

Apollo Root Cause Analysis – A New Way Of Thinking

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Editors Note: The following chapter has been modified slightly to accommodate the website presentation. Chapter One provides valuable insights into why 70% to 80% of the population are less than adequate problem solvers. This sets the stage for the rest of the book, which discusses the cause and effect principle and a set of simple tools that will significantly improve your problem solving ability.

Chapter One: Set Up To Fail

Ignorance is a most wonderful thing.

It facilitates magic.

It allows the masses to be led.

It provides answers when there are none.

It allows happiness in the presence of danger.

All this while, the pursuit of knowledge can only destroy the illusion.

Is it any wonder mankind chooses ignorance?

In every human endeavor, a critical component to our success is our ability to solve problems. Unfortunately, we often set ourselves up to fail with our various problem-solving strategies and our inherent prejudices. We've typically relied on what we believe to be common sense, storytelling, and categorizing to resolve our problems. Conventional wisdom has us believe that problem solving is inherent to the subject at hand—the doctor solves medical problems, the mechanic fixes our car, etc. Using the strategies most of us have learned in our lives typically leads to conformity, which brings complacency and mediocrity. This chapter will dispel these false notions and many others that prevent us from being effective problem solvers.

As we explore the reasons behind ineffective problem solving, we will see how rule-based thinking creates the illusion of one right answer and a misguided belief in common sense. We will also see how our natural prejudices prevent effective problem solving. By dispelling the notion of common sense, we are able to replace it with a common reality that allows extremely effective communication. By appreciating all views and seeking causes, not blame, we will start down a path that leads to effective solutions for everyday problems every time.

Please open your mind and join me on an adventure into a new way of thinking that will improve your problem-solving skills and enable much more effective communications.

Problem solving is generally understood to mean overcoming some kind of difficulty by implementing a solution. The best solutions are often the most difficult to find, not because they are hiding but because we don't bother to look for them. We call these untapped solutions creative solutions because they are seemingly created from inside our minds. Like the sculptor's notion that the statue lies within the stone, many effective solutions are waiting to be revealed.

Depending on the various abilities we start out with, combined with the experiences we encounter in life, we each develop our own strategies for coping with life's problems. We each define our own world by creating our own reality. We observe how different things interact and establish our own understanding of the world through these relationships. We learn to control various causes (for example, people and things) to obtain certain goals. We do all this without even knowing it. It is simply part of our nature to explore and understand the world around us. Problem-solving skills vary significantly from person to person, and most are ineffective.

The notion of a single right answer, the belief in something we call "common sense," and the natural tendency to establish biases and prejudices are all strategies that block effective solutions. This chapter will explore some of these strategies and where they come from.

Problem Solving

One of the most difficult questions I am asked as I travel around the world is, "What do you do for a living?" The answer to this question is difficult because most people are not familiar with what I do. My usual response, "I teach people how to be better problem solvers," is understood in many ways, but rarely as I intended. "Oh, are you a psychologist?" "Oh, are you a college professor?" "What kind of problems?" "Are you a management consultant?" I am frustrated because I can't think of any other way to summarize what I do that will be understood. Every response reminds me how each person perceives the world differently and how the notion of problem solving has no common meaning.

Pondering why this is so, I wonder if it may be because our education systems do not recognize problem solving as an entity unto itself. Since problem solving has never been established as a separate subject or curriculum, our skills are not well developed. Aside from the sometimes boring and difficult dictums found in college courses on logic and critical thinking, no fundamental principles have been laid down on which to build a problem-solving curriculum. Problem solving is understood to be inherent in each subject, so problem solving for the computer engineer or the mechanic is thought to be unique to their occupations. Based on this belief, we have failed to teach effective problem solving.

I have discovered that while specific knowledge lies within the job, profession, or subject matter, effective problem solving can be universal to all subjects. Certainly most mechanics can't solve highly technical computer problems nor can the typical computer engineer be expected to rebuild an engine, but they both can use the same problem-solving strategies in their work and their lives.

While problem solving can be categorized in many ways, we usually treat problems as if they are rule based. That is, we seem to believe all problems have "one right answer." A colloquial saying even expresses this notion: "It's the right thing to do." Many people are so intent on solving all problems with rules that they limit themselves to the same old favorite solutions that failed to prevent them from recurring in the first place.

Rule-based problems follow rules created by people to help us understand repeatable events, such as a company procedure or established laws. In rule-based problems we agree to a convention, and thus a single answer or pre-defined solution is usually

available, for example, $2 + 2 = 4$, or if we run a red light we may be fined, or three strikes and we are out. In each case, the answer is predefined by a set of rules. The rule-based approach is often more concerned with conformity and consistency than with accomplishing our goals. Rule-based problem solving is often ineffective because our daily lives are filled with the immense variability of the human condition. As such, most problems do not have one right answer—only good, better, and best. These daily problems are called event-based problems.

The concept of the “right answer” was brought home to me a few years back when I was teaching a class at a national laboratory. As we will discuss later, asking “why” is an important part of my approach in identifying causes and effects in problem solving. A Ph.D. physicist, who was also a tenured professor at a prestigious college, informed me during class that to ask “why” was foolish. He talked about Einstein and Niels Bohr and stated that “why” should never be asked. Since this was a total affront to the theme of my class, we had many discussions over the next two days and I finally came to understand his perspective. In his world of experimental physics, he always establishes a box around the experiment so there are no unknown variables. In scientific experiments, everything is known, a condition is changed, and the result is documented and used to provide evidence of a theory or premise.

When I discovered his perspective, I pointed out to him that the world outside his boxes did not have the luxury of complete knowledge. Variables exist in the infinitum, I explained. He understood what I had said, but it destroyed his illusion of the perfect world where everything is known and right answers always exist.

When we cling to a rule-based mindset, we set ourselves up to fail when trying to solve event-based problems in daily life. We so often look for one right answer because that is what we have been taught to do. The next section takes a look at the practices we have so carefully cultivated and refined but that unfortunately allow us to repeat our problems rather than prevent them from recurring.

