Table of Contents

Do Learning Teams Make RCA Obsolete?

Introduction and Fundamentals

Motivation for this Paper.

I recently attended a conference where I listened to a presentation on Human Performance Improvement (HPI) by Dr. Todd Conklin and other speakers advocating Dr. Conklin's 'Learning Team' approach. This was the first time I had heard Root Cause Analysis (RCA) referred to as 'old school' and obsolete. This got me to thinking, given I have been in the RCA business for decades, is what I do for a living…obsolete?

Abstract.

In this paper I will contrast the concept of Learning Teams as expressed by its advocates, to that of RCA Investigative Teams from my perspective. I am not speaking for all 'RCA' providers, as they vary widely and can better represent themselves (which I hope they do in response to this article). However, I believe there are fundamental steps to any professional investigative occupation that are required in order for an RCA to be 'valid'.

In the end, I will seek to answer the following questions:

1. *How does the HPI community define and view RCA versus me?*
2. *Do these two approaches complement or compete with each other?*
3. *Is there room for them to work together to accomplish a common goal?*

It is my hope that after reading this paper, both sides have a greater appreciation for the views of the other. Since my expertise is not in facilitating 'learning teams', this paper is primarily focused on defining my holistic, non-traditional view of RCA. I am then contrasting that view against what I have come to know about learning teams. It is the constructive, fact-based debate I seek to narrow the gaps in my understanding between the two approaches.

The Criticality of Defining Terms.

I've noticed that at least some of the misunderstandings regarding RCA and HPI lies in how the end-users define the terms related to the tool(s) they are using. The definitions below are from noted texts[1] [2]on the subjects of HPI and RCA. Using these published definitions will establish a common language that will then allow us to determine the extent to which we agree, and disagree, on the appropriate boundaries that govern how we properly apply and maintain the integrity of HPI and RCA.

Performance: Deviation from an expected outcome (Conklin, 2014, p. 6).

Safety: The ability to perform work in a varying and unpredictable workplace environment (Conklin, 2014, p. 8).

Human Error**:** An unexpected deviation from an expected outcome (Conklin, 2014, p. 8).

[1] Conklin, Todd. 2012. *Pre-Accident Investigations*. Burlington. Ashgate Publishing Company.
[2] Latino, Robert J., Latino Kenneth, C. and Latino, Mark A. 2011. *Root Cause Analysis: Improving Performance for Bottom Line Results.* 4th Ed. Boca Raton. Taylor & Francis.

Failure**:** The unexpected combination of normal performance variability (Conklin, 2014, p. 21).

Root Cause Analysis**:** The establishing of logically complete, evidence-based, tightly coupled chains of factors from the least acceptable consequences to the deepest significant underlying causes (Latino R. L., 2011, p. 15).

These terms are frequently associated with applying HPI principles. However, looking at them as individual terms, they all apply to foundational RCA principles as well. While this seems obvious on the surface to experienced RCA practitioners, a big problem lies in the perceptions held by those outside the RCA and HPI disciplines about when and how the principles of RCA and HPI are appropriately applied.

Let's now look at HPI perceptions about traditional applicability of HPI and RCA principles.

The term 'RCA' is quite vague, misleading and easily misinterpreted by those who are not immersed in its use.

Human Performance Investigation: HPI strives to understand and explain what happened without judgment, in order to understand the story and to provide a just and honest conclusion in each case. This gives the organization information that is incredibly comprehensive, makes it easier to identify what to correct than with 'old school' methods (Conklin, 2014, p. 45). HPI constructs the event context, and looks not at the individual pieces but at the relationships between those pieces (Conklin, 2014, p. 68).

Root Cause Analysis: RCA is widely viewed as a reactive tool that requires a high severity trigger in order to be applied. The trigger could be excessive costs/downtime, regulatory violation, injury and/or death. RCA is often associated with being a tool applied effectively, only on mechanical (physical) failures. In a classic RCA, it deconstructs the event down to its minutest part, analyzes those parts and fixes whatever is broken (Conklin, 2014, p. 68).

So it is obvious, there is a clear (perceived) distinction between the purpose and intent of these two sets of principles and their associated tools. I emphasize the word 'perceived' because it is my opinion these two approaches are not only complementary, but critical to each other's success *when fully understood and properly applied*.

The Stigma of 'RCA'

. Let's start off with some honesty…the term 'RCA' is quite vague, misleading and easily misinterpreted by those who are not immersed in its use. It is a useless and counter-productive term because there is no universally accepted, standard definition. Therefore, any process/tool someone is using to solve a problem is likely to be labelled as 'RCA'. It could be troubleshooting, brainstorming and/or some other more structured problem solving approaches such as 5-Whys, fishbone diagrams, causal factor trees and/or logic trees.
In an effort to seek balance in my understanding of HPI versus RCA, I sought the perspective of a valued colleague of mine, Ron Butcher. Ron is Director of Health and Safety, U.S. Competitive Generation, for AES. He has been fortunate enough to have worked within the aviation

community and see the similarities between aviation, nuclear, medical and certain aspects of the marine community (passenger carrying submarines) that live and breathe within systemic structures focusing on operational excellence and continuous improvement. Ron also thoroughly understands my holistic view of RCA and can contrast this to his unique background.

Ron told me:

> ***"I think the greatest single challenge to an effective causal analysis processes, from an organizational perspective, is the focus on the word "root" – Ron Butcher***

"I think the greatest single challenge to an effective causal analysis processes, from an organizational perspective, is the focus on the word "root". This focus tends to imply a single cause through a historical and largely anecdotal use of the acronym RCA. This tends to get reinforced organizationally by requirements that every incident investigation determine at least one (1) each Physical, Human and Latent root, regardless of the facts presented.

