diffuse objective subjective answer an answer left

brainright brain verbal visual linear associative reasoning richness, novelty yes but yes and

In an activity like problem solving, both kinds of thinking are important to us. First, we must analyze the problem; then we must generate possible solutions; next we must choose and implement the best solution; and finally, we must evaluate the effectiveness of the solution. As you can see, this process reveals an alternation between the two kinds of thinking, critical and creative. In practice, both kinds of thinking operate together much of the time and are not really independent of each other.

What is Creativity?

An Ability. A simple definition is that creativity is the ability to imagine or invent something new. As we will see below, creativity is not the ability to create out of nothing (only God can do that), but the ability to generate new ideas by combining, changing, or reapplying existing ideas. Some creative ideas are astonishing and brilliant, while others are just simple, good, practical ideas that no one seems to have thought of yet. Believe it or not, everyone has substantial creative ability. Just look at how creative children are. In adults, creativity has too often been suppressed through education, but it is still there and can be reawakened. Often all that's needed to be creative is to make a commitment to creativity and to take the time for it.

An Attitude. Creativity is also an attitude: the ability to accept change and newness, a willingness to play with ideas and possibilities, a flexibility of outlook, the habit of enjoying the good, while looking for ways to improve it. We are socialized into accepting only a small number of permitted or normal things, like chocolate-covered strawberries, for example. The creative person realizes that there are other possibilities, like peanut butter and banana sandwiches, or chocolate-covered prunes.

A Process. Creative people work hard and continually to improve ideas and solutions, by making gradual alterations and refinements to their works. Contrary to the mythology surrounding creativity, very, very few works of creative excellence are produced with a single stroke of brilliance or in a frenzy of rapid activity. Much closer to the real truth are the stories of companies who had to take the invention away from the inventor in order to market it because the inventor would have kept on tweaking it and fiddling with it, always trying to make it a little better.

The creative person knows that there is always room for improvement.

Creative Methods

Several methods have been identified for producing creative results. Here are the five classic ones:

Evolution. This is the method of incremental improvement. New ideas stem from other ideas, new solutions from previous ones, the new ones slightly improved over the old ones. Many of the very sophisticated things we enjoy today developed through a long period of constant incrementation. Making something a little better here, a little better there gradually makes it something a lot better--even entirely different from the original. *For example, look at the history of the automobile or any product of technological progress. With each new model, improvements are made. Each new model builds upon the collective creativity of previous models, so that over time, improvements in economy, comfort, and durability take place. Here the creativity lies in the refinement, the step-by-step improvement, rather than in something completely new. Another example would be the improvement of the common wood screw by what are now commonly called drywall screws. They have sharper threads which are angled more steeply for faster penetration and better holding. The points are self tapping. The shanks are now threaded all the way up on lengths up to two inches. The screws are so much better that they can often be driven in without pilot holes, using a power drill.*

The evolutionary method of creativity also reminds us of that critical principle: **Every problem that has been solved can be solved again in a better way.** Creative thinkers do not subscribe to the idea that once a problem has been solved, it can be forgotten, or to the notion that "if it ain't broke, don't fix it." A creative thinker's philosophy is that "there is no such thing as an insignificant improvement."

Synthesis. With this method, two or more existing ideas are combined into a third, new idea. Combining the ideas of a magazine and an audio tape gives the idea of a magazine you can listen to, one useful for blind people or freeway commuters. *For example, someone noticed that a lot of people on dates went first to dinner and then to the theater. Why not combine these two events into one? Thus, the dinner theater, where people go first to eat and then to see a play or other entertainment.*

Revolution. Sometimes the best new idea is a completely different one, an marked change from the previous ones. While an evolutionary improvement philosophy might cause a professor to ask, "How can I make my lectures better and better?" a revolutionary idea might be, "Why not stop lecturing and have the students teach each other, working as teams or presenting reports?"

For example, the evolutionary technology in fighting termites eating away at houses has been to develop safer and faster pesticides and gasses to kill them. A somewhat revolutionary change has been to abandon gasses altogether in favor of liquid nitrogen, which freezes them to death or microwaves, which bake them. A truly revolutionary creative idea would be to ask, "How can we prevent them from eating houses in the first place?" A new termite bait that is placed in the ground in a perimeter around a house provides one answer to this question.

Reapplication. Look at something old in a new way. Go beyond labels. Unfixate, remove prejudices, expectations and assumptions and discover how something can be reapplied. One creative person might go to the junkyard and see art in an old model T transmission. He paints it up and puts it in his living room. Another creative person might see in the same transmission the necessary gears for a multi-speed hot walker for his horse. He hooks it to some poles and a motor and puts it in his corral. The key is to see beyond the previous or stated applications for some idea, solution, or thing and to see what other application is possible.

For example, a paperclip can be used as a tiny screwdriver if filed down; paint can be used as a kind of glue to prevent screws from loosening in machinery; dishwashing detergents can be used to remove the DNA from bacteria in a lab; general purpose spray cleaners can be used to kill ants.

Changing Direction. Many creative breakthroughs occur when attention is shifted from one angle of a problem to another. This is sometimes called creative insight.

A classic example is that of the highway department trying to keep kids from skateboarding in a concrete-lined drainage ditch. The highway department put up a fence to keep the kids out; the kids went around it. The department then put up a longer fence; the kids cut a hole in it. The department then put up a stronger fence; it, too, was cut. The department then put a threatening sign on the fence; it was ignored. Finally, someone decided to change direction, and asked, "What really is the problem here? It's not that the kids keep getting through the barrier, but that they want to skateboard in the ditch. So how can we keep them from skateboarding in the ditch?" The solution was to remove their desire by pouring some concrete in the bottom of the ditch to remove the smooth curve. The sharp angle created by the concrete made skateboarding impossible and the activity stopped. No more skateboarding problems, no more fence problems.

This example reveals a critical truth in problem solving: **the goal is to solve the problem, not to implement a particular solution.** When one solution path is not working, shift to another. There is no commitment to a particular path, only to a particular goal. Path fixation can sometimes be a problem for those who do not understand this; they become overcommitted to a path that does not work and only frustration results.

Negative Attitudes That Block Creativity

1. Oh no, a problem! The reaction to a problem is often a bigger problem than the problem itself. Many people avoid or deny problems until it's too late, largely because these people have never learned the appropriate emotional, psychological, and practical responses. A problem is an opportunity. The happiest people welcome and even seek out problems, meeting them as challenges and opportunities to improve things.

Definition: a problem is (1) seeing the difference between what you have and what you want or (2) recognizing or believing that there is something better than the current situation or (3) an opportunity for a positive act. Seeking problems aggressively will build confidence, increase happiness, and give you a better sense of control over your life.

2. It can't be done. This attitude is, in effect, surrendering before the battle. By assuming that something cannot be done or a problem cannot be solved, a person gives the problem a power or strength it didn't have before. And giving up before starting is, of course, self fulfilling. But look at the history of solutions and the accompanying skeptics: man will never fly, diseases will never be conquered, rockets will never leave the atmosphere. Again, the appropriate attitude is summed up by the statement, "The difficult we do immediately; the impossible takes a little longer."

3. I can't do it. Or There's nothing I can do. Some people think, well maybe the problem can be solved by some expert, but not by me because I'm not (a) smart enough, (b) an engineer, or (c) a blank (whether educated, expert, etc.) Again, though, look at the history of problem solving.

Who were the Wright brothers that they could invent an airplane? Aviation engineers? No, they were bicycle mechanics. The ball point pen was invented by a printer's

proofreader, Ladislao Biro, not a mechanical engineer. Major advances in submarine design were made by English clergyman G. W. Garrett and by Irish schoolmaster John P. Holland. The cotton gin was invented by that well known attorney and tutor, Eli Whitney. The fire extinguisher was invented by a captain of militia, George Manby. And so on. In fact, a major point made by recent writers about corporate excellence is that innovations in industry almost always come from individuals (not research groups) outside of the area of the invention. General Motors invented Freon, the refrigeration chemical, and tetraethyl lead, the gasoline additive. Kodachrome was invented by two musicians. The continuous steel casting process was invented by a watchmaker (fooling around with brass casting). Soap making chemists turned down the problem of inventing synthetic detergents: those detergents were invented by dye making chemists. In a nutshell, a good mind with a positive attitude and some good problem solving skills will go far in solving any problem. Interest in and commitment to the problem are the keys. Motivation--a willingness to expend the effort--is more important than laboratory apparatus. And remember that you can always do something. Even if you cannot totally eradicate the problem from the face of the earth, you can always do something to make the situation better.

4. But I'm not creative. Everyone is creative to some extent. Most people are capable of very high levels of creativity; just look at young children when they play and imagine. The problem is that this creativity has been suppressed by education. All you need to do is let it come back to the surface. You will soon discover that you are surprisingly creative.

5. That's childish. In our effort to appear always mature and sophisticated, we often ridicule the creative, playful attitudes that marked our younger years. But if you solve a problem that saves your marriage or gets you promoted or keeps your friend from suicide, do you care whether other people describe your route to the solution as "childish?" Besides, isn't play a lot of fun? Remember that sometimes people laugh when something is actually funny, but often they laugh when they lack the imagination to understand the situation.

6. What will people think? There is strong social pressure to conform and to be ordinary and not creative.

Here are some overheard examples:

Creative Person: "I like to put water in my orange juice so it's less sweet." **Ordinary**

Person: "You're weird, you know?"

Ordinary Person: "What are you doing?" **Creative Person:** "We're painting our mailbox." **Ordinary Person:** "You're crazy."

Creative Person: "Why don't we add a little garlic?" **Ordinary Person:** "Because the recipe doesn't call for garlic."

Ordinary Person: "Why are you going this way? It's longer." **Creative Person:** "Because I like the drive." **Ordinary Person:** "Did anyone ever tell you you're strange?"

The constant emphasis we see in society is toward the ruthlessly practical and conformist. Even the wild fashions, from those in Vogue to punk rock, are narrowly defined, and to deviate from them is considered wrong or ridiculous. Some peoples' herd instinct is so strong that they make sheep look like radical individualists.

So, what will people think? Well, they're already talking about you, saying that your nose is too big or your shoes are funny or you date weird people. So, since others are going to talk about you in unflattering ways anyway, you might as well relax and let your creativity and individualism flow.

Almost every famous contributor to the betterment of civilization was ridiculed and sometimes even jailed. Think about Galileo. And look what happened to Jesus.

Quotation: "Progress is made only by those who are strong enough to endure being laughed at." Solutions are often new ideas, and new ideas, being strange, are usually greeted with laughter, contempt, or both. That's just a fact of life, so make up your mind not to let it bother you. Ridicule should be viewed as a badge of real innovative thinking.

7. I might fail. Thomas Edison, in his search for the perfect filament for the incandescent lamp, tried anything he could think of, including whiskers from a friend's beard. In all, he tried about 1800 things. After about 1000 attempts, someone asked him if he was frustrated at his lack of success. He said something like, "I've gained a lot of knowledge--I now know a thousand things that won't work."

Fear of failure is one of the major obstacles to creativity and problem solving. The cure is to change your attitude about failure. Failures along the way should be expected and accepted; they are simply learning tools that help focus the way toward success. Not only is there nothing wrong with failing, but failing is a sign of action and struggle and attempt--much better than inaction. The go-with-the-flow types may never fail, but they are essentially useless to humanity, nor can they ever enjoy the feeling of accomplishment that comes after a long struggle.

Suppose you let your fear of failure guide your risk taking and your attempts. You try only three things in a year because you are sure of succeeding. At the end of the year the score is: Successes 3, Failures 0. Now suppose the next year you don't worry about failing, so you try a hundred things. You fail at 70 of them. At the end of the year the score is Successes 30, Failures 70. Which would you rather have--three successes or 30--ten times as many? And imagine what 70 failures will have taught you. Proverb: *Mistakes aren't fun, but they sure are educational.*

Myths about Creative Thinking and Problem Solving

1. Every problem has only one solution (or one right answer). The goal of problem solving is to solve the problem, and most problems can be solved in any number of ways. If you discover a solution that works, it is a good solution. There may be other solutions thought of by other people, but that doesn't make your solution wrong. What is THE solution to putting words on paper? Fountain pen, ball point, pencil, marker, typewriter, printer, Xerox machine, printing press?

2. The best answer/solution/method has already been found. Look at the history of any solution set and you'll see that improvements, new solutions, new right answers, are always being found. What is the solution to human transportation? The ox or horse, the cart, the wagon, the train, the car, the airplane, the jet, the SST? Is that the best and last? What about pneumatic tubes, hovercraft, even Star Trek type beams?

What is the best way to put words on paper? The word processor? Is that the last invention? How about voice recognition, or thought wave input?

