The Thinker's Toolkit

Fourteen Powerful Techniques for Problem Solving

Morgan D. Jones

Revised and Updated

THREE RIVERS PRESS
NEW YORK

Grateful acknowledgment is made to the following for permission to reprint previously published material:

The Washington Post: "Bike Trail into Mean Street" by Steve Bates (May 15, 1994), "U.S. Contractors in Dogfight over MiG Modernization" by John Mintz (June 14, 1994), and "Groping Toward a Way to Share the Reins: A Major Survey Finds That Most Employees Want Cooperation and a Voice, if Not a Union, on the Job" by Frank Swoboda (December 11, 1994). Copyright © 1994 by *The Washington Post*. Reprinted by permission.

Steve Sternberg: Excerpt from "Tracking a Mysterious Killer Virus in the Southwest" by Steve Sternberg (*The Washington Post,* June 14, 1994). Copyright © 1994 by Steve Sternberg. Reprinted by permission of Steve Sternberg, a Washington-based freelance writer and media fellow at the Kaiser Family Foundation in Menlo Park, California.

Firehouse Magazine: Excerpt from "Juvenile Firesetters: Part II, Effective Intervention" by Jessica Gaynor, Ph.D., and Daniel Stern, Ph.D. (October 1993). Reprinted by permission of *Firehouse Magazine*.

Simon and Schuster, Inc.: Excerpt from *Thinking in Time: The Uses of History for Decision-Makers* by Richard E. Neustadt and Ernest R. May. Copyright © 1986 by Richard E. Neustadt and Ernest R. May. Adapted with permission of The Free Press, a division of Simon and Schuster, Inc.

Published by Three Rivers Press, New York, New York.
Member of the Crown Publishing Group.

Random House, Inc. New York, Toronto, London, Sydney, Auckland
www.randomhouse.com

THREE RIVERS PRESS is a registered trademark and the Three Rivers Press colophon is a trademark of Random House, Inc.

Originally published by Times Books in 1995 and 1998.

Printed in the United States of America

Design by Leon Bolognese

Library of Congress Cataloging-in-Publication Data
Jones, Morgan D.
The thinker's toolkit: fourteen powerful techniques for problem solving / by Morgan D. Jones.
Includes bibliographical references and index.
1. Decision-making—Problems, exercises, etc. I. Title.
HD50.23.J66 1995 153.4'5—dc20 95-19164

ISBN 0-8129-2808-3

20 19 18 17 16 15 14 13 12 11

Dedicated to my beloved wife, Rita, whose deep affection and devoted care liberate whatever creativity God gave me

Introduction

All of us regularly make mistakes of judgment based on faulty analysis—mistakes as minor as buying the wrong brand of cereal at the grocery and as major as investing a million dollars in a losing enterprise. While some of these errors can be blamed on a lack of information or education, most occur because of the way our minds work. Our minds frequently mislead us, giving us a false understanding of events and circumstances and causing our analysis of events and circumstances to be flawed. In some cases, the consequences can be costly, even deadly.

But we don't have to passively accept the analytic batting average that nature has given us. By learning about the mental barriers and pitfalls that impede effective analysis and acquiring the skills and techniques to overcome them, our batting average can be improved, and significantly so. That improvement might be the determining factor in a decision that is crucial to personal happiness, professional success, or even life itself. The skills and techniques I speak of are what this book is about: ways of *organizing,* or *structuring,* our analysis of problems.

The book explains what it means to *structure* analysis; identifies and describes the mental traits that tend to lead us astray; explains how structuring our analysis of problems overcomes the ill effects of these traits; describes fourteen easily understood structuring techniques; and provides exercises through which the reader can begin to master them.

Exactly what does *structuring one's analysis* mean? The word *analysis* means separating a problem into its constituent elements. Doing so reduces complex issues to their simplest terms.

One can find countless informative descriptions of this approach in any library. One I find especially appealing is that of the English

philosopher Bertrand Russell, who in 1901 wrote in his classic *Principles of Mathematics* that, with regard to interpreting the language of philosophic theories, the solution is *the analytic method*—the breaking down of language until a theory shows itself to be either a set of sensible substatements or just nonsense. In this way, he said, many philosophic "problems" just disappear. Russell's book changed the way English philosophy was conducted by establishing the "analytic approach" as the only reputable method of studying philosophical questions.

To *structure* one's analysis means separating the constituent elements of a problem *in an organized way.* An example of structuring is the diagram we were taught in elementary school for doing division:)‾‾‾. Most of us visualize this diagram when we do division in our heads. Another familiar structuring device is the fearsome IRS Form 1040, which breaks down the process of computing one's taxes into a manageable, though complex, series of steps. Indeed, we use such devices all the time.