Typical Problem-Solving Practices

When I first began teaching root cause analysis, I taught some of the conventional wisdom of the day. I taught people how to categorize causes and how to find the “real” root causes. In each class, a few students would seriously challenge what I was teaching. With an aversion to contradictions, I reflected on each class and was constantly learning and changing what I taught. In the process, I identified several problem-solving strategies that are detrimental to effective problem solving. The most common detrimental problem-solving practices used by individuals and organizations the world over include stopping too soon, the need to place blame, the root cause myth, the false belief in common sense and a single reality, groovenation, storytelling, and categorical thinking. We are going to examine each one of these practices.

Stopping Too Soon

In recent years, businesses have been inundated with one new management program after another. One of the key elements of several management initiatives is the notion of empowerment, where the decision process is moved to the lowest possible level in the

organization. Like most management initiatives, the success of empowerment requires each person to be an effective problem solver. Unfortunately, only a small portion of the population can be counted on to provide effective solutions.

After a few disappointments with empowerment, most managers give up and go back to the old “carrot-and-stick methods.” They have failed to recognize that most of the empowered employees have been set up to fail. The assumption is that everyone has basic problem-solving skills, and all they need bring to the table is their specific knowledge. Consider the following example of an empowered work group at one of North America’s larger manufacturers.

“Hey, Frank, our building needs more lights! Is it OK for us to order new lights? I mean with this new empowerment thing, we should be able to just do it, right?” Seeking to better understand the situation, Frank asked, “What do you mean you need more lights?” “Well, in our quality circle the other day, the guys decided the lighting in here is no good. When we asked management for money to buy more lights, they wouldn’t give us any. I don’t think they really believe in this empowerment stuff. I think it’s just the latest flavor-of-the-month program, you know!”

Again, Frank persisted, “So tell me more about your lighting problem. I hear a problem and a solution in the same sentence. Why do you think the light is so bad?”

“Like I told you, there ain’t enough lights in here.”

“Well, can you show me what you mean?” Frank continued.

As Frank looked around the building for possible causes, he found light fixtures covered with several layers of white paint. New cable trays had been installed and blocked the light. Several light bulbs were burned out, and one lighting circuit was not working. Frank had the fixtures cleaned or replaced and cable trays moved. No additional lights were needed.

Fortunately for this company, they had Frank, who understood effective problem solving. The people in the quality circle had a solution without fully understanding the problem. As a result, their solution was inappropriate. If we are going to empower people, we need to make sure they have good problem-solving skills, or we are setting them up to fail. A recent survey¹ documented just how bad our problem-solving skills are. The survey, which was a limited nonscientific study, revealed that only 20% of the general populace understand the concept of basic problem solving. Five simple events were presented to each participant. Each event had an unacceptable consequence, and the participants were asked to place themselves into the situation and find out what happened so they could prevent the problem from happening again. The entire conversation was recorded and documented.

While evaluating the responses is subjective, clear trends emerge. In about 10% of the responses, participants immediately sought to place blame. Another 26% immediately expressed an opinion of the causes and offered a solution without investigating the problem. It was encouraging to find 50% of the participants immediately asked “why,” yet most stopped this line of questioning after only two or three “whys.” When they stopped asking “why,” their solutions either sought to place blame or were a favorite solution that seemed to fit.

Only two out of every ten responses continued to pursue causes until they found enough cause and effect relationships to allow an effective solution to be implemented. This is a significant indictment of the general populace’s problem-solving skills. My own study of

industry in the United States and abroad indicates that we only find effective solutions about 30% of the time. It doesn't matter whether it is a safety incident, equipment failure, or customer service issue. Regardless of the industry, the company, or the country, I have found that companies' incident reports reflect the same symptoms and the same poor problem-solving skills as the study discussed above. Furthermore, this failure goes beyond the incident reports to the techniques people use and the way people think about problem solving.

Stopping too soon seems to be caused by the need to get on with a solution, which we will discuss later, but I also suspect that most people know they are not good at analysis so they rely on their past experience and just wing it. The fact that we seek to place blame about 20% of the time is also very disturbing because it is rarely an effective solution.

The Need to Place Blame

A contractor employee was driving his backhoe through the construction site when his boom struck an overhead power line. The subsequent line break caused a power outage and disruption of work over a large area. Safety investigators were promptly dispatched, and root causes identified. The first root cause was personnel error, and the veteran backhoe driver was fired. Other minor causes were identified, but the emphasis was on personnel error.

This is only one of thousands of examples that happen daily in American businesses, where punishment is perceived as an effective corrective action. Consider the example. Since this was a veteran backhoe driver (who by the way had never had an accident before), how will firing him prevent recurrence? Moreover, who learned the most from this event? The backhoe driver, of course. Firing this driver is like sending an employee to an expensive training course and then firing him when he returns. In effect, this company probably replaced the most experienced person with someone who has no experience with overhead wires. They may have reestablished the same conditions they had before the event. They have done nothing to prevent recurrence, and they have set someone else up to fail in the future.

The belief that punishment will improve behavior in adults is not supported by any facts or studies. In fact, most of the time, punishment causes the exact opposite behavior. If we are unduly punished, we do not strive to do better. We are more likely to seek revenge or to give up. Since we perceive ourselves as mature adults, we do not appreciate being treated as children. This often causes childlike behavior, which is not a question of maturity or self-discipline, but a human reaction. You cause me pain, I react. The rational, reasoning "self" may not come into play when dealing with hurt feelings and emotional pain.

More important than the ignorance of our actions is the causes behind them. In the work place, we place blame because we don't know what else to do. Like parents, most supervisors and managers are not prepared for their job. If we have not developed a philosophy for certain situations, we are forced to draw on other life experiences. In the case of personnel error and punishment, we look to similar past experiences. We may find them in a parent-child relationship, a military experience, a teacher-student experience, a theological teaching, or the criminal justice system that we read about every day. Since the workplace is not a family, the military, school, church, or prison, none of

these experiences provide an effective reference for dealing with personnel performance problems in the workplace. We have been set up to fail by our environment.

Using punishment to prevent problems is rarely effective. Unless you believe, based on some evidence, that punishment will prevent recurrence of your problem, don't do it!