On a more everyday level, many solutions now seen as best or at least entrenched were put in place hastily and without much thought--such as the use of drivers' licenses for ID cards or social security numbers for taxpayer ID numbers. Other solutions are entrenched simply for historical reasons: they've always been done that way. Why do shoe laces still exist, when technology has produced several other, better ways to attach shoes to feet (like velcro, elastic, snap buttons, and so on)?

3. Creative answers are complex technologically. Only a few problems require complex technological solutions. Most problems you'll meet with require only a

thoughtful solution requiring personal action and perhaps a few simple tools. Even many problems that seem to require a technological solution can be addressed in other ways. *For example, what is the solution to the large percentage of packages ruined by the Post Office? Look at the Post Office package handling method. Packages are tossed in bins when you send them. For the solution, look at United Parcel. When you send a package, it is put on a shelf. The change from bin to shelf is not a complex or technological solution; it's just a good idea, using commonly available materials. As another example, when hot dogs were first invented, they were served to customers with gloves to hold them. Unfortunately, the customers kept walking off with the gloves. The solution was not at all complex: serve the hot dog on a roll so that the customer's fingers were still insulated from the heat. The roll could be eaten along with the dog. No more worries about disappearing gloves. (Note by the way what a good example of changing direction this is. Instead of asking, "How can I keep the gloves from being taken?" the hot dog server stopped thinking about gloves altogether.)*

4. Ideas either come or they don't. Nothing will help. There are many successful techniques for stimulating idea generation. We will be discussing and applying them.

Mental Blocks to Creative Thinking and Problem Solving

1. Prejudice. The older we get, the more preconceived ideas we have about things. These preconceptions often prevent us from seeing beyond what we already know or believe to be possible. They inhibit us from accepting change and progress.

Example problem: How to connect sections of airplanes with more ease and strength than using rivets. A modern solution is to use glue--glue the sections together. We probably wouldn't think of this solution because of our prejudice about the word and idea of glue. But there are many kinds of glue, and the kind used to stick plane parts together makes a bond stronger than the metal of the parts themselves.

Another problem: How can we make lighter weight bullet proof windows? Thicker glass is too heavy. Answer: Use plastic. Again, we are prejudiced against plastic. But some plastics are not flimsy at all and are used in place of steel and in bullet proof windows.

Another problem: Make a ship's hull that won't rust or rot like steel or wood. Solution: Use concrete. Our prejudice is that concrete is too heavy. Why not make lightweight concrete? That's what's done.

Final example: How to divide a piece of cake equally between two kids so they won't complain that one kid is preferred over the other: "You gave him the bigger piece; you like him better! Waaaah!" Solution: Put the kids in charge of dividing the cake. Our prejudice is that immature, selfish kids can't do the job. But the solution, one cuts the cake, the other has first choice of pieces, works very well.

2. Functional fixation. Sometimes we begin to see an object only in terms of its name rather in terms of what it can do. Thus, we see a mop only as a device for cleaning a floor, and do not think that it might be useful for clearing cobwebs from the ceiling, washing the car, doing aerobic exercise, propping a door open or closed, and so on. (Later on in the semester, we will be doing "uses for" to break out of this fixation.)

There is also a functional fixation of businesses. In the late nineteenth and early twentieth centuries the railroads saw themselves as railroads. When automobiles and later airplanes began to come in, the railroads didn't adapt. "That's not our business," they said. But if they had seen themselves as in the people transportation business rather than in the railroad business, they could have capitalized on a great opportunity. *Similarly, when the telephone began its rise, some of the telegraph companies said, "That's not our business; we're telegraph companies." But if they had said, "Hey, we're*

in the communication business, and here's a new way to communicate," they would have grown rather than died. Compare Western Union to AT&T. And have you heard of those big calculator companies Dietzgen or Pickett? No? Well, they were among the biggest makers of slide rules. But when electronic calculators began to rise, they didn't know what business they were in. They thought they were in the slide rule business, when they were really in the calculator business. They didn't adapt, they didn't accept the challenge of change and opportunity, and they fell.

And there's a functional fixation of people, too. Think a minute how you react when you see your pastor mowing his lawn, or your auto mechanic on a television show promoting a book. Stereotyping can even be a form of functional fixation--how many people would laugh at a blonde quoting Aristotle? Too often we permit only a narrow range of attitudes and behaviors in other people, based on bias, prejudice, hasty generalization, or limited past experience. Think of those statements like, "I can't believe he said that," or "Imagine her doing that," and so on. But recall the proverb, "The goal of my life is not to live down to your expectations."

3. Learned helplessness. This is the feeling that you don't have the tools, knowledge, materials, ability, to do anything, so you might as well not try. We are trained to rely on other people for almost everything. We think small and limit ourselves. But the world can be interacted with.

If you are in need of information, there are libraries, bookstores, friends, professors, and, of course, the Internet. And there are also city, county, and state government agencies with addresses and phone numbers and web sites. There are thousands of government agencies that really exist and that will talk to you. Contact the EPA if you're working on air pollution or pesticides. Get some government publications. Call your state senator or federal congressman for help on bills, information, problems. Contact the manufacturer of a product to find out what you want to know about it.

If you are technologically poor, you can learn. Learn how to cook, use tools, make clothes, use a computer. You can learn to do anything you really want to do. All you need is the motivation and commitment. You can learn to fly an airplane, drive a truck, scuba dive, fix a car--name it.

4. Psychological blocks. Some solutions are not considered or are rejected simply because our reaction to them is "Yuck." But icky solutions themselves may be useful or good if they solve a problem well or save your life. Eating lizards and grasshoppers doesn't sound great, but if it keeps you alive in the wilderness, it's a good solution. Perhaps more importantly, what at first seem to be icky ideas may lead to better solutions--de-ickyfied analogues of the original. When doctors noted that some unsophisticated natives were using giant ant heads to suture wounds, they imitated this pincer-closing technique by inventing the surgical staple.

Psychological blocks prevent you from doing something just because it doesn't sound good or right, which is a pretty ridiculous thing. Overcoming such blocks can be really beneficial. Navy commandos in Vietnam overcame their blocks and put on women's panty hose when they marched through the swamps and jungle. The pantyhose cut down on the friction and rubbing from the plants and aided in removing the dozens of leeches after a mission. Overcoming the block to using your own blood to write a help note could save your life someday if you got kidnapped.

Positive Attitudes for Creativity

1. Curiosity. Creative people want to know things--all kinds of things-- just to know

them. Knowledge does not require a reason. The question, "Why do you want to know that?" seems strange to the creative person, who is likely to respond, "Because I don't know the answer." Knowledge is enjoyable and often useful in strange and unexpected ways.

For example, I was once attempting to repair something, without apparent success, when an onlooker asked testily, "Do you know what you're doing?" I replied calmly, "No, that's why I'm doing it."

Next, knowledge, and especially wide ranging knowledge, is necessary for creativity to flourish to its fullest. Much creativity arises from variations of a known or combinations of two knowns. The best ideas flow from a well equipped mind. Nothing can come from nothing.

In addition to knowing, creative people want to know why. What are the reasons behind decisions, problems, solutions, events, facts, and so forth? Why this way and not another? And why not try this or that?

The curious person's questioning attitude toward life is a positive one, not a destructive one reflecting skepticism or negativism. It often seems threatening because too often there is no good reason behind many of the things that are taken for granted--there is no "why" behind the status quo.

So ask questions of everyone. Ask the same question of different people just to be able to compare the answers. Look into areas of knowledge you've never before explored, whether cloth dying, weather forecasting, food additives, ship building, the U.S. budget, or the toxicity of laundry detergents.

2. Challenge. Curious people like to identify and challenge the assumptions behind ideas, proposals, problems, beliefs, and statements. Many assumptions, of course, turn out to be quite necessary and solid, but many others have been assumed unnecessarily, and in breaking out of those assumptions often comes a new idea, a new path, a new solution.

For example, when we think of a college, we traditionally think of a physical campus with classrooms, a library, and some nice trees. But why must college be a place (with congregated students and faculty) at all? Thus, the electronic college now exists, where students "go" to college right at home, online. Correspondence courses have existed for years, too, beginning with the challenging of the school-as-centralized-place idea.

When we think of an electric motor, we *automatically* think of a rotating shaft machine. But why assume that? Why can't an electric motor have a linear output, moving in a straight line rather than a circle? With such a challenged assumption came the linear motor, able to power trains, elevators, slide locks, and so on.

Problem: We make brandy, and for this special edition of our finest kind, we want a fully-grown pear in one piece inside each bottle. The bottle is narrow necked. How can we do it? As you think, watch for the assumptions you are making. Possible solutions (assuming fully grown pear): close the neck or bottom after insertion, use a plastic bottle like heat-shrink tubing, change to a wide mouth bottle. If we do not assume a fully grown pear: grow the pear from a bud inside the bottle.

3. Constructive discontent. This is not a whining, griping kind of discontent, but the ability to see a need for improvement and to propose a method of making that improvement. Constructive discontent is a positive, enthusiastic discontent, reflecting the thought, "Hey, I know a way to make that better."

Constructive discontent is necessary for a creative problem solver, for if you are happy with everything the way it is, you won't want to change anything. Only when you

become discontent with something, when you see a problem, will you want to solve the problem and improve the situation.

One of the hallmarks of the constructively discontented person is that of a problem seeking outlook. The more problems you find, the more solutions and therefore improvements you can make. Even previously solved problems can often be solved again, in a better way. A constructively discontent person might think, "This is an excellent solution, but I wonder if there isn't another solution that works even better (or costs less, etc)."

Another mark of constructive discontent is the enjoyment of challenge. Creative people are eager to test their own limits and the limits of problems, willing to work hard, to persevere and not give up easily. Sometimes the discontent is almost artificial--they aren't really unhappy with the status quo of some area, but they want to find something better just for the challenge of it and the opportunity to improve their own lives and those of others.

4. A belief that most problems can be solved. By faith at first and by experience later on, the creative thinker believes that something can always be done to eliminate or help alleviate almost every problem. Problems are solved by a commitment of time and energy, and where this commitment is present, few things are impossible.

The belief in the solvability of problems is especially useful early on in attacking any problem, because many problems at first seem utterly impossible and scare off the fainter hearted. Those who take on the problem with confidence will be the ones most likely to think through or around the impossibility of the problem.

5. The ability to suspend judgment and criticism. Many new ideas, because they are new and unfamiliar, seem strange, odd, bizarre, even repulsive. Only later do they become "obviously" great. Other ideas, in their original incarnations, are indeed weird, but they lead to practical, beautiful, elegant things. Thus, it is important for the creative thinker to be able to suspend judgment when new ideas are arriving, to have an optimistic attitude toward ideas in general, and to avoid condemning them with the typical kinds of negative responses like, "That will never work; that's no good; what an idiotic idea; that's impossible," and so forth. Hospital sterilization and antiseptic procedures, television, radio, the Xerox machine, and stainless steel all met with hohums and even hostile rejection before their persevering inventors finally sold someone on the ideas.

Some of our everyday tools that we now love and use daily, were opposed when they were originally presented: Aluminum cookware? No one wants that. Teflon pans? They'll never sell. Erasers on pencils? That would only encourage carelessness. Computers? There's no market for more than a few, so why build them?

Remember then that (1) an idea may begin to look good only after it becomes a bit more familiar or is seen in a slightly different context or clothing or circumstance and (2) even a very wild idea can serve as a stepping stone to a practical, efficient idea. By too quickly bringing your judgment into play, these fragile early ideas and their source can be destroyed. The first rule of brainstorming is to suspend judgment so that your idea-generating powers will be free to create without the restraint of fear or criticism. You can always go back later and examine--as critically as you want--what you have thought of.
Proverb: "A crank is a genius whose idea hasn't yet caught on."

6. Seeing the good in the bad. Creative thinkers, when faced with poor solutions, don't cast them away. Instead, they ask, "What's good about it?" because there may be

something useful even in the worst ideas. And however little that good may be, it might be turned to good effect or made greater.

Example problem: How can we get college students to learn grammar better? Solution: Spank their bottoms with a hickory stick. This isn't a good solution, partly because it's probably illegal. But should we just toss it out? Why not ask what's good about it? (1) it gives individual, attention to the poor performers, (2) it gives them public attention, (3) it motivates other students as well as the student being spanked, (4) it's easy and costs nothing. The next question is, Can we adapt or incorporate some of these good things into a more acceptable solution, whether derivative of the original or not?

We easily fall into either/or thinking and believe that a bad solution is bad through and through, in every aspect, when in fact, it may have some good parts we can borrow and use on a good solution, or it may do inappropriately something that's worth doing appropriately. And often, the bad solution has just one really glaring bad part, that when remedied, leaves quite a good solution. In the above example, changing the physical spanking to a verbal spanking changes the entire aspect of the solution while keeping all the good points we identified.