Our normal approaches to analyzing problems are usually adequate for dealing with 90 percent of our problems. It's the other 10 percent—the big problems, the ones that matter most—where these normal approaches are unlikely to give us a better solution. All of us want to make sound, effective decisions in our professional and private lives, but that's not easy when the problems we face are complex and manifold. And in the pell-mell pace of modern living, we usually don't have the time or patience to seek the *best* solution. The crushing necessity to make the problem "go away now" makes us receptive to *any* solution that will provide even temporary relief from an oppressive situation. In this pressure-cooker atmosphere it is difficult to fully resolve, much less fully understand, the problems that confront us. We therefore tend to make do with partial solutions that we justify, not altogether incorrectly, as the best we could do *under the circumstances.*

We settle for partial solutions because our minds simply can't digest or cope with all of the intricacies of complex problems. We thus tend to oversimplify, hopping from one problem to another like jittery butterflies, alighting briefly and only on those elements we can comprehend

and articulate and to which we can confidently assign values and probabilities. Having done so, we are then satisfied to downplay and disregard those elements we do *not* comprehend and to which we *cannot* confidently assign values or probabilities.

If we are to solve problems, from those confined to a single individual to those afflicting whole nations, we must learn how to identify and break out of restrictive mind-sets and give full, serious consideration to alternative solutions. We must learn how to deal with the compulsions of the human mind that, by defeating objective analysis, close the mind to alternatives. Failure to consider alternatives fully is the most common cause of flawed or incomplete analysis.

In other words, we must learn how to keep an open mind—one of the most difficult things we human beings can do. So any technique we can impose on the mind to force it open is helpful. It should come as no surprise, then, that *all* of the techniques presented in this book have the effect of opening the mind. The fact is, structuring one's analysis is the quickest, surest path to opening the mind to alternatives.

Don't confuse *analysis* with *structuring;* they aren't the same thing. Structuring is to analysis what a blueprint is to building a house. Would you build a house without a blueprint? You could, of course, but there's no telling what you'd end up with. Building a house, building anything, without a plan is, to say the least, ill advised. And what structuring is to a blueprint, the techniques of structuring are to a carpenter's tools—not components of a single, unified system for analyzing problems but an assortment ot techniques that can be used singly or in combination, as a problem requires. And different problems usually require different analytic tools.

By the same token, structuring is like a road map for a trip. Structuring (the road map) shows that the trip has a single beginning but many alternative endings. Where you end up, which alternative path you take, is determined not by the road map but by your analysis and by what you do along the way during the trip.

But other than showing, as Bertrand Russell said, whether the elements of a problem are sensible or nonsensical, what does structuring—separating elements in an organized way—buy us? The answer is

a number of things, all of which are necessary for effective problem solving and decision making.*

First, structuring helps the mind make sense out of complex problems. Most problems, even the ones we regard as fairly simple, are much too complex and ambiguous to analyze without some kind of structuring. I use structuring when I work a jigsaw puzzle. I group pieces of the same or similar color or texture together—the all-blue sky pieces, for example. I then arrange these pieces in subgroups according to their shape. This approach allows my mind to focus on the subgroup of pieces that will most likely fit, eliminating hundreds of alternatives from consideration. Were I not to group the pieces, I would be forced to continually scan the entire field of unused pieces to find the few that are likely candidates. Yet this is exactly how most of us work a problem. We take in the entire problem (the entire puzzle) with all its complex dimensions (all of its pieces) in one gulp and try to digest it. Structuring frees us from this trap.

Second, structuring allows us to compare and weigh one element against another. Instead of looking at a whole bowl of vegetable soup, we look at the soup's ingredients, one ingredient at a time. This identifies which factors and relationships are critical not only to our analysis but also to the concerns of those who will make use of our findings.

Third, structuring helps us focus our analysis. The mind instinctively *focuses*. That's how the mind works, so it's going to focus whether we want it to or not. Therefore, we're better off to work *with* the mind than *against* it and, in doing so, control what it focuses on. If we don't, it will do its own focusing, and its shortcuts can lead us down the wrong path.

* Some people draw a sharp distinction between *problem solving* and *decision making*. Problem solving, they say, focuses on the cause of a problem and on correcting it, while decision making focuses on a specific issue to be resolved. Analytically, I see no real difference between the two. In either case, one must gather information and data to determine the cause or nature of the problem or issue; one must consider alternative options for resolving the problem or issue; and one must evaluate alternative outcomes or consequences of the chosen solution or decision. The analytic process, though not identical, is very similar. In either case, application of analytic structuring techniques facilitates and empowers the process.

Fourth, structuring focuses on one element at a time, which, compared to our instinctive scattershot approach of tackling all elements simultaneously, is more systematic, more thorough, and more productive of relevant ideas.

Fifth, by establishing rational, systematic frameworks within which to analyze problems, analytic structuring techniques enable us to *impose our analytic will* on our subconscious mind, overcoming the instinctive mental traits that lead to faulty or incomplete analysis.

