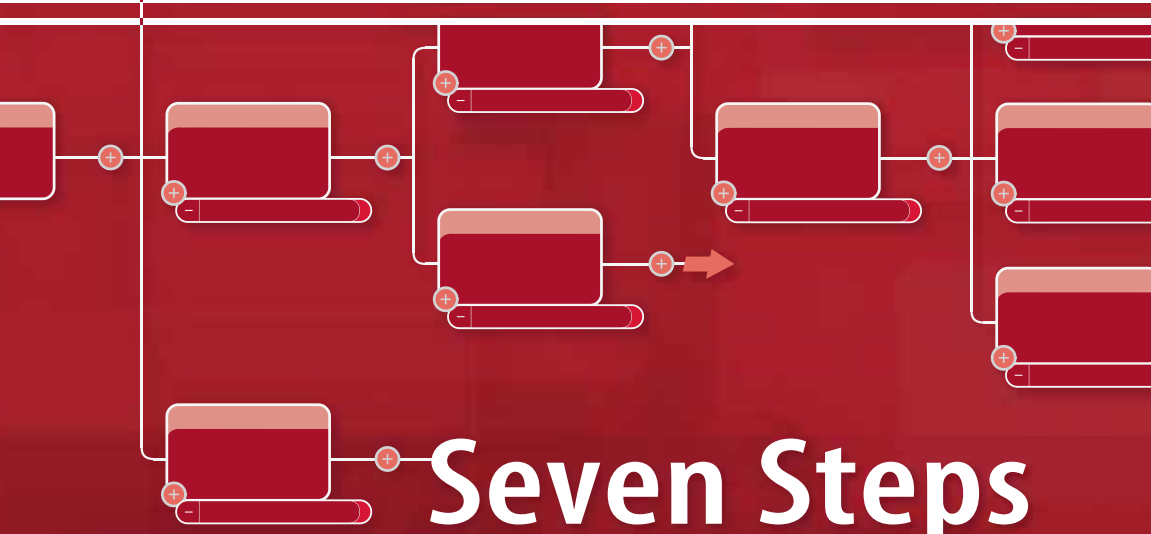
RealityCharting®



Seven Steps

To Effective Problem-Solving And Strategies For Personal Success

DEAN L. GANO

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– Larry Reising

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RealityCharting

Seven Steps to Effective Problem-Solving and Strategies for Personal Success

By Dean L. Gano

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To all who value learning

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Preface



At the time of my first book, *Apollo Root Cause Analysis*, published in 1999, the Internet was just beginning to take off and most computers where big bulky things. There was talk of a paperless society and newspapers and books were doomed. Well, it has taken more years than the pundits predicted, but today newspapers are going out of business and electronic book sales increased 400% in 2010.

As you will see in this book, which is being published traditionally and electronically, technology has not only advanced the way we consume information, it has allowed us to communicate much more effectively. Specifically, technology allowed us to create RealityCharting® software back in 2001 and a new online learning module in 2011, both of which allow a more effective use of our valuable time.

The RealityCharting® software allows us, for the first time in history, to easily communicate the causal relationships of any event. Unfortunately, learning how to use the software and the process has historically been difficult and time consuming. The RealityCharting process was first taught in a classroom setting of lecture and exercises and took two days to complete. In 2009, we became aware of a new way to teach, using electronic media, that is better than classroom style learning because it is challenging, interactive, allows learning by failing, provides instant feedback, and facilitates working at your own pace. It has the ability to redo or quickly review and there is no advancement until the prerequisites are learned. There is a focus on learning everything in each lesson and by working exercises that prove you learned the lesson; there is no need for a test—you either learn and show competence in all of the subject matter or you don't move forward. Because of this new learning module, most people can learn the process and the software in half the time (or less) than what it has traditionally taken in a classroom setting. It also ensures uniformity of a quality experience as opposed to the possibility of an inexperienced teacher butchering the intent of the lesson.

Since we know that some people want to know more about the subject than just the basic process and how to use a software application,

I have written this book to meet that need. While it contains some of the basic information that was in my previous book, it has a lot of new material and includes links to the interactive online learning modules provided in the new software as a way to usher in this new learning style. So, this is much more than your usual book—it is an interactive adventure into the world of effective problem solving that will change the way you think, communicate, and make decisions.

Acknowledgments



This book is the product of many years of study driven by my unwillingness to accept contradictions. I see contradictions where most people do not, so I have studied the sciences, religion, and philosophy, and I am grateful for all those who have gone before me in trying to figure out the notion of causation. Aristotle, Aquinas, Pascal, Newton, Buddha, and several modern players like Peter M. Senge, Charles H. Kepner, and Benjamin B. Tregoe have provided valuable steppingstones to the message of this book. I am indebted to my students around the world who have asked invaluable questions and challenged me to know more. Without their questioning attitude, I would never have come this far.

I am particularly grateful for the intellectual stimulation of a few close colleagues, namely Larry Reising, Tim Adams, and my son, Wesley J. Gano. Along with many others who I have encountered along the way, my son Wesley has provided an honest intellectual sounding board often necessary to break outside the envelope of conventional wisdom. Tim Adams is an engineer at NASA who has mentored me for the last fifteen years on everything from Probability Risk Analysis to effective learning strategies. His advice and guidance has been invaluable on more than one occasion. Larry Reising of World-Interplay is a RealityCharting Master Instructor and was instrumental in helping me bring the new learning modules found in this book to fruition. He is dedicated to continuous learning and fundamentally understands the need to innovate.

I had many new challenges along my path, so I am grateful to my wife, Mary, for understanding my needs and to my parents for teaching me to greet every new challenge with a positive attitude.

Honest comments are hard to come by when one presumes to write a book, so I am very thankful for the editorial reviews and critical comments provided by those listed above as well as Jim Davis, Mark Hall, Ned Callahan and Mick Drew.

Editors always win in the end and for this we writers are thankful. I want to acknowledge my editors, Paul McIntire and Sue Gano. I want to thank them for their patience, dedication to a smooth-flowing book, and for putting up with my protestations and analytical mindset.

I also want to thank Ethan Edwards of Allen Interactions for teaching me how to create effective interactive online training.

Introduction

If You Have Ever Asked Why

Asking why things happen is an essential part of being human. When we ask why something happened, we are looking for causes to help us understand reality. But what is reality? How can we know it? What is its structure and is there a single reality that we can all see? As you will learn in this book and the accompanying electronic exercises, there is no single reality, but you will learn how to create a common reality by defining evidenced-based causal relationships. With this common reality, we can predict the outcome of certain scenarios, which allows us to recognize various patterns and thus control the causes to guide us in reaching our goals. The better we understand causal relationships, the higher the probability of attaining our goals both as a group and individually.

The purpose of this book is to help you better understand the notion of reality and provide the basis for teaching everyone how to think causally using a simple process and some very helpful software.

One of the fundamental reasons we are challenged in understanding reality is that it is very complex and our minds simply cannot deal with the complexity without some help. To make matters worse, our language and communication skills have heretofore prevented us from expressing the complexity that is reality—more on this later. However, with the advent of the computer and the creation of a simple tool called RealityCharting® we are now able to unlock the complexity of reality and more importantly provide all stakeholders of a given problem the ability to express and combine their realities. By creating a common reality that defines the known causal relationships of a given event, stakeholders can easily come to agreement on which causes can be controlled and how to control them, to meet their common objectives.

At the heart of this book is a new way of communicating that is revolutionizing the way people solve problems and make decisions together. Imagine your next decision-making meeting where everyone is in agreement with the causes of the problem and the effectiveness of the proposed corrective actions—no conflicts, arguments, or power politics! This is the promise of the RealityCharting process.

RealityCharting

As thinking animals, we understand our world by giving objects names (called "nouns") and we describe actions using various words that we call "verbs." We express variations of these nouns and verbs by adding qualifiers, which we call "adjectives" and "adverbs." We then assemble these words into sentences and tell stories (made of many such sentences) to communicate with others what we think we know. All humans interact with their environment in a slightly different way and thus develop a unique perspective or reality. By sharing our unique reality with others we gradually increase our collective understanding of the world we live in. However, not all of us are good at sharing what we think we know, nor are we always correct in our understanding. As a result, we often find our realities in conflict with others, which can result in ineffective problem solving and can sometimes have serious consequences. Humans have always debated the notion of right and wrong and this conflict is at the core of ineffective problem solving. The cause of these conflicts is a clash of realities, so before we can expect to find effective solutions to human problems, we need to find a way to create a common reality that everyone can agree on.

The basis for a common reality is what we call a "principle," which by definition is a causal relationship that works the same way every time regardless of the observer—the law of gravity is such a principle. As you will learn in this book, several wise men, who have come before us, have defined some fundamental laws or principles of causation that we can use to better understand reality. At the peril of all humankind, we have not learned these fundamentals well and we continue to ignore these great insights—this error will be corrected by reading this book.

The RealityCharting process described herein is based on these fundamental principles from the ancients and thus provides a principle-based approach to understanding and solving human problems. By expressing the causal relationships of a given event that includes all stakeholders' reality, we can capitalize on the knowledge of the many to create a more complete reality. Not "Reality" with a capital R, because there is no such thing, but a common reality that everyone can see and agree with.

Personal Success

Success in life is driven by the human need to be happy, regardless of how you define success or happiness. Among other things, happiness/success is caused by the absence of stress. To avoid stress we attempt to create stress-free conditions by controlling the causes of stress in our lives. To be effective at removing stressful conditions we need to understand the causal relationships that initiate stress in the first place. While we seem to know that removing stress makes us happier, research shows that stress actually damages the mechanisms that control the division of living cells in our bodies. This damage results in a shorter life due to cancer and early aging. On the flip side, research also shows that those who have more control over their lives have less stress and live longer. So, personal success and individual happiness are directly related to understanding the causal relationships that govern stress.

As you will see, the RealityCharting process is very simple and can be used on any event-type problem. But this book is more than just a way of learning how to be a better problem solver. It will take you on a journey of principles and philosophy that can lead to a better understanding of the big questions in life, like what is reality and why are we here?

1

Paradigm Shift

It becomes obvious that if we want to make relatively minor changes in our lives, we can perhaps appropriately focus on our attitudes and behaviors. But if we want to make significant quantum change, we need to work on our basic paradigms.

—Stephen R. Covey

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 typically rely 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 expose the ineffective strategies that prevent us from being effective problem solvers.



In his highly successful book, *The Seven Habits of Highly Effective People*, Stephen Covey so eloquently shares the notion of a paradigm shift. This is the big "aha" moment where we realize that what we have been doing all these years was fundamentally wrong and more importantly that a new understanding can totally change our effectiveness.

Thomas Kuhn first introduced the term "paradigm shift" in his book, *The Structure of Scientific Revolutions*. Mr. Kuhn explains that at the core of all science is the need to prove the current theory wrong and that breaking with old beliefs and accepting totally new and different views of the subject at hand causes nearly every scientific breakthrough. Indeed, as you will learn from one of the principles of causation, the more we know, the more we know we don't know. Or to put it another way, the more we know, the dumber we get. It is not the pursuit of existing knowledge that makes us effective problem solvers, but the pursuit of understanding our ignorance—to find answers to what we don't know. And since the human condition is wrought with complacency, ignorance, and arrogance, this can be a hard pill to swallow.

I first discovered this problem with conventional problem-solving methods in 1979 while working in the nuclear power industry and investigating the incident at the Three Mile Island Nuclear Power Plant. As you may recall, they experienced a reactor core meltdown and released a small amount of radioactive gasses to the local environment. I was involved in an industry group trying to understand what went wrong and to use the lessons learned from the event to make nuclear power even safer than it was at the time. In the process of evaluating and performing root cause analysis on the various failures that occurred at the Three Mile Island Plant, I discovered that the problem-solving methods of the time were grossly inadequate—and so began a thirty-plus-year journey of studying human problem solving.

By first recognizing the failed strategies of the past, I began an evolution of thought to a new paradigm about problem solving—a paradigm shift that has the potential to fundamentally change the way humans forever evaluate and solve human problems of all kinds. Being an analytic by nature and an engineer by training, I was surprised to find that there were no common or universally accepted fundamental principles of causation. Most of the problem-solving processes, and certainly the most popular ones, were people centric and subjective rather than principle based and objective. In shock, I began doing research on human problem solving and read many books, but did not find any evidence of fundamental principles

of causation, so I came up with my own. I experimented and refined them while teaching a form of root cause analysis to various companies throughout the world until I found universal acceptance. But it wasn't until several years later, with the growth of the Internet and the Google search engine, that I was able to do an extensive search of the subject. To my delight, I discovered that a few individuals had made huge paradigm shifts regarding causation in the last 2,600 years. While I was confident in the principles I had defined, I was uncomfortable with seemingly being alone in my protestations against conventional wisdom. As discussed in the next sections, I discovered I was not alone, but rather in the presence of good company.

Traditional Problem-Solving Strategies

The most basic approach to problem solving, discussed throughout history, from Buddha[1] to present time, is *causal observation*. Sometimes referred to as "street smarts," this strategy calls for observing our environment with an eye toward cause-and-effect relationships. For example, if you see smoke, you know there may be a fire, because you understand the set of causes associated with smoke. While causal observation serves us well, there are no commonly accepted principles of causation to actually guide us in this strategy. Instead we use various other strategies, such as linear thinking, categorization, storytelling, common sense, and various forms of so-called "root cause analysis," that focus on finding root causes rather than effective solutions. Let's examine each of these failed strategies.

Linear Thinking

Like a string of falling dominos, when we simply ask why, why, why, like the conventional Five Whys method, we believe that A caused B, B caused C, C caused D[2], and somewhere at the end of this causal chain there is a magical single cause that started everything, i.e., the root cause.[3]

In the thirteenth century, St. Thomas Aquinas of Sicily taught us the fallacy of this strategy when he proposed that "potency cannot reduce itself to act."[4] Or, as he clarified with this example, "the copper cannot become a statue by its own existence." It requires the conditional cause of the copper's existence *and* the actions of a sculptor. Unfortunately, this simple and important observation has not been understood or

incorporated into everyday thinking, and most people continue to see the world linearly.