7. Problems lead to improvements. The attitude of constructive discontent searches for problems and possible areas of improvement, but many times problems arrive on their own. But such unexpected and perhaps unwanted problems are not necessarily bad, because they often permit solutions that leave the world better than before the problem arose.

For example, the first margarine was made from beef fat, milk, water, and chopped cow udder. It wasn't extremely tasty or healthy. Then about the turn of the century a shortage of beef fat created a problem. What to use? The margarine makers turned to vegetable fats from various plants and the soybean, corn, and sunflower oils they used are still used today. The margarine is healthier and tastes better.

Or think about exams or papers. When you don't do as well as you want, you think, "Oh no!" But actually, you have a good insight into what you don't know and still need to learn. You are aware of the geography of your knowledge in a much more detailed form than before the errors showed up.

8. A problem can also be a solution. A fact that one person describes as a problem can sometimes be a solution for someone else. Above we noted that creative thinkers can find good ideas in bad solutions. Creative thinkers also look at problems and ask, "Is there something good about this problem?"

For example, soon after the advent of cyanoacrylate adhesives (super glue), it was noted that if you weren't careful, you could glue your fingers together with it. This problem--a permanent skin bond--was soon seen as a solution, also. Surgeons in Viet Nam began to use super glue to glue wounds together.

Another example, also involving glue: 3M chemists were experimenting with adhesives and accidentally came up with one that was so weak you could peel it right back off. Hold strength, shear strength, all were way below the minimum standards for any self-respecting adhesive. A glue that won't hold? Quite a problem. But this problem was also a solution, as you now see in Post-It Notes.

9. Problems are interesting and emotionally acceptable. Many people confront every problem with a shudder and a turn of the head. They don't even want to admit that a problem exists--with their car, their spouse, their child, their job, their house, whatever. As a result, often the problem persists and drives them crazy or rises to a crisis and drives them crazy.

Creative people see problems as interesting challenges worth tackling. Problems are not fearful beasts to be feared or loathed; they are worthy opponents to be jostled with and unhorsed. Problem solving is fun, educational, rewarding, ego building, helpful to society.

Miscellaneous Good Attitudes

1. Perseverance. Most people fail because they spend only nine minutes on a problem that requires ten minutes to solve. Creativity and problem solving are hard work and require fierce application of time and energy. There is no quick and easy secret. You need knowledge gained by study and research and you must put your knowledge to work by hard thinking and protracted experimentation. You've surely read of the difficulties and setbacks faced by most of the famous inventors--how many filaments Edison tried before he found a working one, how many aircraft designs failed in the attempt to break the sound barrier. But planning to persevere is planning to succeed.

2. A flexible imagination. Creative people are comfortable with imagination and with thinking so-called weird, wild, or unthinkable thoughts, just for the sake of stimulation. During brainstorming or just mental playfulness, all kinds of strange thoughts and ideas can be entertained. And the mind, pragmatist that it is, will probably find something useful in it all. We will look at several examples of this later on.

3. A belief that mistakes are welcome. Modern society has for some reason conceived the idea that the only unforgivable thing is to fail or make a mistake. Actually failure is an opportunity; mistakes show that something is being done. So creative people have come to realize and accept emotionally that making mistakes is no negative biggie. One chief executive of a big American corporation warns all his newly hired managers, "Make sure you make a reasonable number of mistakes." Mistakes are educational and can lead to success--because they mean you are doing something. *Sir Francis Pettit Smith, one of the early developers of the screw propeller, tried one design in 1836. During the test, half of it broke off--what a failure--but then the boat increased in speed substantially, revealing the efficiency of a new design, formed from a mistake.*

In sum, as Vergil once said, "They can who think they can." Having the proper positive attitude about generating new and useful ideas and solving problems is really a large part of the whole process.

A few years ago, the pipes in my mom's house had finally rusted through and I was faced with the task of finding a plumber to get a bid. Knowing how much they charge for small repairs, I knew that doing a whole house would cost a fortune. I thought, "You know, I'd really like to do this job myself, but I wonder if I can." My neighbor happened to be around once when I said this, and he said, "Oh, you can do it." Just that simple expression gave me the positive attitude I needed to do it. So I did.

Characteristics of the Creative Person

curious

seeks problems

enjoys challenge

optimistic

able to suspend judgment

comfortable with imagination

sees problems as opportunities

sees problems as interesting
 problems are emotionally acceptable
 challenges assumptions
 doesn't give up easily: perseveres, works hard

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historical notes December, 1951

CREATIVE THINKING by J. R. Pierce

I have been asked to talk to you about creative thinking. While I am glad to do this, I feel some trepidation about discussing a non-technical subject, and I think I should tell you why.

It seems to me that engineering and science are sharply set apart from all other fields of human activity. If I tell you that a certain theory predicts the behavior of electrons or neutrons, or that a network designed in such and such a way will have such and such properties, you can check my statements by observing the particles or by testing the network. In contrast, even a historian or a witness to an event can offer you only his documents or his word to testify that what he recounts actually happened. You can't check by making an experiment. When one deals, as I shall, with surmises about partially-known experiences and events, you will be still farther from being able to verify what I say. If I put forth an idea as being plausible, you should be forewarned that people in other times and other places have found witchcraft and astrology to be plausible, and a host of other things which we regard as ridiculous. If I pose as an expert in creative thinking or as an authority on creative thinking, I should at least warn you that I have heard people whose individual actions and decisions I respect greatly give forth generalizations and analyses for which I had much less respect.

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Although I talk with some trepidation, I have no real pangs of conscience. I will be honest and thoughtful to the best of my ability, and I have warned you. Thus, despite my doubts, I shall thoroughly enjoy talking about creative thinking. People like to discuss ill-understood problems which seem more "human" and more "profound" than the technical details of engineering and science. I hope that some day someone will be able to talk about creative thinking in a sounder way than I am able to, but he will probably get less pleasure from his science than I shall from my fancy.

The other part of my trepidation has another cause. Suppose that what I say is true and wise and constitutes good advice. What is the use of saying it? Through a good while at the Bell Laboratories I have seen certain people, figuratively, of course, hitting themselves on the heads with hammers, sawing off their noses, trying to walk through brick walls, riding off rapidly in all directions at once, lying under the flapdoodle trees waiting for the fruit to fall in their mouths, and generally behaving in what seem to me uninstructed if not irrational manners. Surely, someone must have told them better.

Sometimes I've tried to myself. Yet year after year they pursue the same courses. What good does it do to tell people non-technical things, anyway?. You may be able to persuade a man to add 2 and 2 and get 4 rather than 5, but can his conduct in more general matters be influenced? I don't know, and if it can't, maybe that is a good thing. In any event, I

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don't intend to let this doubt as to the utility of what I say dull my pleasure in saying it. With these warnings and explanations, I propose to tell you how I feel about creative thinking. Don't believe me if you don't want to. Don't expect to get much good out of what I say. I hope it gives you some pleasure.

I think the words of the subject deserve a little attention, although I don't intend to give them a precise meaning. I think of creative thinking as referring to the fact that something has been created through thought. In our case, it may be a physical theory; the understanding of a class of phenomena; it may be an invention; it may be a way of getting around a difficulty; it may be an overall or a detailed design for a communication system. What I want to do is to distinguish creative from original and especially from bizarre or novel. To me, creative thinking produces something substantial and reasonably permanent, something which may be understanding, art, or a piece of equipment.

Now, not all substantial accomplishments are the results of thinking. A dictator may have a whole class of people liquidated; an executive may order that no one with more than ten years' service shall achieve district status. The results produced in such cases can be substantial and reasonably permanent, but thinking is not necessarily involved. In considering creative thinking, I associate thinking with that ordered progress which we see so clearly in engineering

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and science and which we may find lacking in many other fields of human endeavor. In navigation, the quadrant marks a clear advance over the astrolabe, and the sextant marks an even greater advance over the quadrant. A vacuum tube of today is just plain better than a vacuum tube of 1920, and the same thing is true of today's refrigerator. Today, through wave mechanics, we understand things about the motions of electrons and about the constitution of atoms which were completely hidden from us thirty years ago.

In engineering and science, progress is evident in a series of steps, each of which adds to what we already know or to what we already have done or can do. It is a great part of the satisfaction of one who works in these fields to contribute to this progress. It is of this progress, this adding to our technical capabilities and knowledge, that I associate the words creative thinking,

When I think back over fifteen years at the Bell Laboratories and consider the examples of creative thinking which I have seen, one thing which strikes me most forcibly is the variety of people who have added to our technical capabilities and knowledge, and the variety of ways in which they have done this creative thinking. People are widely different and sometimes exasperatingly different. Moreover, the difference is not so much that some people can do one job and others can't; it is that some people will do a job in one manner and others in

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another. When we add the fact that there are many ways to achieve a particular piece of creative thinking to the fact that there are many sorts of creative thinking to be done, generalization becomes very difficult and it is perhaps best to turn to particular examples.

As one rather extreme case, I know a man at the Bell Laboratories who has a record of turning up one good thing after another. One can describe his field roughly by saying that he works on small component parts. He works in a diversely equipped laboratory and shop, with the aid of a technical assistant, and there he not only invents devices and processes, but he makes samples and even whole lots for other people to work with.

I find this man a very puzzling phenomenon. He works with devices and processes which to me seem bewilderingly complex. Of all the multitude of things which he might try, he has some way of hitting on the right things, time after time. He must have some guiding principle of creative thinking which helps him. I find this particularly striking because I have talked with him about his work repeatedly, and I have never got the slightest clue to his way of thinking.

I suppose that the uninitiated might say that anyone messing around in a laboratory will come up with something new and useful. Experience shows that this just isn't so. For experimental work to be fruitful, there must be choice as to what is tried and the results of experiments must be evaluated.

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It is clear that the man of whom I am speaking is doing creative thinking of a high order. The fact that I cannot fully understand the nature of his creative thinking shows a lack in me, not in him.

Does this man represent an important aspect of creative thinking? I know several men around the Bell Laboratories who are much like this. But even more important, I think that the thing on which the man I have described relies so strongly helps many of us in some lesser degree. I think I could even cite a homely example of this.

Once upon a time a man started to build an elaborate oscilloscope. When it was almost complete and was working in a halting fashion, he left the Bell Laboratories and went to work for Hughes, where he lived happily ever after. The oscilloscope was turned over to a T.A. for debugging. Instead of improving, the device suffered a series of relapses until it wouldn't function at all. At this point it was turned over to another T.A., who is now a T.S.A, by the way. The oscilloscope took a miraculous upturn and was working well in a week or so. In my estimation, this showed at least some creative thinking on the part of the TA.

We can describe the sort of thinking I have been discussing by a name if we wish: intuition; skill; art. I am even willing to speculate on its ingredients. Partly, I think it grows through long familiarity. A boy who plays with Erectors and graduates through hot rods will acquire a feel

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for things mechanical. He learns by some informal and partly unconscious process. For such learning, I think that both interest and long acquaintance are necessary. I believe that something else is necessary as well; innate ability.

This type of intuitive thinking is extremely valuable. How are we to get enough of it? I can't give any directions for teaching it or practicing it; I think that we can only recognize it where it occurs and value it highly. We must to some extent take it as it is. In the fairy story, the man killed the goose that laid the golden egg in a foolish investigation of the source. Intuitive thinkers must be treated tenderly if they are to continue to function. One might even extend the parallel, and invent a man who despised the goose because it couldn't tell how it made the golden egg. In this connection, I can only drag up two old saws; "gold is where you find it"; and, with some possible confusion of thought, "don't look a gift horse in the mouth."

Because I have praised and valued intuitive thinking, even in extreme forms, you may wonder whether I am advising you to practice it. The answer is, not unless you can. I do say, by no means despise it. A device can be good, an invention can be valuable even when its author cannot explain it to another's satisfaction, But for heaven's sake, don't try this approach unless you know by experience that you are good at it.

Let us turn to another sort of creative thinking. I know one man who sits in an office and makes marks on pieces

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of paper. He thinks about other people's experiments. He makes up mathematical theories which purport to tell, in terms of known physical laws, what ought to happen when experiments are performed. He analyzes experimental results and tries to find out what caused them. He can explain to any competent man in detail just what he has done and why he did it, although one may still wonder what inspired him to do it.

Is this man's thinking a mere gloss on someone else's work; is it only an explanation of what we already know? No, it is not. Sometimes this man finds that other's ideas about things are just wrong-headed and misleading. In such cases he clears up their confusion and reorients their thinking and their work. In other cases he foresees consequences which others have not thought of. When he formulates problems in mathematical form they become simpler and less puzzling, and he can foresee necessary consequences which would escape one who thought in looser terms. Such a man can make discoveries and inventions; these are not reserved for the intuitive experimenter.