With what has been a laudable push toward safer workplaces, a bit of a commercial boom in "safety improvement" has occurred with some players bringing new insights (Latino, C. J., Dekker, Conklin, Hollnagel, Leveson, Deming and others) to the complex sociotechnical systems of the modern workplace. These newer views have combined with the view of those that cling to the 1930's technology of Heinrich, Taylor, DuPont, reductionists and a score of smaller "next great THING" RCA problem-solvers. In many cases this becomes an effort to sell offerings, more than solve problems. This has devalued the more comprehensive and field-proven RCA community through the years.

Given this variability in application of 'RCA' relative to safety, it's impossible to trend any meaningful corporate results, which largely goes to the context and process complexity as described by Dr. Leveson in 'Engineering a Safer World'[3]."

If the stigma of 'RCA' is so bad, why use it? One reason is that from a business standpoint, target markets will continue to do their due diligence when selecting qualified providers by searching on the term 'RCA'. If an RCA provider were to change the analysis name in an effort to create a marketing uniqueness, this means their target market would have to be aware the new term exists.

In response to this focus on the word "root", Jake Mazulewicz, Owner and Principal at JMA Human Performance (jake@reliableorg.com) suggested changing the term to "Root Causes Analysis". This, while a subtle change, addresses the misconception the singular term portrays. This certainly provides food for thought especially from a marketing perspective.

Essentially the term 'RCA' is a noun these days. The different brands of RCA on the market (such as our PROACT ® RCA brand being described in this article) are merely the adjectives describing different RCA approaches and providers [1]. The brand then becomes the 'uniqueness'.

[3] Leveson, Nancy G. 2011. Engineering a Safer World: Systems Thinking Applied to Safety. Cambridge. MIT Press.

Unfortunately, many in the HPI space will still associate the acronym of RCA with the widely known and very basic 5-Whys approach (linear in nature and concludes with a single root cause). I spoke with Dick Swanson (Owner, Performance Management Initiatives, Inc.) and he said, "The irony of this association is rooted in the fact that the 5-Why approach was developed by Toyota as a tool for assembly floor supervisors to keep production moving, and not as a tool to identify deep, underlying causes of complex events".

Having been in the RCA business for over three decades, I know of no seasoned investigator that would consider using only a 5-Whys approach on an event of any significance.

What Constitutes a 'Valid' RCA?

To look at RCA agnostically, getting away from brands and labels, let's briefly explore what core steps constitute a valid RCA. As mentioned earlier, if we look at any professional investigative occupation, what are the core, critical steps to a valid RCA? Dick Swanson and I suggest the following:

1. Utilization of a disciplined evidence-gathering approach, that includes,
    a. identification of relevant evidence to collect,
    b. preservation of such evidence in the field,
    c. defined strategy to collect such evidence and,
    d. development of a plan for storing and managing such evidence
2. Converting the evidence to useful information (i.e. – qualification, validation and verification [QV&V]),
3. Mitigating/minimizing potential biases of team leader and team members
4. Creation of an efficient and effective means to express and communicate the reconstruction of the Event, clearly identifying proven causal factors,
5. Ensuring the proper and timely implementation of approved corrective actions,
6. Tracking effectiveness of implemented corrective actions against measurable and meaningful bottom-line metrics,
7. Leveraging learning from successful RCA's across an organization to prevent recurrence

Root Cause Analysis (RCA) Versus Shallow Cause Analysis (SCA).

The creation of an efficient and effective expression of an Event reconstruction is more than meets the eye. The span of time from the Event to the identification of the contributing physical factors utilizes deductive logic to draw evidence-based conclusions. This is accomplished by asking 'How Could?' the facts (evidence) presented, come to be. When we explore the hard side of failure, or the physics of failure, deductive logic is appropriate because these pathways represents the visible consequences of our decisions. When we first visit a failure scene, we have to first generalize based on the 'facts' known at the time. Then we use deductive reasoning to determine how those facts came to be. This 'hard side' exploration is what we referred to as Root Cause Failure Analysis (RCFA) or simply Failure Analysis (FA).

The Switch from Deductive to Inductive Logic.

However, when we identify the Human Factors, or decision errors, and switch our questioning to 'Why', we start to employ the use of inductive logic (See Figure 1). This is the 'soft side' of the investigation/analysis. We start to explore the human reasoning process where the decision-maker was faced with specific information about the conditions at the time. At that point, they had to assimilate data in their minds and draw a conclusion to make their decision. This phase of the analysis really starts the

delving into the Decision Analysis (DA). It is here I find significant similarities between the role of an RCA team (as described in this article) and a 'learning team'. This is the point where I see HPI and RCA, working in unison. Both approaches have unity in purpose at this point in analysis.

It doesn't matter if we call the event reconstruction expression a logic tree or learning team tree (or whatever else one wants to call it), but it allows a collective expression of a common thought process the team can see and agree on (or debate). It is just a time reconstruction expression, where those closest to the work fill-in-the-blanks with facts about their realities. It is simple cause-and-effect depictions capable of representing multiple, complex paths of relationships that combined to contribute to an undesirable outcome.