Categorization

Categorizing causes is a very common event-type problem-solving strategy. Instead of identifying the actions and conditions of each effect, as St. Thomas Aquinas would have us do, this strategy places causes in a predefined box, which implies some causal information.

Categorical schemes like fishbone diagrams, management oversight and risk tree (MORT)[5], and cause trees of every ilk[5] prescribe a hierarchical set of causal factors based on the reality of one person or a group of individuals[6], depending on the source. Using a tree of causal factors (not causes) usually starting with the categories of manpower, machinery, materials, methods, and environment, these methods provide a list with subcategories and sub-subcategories, branching like the roots of a tree so the sophomoric analogy goes. These lists, which range from one page to several, often claim to include all the possible causal factors governing human activities. The stated goal of these methods is to find the root cause or causes. This is accomplished by asking if the problem at hand encompasses any of the causal factors on the predefined list. Each category is examined and evaluated to determine if the causal factor was involved in the event. If any correlations are found, the stakeholders discuss them and vote on which causal factors are the "root causes" and then solutions are applied to these so-called "root causes." It is important to note at this point that these are not causes they are evaluating; these are causal factors and there is no attempt to identify causal relationships—only to determine if this category was a factor in the event being scrutinized. Some of these methods are bold enough to provide predefined solutions for *your* problem—as if they understand the details of *your* business and the people involved. While these methodologies provide some structure to the problem-solving process and provide a reference list of possible causal factors that may help you discover some things you did not know, categorical methods are not principle-based and thus create many other problems as discussed below.

In addition to what we learned from St. Thomas Aquinas that every effect has at least two causes, as early as the fifth century BC, Buddhist writings reveal that "as a net is made up of a series of knots, so everything in the world is connected by a series of knots."[7] At the heart of this observation is a fundamental principle that all causes are part of a very complex, infinite set of causes, yet we ignore this simple observation when using prescribed categorical problem-solving strategies.

Buddha went on to state that duality and categorization are simple-minded constructs that ignore the reality of causal relationships.[8] For example, is it good or bad that the lion eats the gazelle? Neither—it is an event consisting of many complex and interactive causal relationships. Using the duality of good or bad/right or wrong simply puts the problem in a category and ignores the causal relationships of the event.

The categorization strategy is part of a larger, very simplistic strategy, which goes on to suggest that if we can categorize something, we can implement standard solutions. For example, if something is bad, we must act against it, or if something is good, we should revel in it. Or, if the training is inadequate, we can make it better, but "inadequate" is not an actionable cause. Categorical strategies may have worked fine in a simpler past, but in today's world, understanding the causal relationships of significant events can make the difference between extinction and survival, not just in business, but personally and as a species as well.

However, like the causal observation strategy, categorizing is at the core of pattern recognition, which is a fundamental biological process built into the genome of higher life forms, so it is only natural that we would develop methods like causal factors charts. Because categorization is a natural brain process, people who use these methods think they are effective. When asked to explain *all* the causal relationships of a given event, they can't do it, but they usually have a good understanding of the main causes and may even be able to explain some of the causal relationships. At the same time, they are unable to effectively communicate them, because these relationships reside in the mind, not in a graphical form that can be shared and openly discussed with other stakeholders. Categorical processes simply do not delineate causal relationships.[8] When other stakeholders cannot clearly see the reasons (causal relationships) behind a decision to change, or are not able to share their causal understanding of the problem, they are often very reluctant to accept the proposed solutions—often resulting in conflict and disagreement.

A classic example of this "causal factor" strategy can be seen in the *Deepwater Horizon Accident Investigation Report* presented by British Petroleum in September 2010. In this report, they explain that there were four "critical factors" involved when the Deepwater Horizon Oil Drilling Rig caught fire and subsequently caused the largest oil spill in the history of the United States. The critical factors identified were:

1. Well integrity was not established or failed.
2. Hydrocarbons entered the well undetected and well control was lost.

3. Hydrocarbons ignited on Deepwater Horizon.
4. Blowout preventer did not seal the well.

They also identified "eight key findings."

1. The annulus cement barrier did not isolate the hydrocarbons.
2. The shoe track barriers did not isolate the hydrocarbons.
3. The negative-pressure test was accepted although well integrity had not been established.
4. Influx was not recognized until hydrocarbons were in the riser.
5. Well control response actions failed to regain control of the well.
6. Diversion to the mud gas separator resulted in gas venting onto the oil rig.
7. The fire and gas detection and suppression systems did not prevent hydrocarbon ignition.
8. The blowout preventer (BOP) emergency mode did not seal the well.

While the report goes on to provide many causes for each of these categorical factors or findings, the investigation uses conventional problem-solving strategies to examine the causes. As a result, the analysis is incomplete and very difficult to understand. By focusing on these four "critical factors" and "eight key findings," the investigation team missed the opportunity to clearly understand all the causal relationships and more importantly to effectively communicate the many causal relationships they did understand.

To read the entire Deepwater Horizon Accident report, go to http://Coach.RealityCharting.com/book/Deepwater-Horizon.

Storytelling

Throughout history, our primary form of communication has been through storytelling. This strategy describes an event by relating people (who elements), places (where elements), and things (what elements) in a linear time frame (when elements). Stories start in the past and move linearly toward the present, while cause-and-effect relationships always start with the undesirable effect (the present) and go back in time, branching with at least two causes each time we ask why—two totally opposite concepts.

In addition to using causal factors analysis, the *Deepwater Horizon Accident Investigation Report* presented by British Petroleum uses storytelling, barrier analysis, and a crude form of fault tree analysis to understand the event. The following is an example of how they used storytelling to analyze one of the reasons why the blowout preventer did not seal the well and oil was released.

> "Solenoid Valve 103 Condition: During the yellow pod test performed by Transocean and Cameron after the accident, both coils on solenoid valve 103 failed to energize, suggesting electrical faults. The investigation team found no evidence that this failure occurred after the accident; rather, the team concluded that this failure condition very likely existed prior to the accident. (*Refer to 5.1 Maintenance* of this analysis) A faulty solenoid valve 103 would mean that the yellow pod could not have performed the Automatic Mode Function (to isolate the well), as no pilot signal could have been sent to the pilot-operated control valve to activate the high-pressure Blind Shear Ram close function. As described in *5.5 Monitoring and Diagnostic Capability* of this analysis, the rig's Blowout Preventer control diagnostic system should have been capable of remotely detecting the faulty solenoid valve and recording it on the system event logger."

Furthermore, *Section 5.1 Maintenance* of this analysis provides the following story:

> "In September 2009, A BP rig audit team conducted an audit of Deepwater Horizon. This audit included the maintenance management system for the Blowout Preventer. One finding was, "Overdue maintenance in excess of 30 days was considered excessive, totaling 390 jobs and 3,545 man hours. Many of the overdue routines were high priority." This audit, which the team performed at the end of the rig out-of-service period for ten-year maintenance and inspection, identified thirty-one findings that were related to the well control system maintenance. Of these, six findings related to Blowout Preventer maintenance; all findings were outstanding as of December 2009.

The following maintenance-related audit findings were associated with the Blowout Preventer.

- *The subsea maintenance personnel recorded well control-related equipment maintenance manually on separate spreadsheets and in the daily logbook, instead of the Transocean maintenance management system (RMS-II). This practice made it difficult to track Blowout Preventer maintenance.*
- *The lower (test), middle and upper ram bonnets had not been recertified since 2000. The original equipment manufacturer (OEM) and API-recommended recertification period is five years.*
- *The maintenance records did not substantiate that Transocean was in conformance with its five-year replacement policy for replacement of high-pressure hoses."*

The report goes on to list many other maintenance deficiencies in this same storytelling fashion.

To wit, *Section 5.5 Monitoring and Diagnostic Capability* not only provides more storytelling, but most disturbingly fails to identify critical causes as you will see from the following:

> "Diagnostics of the Blowout Preventer control system were available to the rig crew and subsea personnel through an alarm indication system and event logger. The alarm system was integrated into the driller's control panel and into the Tool Pusher Control Panel (TCP). The event logger was located in the subsea workshop, and it may never be recovered.
>
> The control panels displayed alarms in two ways: through the alarm display and through an array of dedicated alarm lights. The alarm display provided alarm tables that were programmed into the programmable logic controller (PLC), based on the importance of the component being monitored. It displayed alarm notifications for low accumulator pressure, PLC system failure, pod SEM mismatch, coil fault in the active pod, hydraulic pressure unit not available, low pilot pressure and a number of other parameters. The dedicated alarm lights displayed the most critical fault alarms selected and pre-programmed from the PLC alarm tables.
>
> The control system was capable of identifying the coil defects in solenoid valves 103 and 3A in the yellow pod and logging them

in the event logger. A failure mode effects and criticality analysis (FMECA) performed as part of the Blowout Preventer assurance analysis of *Deepwater Horizon* Blowout Preventer stack identified this failure mode. As stated in the FMECA report, when this failure is detected, the mitigation is "Switch to alternate pod, secure well and pull the Lower Marine Riser Package."

Even though this investigation is not a causal analysis, the story leaves us hanging on the next why question. Why didn't someone see or do anything about the failed solenoid valve, which they state would have been identified by an alarm at two different control panels and the event logger? There is no discussion as to whether they even made an attempt to ask the operators if such an alarm had been identified or if the operators ever looked at the event logger. Instead we are left with a dead-end cause path.

More importantly, by using storytelling to analyze the event, the causes that are identified in the report are very difficult to follow and hence hinder our ability to understand the relationships between all the causes and hence provide an honest critique of the analysis. The investigators may very well understand all the causal relationships, but because they are not presented causally we will never know and peer reviews will certainly result in many questions. Furthermore, when you discover a huge gap in the story such as why the solenoid valve failure went undetected, the entire analysis becomes suspect.

To better understand the difference between storytelling and causal analysis, compare what you just read about the oil release and the following causal analysis shown below, that was derived from the investigation report. The page numbers provided in the evidence balloons under each cause are the page numbers from the Deepwater Horizon Accident report.

Hopefully you can see from this comparison that a Realitychart provides a much clearer understanding of the event than storytelling provides.

In our normal conversations, stories are usually void of causes and also tend to leave out causal evidence. They often use categories, innuendo, and symbolism to infer causal relationships. Stories by their very nature are often focused on human actions while ignoring the necessary conditional causes. For example, a story might tell of a fire being started by an arsonist, but will not mention that the cause of the fire also included the conditional causes of flammable material, a match, and oxygen and that all these things occurred at the same point in time and space.

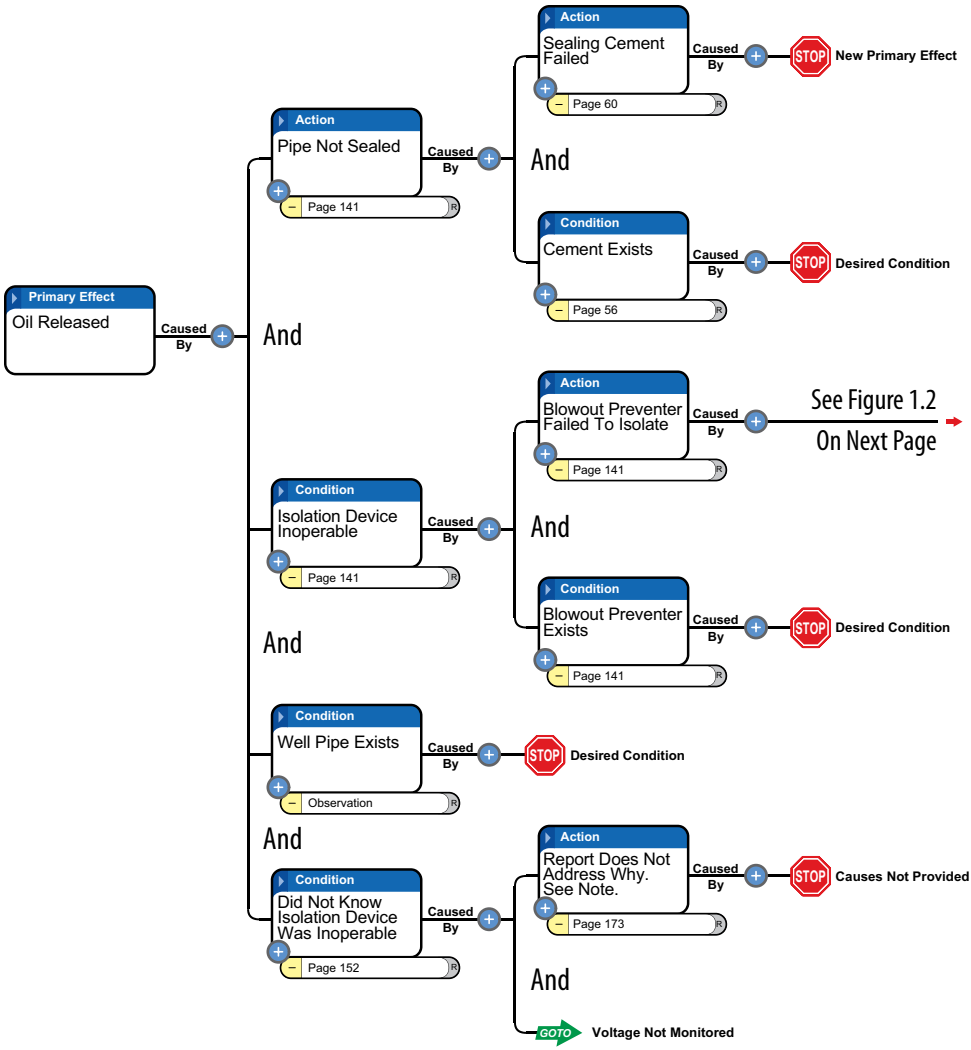


Figure 1.1. Realitychart Page 1: Deepwater Horizon Oil Spill

While conditional causes may not be important in an entertaining story, they are often the source of the most effective solutions to a problem because they are more easily controlled than human actions. For example, to prevent fires we often separate the conditional causes in time and space by not allowing the fire source (match or flame) and the combustible material to be in the same proximity at the same time.