Such theoretical workers provide the backbone, the skeletal structure of engineering and science, without which these fields would collapse into an amorphous mass of unrelated devices and facts. Without them we would not have that clear and steady progress in art and understanding which distinguishes engineering and science from other fields of human endeavor,

Do I advise all of you to become theorists? There is something to be said for this in a small way at least, for we

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know what the tools are. As opposed to an intuitive appreciation of things, physics and mathematics can be taught by fairly straightforward methods. But, this is not necessarily true of the ability to use them. I have known people with a good knowledge of physical laws, with an extensive knowledge of mathematics and with considerable skill in its manipulation who simply didn't know what to do with their knowledge. Such people either can't get started on a problem, or else they get hopelessly bogged down in

details. Certainly, you shouldn't learn more mathematics and theory than you can digest, make your own, and use effectively.

I have described two extreme sorts of people whom I have met; very intuitive men who accomplish experimental results no one knows how, and theorists who proceed by consistent and well ordered reasoning. Of course, most of us have some of each of these qualities. I am thinking at the moment of two people who as nearly as I can see get their good ideas while carrying out experiments; they are prompted to creative thinking chiefly through the behavior of the apparatus they work with. Yet, each of these men is quite capable of expressing what he has done in clear-cut, even mathematical, terms. I think also of a mathematician who with his own hands builds machines and gadgets embodying his ideas.

I believe that this mixture of experimental insight and theoretical understanding is perhaps the most successful equipment for creative thinking. The virtue of experiment is

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that, however complex the situation, nature always knows the right answer, by definition, of course. Anyone who works in a laboratory continually encounters unexpected phenomena, and some of these the creative thinker can recognize, foster and turn to use.

On the other hand, theoretical or analytical ability can in itself be both a guide to understanding new phenomena and a means for deducing something useful from something which might otherwise be merely new and puzzling.

What I have said so far has been about types of people and their methods of tackling problems. The problems themselves are worthy of consideration. Under what circumstances do people exercise their power of creative thought? How do new ideas and things arise? Here I would like to cite a particular, minor, personal example, and I will follow it with others.

Over ten years ago I was working on a type of tube using an electron beam. No one had a method of design which took space-charge into account and produced a gun of predictable properties. I worried about the matter for some time and finally I thought of a means of design. I spent quite a while working this out theoretically and convincing myself and others that it was sound. Then I wrote a paper describing it and published it in the *Journal of Applied Physics*. Certainly, something was created here, for I have found that practically everyone who works with dense electron beams makes use of my work.

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In this case the thing which was created was really a published article which helped other people to design electron guns. The tube I was working on never came to anything. The bare idea of the gun wasn't the end product, for I later found that a friend of mine had speculated about the same idea, but he hadn't worked it out or written about it.

One moral I would like to draw from this illustration is that any challenging job can be a spur to creative thinking. I didn't set out to do something new or something clever; I was forced to think by being faced with a problem which I took seriously and wanted to solve.

Of course, to serve as a stimulus a job must be a real and an interesting challenge to the man who works on it. Some men seem to find no challenge in fields they haven't

read about in the newspapers or heard commended in college. I think that this is unfortunate and worth thinking about.

Surprisingly interesting things can come out of jobs which may seem very prosaic. Claude Shannon's application of Boolean algebra to switching problems may seem to some more interesting than the original problems. Shannon's work on communication theory might provide another example. From what I know, this was inspired by some discussions of novel ways of modulation such as mixtures of amplitude and phase modulation, and finally pulse-code modulation, Today, communication theory is a broad field related to physics, psychology and I don't know

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what all. I myself have been led to far and interesting fields in connection with traveling-wave tubes, yet as far as I am concerned, as much as anything this arose through repeated insistence on the part of Ralph Bown that resonant circuits limit the bandwidth of vacuum tube amplifiers and that someone should do something about it.

I have said that work on a challenging job can inspire creative thinking, but you will note that an initial inspiration is not enough; one must do something about his insights and ideas in order to create anything. In the case of the new means for designing an electron gun, I at least worked out some of the ideas and published a paper, while a friend who had the same general ideas but less interest in the matter did nothing. Ideas which are not developed and carried to some conclusion become as if they never had been. The process of creative thinking can easily be interrupted before anything is really created, and in such cases whatever time and effort have been expended are totally lost.

Some simple, isolated ideas can be worked out and given physical form or published by one man in a short time. In other cases the process of creation is long and necessarily involves many people. I think particularly about some aspects of the L3 carrier development, and about the work that led to the 416A microwave triode.

An example drawn from the L3 development is the application of quality control and statistical methods to every

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vital component used in the system and to the system as a whole. For one thing, this meant that everyone working directly on the project had to keep continually in mind the meaning and details of this approach. For another thing, those who worked directly on the project had to cooperate closely with groups which produced components such as, for example, vacuum tubes. For the first time, specifications were put on all tube parameters affecting system performance, and for the first time tolerances were set on the basis of control limits of a process which was known to be in control.

I am in no position to go into further details here, but the point is that this seemingly simple idea of applying quality control in system design could be called into real existence only through persistent work over a period of years by a whole group of people.

Another example is provided by the development of the 416A triode. The original and startling germ of a creative idea was that after all these years a triode might still be the best amplifier for microwaves, if only the spacing were close enough and the grid fine enough. An auxiliary idea was that close enough spacings could be attained and held by

grinding the cathode and a surrounding ceramic co-planar, and then supporting the grid from the ceramic. These were, however, mere germs of an idea. Something real and complete was brought into existence only after years of concentrated effort, including the inauguration of a program of cathode studies which is still being pursued for other purposes.

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My position so far has been that one needs some ability, intuitive or theoretical, and preferably both, for creative thinking. Frequently, one needs the inspiration of working hard on a job. One further needs the persistence to bring an idea into real being. There is, of course, more than this: one needs the right environment; the right job.

I believe that there are certain general specifications which an environment should meet to foster creative thinking. For one thing, a man should get credit, encouragement and reward if he does produce good, new things. He should feel that his supervisor is helping him and advertising his success, not competing with him or exploiting him. If the man is in a position to exploit his idea himself, he should be allowed to; if it must be turned over to someone else, the originator should get his fair share of credit. In any event, he should be encouraged to publish what he has done, for his own good and for the good of the Bell Laboratories.

For another thing, a man should not be plagued with any irrelevant matters which he can be spared. It is hard enough for him to keep the technical part of a job in hand and to take care of his personal relations with other technical men. To encounter red tape or inefficiency or inadequacy in purchasing, in shops, in space allocations and changes, in personnel matters, and, especially, in interdepartmental relations cannot help but have a bad effect.

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What about actual physical working arrangements? Some of the best work of which I know has been done in gloomy, dirty, noisy and even crowded university laboratories. This of course shows a certain triumph of the intellectual or spiritual over the physical, and indeed I believe that the matters I have mentioned a little earlier are much more important than are physical surroundings.

It seems to me reasonable that one should have good physical surroundings if his employers can afford them. Some people may be sensitive to noise, and why should a laboratory or an office be noisy? Some people may be sensitive to heat, and air conditioning is nice if one can afford it. Personally, except for some cases in which certain standards are set by technical requirements of special jobs, I regard the nature of surroundings as something to be chosen more with regard to custom, decency, and respect for people as human beings, than with regard to their influence on quality or quantity of work. If I were to make a personal choice as to surroundings, I would like most of all authority to change and arrange them to suit convenience, without regard to general plans or rules. I think that this is something which can easily be overlooked by people who no longer do laboratory work.

These general matters of satisfactory supervision, satisfactory facilities and, perhaps, suitable physical surroundings, I believe to be very important. I think that for most people the specific nature of the job they are asked to do is of

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less importance. A person with some intuitive grasp of engineering and an understanding of some basic physical laws and mathematics can tackle almost any engineering problem and do creative work, granted the right general atmosphere. There are, of course, exceptions. I believe that highly exceptional people who have to be carefully fitted to a particular field or job are in the minority. I have no trouble thinking of examples, however; people who succeeded after changing jobs where they had failed before, and people whom I cannot imagine doing anything very much different from what they are doing now.

For instance, an extremely intuitive person who thinks with his hands in a laboratory is not the man to do long-range systems planning. He belongs in a niche by himself, in research or advanced development. A man with a really profound knowledge of mathematics and broad interests shouldn't be tied down to a single long-range project, where he will soon have contributed everything his particular talents have to offer. And, a small minority of workers seem to be real self-starters, who break into intellectual combustion spontaneously without the spur of a job and think truly profound thoughts. In their exceptional case, a set task is bad, rather than good, and they should not be burdened with demands or instructions.

On the other hand, for each of such exceptional people I have certainly seen at least one rather unsuccessful man who didn't like and didn't work very hard at a job of which he could have made something, but who longed for some other work, and in

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many cases for work which he could not do well. Occasionally such men do produce a stream of ideas outside of their field, but most often the ideas are not very good, because they don't strike at the heart of the problem, and the ideas are seldom worked out far enough to be anything but material for conversation.

Now I have talked about types of ability, about a job as an inspiration, about carrying ideas from a glimmering into real being, and about working conditions and jobs. You may believe that I have omitted the really vital point; granted some sort of ability, some sort of problem and reasonably satisfactory surroundings, how does one get the sort of idea that can really advance the art and put us on territory where we weren't before? One source of ideas which no one should overlook is the ideas of others. The world is full of half-born ideas; ideas that came too soon; ideas that were not fully appreciated by the men who had them; ideas that someone is trying to promote. I have got some of my very best ideas from other people, usually through personal contact or current publication. There must be many ideas in the technical literature of past years, but in my personal experience these have most often been turned up by the patent department to show that I hadn't invented something when I thought I had. As an example of an idea which I got from another, I will cite the traveling-wave tube. In this case, I saw in a device which was on the point of being abandoned as a solution for one problem potentialities which other people seem to have been blind to.

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Sometimes, however, one can't find what he wants by shopping around. How, then, does one get an idea when he is forced to have it himself? And how does he bring it from a germ of an idea into true being?

Happily, there is much more agreement on this than one might imagine. One gets new

ideas by inspiration or accident, and one tests, verifies and makes something of them by expert knowledge and hard work.

Let me tell the story of a couple of my ideas. I don't claim that they are very good ideas, but they are about as original as any I have ever had.

One evening W. B. Hebenstreit and I were working late at the Laboratories, on a book which, incidentally, never got written. We had been trying to deduce mathematically the effect on tube noise of the fact that an electron beam is made up of electrons with many velocities. Because many velocities were too much for our feeble mathematics, we considered a beam composed of electrons of two velocities only. We quickly deduced growing waves. The double-stream amplifier had been conceived. It came into being through further straightforward mathematical work and through experimental work by A. V. Hollenberg. Finally, alas, it was dropped because its alleged advantages came to appear illusory.

For a number of years I have been interested in communication theory. Because of this interest, I have repeatedly

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tried to concoct new and advantageous ways for encoding messages for transmission. Some two years ago I had been thinking a lot about systems with a random element, which have certain alleged general advantages. One day I was talking casually with Claude Shannon, and he described to me in a few words the system a worker outside of the Bell Laboratories had devised. I didn't pay much attention while he was talking, but something of what he had said stayed with me. Then, later in the day, I saw certain advantages of this new system. The next day I went to see Claude and told him that this was a fine idea. As I explained the advantages, he agreed, but he observed that the system I was describing wasn't the one he had told me about at all. I had invented a new system by listening carelessly and pursuing my own thoughts. Since then I have done a good deal of analytical work and further "inventing" in this connection and A.L.Hopper has made an experimental system. I still have hopes for this one.

While I had each of these ideas by accident, I had them only because I had been thinking for a long time in the general field and racking my brains for ways of doing things. Then, suddenly, there was an idea. Sometimes the idea or the glimmering of an idea comes in a less accidental manner, suddenly on the street as one did to the mathematician Henri Poincare, or at night in bed. But it doesn't come without adequate preparation. And, without adequate skill and considerable effort, nothing will come of the incomplete idea; inspiration and accident form only the starting point of creation, not its accomplishment.

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It is because of belief in this sort of genesis of inspiration that I feel that interest in and hard work on a job are more important than just what job it is. If your job poses problems, if you take them seriously, if your boss inspires and encourages you, then, granted even reasonable ability, inspiration will come, and if you follow the inspiration up with sound analysis and work you will have created something.

Now I will admit that there is one catch to this. Sometimes people have good ideas, or the germs of good ideas, outside of the field of their immediate work, There are several things which one can do in such a case.