Here is where we need to fully understand what made sense to the decision-maker at the time they made their decision. This is often an aggregation of deficiencies in our human performance and organizational systems (i.e. – procedures/practices, training, purchasing habits, management oversight, prior accepted practices, cultural norms, changes in environmental conditions, psychological/physiological intrinsic issues, etc). Oftentimes there are revelations when we seek to understand such decisions. Normal practices were often at play and a single condition changed that day, which made normal practices unacceptable. Not going the extra length to uncover this invaluable information and insight from the decision-maker will certainly increase the risk of recurrence somewhere else in the organization. This is because the 'true' roots/factors will still be latent or dormant, and can still be activated by another human decision-maker.

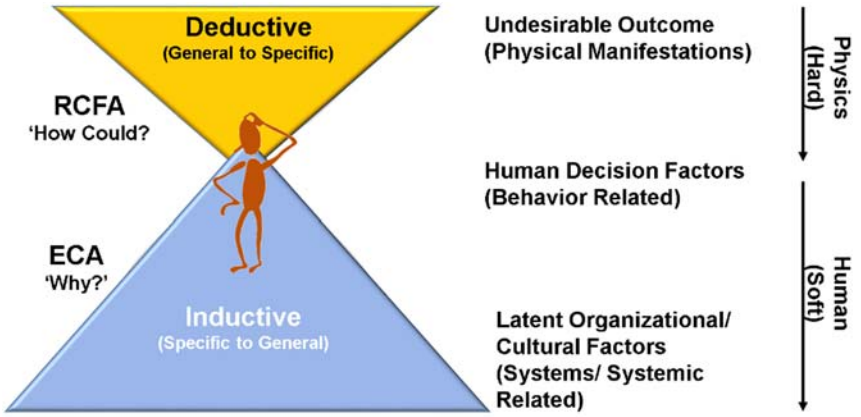

Figure 1: Deductive vs. Inductive Reasoning

ONE APPROACH TO RCA.

In the opening of this paper, I indicated I would only represent my view of RCA and not seek to represent all the other competent and qualified RCA providers. To that end, the following RCA approach represents my personal views of what RCA is based on my 33 year career as an RCA practitioner.

Proactive RCA.

There are two analytical tools I use to help quantify proactive candidates for RCA. They are basic Failure Modes and Effects Analysis (FMEA) and Opportunity Analysis (OA).

When exploring these proactive analytical tools, keep in mind their goals. Both of these tools seek to draw a distinction between 'Work as Imagined (WAI)' and 'Work as Done (WAD)'. WAI

refers to the various assumptions, explicit or implicit, that people have about how work should be done. WAD refers to (descriptions of) how something is actually done, either in a specific case or routinely[4].

Essentially WAI versus WAD is determining the gap in behavior relative to the systems we work in. Whether conducting a FMEA or OA, they both require the establishing of a Process Flow Diagram (PFD) for the process being analyzed.

A PFD is consistent with a graphical expression of Work as Imagined (WAI). In Figure 2, we see a sample PFD of Work as Imagined (WAI). For those who work on the front-lines, they will know the reality that WAI is not always the way work is done. So when looking at PFD's, using FMEA and OA, we seek to find the deviations that occurred from WAI from those who actually do the work.

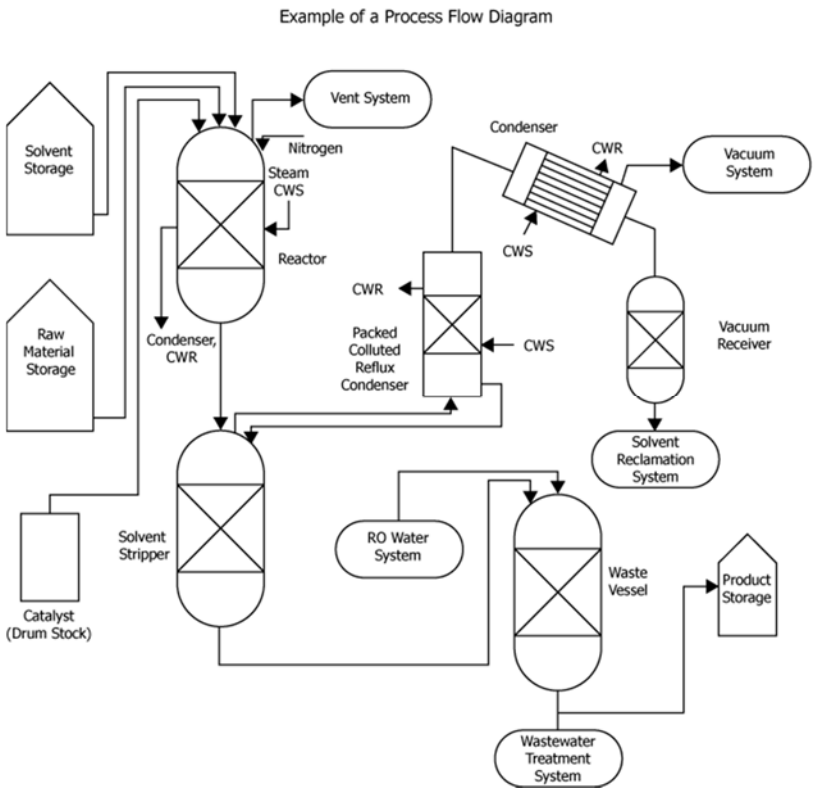

Figure 2: Process Flow Diagram Example

Basic FMEA. Let's look at basic FMEA first. FMEA is a widely used tool in the high hazard industries and a regulatory requirement in many. Its basic premise is the measure of risk

[4] Hollnagel, Erik. 2017. *Can We Ever Imagine How Work is Done?* Hindsight.

associated with a defined process being analyzed. The universal calculation of risk is based on the following calculation:

Probability (P) x Severity (S) = Criticality (C).