I was recently informed that one of our clients wanted to modify the Apollo method to allow disciplinary action as a solution. To my great surprise, he thought the Apollo method does not allow discipline. It seems they wanted to punish their employees and couldn't do it with the Apollo method, so they asked us if they could change our method a little. Contrary to this perception, the Apollo method absolutely supports discipline, but only under circumstances where this is appropriate.

Discipline can be two different things. It can mean the punishment or the praise of an individual to effect a change in behavior. With punishment, the purpose is to stop undesired behavior. A person being praised understands they should continue their behavior. In this sense, discipline is an act of reinforcement and comes in one of two forms, positive or negative. It can be self-generated or come from outside.

When discipline comes from within, be it positive or negative, we accept it as having some value. When discipline comes from outside ourselves, it will seem appropriate and cause change only if we agree with it. To agree we must see the value in the discipline.

While the value is obvious if it is positive reinforcement and allows us to meet our goals, it is something altogether different for punishment.

Value in punishment may be harder to accept, but is not unusual. Most people learn at a young age that if they violate established rules, punishment will surely follow. If taught and learned, we accept this causal relationship as a fact of life. Speeding on the freeway is a good example of this relationship. Not only do I know the speed limit as well as how fast I am going relative to it, I use a radar detector to reduce the likelihood of being caught. If caught, however, I accept the consequences and may modify my behavior. In the long run, I may even value this discipline as helping me grow to be a more responsible adult.

In the workplace we may violate established rules using the same logic. The thinking may go like this: "I know it's wrong, but as long as I can get away with it, I am more productive. I will accept the consequences if I get caught."

In general, we accept the consequences of our actions if the error is one of commission, not omission. That is, when we commit an error with purpose, knowing full well it violates established rules, we expect to be punished if caught and we usually accept it.

When this occurs, we often accept the value of such discipline and change our behavior. If the cause of our behavior is ignorance (i.e., omission) and we are punished, we rarely see the value of punishment and will not change our behavior. Indeed, we often seek revenge or take other actions to show our disagreement with the punishment. Whatever the reaction, punishment for errors of omission will likely not cause a change in behavior because behavior is not the cause; the cause is lack of knowledge.

If we disagree with the rules, the cause may be that the rule is inappropriate and needs review or the individual has deviated from accepted thinking for various reasons. It is imperative that we know the causes of what may appear to be inappropriate behavior. If we find that the behavior included a conditional cause of ignorance and an action cause that precipitated the event, then punishment will not afford effective discipline, because ignorance is part of being human. If the cause was to purposely bypass or violate

established rules, then punishment may be an effective solution. Even here, make sure you know why the rules were bypassed or ignored.

For example, if bypassing the rules is caused by the long-term failure to enforce or reinforce desired performance, then the responsibility also lies in the leadership and not necessarily in the individual worker. We call this “Common Law,” which is not only found in the history of our legal system, it is fundamental to the human condition. If everyone is violating the rules and it is accepted practice, then it is reasonably considered acceptable. In this case, punishment will not be accepted as having value, and behavior will not be modified.

In Common Law situations like this, the performers have been set up to fail by those who are responsible for leading them. A drunk who encourages his child to drink carries a greater burden of responsibility for the consequences of alcoholism than does the child. A leader in any organization must assume the responsibility of setting an example by consistency of purpose or they cannot be called leaders.

Another common cause of inappropriate behavior is the failure to learn. A few people (about 5% of the population) are simply incapable of learning, but a larger number choose not to learn. This cause is evidenced by repeat offenders. If we find an individual does not learn, then reassignment or termination may be the best solution. In this case, however, the solution is not discipline, because it does not seek to change behavior. It seeks to remove the cause of the problem by removing the person who fails to learn. Anyone who thinks they are doing these people a favor by not removing them fails to understand they are actually reinforcing the choice not to learn. Take them out of the cause path.

So yes, punishment is sometimes a viable solution, but it should be applied only when we can be sure that it will prevent recurrence. And that will only occur if we understand the causes. My studies show that we use punishment as a solution about 20% of the time, and it is effective at preventing recurrence less than 1% of the time.

If punishment is used to prevent recurrence, the offending person must know the causes for prevention’s sake and must understand the causes in order to accept responsibility. Sometimes we don’t see our own willful act to violate established rules. Never rule out the delusory ability of the human being. It is by far the most powerful attribute we possess. Confront all delusions head on and remember to “fix the cause not the blame.” Responsibility for your own actions requires an understanding of cause and effect relationships. For those who do not understand the cause and effect principle as discussed in this book, accepting responsibility may be a difficult task. I have found one of the greatest secondary effects of training people in these methods is that they come to believe that stuff does not just happen; everything has a cause. With this understanding comes responsibility, accountability, and pride in effective problem solving.

The Root Cause Myth

Today’s buzz words for problem solving are root cause analysis, yet it has been around for at least 40 years and in a less formal sense much longer than that. Root causes are the causes that solutions act upon by removing, changing, or controlling them such that the problem does not recur.

With these buzz words, a great myth has been created. When I first became involved in problem solving, I was introduced to all the various methods. I took several training classes, read the few books available, talked to industry experts, and tried to implement the various schemes and tools. When I tried to apply these methods, they didn't help me solve my event-based problems any better than my natural instincts. I looked more closely at the methods and tried to separate the parts that worked from the parts that didn't. Over the years I began to find some things worked much better than others. What I eventually discovered is the Root Cause Myth.

The overriding theme of all these methods is the pursuit of a root cause, hence the buzz words: root cause analysis. Funny thing though, there is no accepted definition of a root cause; everyone just makes up his or her own definition. It took me about seven years of study and teaching root cause analysis to figure out why the definition was so difficult: by focusing on finding the root cause, we presume there is one.

This false premise stems from the following linear thinking: A caused B, and B caused C, and C caused D, on down the alphabet. At some point we arrive at the root cause G and since G caused A we can eliminate the problem if we eliminate G. This common but misguided approach assumes causal relationships are linear and that problems are born from a single source. Perhaps this is some anthropomorphic tendency based on the pattern of life, which appears to have a beginning and end. This single source of a problem is generally referred to as the root cause and is the basis for every other root cause analysis methodology. (The Appendix contains further discussion of other methods.) Because these other methods are based on this false premise, they only deliver effective solutions by chance, not by design.