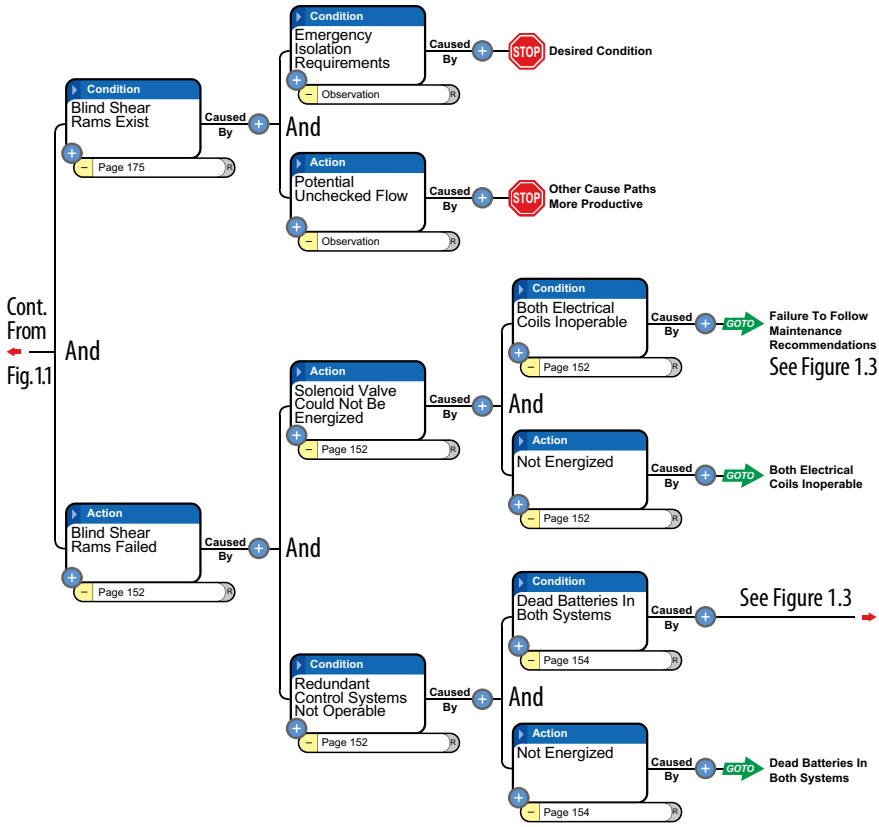


Figure 1.2. Realitychart Page 2: Deepwater Horizon Oil Spill

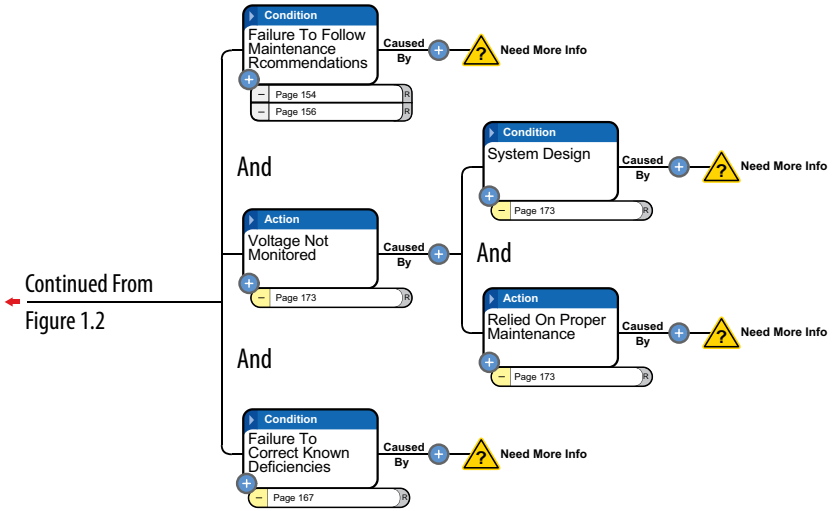


Figure 1.3. Realitychart Page 3: Deepwater Horizon Oil Spill

Common Sense

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 also believe that most of those around us are equally good at problem solving. In fact, we seem to believe that reality 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 our genetic building blocks and the environment in which our perceptions were developed cause that uniqueness. Exploring why our perceptions are 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 operational strategies as they relate to what we already know.
4. Establishing conclusions and prototypical truths.

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 to see, 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.[9]

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 glasses[9] 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.

Processing Data

In the thought-provoking book, *Descartes' Error*,[10] Antonio R. Damasio, M.D., provides great insights into the workings of the mind. Dr. Damasio and others have found the causes of learning 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 as part of this electrochemical process. If the same thought or experience is repeated, the same physical connections become stronger. Figure 1.4 shows a simplified version of this process.

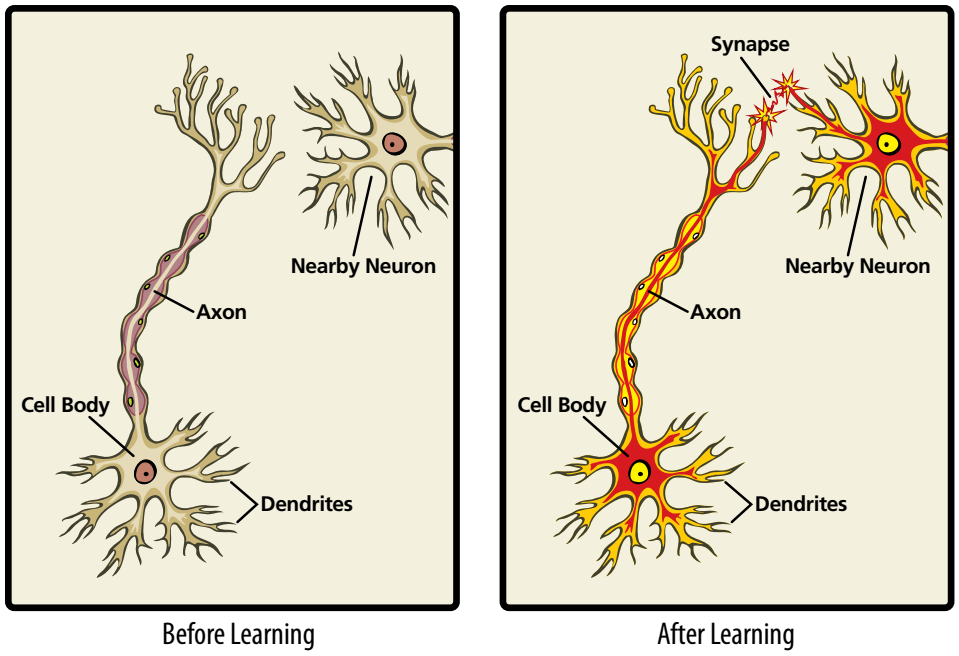


Figure 1.4. Impact of Repeated Stimulation on Learning

This is not to suggest that one connection constitutes a specific piece of conscious knowledge. It is much more complicated than that, but the observation that these neurological connections occur during learning and actually grow in size and strength with repeated exposure to a given stimulus means that we have a predilection or bias when given the same stimulus. Hence our perceptions are hard-wired.

Scientists have recently discovered there are other biological processes that also strengthen these connections. Without going into all the detailed causes, we now know that new ideas require new connections and therefore new ideas are at a disadvantage to old ideas. This does not mean we cannot learn new things, but it does mean we must remove or modify existing connections in order to register new thoughts. Old connections that are no longer needed are actually dissolved (physically) by special compounds in the brain.[11] These normal brain processes help explain the notion of truth or opinion and we can now understand that for the mind to accept a new truth, we not only have to create new neural connections, we have to abandon the existing ones and that takes time and energy, which an economizing brain is reluctant to provide.

Also, 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. Categorization in the mind is physical. Nouns are stored in one physical location of the brain and verbs are stored in another location.

We all have our own interests and abilities based partly on our 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 abandon 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 his or her own experiences, where "best" is unique to each person and is centered around what works to meet their goals and objectives.

Our Unique Conclusions

The mind is continually sensing, ordering, and developing strategies. It is always open to new possibilities but to varying degrees depending on how hard-wired the existing idea is. 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 obviously live in the same environment.

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. But don't worry—a solution is at hand.

Another element of common sense is the degree to which we hold to our beliefs. We call this "bias" or "prejudice." 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. Sometimes we remain intransigent even when the path leads directly to a harmful outcome. The kamikaze pilots in World War II or the suicide bombers of radical Islam provide a vivid example of a highly biased state.

In your daily life, consider the people who judge everything they see and proclaim it right or *wrong*! Prejudice 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. And understanding its causes 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 can become real, regardless of contradictory evidence.

If we spend our lives focused on validating specific relationships, these relationships will indeed become valid. They become valid because of repeated exposure of the mind to the same conditions—we are what we feed our minds. 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. With this belief in our own truth comes the strongest of all human characteristics—denial. Denial is our strongest attribute and now that we understand how the mind works, we can see the causes of denial are also part of our biology.

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 to move to a common reality we need a process that will accommodate everyone's reality. Defining and using fundamental cause-and-effect principles, along with stated evidence for every cause, will lead to this common understanding because it will allow everyone's reality to be included in the event analysis.

Root Cause Myth

This is a common strategy found in most categorical schemes. Again, because of linear thinking, the belief is that there is a root cause at the end of a cause chain, and our goal is to find it so we can remove or control it and thus prevent the problem from recurring (which by the way is the core definition of a root cause).

Historically, we see that this strategy has been around for a long time. In the thirteenth century, St. Thomas Aquinas also stated that nothing is caused by itself, every effect has a prior cause, and therefore there has to be a first (root) cause.[12] However, as St. Thomas has already taught us, causal reality is not linear because it requires at least two causes in the form of an action and a condition for each effect. While St. Thomas Aquinas seemed to miss the contradiction of these two arguments, we can see that the fallacy of finding the rootiest of root causes is nothing new.

Reality is more like Buddha's causal net, which is similar to Figure 1.5, where we see that the minimum causal structure of every event is an

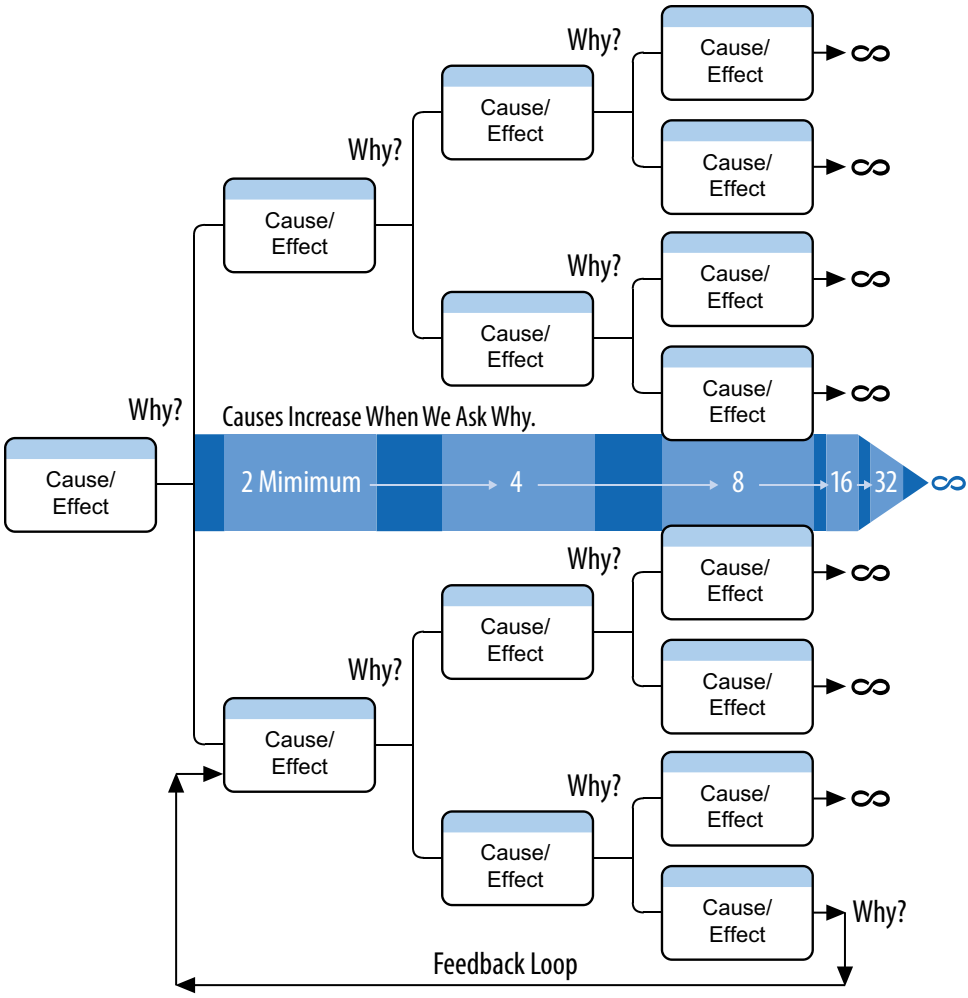


Figure 1.5. Infinite Set of Causes

ever-increasing set of causes from two to four, to eight to sixteen, to infinity with some feedback loops included. Because there is potentially an infinite set of causes for a given event, a singular first (root) cause is not possible. Therefore, in order to ensure effective solutions we must first have a clear understanding of the known causal relationships. Then and only then can we determine which causes that if removed or controlled will prevent problem recurrence. The causes to which the solutions are associated are then, by definition, the root causes. Therefore, root causes are secondary to and contingent upon the solutions, not the object of our search, as those who use the categorical processes would have us believe.