A sample Basic FMEA spreadsheet might look like Figure 3. In this example we are using a value scale of 1 – 10 for Probability and 1 – 4 for Severity.

Item	Failure Mode	Effect on Other Items	Effect on Entire System	Probability	Severity	Criticality
Processing Area/ Patient Rooms	Falls	Harm, > Length of Stay	Reportable Event, Claims	6	3	18

Figure 3: Sample FMEA Spreadsheet

When using FMEA, we are looking for what *could* go wrong in a defined process. In an ideal world, we would be applying this tool to a proposed new process design. This is consistent with WAI. Those who would have to operate and maintain the new process, would review the new process flow diagram (step by step) and provide inputs about the realities on the ground. They will provide input in the form of potential deviations that are likely to occur if the new plan is implemented 'as-is'. Their input would be consistent with the gap between WAI and WAD (current practice).

In Figure 3, the sample FMEA line item indicates the possibility someone could fall and injure themselves in either a manufacturing plant or a hospital room. If the fall were to occur, it could result in harm and possibly a reportable event (or claim). The value of an FMEA is that it quantifies the impacts of the identified potential deviations. In an FMEA the risks of the identified failure modes are rated based on the Probability (P) they will occur and the Severity (S) if they were to occur. So P x S equals Criticality (C). This allows the spreadsheet to sort the criticality column in descending order so we can prioritize our greatest risks.

I am unclear (but striving to learn), as to how HPI learning teams quantify their findings and leverage them for learning in other areas of the organization. I am hopeful this article will yield some feedback from learning team facilitators as to how they leverage their team's learning experiences.

Opportunity Analysis

. Opportunity Analysis (OA) is a tool that was designed to identify chronic failures that *are* occurring in any system/process, and to quantify their total annual losses. These are the failures that occur daily, but do not trigger highly visible bad outcomes. However, they frustrate those on the front lines to no end. This is because they grow tired of fixing the same failures over and over again, as well as creating workarounds to organizational systems that are not working.

The simple calculation using this OA tool is:

Frequency/Year x Impact/Occurrence = Total Annual Loss

Like the FMEA, when using an OA, a Process Flow Diagram (PFD) will be required to represent the current state of the process being analyzed. Figure 1 would work as an example in this case as well.

The following spreadsheet is from past OAs (see Figure 4). Both line items in this example are from actual OA's conducted in the past, showing a sample line item from healthcare and one from the manufacturing industry. For this example, the costs associated with each occurrence are labor costs, material costs and Lost Profit Opportunities (LPO) such as unscheduled downtime or extended lengths of stay in a hospital (due to an error).

This is important to understand because a single blood redraw[5] or a single reset of a conveyor trip will not likely get anyone's attention. Adding in the frequency factor over the past year, bubbles up these seemingly insignificant chronic failures to the top of our annual losses list.

Sub-system	Event	Mode	Frequency/ Year	Impact/ Occurrence ($labor, $ mtrls, $LPO)	Total Annual Loss
ED	Excessive Costs	Blood Redraws	10,000	$300	$3,000,000
Conveying	Production Delays	Conveyor Trips	3,000	$250*	$ 750,000

*$1k/hr downtime rate, Avg 15 minute delay, across 4 operating lines

Figure 4: Sample OA Spreadsheet

When using either of these tools, after the spreadsheets are completed, the Criticality (FMEA) or the Total Annual Loss (OA) columns will be summed up and multiplied by 80%. This will give us the 'Significant Few' number. Then we prioritize our Failure Modes (rows) from highest to lowest, and determine how many of our line items does it take to equal (or greater) our Significant Few value (see Figure 5).

This is taking a Pareto Split of the results. Using such tools determines our quantified, and thus qualified, proactive candidates for RCA. The FMEA hands us our unacceptable high risks. The OA gives us our business case for working on the most costly, chronic failures that have likely been accepted as a 'cost of doing business' and therefore hidden in plain sight. Making these into a business case will now catch the eye of the CFO types, and make those seemingly unimportant chronic failures, more important [2]. More importantly, the frustrations of the front-lines have been voiced and quantified in the form of a business case.

[5] Latino, Robert. 2011. *Patient Safety. The PROACT RCA Approach. Boca Raton*. Taylor & Francis.