One course is to write the idea down in your notebook, perhaps to get it patented if you

can, but to do nothing further. Some day, someone who really needs the idea in his work will have the idea independently and will really work it out. At this point you can flaunt your notebook and perhaps your patent in his face, his boss's face, your boss's face, and so on. Such behavior may give a lot of satisfaction to some people, but I don't see just what it accomplishes,

Another course is to seek out someone to whom you think the idea might be of use and to try to sell the idea to him, or rather, to give it to him. The important thing is to persuade him to take it. As a secondary consideration, you may write a memorandum, or a joint memorandum, or take out a patent if he insists.

Sometimes you can't sell an idea. If the idea still seems good to you, it is appropriate to state it clearly and as

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completely as you can in a memorandum and send it to all the people you think might make use of it. Or, you can go further and publish it.

Sometimes an idea will seem so good and attractive that you want to work on it yourself. If it's that good, your boss is likely to be impressed with it himself, and so will other people, and you will get a chance to work on it if you wish.

It seems to me that I have covered a lot of ground, and that I ought to give some sort of brief summary and drawing together of what I have said. I will make this very brief.

To me, creative thinking implies two things. First, something reasonably substantial and enduring must be created, whether this be embodied in a publication or a piece of apparatus. Second, something must be added to the body of engineering or science, something which can be clearly recognized as a step forward.

Creative thinking can proceed either from a logical approach to a problem, or through an intuitive grasp of it. In exceptional people the logical or the intuitive elements predominate very strongly. If you are one of these, you may succeed only in a rather special sort of job. With a moderate amount of both of these qualities you can do creative thinking in connection with almost any job, provided that you find the job challenging and that you aren't unduly distracted by non-technical or irrelevant matters. Things which make a job challenging are good general working conditions and a good boss who inspires you, and who sees that you get recognition and rewards.

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There is a large element of inspiration and accident in the genesis of creative ideas, but the inspiration doesn't come and the accidents don't happen to people unless they are prepared through hard work and hard thought.

Creative thinking doesn't end with the initial idea. Unless one checks and analyzes the idea and reduces it to an appropriate substantial form, which may be a publication or a physical device, nothing has been accomplished. Knowledge is what people know, not what they have surmised or forgotten. The ratio of inspiration and perspiration varies from creative idea to creative idea, but the perspiration is always there.

Finally, I might add that few satisfactions are so great for the effort spent, or so enduring, as that of having taken a real step ahead in engineering or science. In these pursuits progress is real, and it is recognized and appreciated by all the fraternity of workers. I believe that in no other field of human endeavor can the average worker achieve as secure and enduring a place through his creative accomplishments. Next to

good pay, this should be a considerable inspiration and satisfaction to us.

Historical Notes

This talk was discovered by my father, Herbert Anton Schneider, in his papers. He was at Bell Laboratories, Murray Hill, NJ when he heard it. He wrote '1952' on the top, so presumably he obtained the text January of that year. He sent me a copy.

John Pierce granted me permission to put the talk on the web with no restraints or copyright reservations.

The pages were scanned by a Microtek ScanMaker 4 on a Power Macintosh 7600/120 with OmniPage Pro 8.0 and then edited into html.

To retain the flavor of the original text, which was typewritten, I have kept it broken by the original pagination. I have made corrections indicated in the text. There were a handful of other changes. To avoid disrupting the flow but to keep a record since this is a historical document, I have put them into invisible HTML comments.

This document is at <http://www.lecb.ncifcrf.gov/~toms/pierce/creative.thinking.html>

I thank Denise Rubens for careful proofreading.

- Thomas Schneider

<http://www.lecb.ncifcrf.gov/~toms/>

Schneider Laborigin: 1999 May 4 updated: 1999 July 11

Creative Thinking Techniques

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You'll remember the five creative methods we discussed in the Introduction to Creative Thinking: **evolution, synthesis, revolution, reapplication, changing direction**. Many classic creative thinking techniques make use of one or more of these methods. Note in this section that the goal is to produce a good quantity and a good quality of new ideas and solutions so that the best ones may be chosen. Exactly how those ideas are generated is less important than the ideas themselves. Remember, *the goal is more important than the path*.

Brainstorming

Alex Osborn, advertising writer of the fifties and sixties, has contributed many very powerful creative thinking techniques. Brainstorming is probably the best known and certainly one of the most powerful. For a fuller treatment, see his book, *Applied Imagination*.

Brainstorming is an idea generating technique. Its main goals are (1) to break us out of our habit-bound thinking and (2) to produce a set of ideas from which we can choose. (No one wants to have a choice of only one product when buying detergent or cars, so why have a choice of only one solution when working on a problem?)

Basic Guidelines for Brainstorming

Brainstorming is useful for attacking specific (rather than general) problems and where a collection of good, fresh, new ideas (rather than judgment or decision analysis) are needed.

For example, a specific problem like how to mark the content of pipes (water, steam,

etc.) would lend itself to brainstorming much better than a general problem like how the educational system can be improved. Note, though, that even general problems can be submitted to brainstorming with success.

Brainstorming can take place either individually or in a group of two to ten, with four to seven being ideal. (Alex Osborn, brainstorming's inventor, recommends an ideal group size of twelve, though this has proven to be a bit unwieldy.) The best results are obtained when the following guidelines are observed:

1. Suspend judgment. This is the most important rule. When ideas are brought forth, no critical comments are allowed. All ideas are written down. Evaluation is to be reserved for later. We have been trained to be so instantly analytic, practical, convergent in our thinking that this step is very difficult to observe, but it is crucial. To create and criticize at the same time is like watering and pouring weed killer onto seedlings at the same time.

2. Think freely. Freewheeling, wild thoughts are fine. Impossible and unthinkable ideas are fine. In fact, in every session, there should be several ideas so bizarre that they make the group laugh. Remember that practical ideas very often come from silly, impractical, impossible ones. By permitting yourself to think outside the boundaries of ordinary, normal thought, brilliant new solutions can arise. Some "wild" ideas turn out to be practical, too.

For example, when the subway was being dug under Victoria station in London, water began seeping in. What are the ways to remedy this? Pumps, steel or concrete liners? The solution: freeze it. Horizontal holes were drilled into the wet soil and liquid nitrogen was pumped in, freezing the water until the tunnel could be dug and cemented.

We've already talked about gold plating electrical contacts. In another example, it's a fact that electric generators can produce more power if the windings can be kept cool. How would you cool them? Fans, air conditioned rooms? How about a wild idea? Make the electric windings out of copper pipe instead of wire and pump helium through them. That is what's actually done in some plants, doubling the output of the generators.

3. Tag on. Improve, modify, build on the ideas of others. What's good about the idea just suggested? How can it be made to work? What changes would make it better or even wilder? This is sometimes called piggybacking, hitchhiking, or ping ponging. Use another's idea as stimulation for your own improvement or variation. As we noted earlier, changing just one aspect of an unworkable solution can sometimes make it a great solution.

Example problem: How can we get more students at our school? Brainstorm idea: Pay them to come here. That sounds unworkable, but what about modifying it? Pay them with something other than money--like an emotional, spiritual, or intellectual reward or even a practical value-added reward like better networking or job contacts?

4. Quantity of ideas is important. Concentrate on generating a large stock of ideas so that later on they can be sifted through. There are two reasons for desiring a large quantity. First, the obvious, usual, stale, unworkable ideas seem to come to mind first, so that the first, say, 20 or 25 ideas are probably not going to be fresh and creative. Second, the larger your list of possibilities, the more you will have to choose from, adapt, or combine. Some brainstormers aim for a fixed number, like 50 or 100 ideas before quitting the session.

Practical Methodology

1. Choose a recorder. Someone must be put in charge of writing down all the ideas.

Preferably, the ideas should be written on a board or butcher papered walls so that the whole brainstorming group can see them. Lacking this, ideas should be put down on paper. In an ideal session, the recorder should be a non participant in the brainstorming session, since it's hard to be thoughtful and creative and write down everything at the same time. But in small sessions, the recorder is usually a participant, too.

For a one-person brainstorming session, using an idea map on a large piece of paper is useful. Butcher paper on the walls is good, too. (Large writing helps keep your ideas in front of you. In fact, some people have said that using 11 by 17 inch paper instead of 8.5 by 11 inch increases their creativity. Why not try it?)

2. Organize the chaos. For groups of more than three or four, have a moderator to choose who will offer an idea next, so that several people don't speak at once. The moderator should prefer those with ideas that tag onto previous ideas, then those with new ideas. If necessary the moderator will also remind members of the group not to inject evaluation into the session (in case a member tsks, sneers, says, "Oh, come on," and so forth).

3. Keep the session relaxed and playful. The creative juices flow best when participants are relaxed and enjoying themselves and feeling free to be silly or playful. Eat popcorn or pizza or ice cream or make paper airplanes or doodles while you work, even if the problem itself is deadly serious like cancer or child abuse. Don't keep reminding everyone that "this is a serious problem" or "that was a tasteless joke." As an aid to relaxation and a stimulation to creativity, it is often useful to begin with a ten-minute warm-up session, where an imaginary problem is tackled. Thinking about the imaginary problem loosens people up and puts them into a playful mood. Then the real problem at hand can be turned to. Some imaginary problem topics might include these:

- how to heat a house more efficiently
- how to light a house with a single light bulb
- how to improve your travel from home to work
- inventing a new game for the Olympics
- how to improve institutional food without increasing its cost

4. Limit the session. A typical session should be limited to about fifteen or twenty minutes. Longer than that tends to become dragging. You should probably not go beyond thirty minutes, though thirty is the "ideal" length recommended by Alex Osborn.

5. Make copies. After the session, neaten up the list and make copies for each member of the session. No attempt should be made to put the list in any particular order.

6. Add and evaluate. The next day (not the same day) the group should meet again. First, ideas thought of since the previous session should be shared (entered on the photocopied lists). Then the group should evaluate each of the ideas and develop the most promising ones for practical application.

During the evaluation session, wild ideas are converted to practical ones or used to suggest realistic solutions. The emphasis is now on analysis and real world issues.

Some brainstormers divide the ideas found to be useful into three lists:

A. Ideas of immediate usefulness. These are the ideas you will be able to use right now.
B. Areas for further exploration. These are ideas that need to be researched, followed up, thought about, discussed more fully, and so on.
C. New approaches to the problem. These are ideas that suggest new ways of looking at the situation.

Note here that evaluation does not take place on the same day as the brainstorming session. This fact keeps the idea session looser (no fear that evaluation is coming soon) and allows incubation time for more ideas and time for thinking about the ones

suggested.

Variations

1. Stop and Go. For stop and go brainstorming, ideas are generated for three to five minutes. Then the group is silent (and thinking) for three to five minutes. Then ideas are given out for another three to five. This pattern alternates for the entire session.

2. Sequencing. In this technique, the moderator goes in order from one member of the group to the next in turn or sequence. Each member gives whatever ideas he then has, and they are written down. If a member has no ideas, he just says, "Pass," and the next member responds. This movement in turn or around the table continues throughout the session. (Sequencing has been said to nearly double the number of ideas generated in a brainstorming session.)

Try It Yourself

Brainstorming. Choose one of the following problems for a brainstorming session. Generate at least 35 ideas for solving the problem. Then distill this list into at least three practical, effective ideas.

1. A new snack food
2. How to keep rowdy children quiet on a schoolbus
3. How to get more tourists into the United States
4. How compatible people can meet each other for romance
5. How to reduce hospital costs
6. How to reduce airport congestion and delays
7. A name for a new laundry detergent
8. How to keep your car keys safe at the beach
9. A new toy
10. A new electronic consumer product

Idea Generating Questions

Asking questions to stimulate curiosity and creativity has proven helpful for all kinds of endeavors, whether problem solving, product development, inventing, or communication. A written list of mind-stimulating questions is useful because it reminds us of approaches and possibilities that we otherwise would not have in mind. Yes, it is sometimes possible to be creative in a thorough and even orderly way.

Another of Alex Osborn's contributions to creative thinking is a special list of questions designed to spur creative interaction with ideas and things. His list has become a classic one. Not all questions apply to all ideas under consideration, but there will always be a few questions that stimulate thinking, regardless of what is being considered.

Osborn's Questions

Put to other uses? New ways to use as is? Other uses if modified?

Adapt? What else is like this? What other idea does this suggest? Does past offer parallel? What could I copy? Whom could I emulate?

Modify? New twist? Change meaning, color, motion, sound, odor, form, shape? Other changes?

Magnify? What to add? More time? Greater frequency? Stronger? Higher? Longer? Thicker? Extra value? Plus ingredient? Duplicate? Multiply? Exaggerate?

Minify? What to subtract? Smaller? Condensed? Miniature? Lower? Shorter? Lighter? Omit? Streamline? Split up? Understate?

Substitute? Who else instead? What else instead? Other ingredient? Other material? Other process? Other power? Other place? Other approach? Other tone of voice?

Rearrange? Interchange components? Other pattern? Other layout? Other sequence? Transpose cause and effect? Change pace? Change schedule?