Principles of Causation

With this abbreviated review of human problem-solving, we can see that while the great thinkers had some good ideas, the lessons of the past have not been fully incorporated into traditional problem-solving processes. The following discussion incorporates what we have learned from this stroll through history to help us define some principles of cause and effect (Figure 1.6) and use them to refine the conventional elements of effective problem solving.

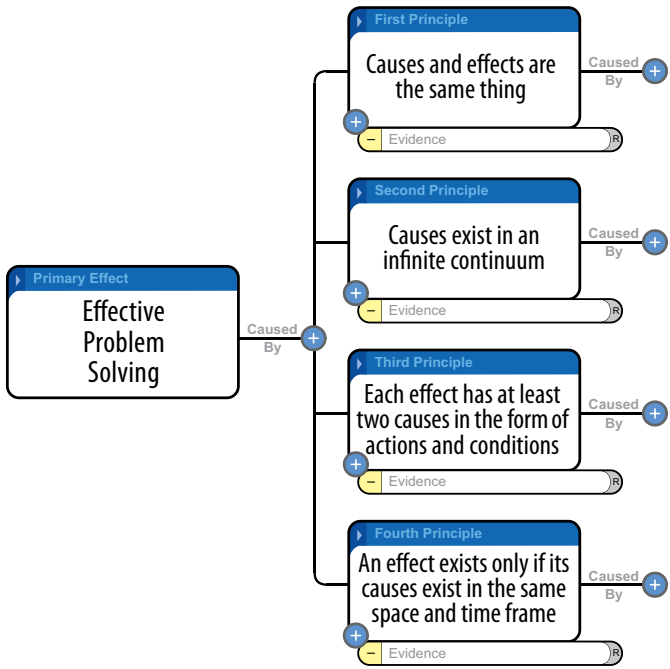


Figure 1.6. Cause-and-Effect Principles

We learned the first principle from Buddha and St. Thomas Aquinas, who recognized that causes are observed as a sequence in time from effect to cause. And since we can only ask why of an effect, what was previously a cause must be referred to as an effect so we can continue to ask why. Therefore, causes and effects are the same thing, only seen from a different point in time. Or, stated another way, the thing we are focusing on can be either a cause or an effect. Second, we learned from Buddha's causal net that causes and effects are part of an infinite continuum of causes—there are no laws or principles that require us to stop asking why,

only our own arrogance to think otherwise. The third principle, from St. Thomas Aquinas, states that each effect has at least two causes in the form of actions and conditions. While he did not require them to occur at the same point in time and space as the fourth principle states, he provided the most enlightening principle of them all—yet it has been completely overlooked by most people. The fourth principle, which states that an effect only exists if its causes exist in the same space and time frame, is self-evident in Newtonian physics.

Seven Steps to Effective Problem Solving

As discussed in the beginning of this chapter, principles are important because they hold true for every observer. To continue using people-centric problem-solving processes instead of principle-based strategies is unacceptable in the complicated world we find ourselves. Instead, we can use the cause-and-effect principles and the discussion provided herein to redefine the protocol for finding effective solutions to event-type problems.

As a minimum, effective event-type problem solving should include the following seven steps:

1. Define the problem.
2. Determine the known causal relationships to include the actions and conditions of each effect.
3. Provide a graphical representation of the causal relationships to include specific action and conditional causes.
4. Provide evidence to support the existence of each cause.
5. Determine if each set of causes is sufficient and necessary to cause the effect.
6. Provide effective solutions that remove, change, or control one or more causes of the event. Solutions must be shown to prevent recurrence, meet our goals and objectives, be within our control, and not cause other problems.
7. Implement and track the effectiveness of each solution.

Each of these steps is discussed is separate chapters of this book.

Continuous Improvement—The Essence of Quality

In our quest for continuous improvement, we must recognize failed strategies, have the courage to abandon them, embrace better ones, and

forever challenge what we think we know. Who knows, if enough people discover these principles and find the courage to abandon the comforts of their own reality by accepting a new paradigm, maybe we can actually live up to the ideal that a dedication to quality requires continuous improvement.

To view a short seventeen-minute video presentation of this chapter, go to http://Coach.RealityCharting.com/book/Effective-Problem-Solving.

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2

Conventional Wisdom Compared

> 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 that humanity chooses ignorance?
>
> — Dean L. Gano

Conventional wisdom in most subjects is nearly always wrong, but when coupled with the intellectual laziness and resistance to change inherent in the human condition, conventional wisdom leads to stasis and a dedication to ignorance. Such is the case with human problem solving. This chapter provides a short description and evaluation of the current and most common root cause analysis tools used in businesses throughout the world.

Now that we understand the fundamental problems with conventional thinking and how it prevents effective problem solving, let's take a look at the various methods people have created to help them solve event-type problems and compare these methods to the RealityCharting process. Because there is no subject or discipline dedicated to effective problem solving in the educational world, businesses have taken it upon themselves to create their own problem-solving processes. These different methods are generally referred to as "root cause analysis," and there are many books available today that discuss these conventional tools and processes.

If you want a more in-depth discussion of these methods, reference 1 provides one of the better comparisons, but it was written before RealityCharting was created, so there is no reference to it there.

Comparison Criteria

If we are to properly evaluate the many so-called root cause analysis methods and tools, we need a standard to which they can be compared. It is generally agreed that the purpose of root cause analysis is to find effective solutions to our event-based problems such that they do not recur. Accordingly, an effective root cause analysis process should provide a clear understanding of exactly how the proposed solutions meet this goal.

To provide this assurance, I believe an effective process should meet the following six criteria.

1. Clearly define the problem and its significance to the problem owners.
2. Clearly delineate the known causal relationships that combined to cause the problem.
3. Clearly establish causal relationships between the root cause(s) and the defined problem.
4. Clearly present the evidence used to support the existence of identified causes.
5. Clearly explain how the solutions will prevent recurrence of the defined problem.
6. Clearly document criteria 1 through 5 so others can easily understand the logic of the analysis.

Note: It should be noted that there is value in all of the tools and methods discussed herein, as they all help us better understand our world. The question in this discussion is which one(s) should you use to find the most effective solutions?

Various RCA Methods and Tools in Use Today

As you will discover in this analysis, there is a clear distinction between a root cause analysis (RCA) method and a tool. A tool is distinguished by its limited use, while a method may involve many steps and processes and has wide usage. I have labeled each process as a (Tool) or (Method).

Events and Causal Factors Charting:

(Tool) A complicated process that first identifies a sequence of events and aligns the events with the conditions that caused them. These events and respective conditions are aligned along a time line. Events and conditions that have evidence are shown in solid lines but evidence is not listed; all other observations are shown in dashed lines. After this representation of the problem is complete, an assessment is made by "walking" the chart and asking if the problem would be different if the events or conditions were changed. This leads to identifying causal factors such as training not adequate, management less than adequate, or barrier failed, which are identified by evaluating a tree diagram (discussed below).

Change Analysis:

(Tool) A six-step process that describes the event or problem, then describes the same situation without the problem, compares the two situations, and documents all the differences, analyzes the differences, and identifies the consequences of the differences. The results of the change analysis identifies the cause of the change and will frequently be tied to the passage of time and, therefore, easily fits into an events and causal factors chart, showing when and what existed before, during, and after the change. Change analysis is nearly always used in conjunction with another RCA method to provide a specific cause, not necessarily a root cause.

Barrier Analysis:

(Tool) An incident analysis that identifies barriers used to protect a target from harm and analyzes the event to see if the barriers held, failed, or were compromised in some way by tracing the path of the threat from the harmful action to the target. A simple example is a knife in a sheath.

The knife is the threat, the sheath is the barrier, and the target is a human. If the sheath somehow fails and a human is injured, the barrier analysis would seek to find out why the barrier failed. The cause of this failure is then identified as the root cause.

Tree Diagrams:

(Method) This type of root cause analysis is very common and goes by many names[1] such as Ishikawa Fishbone Diagram, Management Oversight and Risk Tree Analysis (MORT), Human Performance Evaluations System (HPES), and many other commercial brands. These methods use a predefined list of causal factors arranged like a fault tree (see Figure 2.1).

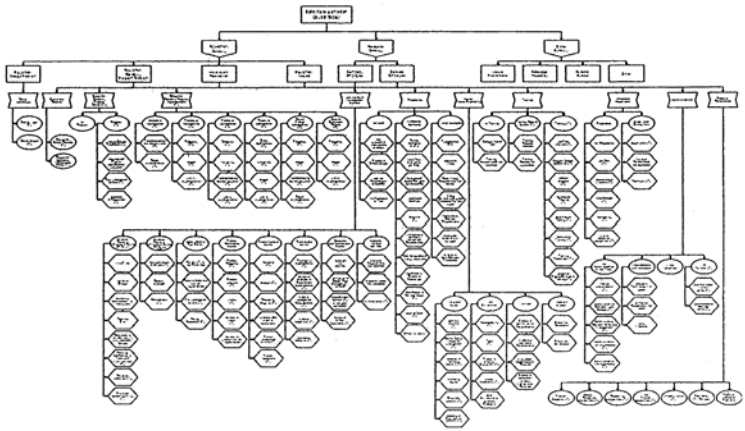


Figure 2.1. One Branch of a Tree Diagram

They are sometimes called "Pre-Defined Fault Trees." The American Society for Quality (ASQ) and others often call these categorical methods "Cause-and-Effect Diagrams." All categorization methods use the same basic logic. The premise is that every problem has causes that lie within a predefined set of categories. Ishikawa uses manpower, methods, machinery and environment as the top-level categories. Each of these categories has subcategories and sub-subcategories. For example, within the category of manpower, we may find management systems; within management systems we may find training; and within training we may find training less than adequate; and so on. These methods ask you to focus on one of the categories such as people and, in reviewing what you know of your event, to choose some causal factors from the predefined list provided. Each categorical method has its own list of causal factors.

After reviewing the list for each category, you are asked to vote on which causal factors most likely caused your problem. After some discussion, the most likely ones are voted on and called "root causes." Solutions are then applied to these root causes to prevent recurrence. Each commercial brand of categorical method systems has a different definition of root cause, but it is generally a cause that you are going to attach a solution to that prevents recurrence. Some of these methods refer to themselves as "Expert Systems" and also provide predefined solutions for your problems.

Why-Why Chart:

(Method) One of many brainstorming methods also known as "the Five Whys method." This is the most simplistic root cause analysis process and involves repeatedly asking why at least five times or until you can no longer answer the question. Five is an arbitrary figure. The theory is that after asking why five times you will probably arrive at the root cause. The root cause has been identified when asking why doesn't provide any more useful information. This method produces a linear set of causal relationships and uses the experience of the problem owner to determine the root cause and corresponding solutions.

Pareto Analysis:

(Tool) A statistical approach to problem solving that uses a database of problems to identify the number of predefined causal factors that have occurred in your business or system. It is based on the Pareto principle, also known as the 80-20 rule, which presumes that 80% of your problems are caused by 20% of the causes. It is intended to direct resources toward the most common causes. Often misused as an RCA method, Pareto analysis is best used as a tool for determining where you should start your analysis.

Storytelling Method:

(Method) This is not really a root cause analysis *method* but is often passed off as one, so it is included for completeness. It is the single most common incident investigation method and is used by nearly every business and government entity. It typically uses predefined forms that include problem definition, a description of the event, who made a mistake, and what is going to be done to prevent recurrence. There is often a short list of root causes to choose from so a Pareto chart can be created to show where most problems originate.

Fault Tree Analysis:

(Method) Fault tree analysis (FTA) is a quantitative causal diagram used to identify possible failures in a system. It is a common engineering tool used in the design stages of a project and works well to identify possible causal relationships. It requires the use of specific data regarding known failure rates of components. Causal relationships can be identified with "and" and "or" relationships or various combinations thereof. FTA does not function well as a root cause analysis method, but is often used to support an RCA. More about this later.

Failure Modes and Effect Analysis:

(Tool) Failure modes and effects analysis (FMEA) is similar to fault tree analysis in that it is primarily used in the design of engineered systems rather than root cause analysis. Like the name implies, it identifies a component, subjectively lists all the possible failures (modes) that could happen, and then makes an assessment of the consequences (effect) of each failure. Sometimes a relative score is given to how critical the failure mode is to the operability of the system or component. This is called FMECA, where C stands for criticality.

RealityCharting:

(Method) A simple causal process whereby one asks why of a defined problem, answers with at least two causes in the form of an action and condition, then asks why of each answer and continues asking why of each stated cause until there are no more answers. At that time, a search for the unknown is launched and the process is repeated several times until a complete cause-and-effect chart, called a Realitychart, is created, showing all the known causes and their interrelationships. Every cause on the chart has evidence to support its existence or a "?" is used to reflect an unknown and thus a risk. All causes are then examined to find a way to change them with a solution that is within your control, prevents recurrence, meets your goals and objectives, and does not cause other problems. The result is clear causal connections between your solutions and the defined problem. Because all stakeholders can insert their causal relationships into the Realitychart, buy-in of the solutions is readily attained.

RCA Methods and Tools Compared

Many purveyors of root cause analysis state the process is so complicated that you should use several of them for each problem or select them based on which type of problem you are experiencing. In researching the various proponents of this approach, I find that the reason some people think root cause analysis is so complicated is that they don't understand the cause-and-effect principle. To quote Albert Einstein, "If you can't say it simply, you probably don't understand it."