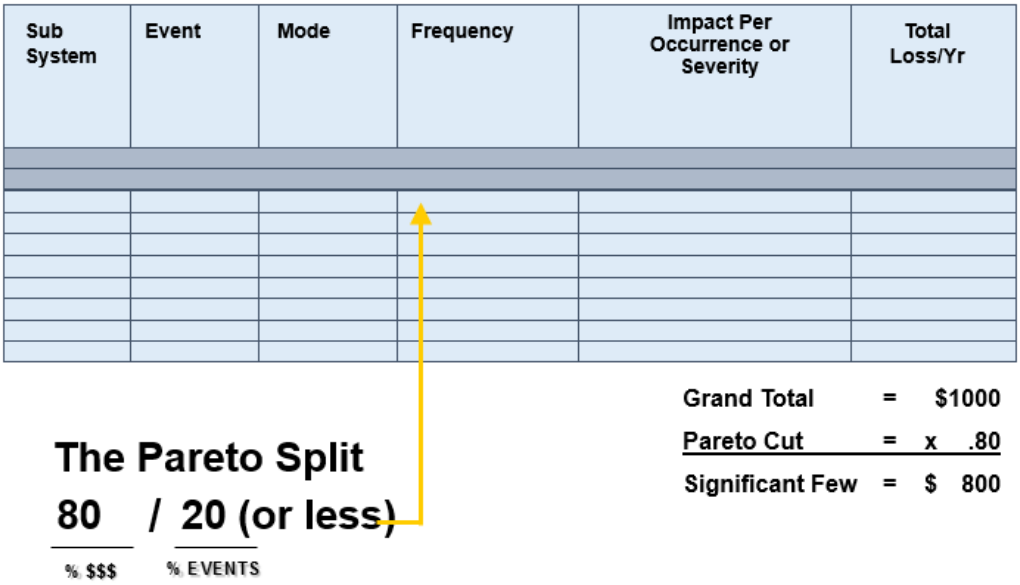

Figure 5: Determining the Significant Few (The 80/20 Split)

The end result of using these two tools, is they provide qualified, proactive candidates for conducting RCAs, which would otherwise not be analyzed in any depth.

Gathering and Processing Evidence/The 5-P'S.

Prior to conducting a formal RCA, investigators must be efficient and effective at developing and implementing their evidence collection strategies. The better we are at initial data collection, the more timely and thorough the RCA will be.

I use something called the 5-Ps to help guide me to collect data in the following categories: Parts, Position, Paper, People and Paradigms (See Figure 6). This evidence is eventually used to validate Hypotheses (H), created in the logic tree (or our event reconstruction tool to be discussed).

The 5-P's descriptions below are very broad summaries. The reality is my firm teaches workshops focused on evidence collection, analysis and validation alone, ranging from 2 to 5 days. I do not want to minimize the critical importance of proper evidence collection and validation, prior to and throughout the analysis itself [3]. Since the focus of this paper is to contrast learning teams to RCA, we will not delve into the vast topic of failure scene investigation.

Other effective evidence approaches exist. The important issue is that such data is identified, preserved, collected, validated and properly documented.

From a terminology perspective, the evidence gathering phase is what we refer to as the 'investigation'. When we start to reconstruct the event using such evidence, this is the 'Analysis' phase.

Figure 6. The 5-Ps Data Collection Categories

Understanding the Event/Event Reconstruction**.** As a career investigator, I have found a logic tree to be a much more effective tool to construct and express the complex, inter-relationships of an event. A logic tree is a reconstruction tool that seeks to unwind the timeline using short, successive iterations of cause-and-effect relationships moving backwards in time. The logic tree is a retrospective tool.

A logic tree starts with the **Event** (E) or Undesirable Outcome (deviation from an expected outcome). Usually the Event is the final consequence of the failure (the effect), or the reason you care and are conducting an RCA. Typically the event is a business level concern where there was excessive costs incurred, harm/injury/fatality, regulatory violation of some nature or a high risk, near miss.

The **Modes (M)** are the physical manifestations of the failure that led to the final consequence or Event. These are observable, indisputable facts/anomalies at the scene of the failure (see Figure 7). Examples of Modes may be things like a pump failure, laceration to a hand, loss of a key client, low process yield and contaminated product. Think of the purple lined box encompassing the Event and Modes, as the caution tape around the crime scene. Everything inside it, is an indisputable FACT. Such facts exist and need to be explained.

As we drill down from the known facts (Modes), we now have to determine/hypothesize possibilities of how the facts came to be. We will use previously collected data using the 5-P's data collection process to validate our hypotheses.

Hypotheses proven to be true, continue to be drilled down by asking the same question of 'How Can?' **Hypotheses (H)** proven not to be true are marked out with an 'X'. By asking the question

'How Can?' versus 'Why?", we are seeking all possibilities as opposed to the single most obvious one.