Before I discovered the fallacy of root causes, I taught people how to find the real root cause. After many arguments about whose real root cause was the true root cause, I came to understand that there are many possible root causes; and they are a function of who owns them. More importantly, I began to realize that the focus on root causes is a wasted effort because we are seeking solutions, not root causes.

To illustrate this, let's look at an example problem: preventing a fire from occurring. If fire prevention is our goal, then we can look at the causes of the fire and identify an action that will prevent it from occurring. The three causes of a fire could be an ignition source, combustible materials and oxygen. If we choose a solution that acts upon all ignition sources by removing them, there will be no fire. If we use this simple set of causes for a fire, what is the root cause? We all know how to prevent fires, so what is the root cause?

Regardless of how hard we try, it is not possible to find the real root cause of a fire because there are many possible causes of a fire. More importantly, there are several ways to prevent the fire, assuming this is our goal. To reach our goal of prevention, we must find at least one cause that we can act upon such that it meets our goals and objectives and is within our control. In the fire example, if we choose to remove all ignition sources, then the root cause of the fire is ignition sources. If we decide we can control all combustible material in the area, then the root cause is combustible material. If we can control the oxygen, such as inerting a confined space inside a tank with nitrogen, then our prevention goal is met and the root cause is now oxygen.

As you can see from this simple example, effective problem solving results from pursuing a preventive solution that is within our control and that meets our other goals

and objectives. It is not the pursuit of a root cause. By pursuing a root cause, we end up stopping on a single cause that may or may not produce the best solution. We are misled into categorical thinking that fosters favorite solutions that didn't work last time and probably won't work this time. You know the ones: retrain the employee or blame management and have them study the problem.

This does not mean there is no such thing as a root cause, it simply means that a root cause cannot be labeled until we decide on which solutions we are going to implement. The root cause is secondary to and contingent upon the solution, not the other way around, as conventional wisdom would have us believe. Only after the solutions have been established, can we identify the root causes. They are the ones that are being acted upon by the solutions.

The Illusion of Common Sense and a Single Reality

When the jury in the Oklahoma City bombing trial could not decide on the death penalty for convicted terrorist Terry Nichols, a jurist lamented, "If I learned anything from this, it is that two people can look at the same situation and see two completely different things." Indeed, how could this happen? Where is the common sense? The evidence was obvious, the decision clear. What's wrong with some people anyway? We usually end this line of thinking by concluding that some people just don't have any common sense. When asked, most of us believe we have our world pretty well figured out and are good problem solvers. We even believe that most of those around us are equally good at problem solving. In fact, we seem to believe that problem solving is the same for everyone. We believe that if we are able to think of it, it must be common to everyone else. Sometimes, when people don't act according to our preconceived ideas, we say they don't have any common sense. We may even question our friendship with them because we certainly don't want to associate with idiots.

Common sense is defined as the common feeling of humanity. With tongue in cheek, it can be defined as that body of knowledge that my friends and I share. In either definition, it is anything but common because we don't have the same friends or the same feelings as the next person. Common sense is often used as an excuse for explaining why others do not "see" things the way we do and then punishing them for it. I once heard a chemical plant manager say, "Since when did our people start checking their common sense at the gate?"

Each one of us is unique, and that uniqueness is caused by our genetic building blocks and the environment in which our perceptions were developed. Exploring why our perception is unique helps us debunk the notion of common sense. Perception exists within each mind and is a four-step process:

1. Receiving data from the senses.
2. Processing the data in the mind to form knowledge.
3. Developing problem-solving strategies.
4. Establishing conclusions and prototypes.

Our Unique Senses - Receiving data from the senses is unique to each one of us. Our sight, hearing, touch, smell, and taste are different than other people—sometimes significantly different. Some people need glasses, others don't. Our senses are developed early in life and are a direct function of our environment. Research indicates that children

who are visually entertained in the first year of life establish more neural connections and hence have more active minds.²

The brain reserves certain areas for each sense. The visual cortex, for example, is located at the rear of the brain, the sensory cortex along the sides, and so forth. As each sense is stimulated, neurological connections are being made in the respective portion of the brain. Patterns are recognized and value assigned to each stimulus in each sensory portion of the brain.

The development of each sensory portion of the brain is a function of the genetic structure of the mind and environmental stimulation. Each sense is on a genetically coded timeline for development. Once that time frame has passed, the sense will all but stop developing.

The acuity of each sense depends on the richness of the environment to which it is exposed during the window of opportunity. For example, if a child is completely blindfolded for the first three to six years of life, the sight portion of the brain will not develop and the child will never see, even though the eyes are completely functional. Physicians have found that covering one eye of an infant for a short period of time (a week or more) will likely cause that eye to be less developed than the other one, resulting in the need for glasses³ and in a different perspective of the world.

And so, on goes the development of our senses, such that every person senses the world differently and creates his or her own unique sensory perception.

Our Unique Knowledge - As data or information is sensed, it is processed into categories for economy of thought. We assign nouns to things and verbs to actions. Everything is sorted, prioritized, and possibly stored.

When we are young, there is little judgment going on; the mind is like a sponge that simply wants to be stimulated. The more time spent learning, the greater our knowledge. A person who is preoccupied with survival, such as our recent ancestors, had little time left for learning beyond what was required to survive. Today, survival is much easier and knowledge is abundantly available to most people. With this abundance comes a greater diversity of thought.

Over time, sensed data is organized and stored as knowledge. This knowledge is structured and valued in various ways but is always shaped by our environment into a unique perception of the world. For example, in some cultures animal sacrifice is a holy event, in others it is cruelty.

We all have our own interests and abilities based partly on the environment and partly on our genetic makeup. Growing up in Africa with Jane Goodall as your mother would provide you with different knowledge than if you grew up in a poor neighborhood in a large city, such as New York. The resulting personalities and perspectives would also be quite different. While we share many common characteristics, we each possess our own unique knowledge base.