Method/Tool	Type	Defines Problem	Defines All Known Causes	Provides A Causal Path To Root Causes	Delineates Evidence	Explains How Solutions Prevent Recurrence	Easy To Follow Report	Score
Events & Causal Factors	Method	Yes	Limited	No	No	No	No	1.5
Change Analysis	Tool	Yes	No	No	No	No	No	1
Barrier Analysis	Tool	Yes	No	No	No	No	No	1
Tree Diagrams	Method	Yes	No	No	No	No	No	1
Why-Why Chart	Method	Yes	No	Yes	No	No	No	2
Pareto	Tool	Yes	No	No	No	No	No	1
Storytelling	Method	Limited	No	No	No	No	No	0.5
Fault Tree	Method	Yes	Yes	Yes	No	Yes	No	4
FMEA	Tool	Yes	No	Limited	No	Limited	No	2
RealityCharting®	**Method**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**6**

Figure 2.2. Comparison of Selected RCA Methods and Tools

Using the comparison criteria we established earlier, Figure 2.2. provides a summary of how each method or tool meets the criteria. One point is scored for each criterion that is met. "Limited" is scored as 0.5 points.

While the comparison in Figure 2.2 serves to show how poorly these conventional tools and methods provide effective solutions, it does not tell the whole story, as explained below.

Events and Causal Factor Charting can provide the time line to help discover the action causes, but is generally inefficient and ineffective because it mixes storytelling with conditional causes, thus it produces complicated relationships that are not necessarily causal and this only serves to add confusion rather than clarity. Instead of identifying the many causal relationships of a given event, events and causal factor charting resorts to categorizing the important causes as causal factors,

which are then evaluated as solution candidates using the same method as the categorization schemes discussed below. Events and Causal Factor Charting does not follow the principles of cause and effect discussed in chapter one.

Change Analysis is a very good tool to help determine specific causes or causal elements, but it does not provide a clear understanding of the causal relationships of a given event. Unfortunately, many people who use this method simply ask why the change occurred and fail to complete a comprehensive analysis.

Barrier Analysis can provide an excellent tool for determining where to start your root cause analysis, but it is not a method for finding effective solutions because it does not identify why a barrier failed or was missing. This is beyond the scope of the barrier analysis. To determine root causes, the findings of the barrier analysis must be fed into a principle based method to discover why the barrier failed.

Tree Diagrams also known as **Categorization Schemes**, are steadily being replaced with RealityCharting® but continue to retain a few followers because they appeal to our sense of order and "push-button" type thinking (as discussed in chapter one). There are at least seven major weaknesses in the tree diagram model.

Weakness 1. A tree diagram is clearly not a cause-and-effect chart, as the proponents of these methods would have us believe. It simply does not show all the causal relationships between the primary effect and the root

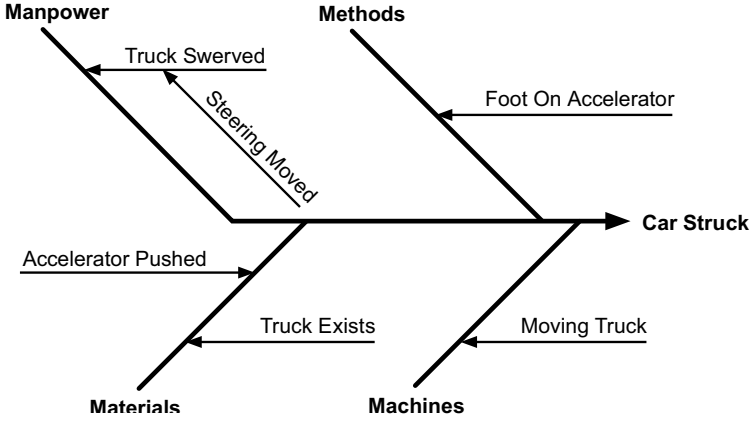


Figure 2.3. Fishbone Diagram

causes. Consider the following example. Given a simple event, I have arranged the causes according to the rules of a fishbone diagram in Figure 2.3.

As we can see, the causal relationships are not clear at all. Could it be "Car Struck" was caused by "Foot on Accelerator" and "Truck Swerved" and "Truck Existed" and "Moving Truck?" Certainly these are some causes, but their relationships are not apparent. The diagram was created by looking at the event as I understand it, asking what causes could be classified as manpower, methods, materials, and machines and then placing those causes on the fishbone according to the categories they belong in—not how they are connected causally. The theory behind these tree diagrams is that because all events have certain causal factors we can find the root causes by looking for them in the predefined set provided. And while it can help jog the mind into certain lines of thinking, it fails to provide a causal understanding of the event. And without that understanding it is not possible to know if the causes you attach the solutions to will actually affect the defined problem.

If we use this same event and create a Realitychart (Figure 2.4) we can clearly see the causal relationships. I have added the categories to the top of each cause to emphasize how knowing the category provides no value whatsoever.

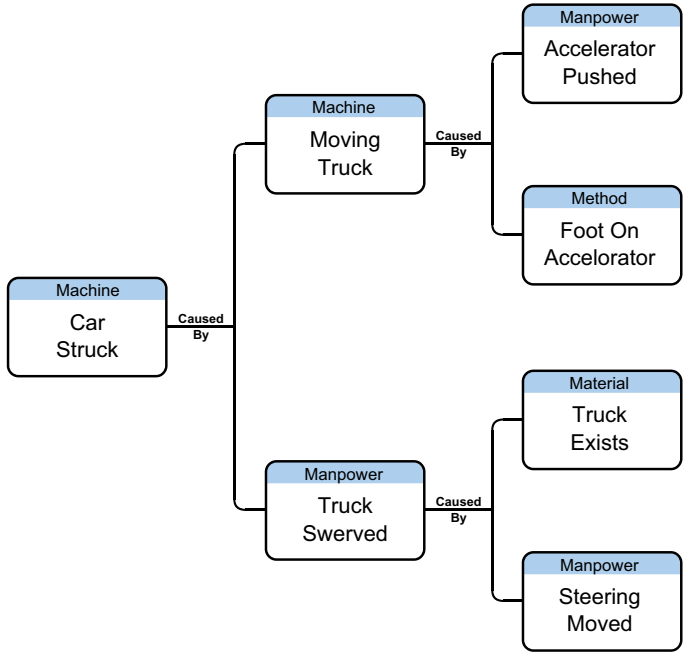


Figure 2.4. Realitychart vs. Categorization

Weakness 2. No two categorization schemes are the same, nor can they be, because as discussed in chapter one, we each have a different way of perceiving the world.[2] Therefore, we have different categorical schemes and that is the reason there are so many different schemes being sold. When asked to categorize a given set of causes it is very difficult to find a consensus in any group. For example, what category does "Pushed Button" fall into? Some will see this as hardware; some will see it as people; and some will see it as procedure. If you have ever used any of these categorization methods to find a root cause, I know you have incurred many a wasted hour debating which is the correct category.

Weakness 3. The notion that anyone can create a list of causal factors that includes all the possible causes or causal factors of every human event should insult our intelligence. Ask yourself if your behavior can be categorized in a simple list and then ask if it is identical to every other human on the planet. The very fact that a method uses the term "causal factor" should be a heads-up that it does not provide a specific actionable cause but rather a broader categorical term representing many possible specific causes. At best, it acts as a checklist of possible causes for a given effect, but it does not provide any causal relationships. Since this error in logic is very contentious with those who use these methods, it begs the question why do these methods seem to work for them. What I have discovered, after talking with many people who claim success in using these methods, is that it works in spite of itself by providing some structure for the experienced investigator whose mind provides the actual causal relationships. It is not the methodology that works, but the experience of the investigator who is actually thinking causally. And while these methods seem to work for the experienced investigator, they are still incapable of communicating the reality of causal relationships. This inability to effectively communicate prevents the synergy among stakeholders necessary to fully understand the causes of the event, which is required to get buy-in for the solutions.

Weakness 4. These models do not provide a means of showing how we know that a cause exists. There is no evidence provided to support the causal factors in the list, so it is not uncommon for causal factors to be included that are politically inspired with no basis in fact. With these methods, the best storytellers or the boss often get what they want, and the problem repeats. This may help explain why many managers and self-proclaimed leaders like this method.

Weakness 5. Categorization schemes restrict thinking by causing the investigator to stop at the categorical cause. Some methods reinforce

this fallacy by providing a "root cause dictionary," implying that it is a well-defined and recognized cause.

Weakness 6. Categorization methods perpetuate the root cause myth discussed in chapter one, based on the belief it is a root cause we seek and solutions are secondary. Because these methods do not identify complete causal relationships, it is not obvious which causes can be controlled to prevent recurrence; therefore, you are asked to guess and vote on which causal factors are the root causes. Only after root causes are chosen are you asked to identify solutions and without a clear understanding of all known causal relationships between the solution and the primary effect, this method works by chance not by design.

Weakness 7. As mentioned earlier, some of these categorical methods provide what is called an "expert system" and includes solutions for a given root cause. Expert systems can be quite useful for a very specific system such as a car or production line where most of the causal relationships are well known and have a long history of repeatability. To presume that one could provide an expert system applicable to all event-based problems seems to me to be incredibly arrogant. How could anyone presume to know the causal relationships for all systems, how they interrelate, and what constitutes the best solution for every organization or individual? Beware the salesperson.

As you can see from all these weaknesses Tree Diagrams are people centric and do not follow the principles of cause and effect discussed in chapter one.

The Five Whys method is inappropriate for any complicated event, but it is actually quite useful when used on minor problems that require nothing more than some basic discussion of the event. Unlike most of the other methods, it identifies causal relationships, but still subscribes to the root cause myth of first finding the root cause and then assigning solutions. It should never be used for formal incident investigations, but is perfectly acceptable for informal discussions of cause. A better approach to simple problems is RealityCharting Simplified™, a free software application that follows the Five Whys philosophy, but includes principle-based causal logic. To learn more about RealityCharting Simplified™ go to http://www.RealityCharting.com/RealityCharting/simplified.

Pareto Analysis uses a failure database to trend the frequency of categorical failures. This process is fraught with many landmines, a few of which are discussed below.

1. The accuracy of a Pareto chart is limited by the accuracy of the data used to create it. If you use a failed approach like tree diagrams to determine the causes, the Pareto chart will only reflect causes from the predefined list provided.
2. The cause-and-effect principle dictates that all causes and effects are part of the same continuum. It many cases, certain causes will be closely linked (i.e., close to each other). For example, the cause "procedures not followed" could be caused by "procedures not accurate." In the Pareto analysis, this causal connection is lost. Instead, we see both "procedures not followed" and "procedures not accurate" in those top causes, so we end up working on solving both problems when in reality we may only need to solve the "procedures not accurate" problem. In this example, the incomplete view of reality provided by a Pareto analysis may have caused you to expend more resources than necessary.
3. Pareto analysis can mask larger, more systemic issues. For example, if quality management has transitioned into a state of dysfunction, this can cause symptoms in many different areas, such as poor procedures, inadequate resources, outdated methods, high failure rates, low morale, etc. Pareto analysis has you capturing all these symptoms of a larger problem as causes, and wasting time solving the symptoms rather than the problem.

Storytelling:

Perhaps the most common of all methods is storytelling, also known as the fill-out-a-form method. This method was discussed in more detail in chapter one but is summarized here for consistency. The primary difficulty with this approach is that you are relying completely on the experience and judgment of the report authors in assuring that the recommended solutions connect to the causes of the problems. The precise mapping between the problem and the recommended solutions is not provided.

The primary purpose of this method is to document the investigation and corrective actions. These forms usually do a good job of capturing the what, when, and where of the event, but little or no analysis occurs.

Consequently, the corrective actions fail to prevent recurrence most of the time.

With such poor results, you might be wondering why organizations continue to use this method. The answer is twofold. First, most organizations do not measure the effectiveness of their corrective actions, so they don't know they are ineffective. Second, there is a false belief that everyone is a good problem solver, and all they need to do is document it on a form. For those organizations that recognize they are having repeat events, a more detailed form is often created that forces the users to follow a specified line of questions with the belief that an effective solution will emerge.

This is a false promise because the human thinking process cannot be reduced to a form. In our attempt to standardize the thinking process, we restrict our thinking to a predefined set of causes and solutions. The form tacitly signals the user to turn off the mind, fill in the blanks, and check the boxes. Because effective problem solving has been short circuited, the reports are incomplete and the problems keep occurring.

Fault Tree Analysis is not normally used as a root cause analysis method[3], primarily because it does not work well when human actions are inserted as a cause. This is because the wide variance of possible human failure rates prevents accurate results. But it works extremely well at defining engineered systems and can be used to supplement an RCA in the following ways:

1. finding causes by reviewing the assumptions and design decisions made during the system's original design
2. determining if certain causal scenarios are probable, and
3. selecting the appropriate solution(s).

Additional insight into the various RCA methods, and how RCA integrates with quantitative methods such as fault tree analysis can be found in Reference 3.

To view this reference go to http://coach.RealityCharting.com/_public/site/files/learning_center_libr/RCA-and-Quantitative-Methods.pdf

Failure Modes and Effect Analysis:

Failure modes and effects analysis (FMEA) is sometimes used to find the cause of a component failure. Like many of the other tools discussed herein, it can be used to help you find a causal element within a Realitychart.

However, it does not work well on systems or complex problems because it cannot show evidence-based causal relationships beyond the specific failure mode being analyzed.

RealityCharting:

RealityCharting is unlike all other RCA tools and methods. It is the only one that actually provides a graphical representation with evidence of all causes and their interrelationships. With this clear understanding of your reality, it can easily be communicated to other stakeholders, which allows them to add their reality, and in turn fosters a full appreciation of how the solutions will prevent the problem from recurring.

Summary

While conventional root cause analysis tools provide some structure to the process of human event-type problem solving, this review shows how they are significantly limited and often work by chance not by design. The common processes of storytelling and categorization are the product of thousands of years of evolution in our thinking, but it is time to move on. RealityCharting® is becoming the standard for all event analysis because it is the only process that understands and follows the cause-and-effect principles, thus it is the only process that allows all stakeholders to create a clear and common reality to promote effective solutions every time.