Reverse? Transpose positive and negative? How about opposites? Turn it backward? Turn it upside down? Reverse roles? Change shoes? Turn tables? Turn other cheek?

Combine? How about a blend, an alloy, an assortment, an ensemble? Combine units? Combine purposes? Combine appeals? Combine ideas?

The Journalistic Six

These are the six key questions that journalism students are taught to answer somewhere in their news articles to make sure that they have covered the whole story. For creative thinkers, these questions stimulate thinking about the idea in question and allow approaches to it from various angles.

1. Who? (Actor or Agent) Who is involved? What are the people aspects of the problem? Who did it, will do it? Who uses it, wants it? Who will benefit, will be injured, will be included, will be excluded?

2. What? (Act) What should happen? What is it? What was done, ought to be done, was not done? What will be done if X happens? What went or could go wrong? What resulted in success?

3. When? (Time or Timing) When will, did, should this occur or be performed? Can it be hurried or delayed? Is a sooner or later time be preferable? When should the time be if X happens?

4. Where? (Scene or Source) Where did, will, should this occur or be performed? Where else is a possibility? Where else did the same thing happen, should the same thing happen? Are other places affected, endangered, protected, aided by this location? Effect of this location on actors, actions?

5. Why? (Purpose) Why was or is this done, avoided, permitted? Why should it be done, avoided, permitted? Why did or should actor do it? Different for another actor, act, time, place? Why that particular action, rule, idea, solution, problem, disaster, and not another? Why that actor, time, location, and not another?

6. How? (Agency or Method) How was it, could it be, should it be done, prevented, destroyed, made, improved, altered? How can it be described, understood? How did beginning lead to conclusion?

Historical Examination

These questions are especially useful for generating ideas for improving something (the evolutionary approach), but they also help to break thinking out of the evolutionary mode and put it into the revolutionary mode by returning the thinker to the origin and purpose of the idea or solution. By returning to the roots of the problem, a new vision can be created.

1. Essence. What is it? object, concept? What is it made of? What is its real, elementary nature? What are its parts? What is it like, unlike? (Similes and metaphors help in understanding abstractions). What is it related to? What are its various kinds, facets, shades? What is it a part of? Which part of it is unusual or outstanding? In what forms does it appear? Is it typical or atypical of its kind? What is it not? What is it opposed to? How is it different? What makes it different?

2. Origin. Where did it come from? How was it made or conceived or developed? What caused it? If an idea, how did it arise? Are its origins meaningful now? What makes it spread or multiply or gain adherents? What was the reason behind it? Is the reason still valid or useful? Why? Why not? Is it still needed? What influences it? Does it change? Can it, should it be changed, strengthened, eliminated? What could have prevented,

delayed, encouraged it?

3. Purpose. What does it do? How does it work? What is its purpose? Is the purpose fulfilled? Better than by its predecessor? Can it, should it be improved? Is it helpful or harmful in intent? What are its implications; what does it lead to? Does it have obvious or hidden consequences? Does it have more than one purpose? What are its immediate effects and its long-term effects? Is its actual function the same as the original purpose intended by its originator? Can it be put to other uses?

4. Import. What is its overall significance? What is its significance to man, environment, civilization, happiness, virtue, safety, comfort, etc.? How is it important? Is it a key element in life, civilization, local area, one man's existence? Is it necessary? Is it desirable?

5. Reputation. What do you think about it? What are your underlying assumptions? What do others think about it? Do you find consensus, division? Is it good, bad, helpful, harmful in fact or in the opinion of others? Can you resolve any differences between truth and opinion, intent, and actuality, pro and con members? What weaknesses are commonly identified? Are there obvious areas of desired change or improvement or elimination?

Blocking and Block Busting

Many people complain of not being creative when in fact their creativity has merely been blocked. Once the blocks are removed, nearly everyone can exercise a high degree of creativity. Several techniques exist which will help remove the usual blocks to creativity, but before we discuss these, we should say a few words about the blocks themselves.

Sources of Blocking

1. Functional Fixation. As we mentioned earlier, functional fixation arises when someone is unable to see beyond the historical or accepted use for an item, often identified by its name or label. Thus, for example, a screwdriver is a tool for tightening or loosening screws, just as its name says. A person suffering from functional fixation would be unable to see any other uses for the item. But, of course, a screwdriver can also be used as a paint can opener, an ice pick, a plumb bob, a paper weight, and so on.

Similarly, to see a length of water pipe and to think only of water pipe may block your thinking if you are need of pry bar, a blow gun, a plant prop, a flag pole, a fishing rod, a measuring stick, or something else that the pipe might serve for.

An interesting example of how people are almost by nature functionally fixated comes from an experiment. Several people were placed in a room where a short length of pipe containing a ping pong ball was anchored in the floor. The task of the people was to remove the ball from the pipe without damaging either. Several sets of people were given this same task. For some of the sets, a bucket of water was placed on the floor. When this was the case, over 80 percent of the groups solved the problem by pouring water into the pipe and floating the ball out. For some of the other sets, a pitcher of ice water and some drinking glasses were placed on a table in the room. When this was the case, fewer than 40 percent of the groups solved the problem by using the water in the pitcher. The pitcher of water and the drinking glasses so fixated them on the idea of refreshment, that they could not see beyond the ostensible purpose of the pitcher to its use as a solution to their problem.

2. Adequacy Blocking. A second major inhibitor of creativity is the problem of adequacy. When something works, is good enough, serves the purpose, we tend not to see any deficiencies. That a solution is suboptimal does not occur to us if the solution works--we become blocked by its adequacy.

There are three basic blockages in life. The first is the blockage of a gap, the missing part, the limited vision, the seeming end. We become blocked when the road runs out, when we can't see any further, when we get "to the end of the rope." In such a case, we must have the vision necessary to see beyond the gap to bridge it. The second kind of block is that of an obstacle, something in our way. To proceed, we have to remove the obstacle, or go over, under, around, or through it. These kinds of blocks are quite common and obvious and we recognize them often *precisely because they are visible*. We know when one of these blocks hinders our progress. But the third kind of block, the adequacy block, is often overlooked because it is essentially invisible. We don't see the block because there is nothing in the way. Because a particular route to the mall works fine, we don't think of looking for alternative routes. Because a particular method of studying gets us passing grades, we don't look for better methods. The same is true for farming, manufacturing, teaching, and many other endeavors. Edward de Bono, in his book *Lateral Thinking* says pointedly,

Adequate is always good enough. It is interesting that in our thinking we have developed methods for dealing with things that are wrong but no methods for dealing with things that are right. When something is wrong we explore further. When something is right our thinking comes to a halt. That is why we need lateral thinking [his term for creativity] to break through this adequacy block and restructure patterns even when there is no need to do so.

An interesting thinking habit to develop that will help reduce adequacy blocking is the "yes, and" technique. When you find a solution, new or old, think, "Yes, this is a good and workable solution, *and* what else might work?" Or, "Yes, this is great, *and* is there something better?" Or, "Yes, this is a good way to do that, *and* can we find another?" Note that this technique deliberately eliminates the negative reaction of objecting that a "Yes but" mindset would create.

Block Busting Techniques

1. Uses For. This is a simple technique that can be used for mental stimulation or practical application, depending on what you have in mind at the time. It is an excellent tool for breaking you out of a functionally fixated mindset. To use this technique, think of an item or object, usually a common one like a brick, toothpick, pencil, or bucket, and set the task of thinking of all the possible uses for that object, without regard to what the object is normally used for, what it is named, or how it is usually thought of.

Sometimes a time limit, like three to five minutes, is given. Other times a quantity limit, like 25 to 100 is given. All the techniques of idea generation are used, from checklist to attribute analysis to random stimulation.

For example: What are the possible uses for a brick? Ideas: doorstep, boat anchor, build a wall, build a walk, ballast, sanding block, powder and make dye, put on white background and make a sign (red letters), nut cracker, shoes, straightedge, red chalk, stop signal (use something green like a cucumber for go), heat reservoir, leaf press, paper weight, step stool, target for shooting, children's toys, scale weight standard, distance standard, definition of red, water holder (soaked), tamper, pattern maker (in soft material), pendulum weight, bell clapper, roofing material (crushed)

Another example: What are the possible uses for a steak knife? Ideas: hot pad, planter

stick or prop, hole digger, popsicle stick, bubble wand (through hole in handle), flipping tool or spring, hammer, gun sight, fishing weight/float, compass (magnetize the steel), plumb bob, drill, can opener, carving tool, electrical (knife) switch or other electrical conductor use, awl, measuring device (two knives long and three knives wide), shim, design maker in wet plaster (serrated edge), writing instrument (dip in ink), all cutting and chopping uses, guitar pick, branding or soldering device (get red hot first), ice climbing aid (hook or glue to boots with part of blade down into ground)

Try It Yourself

Uses For. Choose one of the items below and think of at least 25 original uses for it. (That is, you cannot list things that the item is already used for.) The uses can be fanciful, but should at least approach practicality. Describe each use in a sentence or two.

Example: Uses for a steak knife. 1. Drill a hole in the tip and use it as a "knife switch" to turn electricity on and off. 2. Use the wood or plastic handles of two or three to make a hot pad for serving casseroles or soup in hot containers. 3. Use it to measure a spot for a new sofa, so when you go to the store you will know how many "steak knife units" long your new sofa can be. 4. Use it to drill holes in plasterboard walls.

a cardboard box
a towel
a nail
a sheet of paper
a spoon
a fan
a roll of adding machine paper
a ball point pen
the yellow pages
an inner tube
a candle
three feet of Scotch tape
popsicle sticks
a plastic drinking glass
a toothpick
a marble
old newspapers
ball bearings that aren't round
worn out automobile tires
non-returnable soda bottles
stones of broken rubber bands
pencils

Versa Tarp. You have been hired by Acme Manufacturing to write an advertising brochure for its new product, Versa Tarp. The product is an 8 by 10 foot plastic tarp with the usual spaced grommets and reinforcing. (You can see tarps like this at most hardware stores.) In the brochure, Acme wants you to list as many good, practical uses for this tarp as you can, to show just how versatile it is. List at least 25 practical uses, with explanations if necessary. Drawings would be good, too.

Hole Punch. Redwood Mills, Incorporated is a manufacturer of paper. A principal product of theirs is three-hole punch notebook paper for schools. A byproduct of making this paper is tons and tons of punched paper holes. You have been hired to suggest as many uses for these punched pieces of paper as possible. Be imaginative and practical. Think of at least 25 uses.

Steamer. The Heiss manufacturing company of Germany has been making a steam-producing home appliance, designed to be used to steam milk in the making of cappuccino. Unfortunately for the company, its competitors now incorporate a steam maker right into the cappuccino maker, so that a steamer-only design no longer sells. You have been hired by a liquidator company that has acquired 40,000 of these steamers to write an advertising brochure, describing as many practical uses for this steamer as you can. Your basic task is to think of what steam can be used for. Describe at least 25 good uses, with any necessary explanations or drawings.

2. Improvements to. "Improvements to" is the counterpart of "uses for." Whereas "uses for" concentrates on using a given item, often unchanged, for multiple purposes different from the item's original purpose, the "improvements to" technique focuses on altering an

item to enhance its original, given purpose. The item in question can be any of several kinds and is not limited to objects.

A. Objects. The first and most obvious "thing" to improve is an object, usually something common that most people would never think of changing. The classic, textbook example item is the coffee cup. Suggested improvements have included things like

multiple handles

anti skid

anti tip over

anti spill (lids)

built-in heater

decorations

wheels

tea bag holder on side

insulated

self brewing

self cleaning

and so forth. The improvements ideally should move away from obvious bolt-on things, however. For example, in the problem, "Think of several ways to improve books," the first things that come to mind might be the addition or repair ones like

better binding

lighter weight

lower cost

clearer type

more color pictures

better indexes

but we might also think about more imaginative improvements like

books that read themselves (talk to you)

books with three dimensional pictures

books with multiple reading paths

books that explain their hard parts (better glosses?)

books that project on the wall so you don't have to hold them

B. Places, Institutions, Things. In addition to the object, a second kind of thing that improvements for can be applied to is a place, institution, or thing. For example, list ten ways to improve a college, or a marriage, or a shopping mall, or the local church, or the road system, or communications channels (telephone, TV, radio). Improvements to these areas require more thoughtful and elaborate proposals, often involving improvements in attitudes, beliefs, behavior, relationships, or other non-tangible things, as well as changes in physical technology. A piece of wood and a tube of glue are no longer sufficient to effect improvement.

C. Ideas. A third area of improvement is even more removed from wood and glue: the improvement of ideas or abstractions. How can we improve art or the writing of history or the application of personal values to our actions?