Our Unique Strategies - A key aspect of perception is how we order knowledge. The ordering process is what we call strategies. For example, an infant may learn that crying causes hunger to go away because it causes someone to feed him. From this causal relationship, children may learn the strategy of whining to get their way. Depending on reinforcement from our environment, we will adopt or drop a given strategy.

If we obtain our goals with a given strategy, we will retain it as part of our belief system. Each strategy becomes part of the mind's operating system, and every person uses

different strategies for dealing with life's problems. One person may find success in stealing, while another finds failure. Or, in the business world one person may use the strategy of building networks to advance whereas another might use the strategy of working long hours on many projects. Hence, each person will determine the "best" strategy based on their own experiences, where "best" is unique to each person.

Our Unique Conclusions - The mind is continually sensing, ordering, and developing strategies. It is always open to new possibilities but to varying degrees. As adults, we seek validation of existing beliefs (knowledge and strategies) and do not like change. Inherent in our operating system, however, is the prototype strategy. We know from past experience that sometimes things don't happen exactly as they did the time before so we reserve the right to change our belief system. In effect, we naturally establish prototypical truths that are the best we know now but are subject to change given strong enough reasons to do so. For example, for most of us the earth does not move under our feet and this is the truth. Anyone who has experienced an earthquake, however, knows this is not valid—the earth does move and it can move violently. If you have felt the earth move under your feet or have seen a wave in the earth move across a field, your first perception may be one of disbelief, but you soon change your belief system to accommodate the evidence.

We hold our belief systems open to change by the use of a prototypical conclusion. Our unique perception of the world, coupled with our unique interaction strategies, combines to form unique people with unique prototypical truths. All these factors are continuously evolving, some more so than others; but there is clearly no way to be anything but unique individuals. No two people will hold the exact same set of prototypical truths, not even conjoined twins who live in the same environment. Once again, our conclusions cause a unique perception of the world.

Understanding this uniqueness calls into question the notion of common sense. What does it mean to have common sense when not a single person has the same view of the world or holds the same belief system? Indeed, what is real? What is reality? Can we know it? When we use the word reality, we assume that there is a single reality and everyone can see it. By understanding the biological impossibility of perceiving the world the same, the notion of a single reality can now be seen as the illusion it is.

The notion of common sense is therefore an illusion created by the false belief in a single reality. Perhaps this need for a single reality is created by our desire to get along with one another. If we all hold the same beliefs, we could always agree. Whatever the cause, the belief in a single reality is one of the greatest barriers to effective problem solving I have found.

So, if perception is reality and everyone's reality is unique, what is reality or truth? This question of the ages continues to haunt us, but the answer is quite simple if you can grasp the notion of relativity. Everything is relative to our own unique perceptions. We each hold our own truths, and the best we can hope for is to find a way to incorporate others' truths into ours. While we use many tools and strategies for doing this, such as team building, they often fail and understanding is left wanting. Once again, we have been set up to fail.

Groovenation

No, this is not a sixties-era song; it is a human condition of the mind that prevents effective problem solving. Groovenation is a term I created to describe the process of justifying our beliefs. To be groovenated is to hold strong biases and prejudices. It is physiological in origin and is found in our search to validate our existing realities. It is the groove we get in by placing a greater value on familiar things than on differences or change. We have a strong desire to be right in our beliefs, and we continuously seek validation over other possibilities.

As we sense the world, we send all data through what I call a “Delta Checker” from the Greek symbol for difference. The Delta Checker, a learned strategy, checks for differences between what we are sensing and our existing prototypes. If something is the same as previously known, we like it. If it is different, we analyze it and make a value judgment. If we place value on the difference, we continue to scrutinize it. Unfortunately, we have a strong tendency to place high value on anything that mirrors our existing reality and low value on everything else. This tendency is caused by the physiology of the mind. For every thought, idea, sense, or motion, many synapses are fired; and with each firing, the connections become physically stronger both in size and chemical response. Just like building muscles, the more we exercise or stimulate the mind, the stronger it gets.

In the thought-provoking book, *Descartes’ Error*,⁴ Antonio R. Damasio, M.D., provides great insights into the working of the mind. Dr. Damasio and others have found the causes of groovenation in the physical nature of the mind. The brain is made up of billions of cells known as neurons, which consist of a cell body, a main output fiber called an axon, and input fibers known as dendrites. These neurons are interconnected in circuits and systems within the brain. Brain functions, including our ideas and thoughts, occur when neurons become active through an electrochemical process. Each time we have a new thought or experience something new, axons and dendrites connect via a synapse. If the same thought or experience is repeated, the same physical connections enlarge.

This is not to suggest that one connection constitutes a specific piece of conscious knowledge. It is much more complex than that, but the observation that these neurological connections occur during learning and actually grow in size with repeated exposure to a given stimulus helps explain the physiology behind groovenation. That is, if a larger connection provides a preferential path for a neuron firing, it would explain the physiology of groovenation. Since new ideas require new connections, new ideas are at a disadvantage to old ideas existing in physically larger connections. This does not mean we cannot learn, but it does mean we must remove or modify existing connections to register new thoughts. Old connections that are no longer needed are actually dissolved (physically) by special compounds in the brain.⁵

It seems that no matter how hard we try, sometimes it is nearly impossible to pull ourselves out of a groove or rut. This groove can be an idea, a belief, or a habit. Someone who is highly groovenated will remain intransigent even when the path leads directly to a harmful outcome. The kamikaze pilots in World War II provide a vivid example of a highly groovenated state.

In your daily life, consider the people who judge everything they see and proclaim it right or “WRONG!” Groovenation is a natural state of being too focused on being right while ignoring a broader perspective. It is present in all humans and varies from inconvenience to the paralyzed mind of a fanatic.