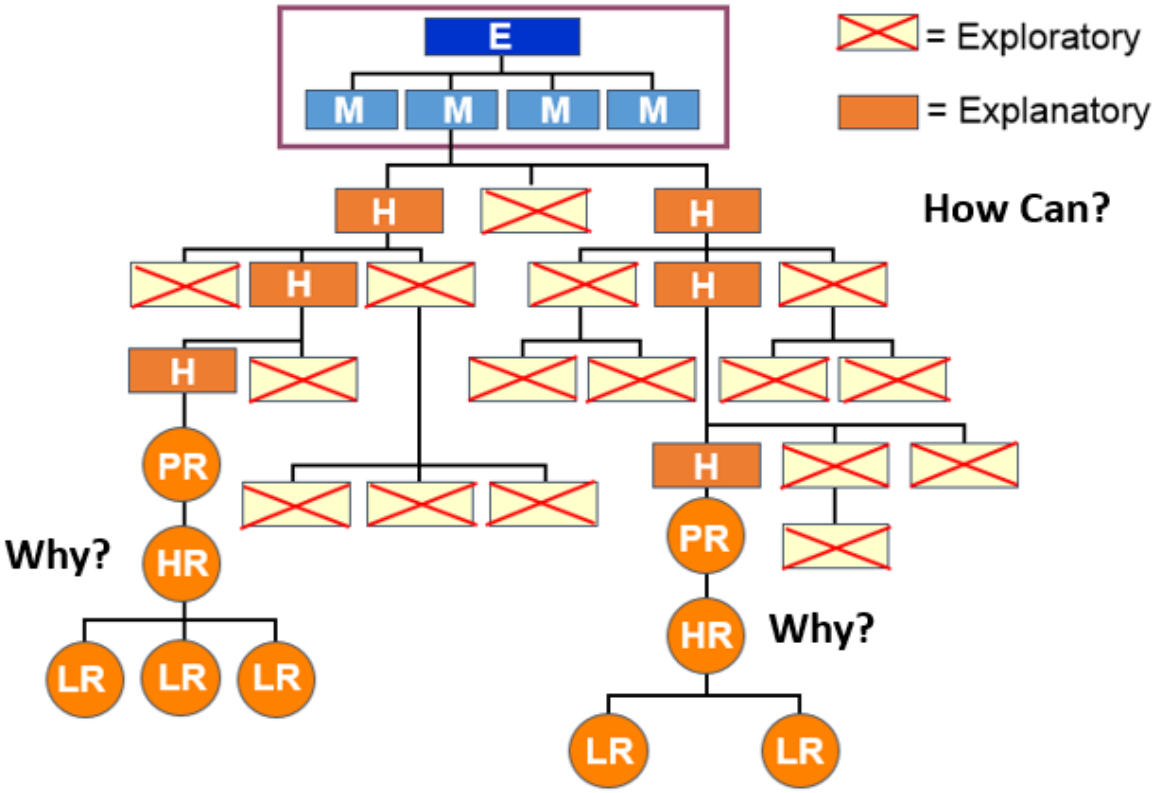

Figure 7: Logic Tree Expression

Asking 'How Can?' vs 'Why?'**.** This seems like semantics but there is a big difference. Think about the population of answers to our 'How Can?' question as opposed to our 'Why?' question. This means in most cases we will find multiple hypotheses occurred at the same time versus only one.

All hypotheses proven to be true, require further investigation/analysis. This will result in the exploration of simultaneous paths to failure as opposed to the single, linear path advocated by the 5-Why approach.

Oftentimes, when people are time pressured to complete an analysis/investigation they will take short cuts. Such short cuts are normally in their efforts to collect evidence, because that is what takes the most time. This also affects our desires to look past the obvious, like a failed bearing, and see if there were other parallel influences at play.

Think about the population of answers to our 'How Can?' question as opposed to our 'Why?' question.

Uncovering 'Root' Factors**.** I agree the term 'root' is very controversial as it is ill-defined. 'Root' insinuates a finality of sorts where we cannot go deeper. The term can also be viewed as negative and therefore connoting blame. This

is especially true when we delve into the human decision-making processes. We will use 'root' in this article as being synonymous with the term 'factors' that led to an undesirable outcome. Had the factor not occurred, the failure path would not have been permitted to start, proceed nor complete. The term 'factor' seems more neutral and less offensive/threatening.

For the reader, call these 'roots' whatever label you want to satisfy the powers that be in your organization. In the end, the label doesn't matter as long as we do something about them in terms of effective corrective actions to change behavior. Don't get hung up on labels; focus on actions to prevent recurrence.

Physical Roots (PR)/Factors**.** As the Event is unraveled going deeper and deeper, we will uncover the physical root causes of the Event. These are what analysts traditionally associate with the goal of an 'RCA', the mechanical and electrical types of causes. When analyses stop at the **Physical Roots (PR)**, those types of analyses are commonly referred to as Root Cause Failure Analysis (RCFA) or just Failure Analysis (FA). [4].

Human Roots (HR)/Factors**.** When using a logic tree, the analyst will go past the physics of failure and inevitably start to uncover decision errors or **Human Roots (HR)/**Factors. These are simply errors of omission or commission by the human being. Workers don't cause a failure, they trigger them (Conklin, 2014, p. 66). It is not as important as to who made a poor decision, but why that person felt the decision they made at the time, was the right one.

"Workers don't cause a failure, they trigger them." – Todd Conklin

When we identify such decision points in our logic tree, we then switch our questioning process from 'How Can' to 'Why'. This is the critical pivot point in the Event reconstruction where we switch from deductive thinking to inductive thinking. This is where we switch from RCFA to exploring human reasoning. This is where we move beyond shallow cause analysis and conduct a true root cause analysis.

We want to know 'why' the decision-maker made the decision they did, at that time. What was the reasoning going into their decision? This is what true RCA is all about, understanding why good people made poor decisions on any given day. What was going on in their minds at that time, because 99%+ of the time, they did not intend for the undesirable outcome to occur.

The research has revealed that an important part of safety is enhancing opportunities for people to recognize that a trajectory is heading closer to a poor outcome and to recover before negative consequences occur (Rasmussen, 1986)[6]. This is the basic premise of proactive thinking. When things do not end up as intended (i.e. – work as imagined), then what was it about the decision-maker's vision of what would happen, differed from what did happen (i.e. – work as done).

[6] Rasmussen, J. (1986). *Information Processing and Human-Machine Interaction: An Approach to Cognitive Engineering.* New York: North-Holland.

When we get to these decision points in a logic tree, this is essentially when an RCA truly starts to yield value. It is here where we seek to thoroughly understand how the organizational systems and cultural norms affected the decision-maker. Decisions and actions having a negative outcome will be judged more harshly than if the same process had resulted in a neutral or positive outcome[7]. We see this all the time. We can go from hero to zero in a matter of seconds.

We learned from the space shuttle Challenger disaster, the term normalization of deviance. Whenever someone is time pressured they are prone to take short cuts. When we take a short cut and nothing bad happens; we have just lowered our standard. This process reiterates until the gap between practice (i.e. – work as imagined) and standard (i.e. – work as done) becomes dangerous.