In all of these cases, problem exploration (an exploration and articulation of needs) is usually the first step. What is there about a coffee cup that is deficient or that could be made better? What about shopping malls do you (and most people) dislike? How is the bulk of recorded or taught history insufficient or imperfect--what keeps it from being described as excellent?

Again, remember the constructive discontent philosophy. The coffee cup, the local

church, the college, art, all may be really good and suitable and "satisfactory" in what they do; to look for ways to improve them should not imply condemnation or rejection. This "either it's fine or it's bad" attitude often gets in the way of thinking calmly about improvements. In personal relationships, romantic or supervisor/employee, in techniques and policies, whenever someone suggests an improvement, the typical response is, "So what's so terrible about it now?" Be sensitive, therefore, to the ego needs of the human element involved in improving things. Don't rush into the cafeteria and declare that you are there to make the putrid food edible at last--think of the people who make it now. Don't rush up to your boss and declare that you are about to reveal why his management style stinks. Don't call your best friend and offer to reform her disgusting and selfish personality.

Try It Yourself

Improvements To. Choose one of the following and think of at least ten practical ways it can be improved. Describe each improvement in a sentence or two (why is it an improvement?) and supply any needed drawings.

pencilcalculatorspoonpaperpostal systemtireslighting in a roomdeskcontrolling a
carmuseumsdatingspelling rulescourt systemtelephoneball-point
pentextbookhamburgerstelephone bookflashlightbicyclepostage stampchair
dryerbuswindow shades

You will probably want to submit drawings with this project to show what your improvements will look like.

An Idea List of Ways to Improve Something

Simplify--remove complexity
 Apply to new use
 Automate
 Reduce Cost
 Make easier to use, understand
 Reduce fear to own, use
 Make safer
 Give more performance, capacity
 Make faster, less waiting
 Provide more durability, reliability
 Give better appearance
 Create more acceptance by others
 Add features, functions
 Integrate functions
 Make more flexible, versatile
 Make lighter weight--or heavier
 Make smaller--or larger
 Make more powerful
 Reduce or eliminate drawbacks, bad side effects
 Make more elegant
 Give better shape, design, style

Provide better sensory appeal (taste, feel, look, smell, sound)
 Provide better psychological appeal (understandable, acceptable)
 Provide better emotional appeal (happy, warm, satisfying, enjoyable, fun, likable, "neat")
 Aim toward ideal rather than immediate goals
 Give larger capacity
 Make portable
 Make self-cleaning, easy to clean
 Make more accurate
 Make quieter

(Refer also to Alex Osborn's list of questions, above.)

Note: Remember that some of the major problems in modern living are too much noise, too much information, too many decisions, too much complexity, together with a general lack of quality and reliability. Intelligent addressing of these problems in connection with your idea should produce welcome improvements to it.

3. What-Ifing. A major block to creativity for many of us is the mind's fierce grasp on reality. This very factor that keeps us sane also keeps us from thinking beyond what we know to be true. What-iffing is a tool for releasing the mind, for delivering us from being blocked by reality.

In its simplest form, what-iffing involves describing an imagined action or solution and then examining the probable associated facts, consequences, or events. Instead of quickly saying, "That sounds dumb," or "That would never work," and leaving our criticism vague, we trace as exactly as our reasonable minds can generate the specific implications or consequences of the newly imagined fact.

For example, what if automobiles were all owned by the government and everybody had a key and could use any car that was handy? Consequences: Parking lot size could be reduced. There would probably be more car pooling with strangers. If cars were maintained by the government, too, some would be in better shape than now, but others would be in worse shape--no pride in personal ownership. On sunny days cars would be plentiful, but on rainy days, you might get stuck at the shopping center. Cars that broke down would be abandoned. You couldn't lock things in your car. You'd never know if the car you drove to a location (like the movie theater at night) would be there when you got out.

Another example might be to ask, "What if we do nothing about the problem?" Then seek as accurately as possible the consequences.

On another level, what-iffing allows us to create a completely new reality, to establish a new chain of being or relationships, to change the unchangeable in hope of generating a new perspective on a problem or a new idea.

For example: What if rocks were soft? We could put big ones in our houses like pillows to lean on in the living room. We could use them like "medicine balls" to toss to each other for exercise. We could line roads with piles of rocks to keep cars from damage when control was lost on dangerous corners. We could jump off high buildings onto rock piles. Crushed rock pits could be used to jump into by athletes. On the other hand, rock grinding wheels wouldn't work anymore. Concrete, made of rock, would be soft. A cinderblock cell would be a padded cell.

Another example: What if we could see odors? You'd know the source of the bad smell in the kitchen--a plant, garbage disposal, wastebasket, old food in the refrigerator. You could see the perfume as it wafted off the girl wearing it--a visible "come on." Since we

can see farther than we can smell, you could see who had an orange or banana or Limburger cheese sandwich in his lunch bag from across the room. Visible odors could be socially embarrassing in ways not necessary to detail.

Whether or not the "seeing odors" thought suggests the invention of an odor detecting device, a super sniffer like the ones used by the U.S. military to sniff out enemy soldiers, a main benefit of practicing what-iffing is to train the mind to explore unreality or imagined reality, to think about, for a few minutes, the necessary, logical consequences or facts needed to support such a change in real things. Too often when someone gets a new idea, little attempt is made to think about its logical consequences for a few minutes.

For example, we have heard some people say that the United States should legalize drugs like cocaine because then the pushers and organized crime couldn't make money and would stop pushing them and the drug problem would go away. Okay, what if drugs were legal? Would they be legal for everyone, even children? Well, no, you'd have to be 18 to buy them. But then wouldn't the pushers concentrate on selling drugs to those under 18 instead of to adults, which would be a worse situation than we have now? Or, would adults stop using cocaine if it were legal and cheap? Or would it be legal and expensive? And so on.

As I said, too often we simply stop thinking altogether when something contrary to fact comes across our minds or else we think about it in the most illogical and impractical way. When we ask, "What if the sky were green?" the response we tend to get, either from others or from ourselves, is, "Well, the sky isn't green, so why think about it?" But if nothing else, thinking about it is good practice at logical thinking.

In more practical terms, though, thinking about what does not exist is about the only way we have of eventually making it exist. In other words, the first step to implementing a new reality is to imagine it.

Notice when you mention a "what if" to your friends, their reaction will probably be to laugh and change the subject, or to laugh and suggest one funny consequence. There is little attempt to trace probable consequences thoroughly, to outline a full set of associated realities. By not doing so, we are in danger of cutting off many new ideas.

Try It Yourself

What If. Choose one of the questions below and then trace the reasonable and logical consequences that would follow. You might be sure to think of both good and bad (and perhaps indifferent) consequences. List or describe (in a sentence or two each) at least ten consequences.

What if anyone could set up as a doctor?

What if each home could run the television only one hour a day?

What if a citizen could serve only one term in one office during a lifetime?

What if gasoline grew on trees and was a renewable resource?

What if exams and grades were abolished in college?

What if our pets could talk?

What if gasoline cost \$25 a gallon?

What if we never had to sleep?

What if we could read other people's minds (and they could read ours)?

What if all marriages were automatically cancelled by the state every three years?

What if everybody looked almost exactly alike?

What if clocks and watches didn't exist and daylight lasted six months?

4. Attribute Analysis. Attribute analysis is the process of breaking down a problem, idea, or thing into attributes or component parts and then thinking about the attributes rather than the thing itself.

For example, let's say you work for a ball bearing manufacturer and you discover that a flaw in one of the machines has caused the production of 800 million slightly out-of-round ball bearings. You could ask, "What can I do with 800 million slightly out-of-round ball bearings?" and, of course, a few things come to mind, like sling shot ammo and kid's marbles. But you could also break the ball bearings down into attributes, such as roundish, heavy, metal, smooth, shiny, hard, magnetizable. Then you could ask, "What can I do with 800 million heavy things?" or "What can I do with 800 million shiny things?"

Further, you can focus on each identified attribute and ask questions about it, like this: *What can heavy things be used for?* paperweights, ship ballast, podium anchors, tree stands, scale weights, and so on *What can be done with metal things?* conduct electricity, magnetize them, melt them, make tools with them

To solve the problem of poverty, ask, what are the attributes of poverty? Some answers: people, crime, lack of food, lack of goods, large families, psychological lacks, low self esteem, welfare, lack of jobs, lack of job skills, lack of value-rich upbringing, lack of education, lack of motivation, poor economic judgment (poor buying skills), poor quality housing, poor quality transportation.

Then, each of these attributes can be addressed, either directly, or through further attribute analysis. For example, take "poor economic judgment." What are the attributes of that? Some possibilities: buying low quality items, buying smaller packages at higher price per ounce, wasteful spending habits, tendency to "blow a wad" on payday, inefficient food buying (expensive rather than quantity or health considerations), lack of market competition (and hence higher prices), lack of ability to budget, tendency to use money for non food items like alcohol, inability to calculate price per ounce, etc. to determine greatest economy

Discovering attributes can be aided by the use of checklists. For example: *Physical:* color, weight, material, speed, odor, size, structure, taste *Psychological:* appearance, symbolism, emotive ("happy smell of detergent") *Functional:* intended uses, applications, how it does what it does *People:* who's involved *Miscellaneous:* cost, reputation, origin, class it belongs to, definition

Attribute analysis is sometimes described as a smashing technique, because it smashes our fixed and frozen collection of thoughts about a problem or idea. Notice that this is accomplished by refocusing onto something belonging to the problem but more general or abstract or more specific and concrete. Often, attribute analysis is another way of recognizing that a given problem is really a collection of interrelated smaller problems. And often it is a way of perceiving the variables that make up a situation or thing in a way that allows us to change one or more and improve the whole thing.

Example problem: How can we read and remember better? First, what are the attributes of reading and remembering? Possibilities: books, repetition, visualization, understanding (comprehension), quantity of material and number of details, length of time desired to remember (short or long or permanent) What are the attributes of visualization? ... Solution: draw pictures of what you read. What are the attributes of understanding? ... Simplify text by rewriting it or summaries of it into your own words

Another problem: What are the uses for a yellow pencil? What are the attributes? Possibilities: yellow paint, hexagonal, pointed, rubber end, metal ring, wood, graphite rod, long and stick-like shape
What are the attributes of wood? burns, floats, electrical insulator, nailable, paintable, gluable, structural component, soaks up liquid slowly, can be sanded or carved

5. Morphological Analysis. Morphological analysis builds upon attribute analysis by generating alternatives for each attribute, thereby producing new possibilities.

The rules are simple:

A. List the attributes of the problem, object, or situation as you would in a standard attribute analysis.
 B. Under each attribute, list all the alternatives you can think of.
 C. Choose an alternative from each column at random and assemble the choices into a possibility for a new idea. Repeat the choosing and assembly many times.
Example problem: Develop a better bandaid. What are the current attributes of a bandaid? In the table below the attributes are listed in the first row and alternates are listed under each attribute:

*stick onflesh coloredplasticrectangulargauzedmagneticred or
 greenclothroundmedicatedtie onflower patternpapertriangularcelluloseglue
 ontransparentTyvekocotagonsawdustpaint onblackmetalsquareplastishredvelcrowords
 (ouch)woodtrapezoidplasticclamp onstripesrubberanimalscotton
 Example problem: Improve the textbookWhat are the current attributes of a textbook?*

size/

*shapebindingcoverpagestypepicturessmallperfecthardbacklargeRomanphotoslarges
 ewnpaperssmallvarieddrawingslongspiralplasticglossycolorcolor
 roundleftnonethickhighlightedhologramsmicrotopthinlargeverticalU-draw*

Try It Yourself

Morphological Analysis. Use morphological analysis to improve or solve one of the following. List at least six attributes and at least six alternatives for each. Then choose one set that forms a practical, useful improvement.

improve a bus

improve a telephone

solve flat tires

improve a chair

solve the problem of low participation in recycling efforts

improve a shoe

improve the game of basketball

6. Manipulative Verbs. Taking a hint from Osborn's questions above, some creative thinkers have asked, Why not use a large list of action verbs to stimulate creative thinking? And that is just what manipulative verbs are all about. The list could be very long; here we have just a few. You can make your own list if you like. Choose one of the verbs and think about how it can be applied to your idea or problem.

For example: The problem is to improve a table. The verb is inflate. What does that suggest? Make the table larger, floating, made of inflated vinyl, thick top and legs, high price to cater to upscale consumers, air vents in table to blow out cool or heated air or

to suck in smoke from cigarettes. And so on. Here are a few verbs to begin with:

freeze crush rotate heat bend transpose melt paint display loosen stretch submerge twist repeat
automate

7. Reversal. The reversal method for examining a problem or generating new ideas takes a situation as it is and turns it around, inside out, backwards, or upside down. A given situation can be "reversed" in several ways; there is no one formulaic way.