Understanding the cause of groovenation can help us understand that it is part of being human. Understanding the physiology behind the process can help us see how easy it is to be brainwashed or to develop an intellect for music, athletics, or whatever we choose. Just like practice makes perfect in sports, repetition of an idea or thought can create a perfect reality that only exists in the mind of the one who created it. It becomes real, regardless of contradictory evidence. Denial is our strongest attribute. If we spend our lives trying to validate specific relationships, these relationships will indeed become valid. They become valid because of repeated exposure of the mind to the same conditions. Pick any controversial topic—extraterrestrials, evolution, creationism, or who has the best football team—and you will find proponents that know the “truth” of their position. What they don’t understand is that their truth is the result of their own brainwashing.

As our brains are conditioned into a physical state by the repeated firing of the synapses, we convince ourselves of the absolute validity of our beliefs. Groovenation presents a formidable challenge to effective problem solving. Because this barrier is deeply ingrained in the human condition, overcoming it is a primary focus of becoming better problem solvers.

Storytelling

Our primary form of communication is through storytelling. Storytelling describes an event that relates people (“who” elements), places (“where” elements), and things (“what” elements) in a linear time frame (“when” elements).

Incident reports provide prime examples of storytelling and its impact on problem solving. The final report below is an example incident report taken from the manufacturing industry and is typical of 60% to 70% of the many incident reports I have seen, with many being much worse. As you read this example, ask what the problem is, what the causes of the problem are, and if the solutions will prevent recurrence of the stated problem. Remember, this is a typical report. The form is filled out, the boxes are checked, and the categories are defined or discussed.

Final Report

Incident Date: 10/28/94 **Time:** 0817
Report Date: 1/7/95 **Facility:** West

Description of Incident: On October 28, 1994, a contractor electrician was conducting an operational check on elevator ELH-23 at TCH-3-675 when a flashover occurred. The electrician needed to check the door motor and switches on the top of the elevator car, requiring the elevator to remain energized in performing this difficult task. While this was going on, a mail person from Central mail pushed the call

button on the first floor ignoring the out of service sign posted over the call buttons. The electrician heard a “buzzer” sound and was able to get clear of the moving parts on the top of the elevator car on which he was working before being injured, but it was a close call. He got control of the car from his location on top of the car, which allowed him to stop the car and exit safely. The main fuse blew and the elevator shut down. Due to multiple parties involved in this incident, extensive discussions and management oversight have occurred. This has caused some delay, however.

Type of Failure: ___Predicted ___Failure ___Failure to Secondary Damage ___
Other

Description of Cause: A critique was held on Nov. 30, 1994, at the incident’s location. The FCT electrician involved demonstrated step by step actions taken before the maintenance activity. The investigation discovered the problem to be human error, and corrective actions are being taken to stop this from happening again.

Corrective Actions:

1. Provide refresher training to all employees on importance of warning signs.
2. Possible testing procedure to include a better lifted leads and jumpers control log.
3. Revise the electrical drawings to show the complete circuit for the elevator controls.
4. Position switches have been ordered to monitor the length of cable.

With the completion of these changes, the problem will not recur.

Root Cause: Defective or Failed Part

Is the problem above an injury, a near-miss with electricity, something called a flashover, or what? Whatever the problem was, are the causes clearly stated? Do the corrective actions support the statement that this will never happen again? What do “position switches” have to do with anything? Also, notice that the report states that the problem is human error, but then says the root cause is a defective or failed part. Aside from this contradiction, these are cause categories—not causes—to which thousands of solutions could be attached. The proposed “Corrective Actions” discuss training, procedures, incomplete drawings, and a position switch. Since these have nothing to do with human error, additional contradictions are presented. Is there a hidden agenda here? Are these vague references listed on purpose, or is this simply another example of poor problem-solving skills? After the company further investigated this problem, it was shown to be painfully ill defined and the solutions woefully inadequate.

Take note of the nice story in the “Description of Incident.” Not only do we write stories in our incident reports, we are told to write stories. Everyone likes a good story. Many companies don’t even write the story down; they get together with the decision makers and tell stories to one another, decide which category the problem fits into, and implement their favorite solution.

While entertaining, stories seldom identify causes because they are busy setting the stage of who was where when some action occurred. The basis for any story is a sequence of

events starting at some arbitrary point in the past, leading the reader to a significant consequence disguised in a statement like, “The final investigation discovered the root cause to be human behavior.” Opinions, or the consensus of a group, are then presented as corrective actions. When corrective actions are disjointed like the ones in this example, the consensus strategy of a committee is probably at work.

Every time I teach a class to a new client, I ask them to send sample event reports. I always find one or more that look like the example discussed here; and when presented to the class, the most common response is that it is typical or not unusual. Supervisors and managers are especially frustrated by such reports but are lost for ways to remedy them. The concern, however, is more than just poor reports; it is poor problem-solving skills that are reinforced by poor report writing and rule-based thinking like filling out a form. Forms subtly tell users to turn off their brains, fill in the blanks with a good story, check the boxes, and identify the right categories.

Another example of an incident or event report is shown below. As the example shows, the focus is on people, places, and things, occurring as a sequence of events. Few causes are stated. Even the stated root cause discussion is mostly story. We are told that an employee was injured because he fell. He fell because a rubber floor mat slipped, and the root cause was operators leaving the pumps on during breaks, causing oil to leak and leading to a slippery floor and the accident.

OSHA Recordable Injury

Discussion: This afternoon an accident that resulted in an OSHA recordable event at about 7:00 p.m. The employee was working in the yellow room on machine #3. The employee was in a rotating position when the rubber floor mat slipped, causing the employee to fall to his knees, with his left knee hitting the metal legs of the worktable. The employee suffered an “abrasion” just below the left knee that was very painful and swollen. I took the employee to the Payton Northeast Hospital emergency room where he was awaiting diagnosis. He contacted his mother to pick him up. I left my name and number and asked him to contact me to let me know how things came out.

I returned to the yellow room to investigate the incident. I asked Diane if anyone was in the area at the time of the incident and she mentioned “Katy, Tom, and Billie.” I asked each employee if they had witnessed anything. They indicated they had not. It is apparent that no one actually witnessed the incident. I returned to the area to talk to the lead person, Billie, but she had gone home for the night. My concern is: 1) whether the incident occurred when the employee was alone, 2) is there a policy about employees working alone in the yellow room, and 3) was this the case?