References

1. Paul Wilson, et al. *Root Cause Analysis—A Tool for Total Quality Management*. Milwaukee, WI: Quality Press (1993).
2. Paul M. Churchland. *The Engine of Reason, the Seat of the Soul*. Cambridge, MA: MIT Press (1996).
3. Larry Reising and Brett Portwood. 2007, "Root Cause Analysis and Quantitative Methods—Yin and Yang?" Presented at the International System Safety Conference (2007).

3

Understanding the Cause-and-Effect Principles

Things don't just happen; they are caused to happen.

—John F. Kennedy

Nothing happens without a cause. The notion of cause and effect is fundamental to all philosophies and major religions and still we hold to the whimsical adage that "stuff just happens." Highly effective problem solvers understand that there is no such thing as magic; there are only cause and effect and the unknown.

Cause-and-effect relationships govern everything that happens and as such are the path to effective problem solving. By knowing the causes, we can find some that are within our control and then change or modify them to meet our goals and objectives.

For at least 4,500 years, humankind has used the notion of causation to express human events.[1] Unfortunately, we have failed to differentiate the immense power of the cause-and-effect principle from the simple notion of causation. This chapter will take you on a journey into the depths of causation like never before documented. As we pull back the veil, we see four cause-and-effect principles:

- *Cause and effect are the same thing.*
- *Each effect has at least two causes in the form of actions and conditions.*
- *Causes and effects are part of an infinite continuum of causes.*
- *An effect exists only if its causes exist in the same space and time frame.*

We will examine each of these principles in detail so that we can build a set of tools that uses these principles to understand and document reality in a totally new way of thinking.



After teaching a class in a small town in Georgia, I was eating dinner one evening at a local restaurant. Sitting alone, I was busy watching people. A young family and their friends were seated at the table next to me. They had a small, perhaps nine-month-old, daughter seated in a highchair near her father. As the adults talked, the child was experimenting with a spoon. She banged it on the top of her highchair, licked it, and banged some more. In time, she leaned over the side of her chair and holding the spoon at arm's length, let it go. As it fell to the floor and bounced, she was immediately amazed. She looked around at the adults to see if they had seen this incredible event. They, of course, had missed it. In fact, she noticed they were paying no attention to her incredible discoveries. "What was the matter with them?" I read on her face.

With an outstretched arm and a grimace on her face, she reached for the spoon to no avail. After a few grunts and wanting cries, her father noticed her and returned the spoon to her tabletop. She smiled and returned to her play. After a few bangs, she decided to try the spoon drop experiment again. Again, it dropped straight down. It did not float upward like those big round colored objects she sometimes played with; this thing went straight down and bounced on the floor. Again, her face said it all. "This is really cool! Did you guys see that?" Looking up for acknowledgment, she seemed amazed at their total disregard for the profundity of her experiments. Again, she motioned and cried for the return of her object so she could further test the limits of her understanding. As the evening continued, she pestered her parents for the fallen spoon and proved that solid objects when released at height will always fall to the floor—it didn't matter if it was a spoon or mashed potatoes, stuff always went in the same direction.

As I watched this simple event, I saw a child learn about the law of gravity—but there was much more going on here. She was practicing a more fundamental life strategy. She was using her ability to control things and people to advance her understanding of the world.

And isn't this what we all do? We control things and we control people to accomplish our goals. In a moment of clarity, I realized that controlling causes is one of our most basic operating strategies. In the process of learning, we identify causal relationships (such as, things always fall down) and by controlling certain causes we are able to accomplish our goals. We learn that to obtain a desired effect we can act upon an object or person, and the effect will be caused to happen. Like the little girl, we may learn that if we whine enough, somebody will fill our need. The more specific knowledge we have

about cause-and-effect relationships, coupled with our ability to act upon the causes within the relationships, the better our problem-solving skills. No matter how complex the causal relationships, be they mere feelings or hard scientific facts, the problem-solving process is always the same—understand the causal relationships, determine which ones you have control of, and act on them in a manner that meets your goals.

In the past, scholars tried to understand causation by labeling and categorizing different kinds of causes. Attorneys use proximate cause and probable cause. Safety engineers use surface causes, causal factors, apparent causes, and root causes. Aristotle had his four causes—efficient, material, formal, and final, which make no sense at all in today's world. By categorizing we create boundaries or boxes that define the category based on our own belief system. Because we all have different belief systems, categorization models immediately set up a quarrelsome environment. To avoid this, it is my goal here to discuss the principles of cause and effect without categorizing different types other than what is required to understand the principles of causation.

So, what is a cause and what is an effect, but more importantly, what is their relationship to reality? This simple notion of cause and effect is easy enough to grasp as the child did in the spoon drop experiment. However, as we will discover herein, there is much more to this fundamental idea than has ever been explained. Let's look at the four principles of causation so that we can understand their structure and how they present themselves.

Cause-and-Effect Principium

The cause-and-effect principium includes four principles:

1. Cause and effect are the same thing.
2. Each effect has at least two causes in the form of actions and conditions.
3. Causes and effects are part of an infinite continuum of causes.
4. An effect exists only if its causes exist in the same space and time frame.

Cause and Effect Are the Same Thing

When we look closely at causes and effects, we see that a "cause" and an "effect" are the same thing, or as others have stated, a single thing may be both a cause and an effect. They differ only by how we perceive them in time. When we start with an effect and ask why it occurred, we find a cause; but if we ask why again, what was just now a cause becomes

an effect. This is shown in Figure 3.1 by listing a column of effects and a column of causes (read left to right, top to bottom).

Effects		Causes
Injury	Caused By	Fall
Fall	Caused By	Slipped
Slipped	Caused By	Wet Surface
Wet Surface	Caused By	Leaky Valve
Leaky Valve	Caused By	Seal Failure
Seal Failure	Caused By	Not Maintained

Figure 3.1. Injury Example

Notice how the cause of one thing becomes the effect when you ask why again. The cause of the "Injury" was a "Fall," and when you ask why "Fall," it changes to an effect and the cause is "Slipped." This relationship continues as long as we continue to ask why.

When asking why of any given effect, we may not always agree on the answer because everyone has their own perspective. Others may perceive a cause or effect differently or more deeply if they have a greater understanding of the causal relationships. For example, we know we have a cold when we ache and cough, whereas a doctor knows we have a cold when he or she can observe a virus on a microscope slide. The effect is the same, but the knowledge of the causes is significantly different depending on perception and knowledge.

Knowing that cause and effect are the same thing only viewed from a different perspective in time helps us understand one reason why people can look at the same situation and see different problems. They are actually perceiving different time segments of the same event. If we treat each perspective as a different piece of a jigsaw puzzle, we can stop the usual arguing and work on putting the different pieces together.

By understanding that a cause and an effect are the same thing only from a different perspective, we get a glimpse of the next principle.

To help better understand this principle, go to http://coach.RealityCharting.com/Book/Exercise3.1.

Each Effect Has at Least Two Causes in the Form of Actions and Conditions

Causes are not part of a linear chain as depicted earlier, but more like a fishnet. As Figure 3.2 shows, we begin to see that each effect has two or more causes and the causes come in the form of conditions and actions.

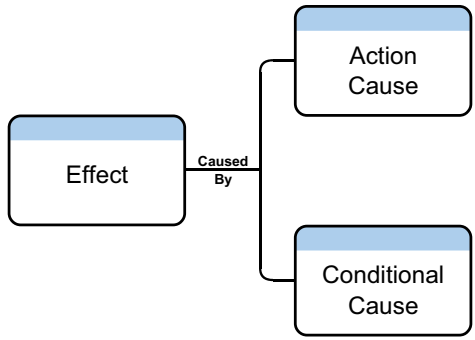


Figure 3.2. The Causal Set

That is, some causes (conditions) exist as a condition prior to the effect, while other causes (actions) seem to be in motion or otherwise active. The fundamental element of all that happens is a single causal relationship made up of an effect that is caused by at least one conditional cause, and at least one action cause.

Definitions

Actions are causes that interact with conditions to cause an effect.
Conditions are causes that exist in time prior to an action bringing them together to cause an effect.
Causal set is the fundamental causal element of all that happens. It is made up of an effect and its immediate causes that represent a single causal relationship. As a minimum, the causes consist of an action and one or more conditions. Causal sets, like causes, cannot exist alone. They are part of a continuum of causes with no beginning or end.

It should be noted that conditions, while generally static or passive, may be in a state of motion and very short lived, such as a knee being at high speed. For example, the condition of knee at high speed, when combined with an action of impacted floor, results in the effect of kneecap broken.

By understanding this principle, we know we should look for two or more causes each time we ask why. Actions are the causes we most easily recognize, while conditions are often ignored. If we are able to see the conditions, we often find that several conditions come together with an action to cause some effect, as in the case of fire in the example of Figure 3.3.

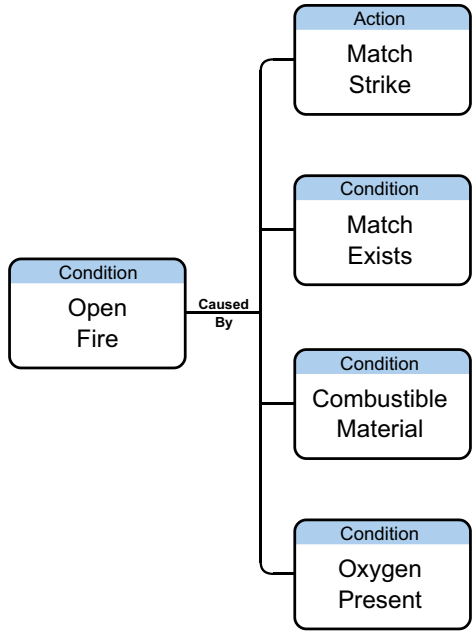


Figure 3.3. Example of Conditions and Actions

As we ask "Why Open Fire?" we see that three conditions exist in the form of "Match Exists," "Combustible Material," and "Oxygen Present." The fire is created at the moment the match strike occurs. In this example, a match strike is the action; and as soon as that match strikes, we have a fire. It takes all three conditions and one action to create the fire.

To learn more about this principle go to http://coach.RealityCharting.com/Book/Exercise3.3.

Causes and Effects Are Part of an Infinite Continuum of Causes

As we observe the structure of the cause chain created by asking why, we are drawn to a linear path of causes. The causes presented in Figure 3.1 have been rearranged in Figure 3.4 to represent a linear chain of causes. This chain of causes seems to go on as long as we keep asking why and getting answers, so where does it start and where does it end?

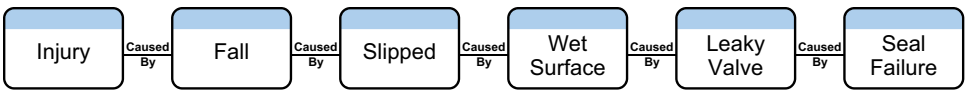


Figure 3.4. A Continuum of Causes

In event-based problem solving, we always start with an effect of consequence that we want to keep from recurring and end at our point of ignorance. Our point of ignorance is where we can honestly admit we don't know why.

Presented with a reality that has a never-ending set of causes is something we have great difficulty accepting and probably explains why we stop asking why at an early age and pursue simpler strategies like categorization and storytelling. Designed to find the right answer, the human mind simply cannot deal with not knowing[2] so we create answers when there are none. This is particularly true in group settings because we don't want to be embarrassed.[3]

Where we begin is a function of our own perspective. If we are the person responsible for valve maintenance in this example, we may choose to start asking why with the leaky valve or possibly the seal failure. If we were the safety engineer, our primary interest would be in preventing the injury from happening again, so we would probably start with injury and begin asking why.

What if we were the injured person? Our interest may be the pain, so our focus would start before "injury" at the effect of "pain"; and we would have a chain of causes that starts with "pain," as shown in Figure 3.5.

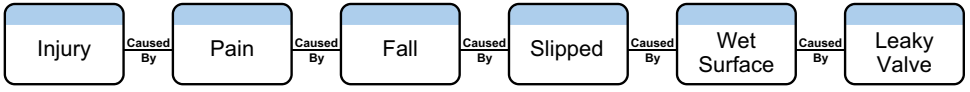


Figure 3.5. New Continuum of Causes

For our convenience, we are going to call this starting point the "primary effect."

A primary effect is any effect that we want to prevent from occurring and it can exist anywhere in the cause continuum.

The primary effect is not a universal point that we must somehow discover. It is a point in the cause chain where we choose to focus and begin asking why. This point can be changed anytime we need to change our focus. We may have more than one primary effect for a given event, which will be discussed later.

Knowing that causes and effects are part of an infinite continuum of causes helps us understand that, no matter where we start our problem analysis, we are always in the middle of a chain of causes. This helps us understand that there is no right place to start. Like a jigsaw puzzle, we can start the problem-solving process anywhere and still end up with a

complete picture. This avoids the usual arguments over who is right and allows us to focus on finding causes. Instead of arguing over what the problem is, like we normally do, we can know that all causes are connected somehow in time and we just need to figure out the relationships.

But as we learned from the second principle, causes are not linear. They branch into at least two causes each time we ask why of an effect. As we begin to explore the possibilities, we begin to see that causes are part of an ever-expanding infinite set. Figure 3.6 shows what happens each time we ask why—we get an ever-expanding set of causes. If a fire has four causes and if each of those causes has four causes, then we can see that the total set of causes grows exponentially to infinite proportions.

