

## Here's to the crazy ones,

the misfits, the rebels, the troublemakers, the round pegs in the square holes... the ones who see things differently –

### they're not fond of rules...

You can quote them, disagree with them, glorify or vilify them, but the only thing you can't do is ignore them because

### they change things...they push the human race forward,

and while some may see them as the crazy ones, we see genius, because the ones who are crazy enough to think that they can change the world,

### they are the ones who do.

—Steve Jobs

## Innovative Problem Solving

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## Objectives

Discuss the learned skills that enable creative thinking

Describe the method for creative problem solving

Apply the methods of innovative problem solving to the laboratory environment

### THREE ZONES OF FUNCTIONING

## Stable Zone

- No growth
- Stagnant
- Comfortable

### THREE ZONES OF FUNCTIONING

## Chaotic Zone

- Low productivity
- Constant crisis
- Haphazard

### THREE ZONES OF FUNCTIONING

## Creative Zone

- Creative tension
- Innovative
- In flux

## Creativity vs. Innovation

Creativity	Innovation
Coming up with <span style="color: #A52A2A;">new ideas</span>	Putting those ideas <span style="color: #A52A2A;">into practice</span>

Maritz, Peter. *Innovation Generation: Creating an Innovation Process and an Innovative Culture*. Milwaukee, WI: ASQ Quality, 2008. Print.

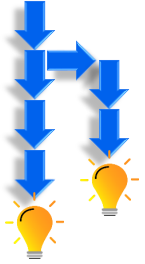
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### CREATIVE THINKING

## Lateral Techniques

Take a good idea and:

- » substitute
- » combine
- » modify
- » adapt
- » magnify




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### CREATIVE THINKING

## Intuitive Techniques

- Relaxation
- Incubation
- Analogies
- Fantasy questions
- Visualization
- Dreaming
- Drawing



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## The Scientific Method

<b>Observation</b>
<ul style="list-style-type: none"> <li>• Ask a question</li> <li>• Understand the background</li> </ul>
<b>Hypothesis</b>
<ul style="list-style-type: none"> <li>• State the likely cause</li> </ul>
<b>Experimentation</b>
<ul style="list-style-type: none"> <li>• Test the hypothesis</li> </ul>
<b>Data Analysis</b>
<ul style="list-style-type: none"> <li>• Collect data</li> <li>• Extract information and knowledge</li> </ul>
<b>Conclusion</b>
<ul style="list-style-type: none"> <li>• Communicate conclusions</li> </ul>

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## The Innovation Method

<b>Background</b>
<ul style="list-style-type: none"> <li>• Describe the outcome</li> <li>• What should have happened?</li> <li>• What actually happened?</li> </ul>
<b>Discovery</b>
<ul style="list-style-type: none"> <li>• State the likely cause</li> <li>• Challenge assumptions</li> </ul>
<b>Solutions</b>
<ul style="list-style-type: none"> <li>• Think creatively—Divergence</li> <li>• Think critically—Convergence</li> </ul>
<b>Analysis</b>
<ul style="list-style-type: none"> <li>• Collect data</li> <li>• Extract information and knowledge</li> </ul>
<b>Innovation</b>
<ul style="list-style-type: none"> <li>• Communicate conclusions</li> <li>• Develop an action plan</li> </ul>


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STEP 1

## Describe the Outcome



Outcome
<ul style="list-style-type: none"> <li>A change to a situation resulting from an action</li> <li>Often involves strong emotions</li> </ul>



Output
<ul style="list-style-type: none"> <li>What is produced in a given time period</li> <li>Mostly tangibles</li> </ul>

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## Listen to the Voices

- Voice of the Customer**
  - I had to be redrawn
- Voice of the Process**
  - I do pretty well until I reach this one step
- Voice of Time**
  - I've seen 4 similar errors this month
- Voice of the System**
  - The downstream effect of this event destabilized the whole organization
- Voice of the Supplier**
- Voice of the Output**

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STEP 2

## What Should Have Happened?

- SOP
- Process flow chart
- Manufacturer inserts
- Interviews

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## Knowledge Elicitation Questions

Goals	Actions	Outcome
<ul style="list-style-type: none"> <li>What were you trying to do?</li> <li>Were there conflicts, trade-offs, time pressure?</li> </ul>	<ul style="list-style-type: none"> <li>Did you know just what to do, or did you weigh several possible responses?</li> <li>What could you influence and what did you think you had no control over?</li> </ul>	<ul style="list-style-type: none"> <li>Is this what you thought would happen?</li> <li>How did you expect this to turn out?</li> </ul>

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STEP 3

## What Actually Happened?

### Interview the players

- Personnel involved
- Uninvolved staff members
- Supervisors and managers
- When possible, the customer

**Go Look, Go See**

**Avoid the natural reactions to failure. Be...**

- GLOBAL not proximal (perspective)
- FACTUAL not second-guessing
- OBJECTIVE not biased
- ATTENTIVE not judgmental