Root Cause: In talking to the lead maintenance person, Ray Longsine, the root cause is “operators leaving the pumps on during breaks.” Per Ray, this causes the pumps to operate at all times holding 8.0 psi of pressure which after a prolonged period, causes the oil to get so hot that the foaming is visible through the oil level check window on the pump. Ray said this will only occur when the pumps run for an extended period of time (> 4 - 5 minutes). He said that all employees have

been told not to leave the machines energized while they take breaks. He has even checked machines during breaks and provided feedback to those in violation. Ray also indicated that the problem only surfaced about three months ago when a lot of new training was being done. It appears that this oil problem is not monitored across all shifts and the oil should have been detected long before it caused an accident.

Corrective Action: Have operators be responsible for checking the machines for oil leaks several times during the shifts for leaks. Also, enforce the policy of not leaving the machines on while taking breaks. Ray indicated that John Sisner had looked into a different type of pump, the type that is used on the new machines. Don't know what the status is on that. The pumps are such that they don't go out, they just start leaking oil. Ray indicated he had changed out five pumps in the last two months.

The root cause, "operators left pumps on," places blame on the operators; and the corrective actions express a pre-established opinion as to what should be done about a condition that somehow may relate to the injury. That is, by making the operators responsible to check for oil leaks, the assumption is that the operators are irresponsible and may even think nothing of working on oil-slickened floors. Once again, the employee has been set up to fail, failed, and then told to be more careful, or in this case, more responsible. All this without ever talking to the injured employee.

If you want to observe a storytelling activity, pick up any newspaper or magazine. Talk to your friends; or the next time you are in a meeting, listen carefully. Or, the next time the President of the United States or any other politician speaks, listen carefully. You will hear all the elements of a story listed above—who, what, where, and when—but you will not hear many causes.

It doesn't matter which culture, country, or education level we observe, we have a common human affliction of poor problem solving, and it is directly proportional to storytelling. The stronger the storytelling culture, the less effective we are at problem solving. A storytelling culture can exist within organizations or within different regions of the country or world.

Storytelling sets us up to fail by ignoring causes and the cause and effect principle, which we will discuss in Chapter 2.

Categorical Thinking

Categorical thinking is caused by the mind's need to order what it perceives. While categorization is a natural process of the mind, the problem comes when we fail to understand how categorization can lead to intellectual laziness. The notion of good and bad is categorical thinking at its most base level. Instead of seeking to understand, we categorize something as good or bad and stop there. Is it good that the lion eats the gazelle, or is it bad? Neither, it simply is; and to assign a categorical answer, like bad, we misrepresent the situation by oversimplification. We establish a course of action because if it is bad we are compelled to right the injustice and make it good. If it is good, we can ignore the situation and move on to more bad things.

Please note, it is not the category that causes the problem. Categorization can be a very helpful strategy. The problem categorization creates is the belief that once categorized we can establish certain relationships and then act according to our favorite solutions or stop thinking.

Categorization is strongly linked to storytelling. As the two incident reports demonstrate, the causes of the events are in categories. That is, the stated causes represent a group of causes, not a specific cause we can act upon. Here are some examples I hear often: “The cause of 95% of all industry accidents is human behavior.” “Corporations have caused most of the environmental disasters in the world.” “The pump failed because it was worn out.” In these three examples, human behavior, corporations, and worn-out equipment are all categorical causes. Stopping at categories like “worn out” usually leads to ineffective solutions such as replacing the equipment. Solutions based on categorical causes fail to correct more fundamental causes like the cause of wear. The end result is recurrence of the event.

The Garbage Solution is my favorite example of categorical thinking. As we go through the day, we have to assess the value of many objects. Some objects have great value; others, like a banana peel, may have none. Our solution: put these no-value things in the garbage and someone will make them disappear. With this strategy, we solve many problems with one solution. The Garbage Solution has us put many problems into one category and solve them with one solution. It appears to be effective and is used extensively in all aspects of our lives. In business, we seek “the biggest bang for the buck!” We put as many problems as we can into a category and then solve it with one solution.

The danger of this strategy is that it doesn’t address each individual problem and may cause many other problems. Examples of this categorical thinking are all around us. Lumber mills used to burn all their scrap until they finally realized they were polluting the air and wasting valuable raw materials. The solution to pollution used to be dilution until we looked closer at its effects. Now most pollutants, including our garbage, are evaluated for cause and effect relationships and individually controlled.

The following is another common example of categorical thinking. We seek to know where people come from, their education level, religion, or political alignment, in order to know “who” they are. Is there anyone among us who doesn’t do this? For example, if you are not well educated and I am, then I can draw certain conclusions and act in a certain way. Such an inference precludes me from knowing the real you, yet we use this strategy daily because we don’t have time to do otherwise.

Categorical thinking creates another significant problem for data collection and analysis. When interacting with others, we assume there is a single reality and therefore our categories are identical to theirs. They are not. I have run hundreds of experiments where I ask students to categorize a list of causes. When completed, we compare notes and find the same causes in completely different categories. The magnitude of this discovery is significant. Every database that has ever been created from the input of more than one person, like most accident reports, has questionable data. I am opposed to categorization, as will be discussed later, but if it must be done, I recommend all categorization be performed by one person or a small cadre of like-minded people. In any database, consistently comparing apples with apples and oranges with oranges is essential. We are

not doing this now because we believe in the notion of a single reality and that everyone “sees” the same world.

Categorization is part of our natural operating system. In the process of categorizing, we assign value that establishes our biases and prejudices. By not recognizing the danger these prejudices bring, we set ourselves up with ineffective problem-solving strategies.

Causes of Ineffective Problem Solving

As we review the many examples of ineffective problem solving, we discover a recurring trend—effective solutions are not found because of three things:

1. Incomplete problem definition.
2. Unknown causal relationships.
3. A focus on solutions.

Let’s assess each one of these factors.

Incomplete Problem Definition

Incomplete problem definition is caused by the false belief that the problem is obvious and the subsequent rush to find a solution. The belief that the problem is obvious is caused by the belief in a single reality discussed above and the notion that we all think the same (common sense).