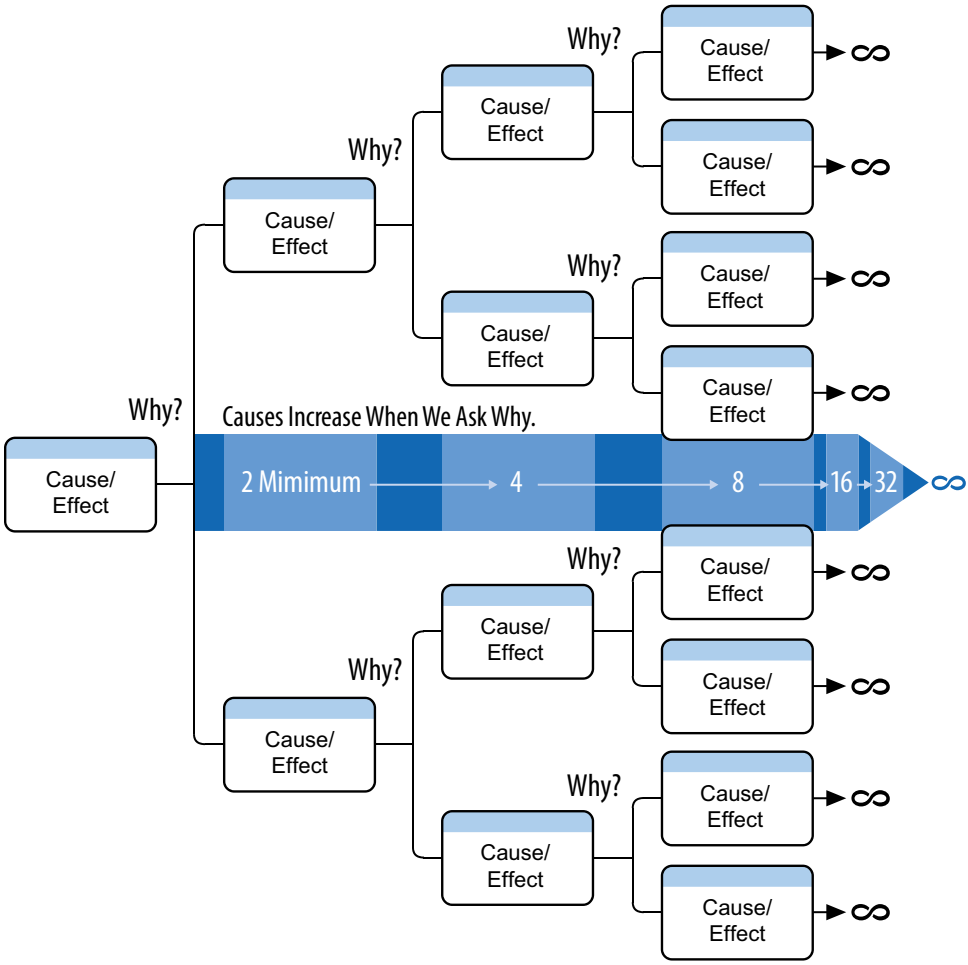


Figure 3.6. Infinite Set of Causes

As we look at this ever-expanding set of causes, we are immediately overwhelmed with too much information and the mind cannot handle it.

The reason we don't see the infinite set of causes in our world is because we have learned to filter out most of the causes. We do this quite naturally by assigning priorities and focusing on certain cause paths. We discriminate by allowing only certain causes to be recognized in our conscious mind. The infinite set is there nonetheless. In fact, you could say that it defines reality, but we only see parts of it because we are limited by our knowledge, lack of interest, available time, and favorite solutions; the natural limitations of our minds and our language do not allow us to see it. And all these filters stifle the questioning attitude we were born with.

If we examine each of these limitations, we see that our level of knowledge limits our ability to know many causes. For example, if we were to ask "why gravity," our ignorance prevents an answer and therefore we cannot continue down this cause path. We must stop and say, "I don't know."

Our level of interest also determines our ability to know causes. In the fire example, where oxygen was listed as a cause, we may ask "why oxygen," but we don't because we are met with the immediate response of "who cares?" We know that this condition cannot be controlled in this situation and hence it has no value to us.

Lack of time keeps us from exploring every causal path in day-to-day problems. We limit our time according to our sense of value or our desire to pursue the problem. This leads to a strategy of checking past experiences to see if we have encountered the same problem before. If we have, we tend to search for the solutions that worked before and implement them. Quite often, we do not clearly identify the problem or spend time understanding the causes. We simply identify the problem categorically, such as human error, and impose our favorite solution, such as punishment or retraining.

Physical limitations of the mind restrict our ability to hold very many thoughts or ideas at the same time. George Miller, in a 1956 article in *Psychological Review*, first showed that adults could only hold about seven pieces of information (data) in the conscious mind at the same time. The variability of this number being plus or minus two. For example, we can usually add a few numbers together in our minds without resorting to pencil and paper: 46 + 54 = 100. Likewise, it is fairly easy to remember a seven-digit phone number, but a ten-digit long-distance number or adding several three-digit numbers usually brings out the pencil. Our conscious mental capacity is limited to a small number of thoughts, and

yet we attempt to solve incredibly complex issues without writing them down. In the process we fail to express details and key pieces of information.

This ability to handle only seven, plus or minus two pieces of data may explain why some people believe the root cause appears after asking five whys. Although we have incredible storage capacity, our working memory and current conscious thinking are very limited.

With this severe limitation and the problems language presents (more on this later), we need some kind of tool or language aid to help keep our thoughts in front of us. This tool would have to allow an infinite set of ideas to be represented. It would have to be clear and simple to use. If we could develop this tool for problem solving and somehow identify all the causes of an event, we could use it to help decide how best to solve our more complex problems. Prior to RealityCharting® this tool never existed.

It is important to remember that while our minds naturally filter out or never know many of the causes of a problem, the causes are there nonetheless. Perhaps the single biggest lesson I have learned from all my studies of human problem solving it is that we must be humble above all things, because the only thing I am sure of is that in the face of the infinite set of causes, we really don't have the slightest idea what is going on.

This principle helps us understand the old saying that the more we know, the more we know we don't know. As you can see from this basic causal structure, every time we ask why we get at least two answers, and at some point along each cause path, we come to our point of ignorance, where we no longer have answers, but because of this principle, we know there must be at least two more causes—we just don't know what they are.

To learn more, go to http://coach.RealityCharting.com/Book/Exercise3.6.

An Effect Exists Only if Its Causes Exist in the Same Space and Time Frame

Cause-and-effect relationships exist with or without the human mind, but we perceive them relative to time and space. From observation we see that an effect exists only if its causes exist in the same space and time frame. For example, the little girl's spoon fell because of at least three causes: gravity, the condition of holding the spoon at some height, and her action of letting it go. If these causes did not exist at the same time frame and space, the spoon would not fall. If the spoon is on the floor, it is in a different space and cannot fall; or if the girl never let go, the spoon never would have fallen.

Every effect we observe in the physical world is caused by at least one action cause coming together with existing conditional causes in the same relative space. A causal relationship is made up of conditional causes with a history of existence over time combining with another cause in some defined time frame to create an effect. If we were able to see the world in stop-action, we could see, for example, a nail held in place by a hand and a hammer's head striking the nail to cause the effect of two boards being nailed together. The nail, hand, hammer, carpenter, strong arm, and wood all exist as conditional causes at the same relative place and in the same time frame of the swinging hammer striking the nail and driving it through the two boards.

One of the greatest difficulties in understanding this time-space relationship is the fact that we do not see our world in stop-action. The world we perceive is one continuous linear set of causes, all acting together like the frames of a motion picture. Our language even prevents us from expressing our thoughts in anything other than a linear time-based sequence. For example, inside the raging fire are many unseen causes coming and going at a rapid pace. If we step back and look at the big picture, we might see something different, as the following example demonstrates.

Since oxygen has existed on this planet for about 2.3 billion years and is always present in our atmosphere, we show it in Figure 3.7 as extending over a long period of time. The oily rags probably have existed only for a short period of time. Assuming the matches existed in the room near the rags for some shorter period of time, one of the matches is struck next to the rags, and we have the effect of a fire. We could say that actions are causes that bring conditions together, as long as we understand that "bring together" does not always imply physical movement. Conditions are causes that exist prior to an action and are required for the effect to occur. Like the ingredients of soup, each component is a condition; and it isn't soup until the cook says its soup. At that moment, the mixture becomes soup, until it is eaten.

When asking why of a primary effect, our linear thinking usually only provides one answer. However, as discussed, every effect is created by at least two causes (conditional and action) coming together. These conditional and action causes must each have the same when and where associated with them for the effect to occur. If we do not see this time-space relationship, the causal relationship is not valid.

There is also a relative time frame component to the causal element. For the example above we represent the match strike as instantaneous. However, if our primary effect is something like "Road Exists," caused by

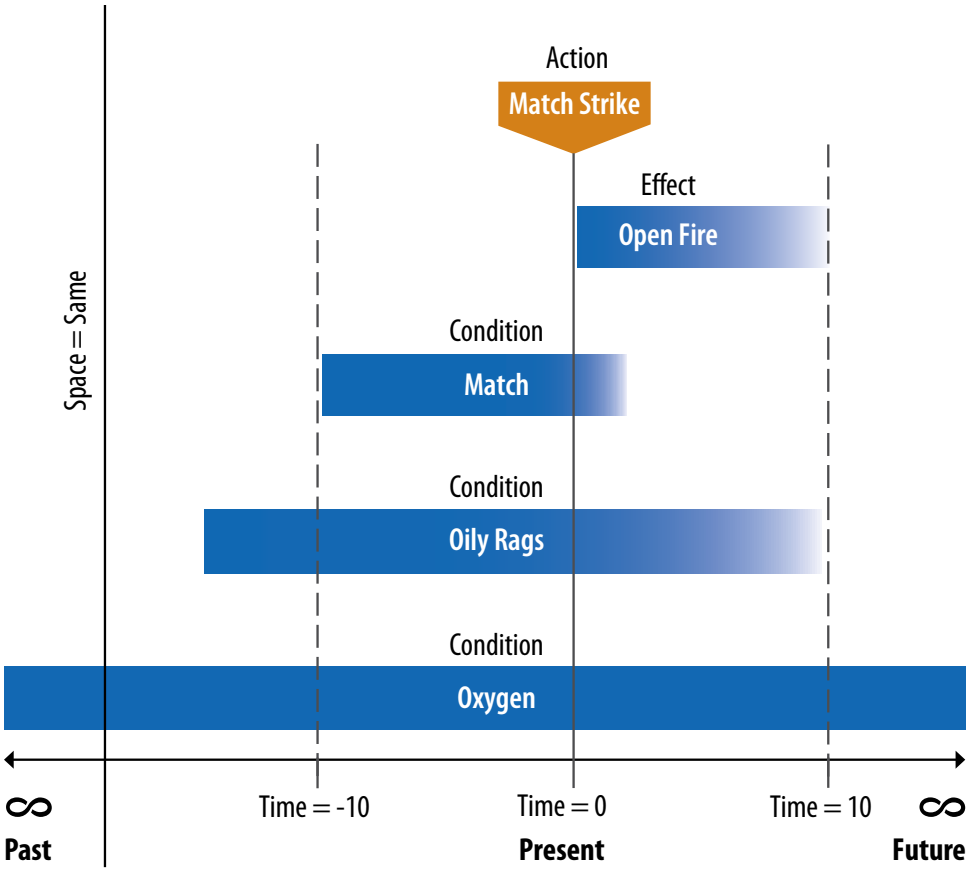


Figure 3.7. Fire Example as a Function of Time

"Road Constructed (Action)" + "Asphalt Exists (Condition)" + "Manpower (Condition)," etc., the time frame for the action cause is much longer than the action cause of the fire. See Figure 3.8.

What makes the causes valid for a given causal element is that all the causes in that element exist *at the same time frame*, where the time frame is relative to the stated causes. What becomes obvious after this discussion is that it is not easy to communicate these simple concepts because everything is relative, and our minds have difficulty processing more than one relative concept at a time, which in turn is reflected in our language. All modern languages propel us along a linear time line from past to present. They do not allow for branches of conditions and actions. I suspect that if we thought this way, language would have developed to allow discussion of the infinite set of causes, but we are really very primitive creatures and like to keep things simple. Even the

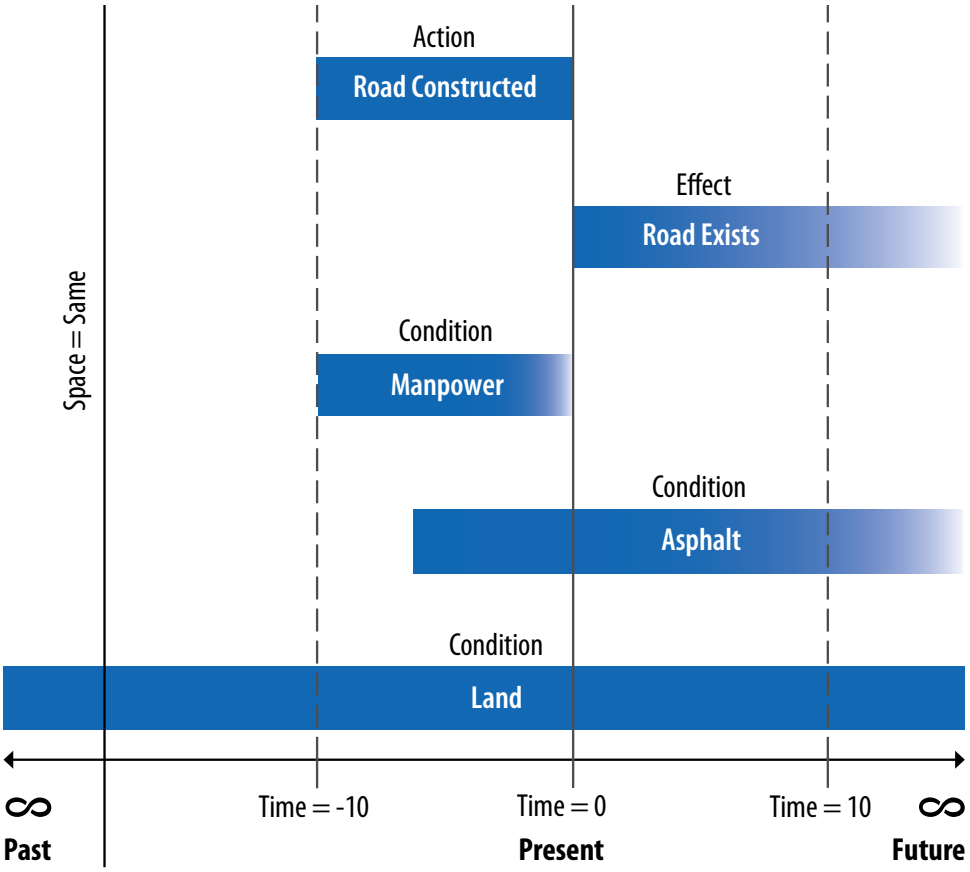


Figure 3.8. Time Frame Example

notion of infinity is difficult for most people, so it is understandable that our language reflects a simple linear causal-thinking pattern without conditional and action branches.