On Challenger, the o-ring design deficiency was known about from the beginning. However, Challenger kept going into space and returning for 25 missions. So the launch decisions under those conditions were acceptable because the previous missions were successful. However, on January 28, 1986, they decided to launch again with the implied pressure there was a teacher on board and the next day President Reagan would be talking with Christa McAuliffe while she was in space. But one condition was different this day, it was 36F at launch, 15F colder than they had ever launched before. That one factor turned the decision-makers from heroes to zeros instantly. Evidence indicates that had the launch temperature been 36F on any other day, the result would have been the same. So what goes through people's minds under such situations, when the physical evidence may not support what is deemed 'right' in the decision-maker's mind?

In order for progress to be made, leadership will at times have to swallow their pride and acknowledge they were part of the problem, if that is what the evidence shows.

Latent Roots (LR)/Factors**.** Drilling past the decision-maker to explore the decision rationale will yield a great deal more information and context on why physical bad outcomes occur (rather than simply blaming the decision-maker). The reality is if we shortsightedly blame people for making poor decisions, the real root causes associated with organizational and human performance system deficiencies or **Latent Roots (LR)**/Factors, will never be uncovered. This means the likelihood of a repeat failure remains, as others will continue to be influenced by those flawed systems.

Factors that reduce error tolerance or block error detection and recovery, degrade system performance[8]. These are our safety systems that we have in place, that have vulnerabilities expressed as holes in the cheese, using Dr. James Reason's Swiss Cheese Model[9]. This is what we are digging for in latency exploration when using a logic tree.

[7] Woods, David D. and Cook, Richard I. Perspectives on Human Error: Hindsight Bias and Local Rationality. Pg.4
[8] Woods, David D. and Cook, Richard I. Perspectives on Human Error: Hindsight Bias and Local Rationality. Pg.4.
[9] Reason J. Human Error. New York: Cambridge University Press; 1990.

Uncovering human performance and system/systemic related flaws that influence people's decision-making, is the key to proaction and prevention of undesirable outcomes.

This is a very sensitive area as well, because leadership may feel they are being blamed for the existence of poor systems. In order for progress to be made, leadership will at times have to swallow their pride and acknowledge they were part of the problem, if that is what the evidence shows.

A safety culture is one that allows the boss to hear bad news[10]. This also means they have to look in the mirror and admit they may have been part of the problem [5].

When used properly, the logic tree is able to directly correlate poor systems/cultural norms to poor decisions and ultimately to undesirable outcomes, using supporting evidence all along the way. The logic tree graphically expresses the complex inter-relationships between system influences, man and machine in a very digestible, efficient and effective manner.

Is RCA a Linear Causal Tree?

This is a common myth because so many associate the term 'RCA' as being consistent with the application of a 5-Why's tree. Traditional use of 5-Whys misleads people into thinking failure is linear and all failures have a single root cause (see Figure 8). I have heard it referred by many to be 'the Eureka Approach'. This is simply not reality. These are actually the primary, technical restrictions of the 5-Whys approach and why it is not considered by many (including me as a practitioner) as a valid RCA tool for complex events. It does not allow the expression of parallel paths to failure, which we know things happen simultaneously all the time and result in an undesirable outcome. 5-Whys is also not known for its rigor when it comes to collecting evidence to back up their linear hypotheses.

[10] Dekker, Sidney. 2002. *The Field Guide to Human Error Investigations.* Burlington. Ashgate Publishing Company.

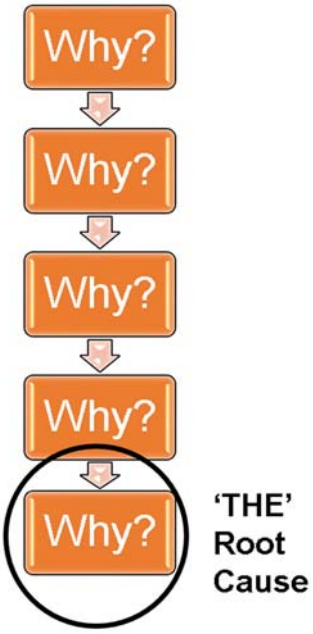

Figure 8: Traditional 5-Whys Expression

The Importance and Method of Telling the Story.

The logic tree also becomes the graphical storytelling tool that can carry an audience through the details of the Event as it unfolded (along with a complete narrative and verification log of evidence). In Figure 7, this logic tree demonstrates the ability to graphically represent the story (paths to failure) of what 'did' happen, within the bigger content of what 'did not' happen. The actual paths to failure represent the *explanatory* tree and the entire tree (including the 'NOT TRUE's) is the *exploratory* tree.

Traditional use of 5-Whys misleads people into thinking failure is linear and all failures have a single root cause.

A logic tree also creates a respository of logic, which is a living and growing knowledge base (database) that can be leveraged throughout the corporation. Lack of such a knowledge base creates an astounding amount of rework, simply because others in the corporation were not aware similar or the same such Events had already been analyzed. Being able to query on such a repository of knowledge is a key corporate asset. To pull all of this together, feel free to watch a full video case study referenced as Resource 6 [6] at end of this article. This storytelling capability, along with the ability to create a meaningful knowledge base of the findings, puts the entire Event into proper context.

RCA Applicability to Safety Events.

Cause-and-Effect relationships are at play whether it is a mechanical, quality, administrative failure or a safety event. It is at this point we consider the Decision Analysis (DA) phase of the RCA, as consistent with the principles of HPI and learning teams. As described, they can both be employed proactively and reactively. The only difference I see is in 'traditional RCA' cases, the Event may be equipment or process related and is Safety, the Events may be

related to injuries and fatalities. The same questioning process from that point on is used to understand direct cause-and-effect correlations until all the physical, human and latent factors are uncovered.