Observing thousands of decision-making meetings, I found that most meetings start with a statement something like, “Thank you for coming. I think everyone pretty much knows what the problem is, so does anyone have any ideas how we can prevent this from happening again?” The leader looks around the room and sees everyone nodding their heads in approval, so continues.

Everyone is nodding in approval but is thinking many different things. The operations manager knows the problem was caused by poor maintenance. The maintenance manager knows it was those darn operators again, and the facility manager knows somebody screwed up again. A few people will offer their solutions and the arguing commences. The battle for the right answer begins and the person with the best story—usually the boss or whoever is considered an “expert”—wins. Quite often the discussion ends with the boss or expert expressing their reality—everyone agrees, and they move to implement that person’s wishes.

Most people have been in this meeting. As you can see, the problem is not defined, causes are ignored, and the focus is on sharing our favorite solutions to show everyone else how smart we are. Little or no synergy occurs; the problem is never fully understood and it happens again. When it does recur, we reconvene the meeting, implement another favorite solution, and the cycle continues.

We track and trend how many times we have certain types of failures and create beautiful graphs and charts showing the various “root causes,” but the problems keep recurring. We become so engrossed in tracking and trending causes that we do not realize we are failing miserably. Effective problem solving means the problem never happens again.

Unknown Causal Relationships

Causal relationships often remain unknown because we do not seem to think causally. Instead, we communicate by telling each other stories, and the inferences surrounding the stories pass as causes. We infer that hardware wore out by recommending replacement. We talk in terms of human error, lack of training, and other categorical causes like management being less than adequate. Instead of continuing to ask “why” to our point of ignorance, we stop at causes that align with a favorite solution. Why did the hardware wear out? This, along with several more “whys,” is required to adequately understand the problem. Our ignorance of the cause and effect principle as discussed in the next chapter is perhaps the largest contribution to incomplete causal analysis.

A Focus on Solutions

By focusing on solutions without clearly defining the problem and its causes, we often find ourselves solving the wrong problem. Today, most people still believe the Exxon Valdez oil spill was caused by a drunk captain. The federal government focused on this issue as the problem and proceeded to penalize the Exxon Corporation as the main solution. Monetary penalties did nothing that I am aware of to prevent future oil spills. (Note: While this is a sad truth, the purpose of the legal system is to punish, not prevent recurrence.) Industry efforts to install double-hulled tankers has done more to prevent recurrence than the fines levied on Exxon.

Focusing on solutions is caused by many things, but chief among them is groovenation. As discussed earlier, our brains are wired such that we search for what we already know and when we find it, we validate the rightness of our search and cease to look any further. My daddy drove a Ford and his daddy drove a Ford; therefore, I will always drive a Ford. This kind of logic is a natural mental process whereby we seek the familiar and call it “right” or “real.” We tell our children “wait until you grow up and have to face the ‘real world.’” The “real” world will be their world, not ours, and it will be much different. This tendency to seek the familiar is called the favorite solution mindset, and it prevents effective problem solving most of the time.

Authoritative and goal-driven personalities contribute to this drive to find a quick solution. The “Ready, Shoot, Aim!” personalities are hard to deal with because they are ensconced in categorical thinking and buoyed by past successes (groovenation). It is important to remember that groovenation is a strong physiological force and that even the best and the brightest can succumb to it.

Set Up to Fail

By sharing my observations of the current state of problem solving, I have attempted to show that we are set up to fail by the processes and strategies we use. Groovenation and

the unintended pursuit of the ignorance it creates are the driving factors in this setup. When coupled with the misguided belief in a single reality and the illusion of common sense that this creates, these strategies set the formula for ineffective problem solving. What we need is some way to express every stakeholder's perspective in a way that complements the learning process. The diversity each person brings to the table provides the opportunity to see a bigger and clearer picture of each situation. Unfortunately, we often look on individuality as counterproductive to effective teamwork, when in fact it is our greatest strength. Conformity, not individuality, is the enemy of effective problem solving. When we conform, we align our thoughts into one point of view.

With many diverse thoughts, there is no limit to what we can accomplish. The bed of nails supporting the East Indian guru can illustrate this principle. The nails together as individual units support the body. If they were all aligned in a row, they would be a big skewer. The guru is not skewered because his weight is distributed over many individual points, each providing a small support and together supporting all the weight. Together, as individuals, we can create a common view greater than any individual reality.

Up until now, we have never had the tools to allow us to create a common view or understanding—to form what I call a common reality. Creating this common reality is what Apollo root cause analysis is all about. By creating a common reality made up of all perspectives, we are able to break out of the illusion of common sense and thus prevent the usual arguing that prevails. It also helps us break the bonds of groovenation by presenting legitimate realities heretofore unknown.

Given proper tools that overcome the handicaps of existing strategies like common sense, single reality, storytelling, categorization, and the pursuit of a root cause, we can find effective solutions to everyday problems almost every time. These tools are based on the cause and effect principle discussed in the next chapter, and they will help us get out of this mess.

The remaining chapters are as follows:

- Chapter 2: Understanding the Cause and Effect Principle
- Chapter 3: Solving Problems Effectively Using Apollo Tools
- Chapter 4: Identifying Effective Solutions
- Chapter 5: Implementing Solutions
- Chapter 6: Facilitating Groups
- Chapter 7: A New Way of Thinking
- Appendix: Comparison of Common Root Cause Analysis Methods

¹ Performed by James M. Stoutenburg as part of his graduate work in Instructional and Performance Technology at Boise State University, Boise, Idaho, 1994.

² *The Amazing Brain*, Robert Ornstein and Richard F. Thompson, Houghton Mifflin Co., Boston, 1984.

³ *The Amazing Brain*, Robert Ornstein and Richard F. Thompson, Houghton Mifflin Co., Boston, 1984.

⁴ *Descartes' Error*, Antonio R. Damasio, M.D., Grosset & Putnam, New York, 1994.

⁵ *Receptors*, Richard M. Restak, M.D., Bantam Books, New York, 1994.