To have some fun with this principle, go to http://coach.RealityCharting.com/Book/Exercise3.7.

Inside the Cause-and-Effect Principle: Baby Steps

If we look inside the dynamics of causal relationships, we begin to see that not only does the infinite continuum of causes expand along both ends of the time line and expand exponentially each time we ask why, but also that there are always causes between the causes. If we change the relative time frame of a causal element to a shorter time frame, we will see more detailed causes.

In our injury example of Figures 3.1 and 3.2, we said the cause of the injury was a fall. While this is a valid statement, there are several possible causes between injury and fall. The example in Figure 3.9 shows the causes between causes and the branches in the cause path. The closer we look and the more we ask why, the more causes we find between the causes. Realizing this begs the question: How far should we go when asking why? The simple answer is always go to your point of ignorance or until you

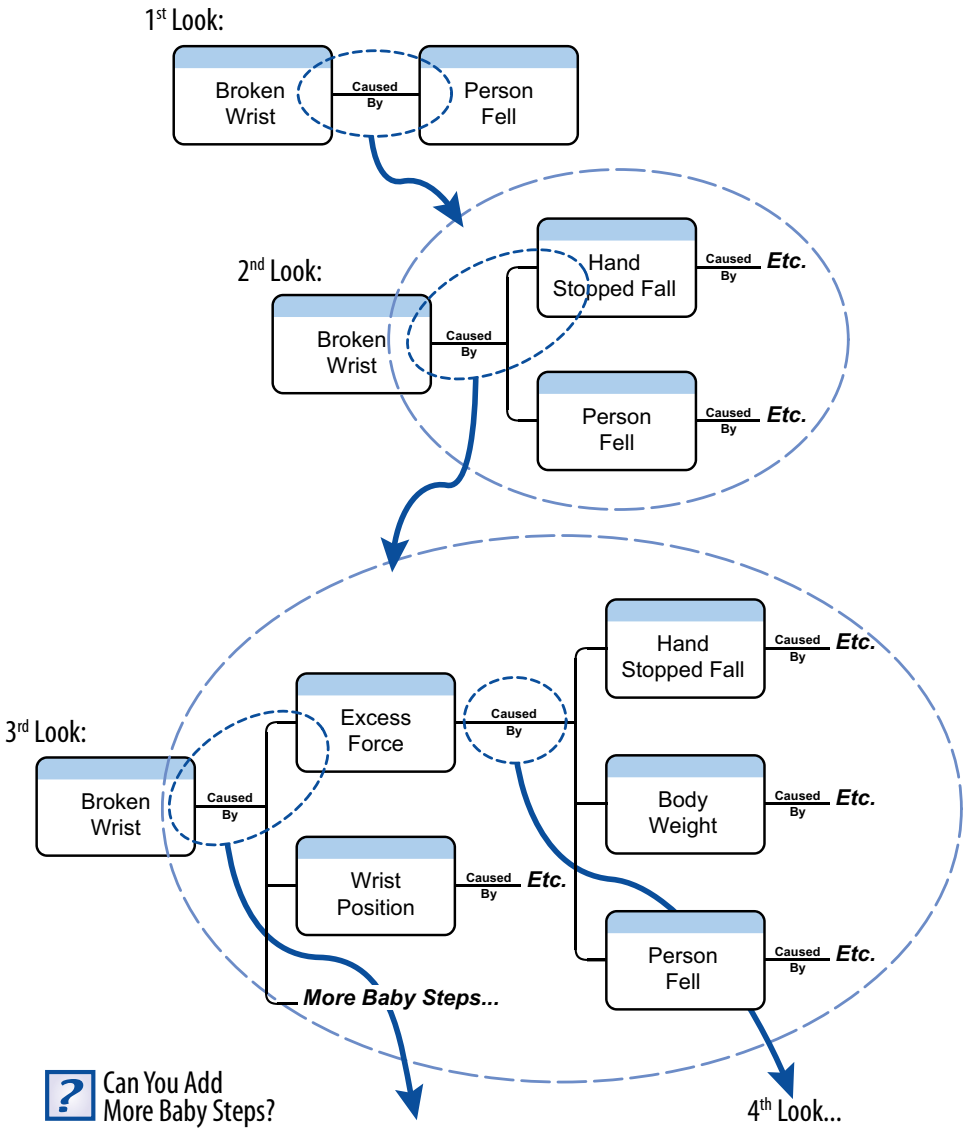


Figure 3.9. Seeing Causes between Causes

decide to stop. The decision to stop should be based on the significance of the problem and your ability to find the best solution.

The limitations of our ability to understand the infinite set of causes also apply to our inability to know all the causes between the causes. Every causal relationship can be broken into smaller and smaller pieces with each shortening of the reference time frame. I call these causes "baby-step causes" because they are like the baby steps we take in the process of learning to run. They are there but are forgotten or unknown to all observers.

Baby steps are found by looking between the causes, but they are often elusive. The more we ask why, the closer we get to understanding specific causal relationships; but the fact is, we will never know all of them. A good example of this is the use of antibiotics today. When first introduced, antibiotics could kill just about any bacterium we wanted eradicated. Today, some bacteria can only be controlled by one antibiotic, and scientists estimate that soon these bacteria will no longer be destroyed by any antibiotic.

When scientists first began using antibiotics, they developed a theoretical model of how a bacterium affects the body. After understanding most of the causal relationships, they found a way to control some of the causes so that the bacterium was killed inside the body. This produced the desired effect of returning to a healthy state, but other causes were acting as well. The bacteria are continually evolving and changing their genetic makeup as a result of environmental influences. Scientists continue to redefine their theoretical model; however, the fact remains, they do not understand all the causal relationships.

We often know enough about the causal relationships of a system to cause certain effects to exist, but we do not know all the causes. We must know more causes of cancer before we can hope to have an effective cure. When that day comes, our current methods will likely seem as barbaric as the bloodletting procedures from the past seem to us today.

When identifying causes, try to go to the level that provides the best understanding of the causal relationship. This can vary, depending upon our needs.

To help you internalize this concept, work the exercise at the following link: http://coach.RealityCharting.com/Book/Baby-Steps.

Linear Language, Linear Thinking

With a new appreciation for cause-and-effect relationships, let's take a deeper look at storytelling and language. Stories, our primary

form of communication, conflict with the cause-and-effect principle in three ways:

1. Stories start in the past, while causal relationships start with the present.
2. Stories are linear, while causal relationships follow the branches of the infinite set.
3. Stories use inference to communicate meaning, while legitimate causal relationships require clear evidence of the existence of each cause.

Let's examine a simple story to see how detrimental these conflicts are.

The little handicapped boy lost control of the run-down wagon and it took off down the hill on a wild ride until it hit the little blind girl next to the drinking fountain by Mrs. Goodwin. The little boy was in the wagon the whole way but was not injured. The boy's mother should never have left him unsupervised. The root cause of the girl's injury was human error.

Stories Start in the Past

As you can see, the story starts in the past at the top of the hill and progresses through time from the past to the present, from the beginning of the ride to the end, from the safe condition to the stated problem of injury. The conflict this creates is that by going from past to present we do not see the branched causal relationships of actions and conditions. If we could know every cause of this injury example, we would see a diagram of cause-and-effect relationships similar to Figure 3.6. That is, we would see a set of ever-expanding causes starting with the injury and proceeding into the past. To express what we know causally in story format, we would first need to express all the causes on the right-hand side of the diagram, i.e., starting from the past. Our language and the rules of storytelling simply do not allow for this. We cannot express sixteen causes and then tell what they caused and so on. No one would sit still for a story told this way because stories are about people, places, and things as a linear function of time.

Stories Are Linear

As we look at this simple story, or any story, we find our language restricts us to a linear path through time and space. Stories go from A to B to C, linearly through time without regard for the order of causal

relationships. We are told of the little boy losing control of the wagon as it goes down the hill and strikes the little blind girl. There is no ever-expanding set of branched causes expressed like those in Figure 3.6.

We have the ability to escape this linearity and express branches if we use the words "and' and "or," but the rules of grammar tell us not to use these connecting words excessively. The best we can accomplish is one or two branches for each sentence. The conflict arises because the cause-and-effect principle dictates an infinite set of causes for everything that happens, while stories are created and expressed linearly.

Storytelling, whether it is ancient history or a recent event description, is a linear understanding of an event in a time sequence from past to present, and totally ignores the cause-and-effect principle. Because we do not understand the branched causes of the infinite set, we use our own understanding of cause, which is generally to follow the action causes.[4] (See Reference 4, for an extensive discussion of this effect.) Because we typically fail to see conditions as causes, we ignore them and primarily focus on a linear set of action causes, which are often initiated by people.

Stories Use Inference to Communicate Causes

Since good stories seem to provide us with a valid perception of what happened, we need to question how this can occur in light of the above conflicts. The key word here is "perception." When we read or hear a story, our mind provides most of the information.[2] As we read the words, we are busy creating images in our mind's eye. These images are created from past experience and assembled into a sequence of events.

Because the sequence of events (the story) does not express the branched causes of the infinite set, we must make up for it somehow and we do this by inference. We infer causes within the story that are not stated. For example, we read that the little handicapped boy lost control of the wagon. Since no cause is stated for how he lost control, we can infer anything our mind will provide, and we do just that if questioned about it. Was the loss of control somehow caused by being handicapped? Could be, and many people might make that assumption, but it would be wrong.

Furthermore, stories infer cause by the use of prepositions such as "in," "on," "with," etc. Prepositions and conjunctions by definition infer a relationship between words, and the relationship is left to the reader. The word "and" is often used to mean "caused." In this story we read that the boy lost control of the wagon *and* it took off down the hill, meaning the

loss of control caused the wagon to take off down the hill. Within this "and" is the potential for many causal relationships and they are left for the reader to interpret. For me, the "and" between *lost control* and *took off down the hill* is obviously a broken steering mechanism, while someone else may picture lack of control by a paraplegic little boy as the cause, and the next person sees the wagon wheel strike a rock that causes the wagon to veer sharply. Because we do not express what is happening causally, each word in the story provides the reader with the opportunity to know more about the event than is stated—to interpret the situation from his or her own biased mind, which is not necessarily what actually happened.

In the end, each one of us thinks we know what happened, but we really don't because stories do not express the full set of causal relationships. Our linear language and the linear thinking behind it prevent us from knowing and expressing what really happens in any given situation. Couple this with the notion of common sense and the false belief in a single reality and you have the causes for miscommunication and ineffective problem solving that is so prevalent in every human endeavor. You have the cause of why almost every decision-making meeting includes conflict and arguments.

What we need is some way to communicate and assemble the causal relationships that each one of us brings to the table. By breaking away from storytelling and knowing the causal set for the problem at hand, we can find effective solutions every time. Just imagine what would happen if politicians were required to create a Realitychart before they enacted laws to solve a problem.

The Cause-and-Effect Principle Defines Reality

By understanding the cause-and-effect principle, we now know the basic structure that reality must follow. Knowing this allows us to represent any situation using causes—all we have to do is fill in the blanks. By knowing that causes are part of an infinite continuum, we know that no matter where we start working on a problem we are always in the middle. Since cause and effect are the same thing, we can move forward or backward along the cause continuum as we learn more about the causal relationships of our problem. With this flexibility we eliminate the typical bickering about what the problem really is. All ideas are accepted and aligned causally in time from present to past.

By looking for an action cause and conditional causes of each effect, we gain a much clearer picture of the problem and its causes. By

understanding the notion of an infinite set of causes, we are no longer restricted by our own paradigms. We know that each cause is like a piece of a puzzle and each person's perspective provides insight into the causes. With this understanding, the task becomes one of assembling all perspectives rather than bickering over who has the correct ones.

By understanding the four principles of the cause-and-effect principium, we can create tools that will help us break out of the old paradigms of linear and categorical thinking. These new tools will allow us to escape the death grip of a single reality and encourage everyone involved to share their ideas and thoughts. In doing so, everyone will come together with their own realities to form the common reality we need to be the best we can be. And being principle-based, this tool will work on any event-type problem.

To practice what you learned about using RealityCharting®, go to http://coach.RealityCharting.com/Book/Practice-Time.

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About the Author

Dean L. Gano is president of Apollonian Publications, LLC, which is dedicated to helping others become the best event-based problem solvers they can be by providing highly effective problem-solving tools in the form of books and computer software. Mr. Gano brings more than forty years of experience in process industries, power plants, and computer software development to this endeavor. He started his incident investigation work and subsequent fascination with problem solving while working on solutions to the incident at Three-Mile Island Nuclear Power Station in the late 1970s.

Gano has participated in hundreds of incident investigations since then and has studied the human problem-solving process ever since. His unique version of effective problem solving has been taught to people from over 2,000 companies around the world for more than twenty years. The RealityCharting process is being taught in seven major languages on five continents and is being used globally by many of the Fortune 500 companies, the National Aeronautics and Space Administration, the Federal Aviation Administration, and other government entities.

Mr. Gano holds bachelor of science degrees in mechanical engineering and general science, was formerly certified as a nuclear reactor operator, and is a Vietnam veteran. He is a senior member of the American Society for Quality and the American Society of Safety Engineers. He is a philosopher and student who finds great happiness in learning and in helping others become more successful in their life pursuits.