Sixth, all of the structuring methods presented in this book are visual processes that involve writing or depicting elements of a problem on paper or on a display board or computer screen, where we can *see* them. Why is *seeing* them important? By enabling the brain actually to *see* the words or numbers or depictions of the problem, we engage more brainpower in analyzing and solving the problem and so gain added insights. Indeed, when elements of a problem are seen visually, we often discover correlations we missed when we simply *thought* about them. The old adage—"A picture is worth a thousand words"—speaks to the power of engaging the brain's visual capabilities.

Lastly, structuring allows us to apply our *intuition*—that mysterious internal sense of knowing—to alternative decisions or solutions in an organized way controlled, not by the unconscious mind, but by the conscious. That is why the visual nature of structuring techniques is important, enabling the conscious mind to better focus on, and exercise more control over, the analysis. The effect is to force our intuition into the open, so to speak, where we can consciously cross-examine it and, in doing so, protect ourselves against the troublesome intuitive mental traits discussed in Chapter 1.

While structuring one's analysis is always helpful and sometimes indispensable, effective decision making and problem solving depends, in the end, not on how we structure our analysis but on the soundness of our thinking, and for that we have to use our mind. But structuring makes that a whole lot easier. Structuring is no substitute for thinking. It is rather a means of facilitating and empowering thinking. Used properly and creatively, structuring techniques will significantly enhance our ability to analyze, understand, and solve problems, lead

to more effective analysis and sounder decisions, and make us feel better about those decisions.

Nowhere else are the methods that are presented in this book taught from such a practical do-it-yourself perspective. What you're going to learn from reading this book is not theory. These techniques really work. I think you'll be amazed at their immense potential to open a problem to analysis, and you will wonder, as I did when I first encountered them at the age of forty-nine, why no one told you about them long ago, when you could have applied them to tough problems. I am confident that, if you complete this book, do the exercises, and practice the techniques, you not only will acquire an array of valuable analytic tools but, what I believe is of greater value, you will gain a totally new and enlightened perspective on problem solving.

Part One

Why We Go Astray

17
Your Next Steps

So there you have it. Fourteen techniques for structuring analysis:

- Problem Restatement
- Pros-Cons-and-Fixes
- Divergent/Convergent Thinking
- Sorting
- Chronologies and Time Lines
- Causal Flow Diagrams
- Matrix
- Decision/Event Tree
- Weighted Ranking
- Hypothesis Testing
- Devil's Advocacy
- Probability Tree
- Utility Tree
- Utility Matrix

This is a veritable armory of analytic weapons (or, for the more peace-minded, a potent assortment of *analytic tools*) with which to survey, probe, dissect, diagnose, and resolve every kind of problem from the simplest to the most complex and foreboding. The techniques are particularly effective when combined, as in the following example:

> Begin the analysis of a problem with Divergent/Convergent Thinking to identify major causal factors. Winnow the generated factors to those you believe are most important.

Use Causal Flow Diagramming to identify and understand how these factors are interacting to create the problem.

Employ Problem Restatement techniques to articulate the problem or problems you will analyze.

Using Divergent/Convergent Thinking and analyzing the Causal Flow Diagram, generate alternative ways to resolve or at least mitigate the problem/s.

Apply either Pros-Cons-and-Fixes, Weighted Ranking, or Hypothesis Testing to evaluate, compare, and choose among the alternative solutions.

If you can't decide on one solution, narrow your choice to three or four.

Using Divergent/Convergent Thinking and the Causal Flow Diagram, generate the major factors that will determine the successful outcome of these solutions.

Then construct a Utility Tree that portrays the possible scenarios that will attend the implementation of each of these three or four solutions, and go with the solution with the greatest expected value.

I originally intended to summarize in this final chapter the many wonderful attributes of structuring analysis, but I now feel that, if you have read the book and completed the exercises as I instructed, you have already discovered these attributes. Moreover, if you have *not* read the book or completed the exercises, there is, I believe, little more I can say that will persuade you of the immense potential of structuring analysis.

When you are confronted with a decision or problem, think of these fourteen structuring techniques as tools in your "analytic toolkit." Because most of the techniques can be applied either individually or in combination to most problems, which technique is best suited for analyzing a particular decision or problem is largely a matter of personal choice. Whichever technique works best for you is the "right" tool. Nevertheless, I offer the following guidelines to assist your selection:

Causal Flow Diagram	Representing graphically how cause-and-effect relationships among major factors give rise to a particular problem.
Chronology (Time Line)	Separating and organizing information chronologically.
Decision/Event Tree	Constructing and identifying alternative scenarios: Selecting the site for a convention. Selling a new idea or proposal to one's boss. Planning strategies for a negotiation.
Devil's Advocacy	Seeking with the same or different evidence to challenge the validity or desirability of a particular viewpoint: Whether the explanation for a situation is true. Whether a project will succeed; or whether it will fail. Whether an applicant will perform satisfactorily on the job.
Divergent/Convergent Thinking	Generating alternative ideas, options, outcomes, and scenarios.
Hypothesis Testing	Ranking competing theories or explanations by the degree to which the pertinent evidence is inconsistent with each. What is causing an engine to malfunction. Who stole money from petty cash. Whether a politician will be re-elected.
Matrix	Arraying analytic elements of a decision or problem against one another to compare and correlate them.
Probability Tree	Determining the likelihood of individual scenarios:

	Which presentational strategy will most likely persuade our boss to approve a new project. Which recruitment strategy to adopt to increase enrollment at a college. Which candidate to support financially in an election.
Problem Restatement	Reframing a problem a number of ways before selecting the problem statement that best captures the essence of the problem as one sees it. Restating the problem several times during the problem-solving process is also helpful.
Pros-Cons-and-Fixes	Evaluating the strengths and weaknesses of an idea and thinking up ways to correct its deficiencies: Which home security system to install. Which house to buy as one's principal residence. Which applicant to hire.
Sorting	Separating and organizing information in a logical, useful way.
Utility Tree/Matrix	Choosing among alternative options (alternative courses of action) by separately evaluating their respective benefits and the probability of achieving those benefits.
Weighted Ranking	Evaluating competing proposals using the same criteria: Buying a car. Selecting a college. Ranking people for any purpose.

The best way—the only way—to learn how to use these techniques effectively is to practice applying them to a variety of problems. I therefore urge you to follow my own time-tested approach, namely, structuring the analysis of problems (events, issues, statements) reported in the news media. News reports provide an endless variety of intriguing problems on which to practice. Try your hand at it with pencil and paper. It's fun and always enlightening. You will find how the underlying complexities of a problem open up almost magically before your eyes to reveal startling insights into the nature and solutions of problems. Such is the power of structuring one's analysis.

A word of caution: We must resist at all costs being captivated by the numbers (like weights and utility values) we use in applying some of these techniques. We must constantly focus on and fully understand the analysis underlying these numbers, for they inevitably tend to take on a life of their own and to *drive*, not *reflect*, our analysis. The fact is, they are nothing more than a device, a vehicle, for achieving analytic ends that cannot be accomplished as easily or effectively any other way. We must keep this fact in mind and be ever on guard, lest we become mesmerized by the numbers and allow them to mislead our analysis.

And now a special word for educators at the secondary and higher levels. Because of your position, you have a unique opportunity—perhaps even a moral obligation—to teach students how to analyze problems. Yet, as I pointed out in the opening chapter, our educational system has historically taught people how to be *subjective advocates*, not *objective analysts*. True objectivity is, indeed, a rare commodity due principally to the way the human mind is programmed to work. As I have explained, we are instinctively subjective, marching obediently to the constant drumbeat of our own self-interest.

But subjectivity is a poor catalyst for finding the best solutions to problems, and that's where educators have a giant role to fill: teaching students how to approach problems objectively. The only sure way I know to achieve objectivity when analyzing a problem is to structure the analysis, setting up at the outset a rigorous step-by-step process to which the subconscious is forced to adhere and which ensures our complete understanding of the problem and full consideration of all reasonable alternative solutions. It is futile to instruct students, or anyone, to "be objective" without equipping them with the knowledge and the tools to do so. I fervently hope that you will integrate into your teaching the structuring techniques presented in this book.

For assistance in understanding these techniques and to obtain information either about computer software with which to implement the techniques or about attending a workshop on analytic structuring techniques, readers are invited to contact the author at the following address:

Analytic Prowess
15423 Beachview Drive
Montclair, VA 22026-1025
703-878-6092
800-661-3921

If you know of a tried-and-true structuring technique that is not included among the fourteen techniques in this book, please inform the author so that it might be included in future editions. Also, the author welcomes any accounts, positive or negative, of how these techniques have been used in analyzing problems. Should the author wish to make use of these accounts in future writings, he will, of course, obtain approval in advance from the submitters and protect the identities of individuals and organizations involved.

Solutions to Exercises

EXERCISE 2

Sample Grading Matrix for Ranking Sports Risks

	ACTUAL RANKING	EXERCISE RANKING	DIFFERENCE
Boxing	1	5	4
College football	2	4	2
Motorcycle racing	3	1	2
Scuba diving	4	7	3
Mountain climbing	5	6	1
Hang gliding	6	2	4
Sky diving	7	3	4
Horse racing	8	8	0
		Total Difference:	20

Step 1: Enter an individual or group ranking under EXERCISE RANKING.

Step 2: Calculate the arithmetic difference between EXERCISE RANKING and ACTUAL RANKING.