The Concept of Learning Teams.

The concept of DA and Learning Teams are not new to me. Their uniqueness may lie in the skill of the team facilitator, but that is typically always the case. In 1989 Jack Welch transformed GE using an approach he developed called 'Work-Out'. While his means may have been different than DA or Learning Teams, the concept of quickly unleashing the creativity of the workforce was very similar.

"This new approach was a complete break from the popular scientific management system created by Frederick Winslow Taylor. Scientific management was the basis of the assembly line - a hierarchical system where employees performed routine specific tasks over and over and over. While Taylor's system was a perfect fit for physical labor, Welch knew the work world had shifted to a knowledge economy, where value was created more by more mental, and less physical, exertion. In this new system employees were no longer regarded as replaceable cogs but rather valuable resources who could provide valuable feedback for organizational improvement. With this in mind, in 1989 Welch launched a bold cultural initiative called "Work-Out."

The Work-Out, as created by Welch, all employees were required to attend their respective Work-Out session. A typical session would last three days and consist of workers giving suggestions to managers for improving processes. Managers were required to say "Yes", "No", or "I'll get back to you at a specific date." Amazing to those who may have worked in a bureaucratic system before, managers in these Work-Out sessions said "Yes" 80 percent of the time.

Over the course of years, looking to employees for suggestions in improvement delivered big results. Among them:

- In just three years after the Work-Out program was launched, company earnings attained double-digit increases in 1992 and continued for every year after that. Previously single-digit increases were the norm throughout the 1980s.
- Inventory turnover, a good measure of how efficiently products are being managed, was over eight in 1999 where it had been in the three to four range for GE's last 100 years.
- Operating margins rose to 17.3 percent in 1999 where they had been under 10 percent for GE's previous century.

By including all employees in the program, Welch managed to unleash the value of GE's 300,000 person work force. GE's receptivity to new ideas also enabled the company to rapidly adopt and popularize the system of production, originally created and used to produce great results at Motorola"[11]

From my perspective, RCFA + DA = RCA (Figure 9) . RCA is NOT just a linear expression of failure logic.

[11] *How Jack Welch Transformed GE With Employee Engagement.2014*.https://www.vocoli.com/blog/december-2014/the-jack-welch-work-out/. Accessed June 26, 2017.

Figure 9: Critical Elements of an Effective RCA System

Are the Myths About RCA True?

So given this detailed explanation about the construct of an effective RCA approach, do the discussed myths about RCA hold up?

1. RCA can't be applied pre-mortem (via FMEA and OA, pages 7-11) **FALSE**
2. RCA can't be used to provide 'context' to the nature of the Event (Storytelling, page 16) **FALSE**
3. RCA can't demonstrate the How (physical), Who (human) and Why (latent) (Logic Tree, page 12) **FALSE**
4. RCA doesn't promote a questioning attitude (How can vs Why, page 13) **FALSE**
5. RCA can't help identify multiple causes (Uncovering Roots, page 13) **FALSE**
6. RCA can't be applied to all undesirable outcomes (Applicability to Safety, page 17) **FALSE**
7. RCA doesn't show how 'good people' can make 'bad decisions', and why they do so (systems influence) on any given day (Latent Factors, page 15) **FALSE**
8. RCA can't demonstrate direct relationships between systems, people and bad outcomes (Event Reconstruction, page 12) **FALSE**
9. RCA can't create a knowledge base of successful logic that can be leveraged for learning across an entire organization (Knowledge Bases/'Retrospect Learning', page 16) **FALSE**
10. RCA can't be used as an effective storytelling tool (Storytelling, page 16) **FALSE**

As stated initially, the judgment as to the answers to these questions will be left up to YOU, the reader. However, it was my intent to demonstrate that RCA (as defined in this paper) and HPI/Learning Teams are complementary and not competing. Perhaps the RCA community is biased, but most cannot see the concept of learning teams completely replacing the rigor, discipline and evidence-based nature of true RCA, especially when analyzing more severe and complex incidents (or high risk events). Conversely, I cannot see RCA being successful without the inclusion of organizational learning as expressed via the Human and Latent Roots/Factors in the logic tree. An RCA without the 'learning team component' would be a 'Shallow Cause Analysis' [7] to me.

This article was meant to trigger a constructive discussion between the two communities, so each can see the other's perspective.

Additional Resources

1. **The Essential Elements of RCA**
    a. https://www.youtube.com/watch?v=350IpBEqFXU

2. **Article: Justifying RCA: Making the Business Case**
    a. http://www.reliability.com/industry/article_db/wp-content/uploads/2014/04/article67x.pdf

3. **Failure Scene Investigation (FSI) Workshops**
    a. https://www.reliability.com/failure-scene-investigation.html

4. **The 4 Basic Root Causes of Component Failures**
    a. https://www.linkedin.com/pulse/4-physical-root-causes-component-failure-basics-part-i-bob-latino

5. **Facing the Facts: Could We Be Part of the Problem?**
    a. https://www.linkedin.com/pulse/mistakes-were-madebut-mefacing-mirror-bob-latino

6. **Boiler Feed Water Pump Failure**
    a. https://www.youtube.com/watch?v=1vnsUxofIUg

7. **Article: Root Cause Analysis vs. Shallow Cause Analysis – What's the Difference?**
    a. https://www.reliability.com/industry/articles/pdf/Root-Cause-Analysis-vs-Shallow-Cause-Analysis-ENG2.pdf