For example, the situation, "a teacher instructing students" could be reversed as students instructing the teacher

the teacher uninstructing students

students instructing themselves

students instructing each other

teacher instructing himself

students uninstructing (correcting?) the teacher

Example problem: a motorist came up behind a flock of sheep in the middle of the road and told the shepherd to move the sheep to the side so that he could drive through. The shepherd knew that on such a narrow roadside, he could not easily keep all his sheep off the road at once. Reversal: Instead of "drive around the sheep," drive the sheep around the car: have the car stop and drive the sheep around and in back of it.

Example: going on vacation: bring vacation home, stay on vacation most of year and then "go on work" for two weeks, make work into a vacation, send someone on vacation for you to bring back photos and souvenirs, etc.

Example: how can management improve the store?

how can the store improve management?

how can the store improve itself?

how can management make the store worse?

how can the store make itself worse?

how can the store hinder management?

Note that in some reversals, ideas are generated which then can be reversed into an idea applicable to the original problem. Example from reversal, "How can management hurt the store?" Hurt it by charging high prices on low quality goods, dirty the floors, be rude to customers, hire careless employees, encourage shoplifting, don't put prices on anything and charge what you feel like, or have to ask for a price check on every item. These bad things can then be reversed, as in, be nice and helpful to customers, make sure all items are priced, etc., and supply a good number of ideas. Sometimes it's easier to think negatively first and then reverse the negatives.

Example: What can I do to make my relationship with my boss or spouse better?

Reversal: what can I do to make it worse? Have temper tantrums, use insults, pretend not to hear, etc. Reverse: control temper, use compliments, be solicitous to needs and requests.

In another example, a variety store chain was being hurt by the competition. Some possible reversals include these:

how can the store hurt competition?

how can competition help the store?

how can the competition hurt itself?

how can the store help itself?

The second reversal, "How can competition help the store?" was chosen and was implemented by sending employees to competing stores every week to examine

displays, sales, floor plans, goods quality and selection, anything that appeared to be effective or useful. The employees brought these ideas back to company, compared, and implemented the best in the store. Result: competition helped the store.

The value of reversal is its "provocative rearrangement of information" (de Bono's term). Looking at a familiar problem or situation in a fresh way can suggest new solutions or approaches. It doesn't matter whether the reversal makes sense or not.

Try It Yourself

Reversals. Choose one of the following situations and suggest at least five reversals for it.

street cleaner cleaning streets

workers striking against the company

clerk helping customer

how can a student improve his ability to write?

how can society solve the drug problem?

8. Analogy and Metaphor. Whether you are teaching someone else something new or trying to learn something yourself or trying to solve a problem, one of the best ways for doing that is to compare the unfamiliar, unknown, or problematic with something familiar and understandable. This is the method of analogy, to find a familiar thing or process that seems somewhat like the idea or problem to be clarified.

In creative thinking, analogies are used for their suggestive qualities, to see what ideas they can break loose, and especially for helping to examine the problem better. By searching for several points of similarity between the analogy and the problem, new aspects of the problem are revealed and new approaches arise.

Example problem: Devise a better way to find your way driving through the fog. Analogy: This is like a nearsighted person finding his way around. How does he do that? feels with his hands, looks at the ground, uses glasses, waves a cane, asks directions. Ideas: feel around--a radar system or fog lights or other feelers, uses glasses--develop a vision enhancing device, such as night light amplification, looks at ground--develop system for car to follow a track on the ground.

Another analogy for the same problem: This is like a traveler in a strange country trying to find his way to a particular location. Use direction signs, radio stations with tourist broadcasts. The traveler goes slow, asks directions, uses guidebook and perhaps foreign language dictionary. What is similar in the problem? Ideas: direction signs--put signs or lights along the side of fog shrouded roads, asks directions--an electronic query system in the car?

A metaphor is a comparison between two unlike things, in which one thing is identified with the other. In problem solving, the use of metaphor helps to break out of a stereotyped or obvious view. Again, similarities between these two essentially unlike things are looked for.

For example: This problem is a real doughnut. My work schedule is a tree or barbed wire fence or brick wall or flowerpot. Hmm. My work schedule is a flowerpot, and right now there are too many flowers in it and not enough water. So I need more water or fewer flowers if I want healthy blossoms. I had been thinking in terms of fewer flowers (fewer things to do), but now I see that if I use more water (get some help and support), then I can do the same amount of work without suffering.

There is still some good thinking in traditional metaphors, like society as a ship, hierarchies as a great chain, and so on. For example, "History's not my cup of tea." Well, what is your cup of tea? What do you really like? A subject that's hot, sweet, strong, clear, weak, brimming over, aromatic, mixed with cream, flavored with honey or orange blossoms? What are the corresponding realities to each part of the metaphor? Strong equals weighty, technical, concrete? Or orange blossom equals improved with esthetics, etc. But new metaphors are often the most revealing. So discover your own.

Try It Yourself

Analogy and Metaphor. Think of a good, original analogy or metaphor for one of the following and the trace at least four similarities. Describe the similarities in complete sentences.

studying

driving a car

solving problems

using a computer

education

love

painting

9. Trigger Concepts. A trigger concept (or idea seed or random seed) is an idea creating technique operated by bringing an unrelated idea into the problem and forcing connections or similarities between the two.

Example problem: improve TV programming
Trigger concept: road
Questions of association: How is TV programming like a road? (a journey, dangerous curves, linear progress--would better continuity improve TV? scenery makes roads interesting); Does TV programming have a road in it? (bumpy, rough, leading astray); What do roads do? They take you somewhere. Does TV programming take you somewhere? Could improved programming do this better? More location filming? More programs from abroad? Programs that take viewers on intellectual journey? What are roads like? ribbons, tourist havens between the scenery, the route to something else, a path toward real life. What about TV programs that are the route to something else, like happiness, education, thinking, art, escape

Another Example Problem: How can we individualize mass education so that students receive as much personal attention and instruction as possible?
Trigger concept: Hatmaker
Ideas: put it on your head, iron each one out, custom made hats, custom made heads, custom made textbooks or information (computer generated?), hatboxes of knowledge, students choose a boxful of information to master, multiple hats like multiple disciplines, one hat at a time, one subject at a time? one student at a time? meet twenty students for fifteen minutes each

As strange as the trigger concept method may sound at first, it can work quite well. And, oddly enough, any random seed will be fruitful if you are patient and energetic.

For example, in his book, The Care and Feeding of Ideas, James Adams gives the following problem and random seed as an exercise: "Assume that you have been hired as a consultant by a restaurant that is having business problems. See how many ways you can think of to improve the business of the restaurant using the concept of a runover dead cat." What are the possibilities here? Cat guts, catgut, tennis racket--make the restaurant a sports club like place or decorate it with a sports theme (The Avon

River Rowing Club?), or install game machines (video) or put in a giant screen TV and show football games on Monday nights. Flat cat, tire tread marks, artsy in the avant garde area--add to the restaurant an art gallery with modern art on the walls, put in chrome and glass and high tech furnishings. Decorated dining plus art sales. Who killed the cat? Offer surprise menu items that guests won't know what they are until the food arrives. Cats, catsup, the Catsup Supper Club--a burger place. The cat was greased, hit--did the Mafia do it? Is the cat run over repeatedly? Build repeat business by giving a free meal, drink, gift after nine (cat's lives) visits.

That's my list, and you can see that what Adams suggests is true: "One of the underlying theories of creativity techniques is that wild ideas are valuable because the normal forces of life will tend to convert them rapidly into practicality."

Final Example Problem: Get a friend who is behind in his payments to the store to catch up and pay regularly. Trigger concept: PotatoIdeas: feed him, peel him, slice him up--divide his payments into smaller pieces, as in every week, and send in the monthly payment made up from that. fry him when he doesn't pay, plant him in the ground. salt him--give him some "flavorful" incentive to pay, as in some gift or verbal reward. Baked potato, butter and sour cream. Potato eyes--growth--convince him his credit rating will grow and be valuable to him if he pays regularly.

Some useful questions to ask that will help you connect your trigger concept to your idea include these:

A. How is the problem or idea like the trigger concept? B. Does the problem have the trigger concept in it? C. What does the concept do? D. What is the concept like? E. What is it not like? F. What does the concept suggest?

Try It Yourself

Trigger Concepts. Choose one of the following items and use its assigned trigger concept to stimulate ideas for improving the item. On the first part of a page, write down the ideas and associations that first occur to you when using the trigger concept. Then on the last part of the page, list at least five improvements, each described in a sentence or two, that resulted from your thinking.

improve an automatic dishwasher using the trigger concept of a stone.

improve a toy store using the trigger concept of hair

improve a library using the trigger concept of candy

Checklists

A checklist is a standard collection of items (things, verbs, questions, approaches, attributes) used to remind the creative thinker of possible ways to approach a problem or shape a solution. When running through a typical checklist, the creative thinker might ask, "Have I taken this into account? How might I change or use this aspect? What effect will this attribute have on my problem or solution or idea?"

Here are a few checklists, which you should supplement with your own customized ones, developed for your particular problem, or the kind of work you do. You might also locate or develop some additional general lists like these:

I. The Five Senses

1. Touch. Feeling, texture, pressure, temperature, vibration. **2. Taste.** Flavor, sweet/salt/bitter. **3. Smell.** Aroma, odor. **4. Sound.** Hearing, speech, noise, music. **5. Sight.** Vision,

brightness, color, movement, symbol.

II. Human Needs

1. Physical Comfort. Food, clothing, shelter, warmth, health.**2. Emotional Comfort.** Safety, security, freedom from fear, love.**3. Social Comfort.** Fellowship, friendship, group activity.**4. Psychological Comfort.** Self-esteem, praise, recognition, power, self-determination, life control.**5. Spiritual Comfort.** Belief structure, cosmic organizing principle. (Note: some needs cross boundaries. These include: pleasure, recreation, activity.)

III. Physical Attributes

1. Shape.**2. Color.****3. Texture.****4. Material.****5. Weight.****6. Hardness/Softness.****7. Flexibility.****8. Stability.** (rolls, evaporates, decomposes, discolors, etc.)**9. Usefulness.** (edible, tool, esthetic, etc.)**10. State.** (powdered, melted, carved, painted, etc.)

IV. Aristotle's Categories

1. Substance or essence. What is it and what makes it unique or individual?**2. Quantity or magnitude.** How many, how much, what degree?**3. Relation.** Rank, comparison, derivation.**4. Quality.** Value, attributes, shape, habits.**5. Action.** What is it doing or does it do?**6. Affection.** Reputation, attitudes toward.**7. Place.** Where is it?**8. Time.** When? (now? historical? future?)**9. Position.** Sitting, standing, displayed, hidden**10. State.** Planned, broken, untried, changing.

V. General Comments

Customized checklists should be developed for individual problems or ideas when several factors must be considered. Listing each condition to be met or part to be covered will assure that none are overlooked. The mind can attend to only about seven items at one time; more than that will have to be recalled from memory, either by force of will or through a checklist. Checklists help enormously in keeping the idea maker or problem solver alert to multiple aspects of the issue at hand.

A checklist of available tools used in your ordinary work can also be helpful. These lists might be called availability reminders. An electrician might have a list (or even a board with samples) of the various kinds of wires and fasteners available. A student might have a list of common reference tools, outlining styles, and information storage methods (like writing, drawing, typing, voice and video recording, model building, memorizing, and so forth). These checklists simply save the mental effort required to bring up what's available when that list gets longer than six or seven.

Try It Yourself

Use one or more of the concepts in this article to respond to one of the following challenges. List the concept(s) you chose to use, and describe how you used it. Then list your suggested names.

Product Name. The KellMills Cereal Company has just created a new breakfast cereal made from formed wheat chunks. Instead of targeting this cereal either to the children's or adult's market, the company would like to target it toward young adults in the 13-19 year-old range. Your task is to think of ten possible names for this product and then to choose one of these names. Explain in a few sentences why the name is appropriate and appealing, and then in a paragraph sketch out a possible advertising campaign or advertisement that will appeal to the targeted group.

You may want to design the look of the cereal box also as part of the advertisement.

Company Name. A new company has been formed through the merger of two conglomerates, AXA Inc. and Flubco Industries. The new company now makes food

items (bread, cake mix, cereal, soup), household products (light bulbs, telephones, dishwashing detergent), and original equipment for manufacturers (automobile mufflers and shock absorbers).

Your task is to create a new name for this company that will be attractive, memorable, and distinctive, and if possible, reflect the kinds of products the company makes and the market it serves. Suggest ten possible names and then choose one that seems to be the best. In a few sentences explain why this is the best choice.

Finally, generate a motto to go with the new name. (For example, "Flubco--Our light bulbs are a bright idea.")

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