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Background	<ul style="list-style-type: none"> <li>Describe the outcome</li> <li>What should have happened?</li> <li>What actually happened?</li> </ul>
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STEP 4: IDENTIFY CAUSES

## The "Five Whys"

**Ask "Why?" in a non-judgmental manner until:**

- » you are discussing causes over which you have no control,
- » you reach the point where the actions seem reasonable,
- » you cannot know the answer, OR
- » the answer is irrelevant to the event

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STEP 4: IDENTIFY CAUSES

## Active Failures vs. Latent Conditions

Active Failures (Physical Actions)	Latent Conditions (System/Process Failures)
<ul style="list-style-type: none"> <li>• Direct and immediate impact</li> <li>• Committed by the people who do the job</li> <li>• Rarely "Root Causes"</li> </ul>	<ul style="list-style-type: none"> <li>• Part of the system's design</li> <li>• Created by organizational management</li> </ul>
<b>10%</b>	<b>90%</b>

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STEP 4: IDENTIFY CAUSES

**Understanding and correcting latent conditions ensures unexpected events do not recur.**

- Active failures are the result of actions that seemed reasonable at the time
- Inaccurate perception of what is reasonable comes from latent conditions
- Use active failures to chase down latent conditions.

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STEP 4: IDENTIFY CAUSES

## Identify Any Contributing Factors

- Institutional
- Organization or Managerial
- Environmental
- Team Dynamics
- Individual
- Task-related
- Customer-related

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Examples:

Regulations are counterintuitive and difficult to apply.

Due to global economic pressures, stress is high, resources are low.

Regulations for each state are different and difficult to remember.

## Contributing Factors

<b>Factor</b>	Institution
<b>Influence</b>	Economics National healthcare climate State regulators and regulations

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Examples:

SOPs are counterintuitive and difficult to apply.

Due to organizational economic pressures, stress is high, resources are low.

Unspoken pressure to work faster, public commitment to accuracy

## Contributing Factors

<b>Factor</b>	Organization and Management
<b>Influence</b>	Finances Organizational structure Policy standards and goals Safety culture and priorities


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**Contributing Factors**

**Factor**  
Work Environment

**Influence**  
Staffing, skills mix  
Workload, shift patterns  
Equipment  
Physical plant conditions

Examples:  
Subtle arrogance of long-term staff members.  
Workload is not matched to staffing levels.  
Equipment is old and requires constant repair and monitoring.  
Construction is noisy and ongoing.




**Contributing Factors**

**Factor**  
Team

**Influence**  
Communication—written and verbal  
Supervision and support  
Team structure

Examples:  
Team is culturally and racially mixed.  
Supervisor is rarely on site.  
Staff are expected to make decisions above their level of authority.  
Staff are rarely involved in or told of decisions that affect them.




**Contributing Factors**

**Factor**  
Individual

**Influence**  
Knowledge and skills  
Competence  
Physical and mental health condition

Examples:  
Attentional resource was not focused on the task.  
Skill level is low.  
Employee training was deficient.  
Employee failed to judge the situation accurately.




**Contributing Factors**

**Factor**  
Task

**Influence**  
Design and clarity  
Protocol accessibility  
Test result accuracy and accessibility

Examples:  
A workaround was in place.  
The task is not designed for error-free work by humans.  
This particular event has never happened before and was not covered in the SOP.




**Contributing Factors**

**Factor**  
Patient/Customer

**Influence**  
Complexity and seriousness of condition  
Communication barriers  
Personality and social issues


Examples:  
Physician was verbally abusive to the employee.  
There was a language barrier between the employee and the patient.  
Employee was not aware of the historical events leading to this encounter.



**Rules of Causation #1**

**Root cause statements must clearly show a “cause and effect” relationship.**

- *Instead of:* “The technologist was tired so she verified the wrong result.”
- “The technologist was fatigued from working overtime, which increased the likelihood that she overlooked a step, which in turn caused the reporting of an incorrect result.”



## Rules of Causation #2

**Negative descriptions should not be used in root cause statements.**

- » *Instead of:*  
"The employees on this shift are lazy."
- » "Employees are expected to process between 10 and 15 samples per hour; during this period, the average number a samples processed for all employees on the shift was 7.5 samples per hour."

## Rules of Causation #3

**Each human error must have a preceding cause.**

- » *Instead of:*  
"The cause of this failure was human error."
- » The employee entered the wrong number
  - *Why?* She was transcribing the results from a worklist and got off line
  - *Why?* The patient name is on the left side of the page and the result on the right side.
  - *Why?* The page has been adapted from another procedure, instead of designed for this one

## Rules of Causation #4

**Violations of procedure are not root causes; they must have a preceding cause.**

- » *Instead of:*  
"This employee never follows procedures."
- » "The procedure is complex and the documentation difficult to follow; thus, employees often develop work-around practices."

## Rules of Causation #5

**Failure to act is only causal when there is a pre-existing duty to act.**

- » *Instead of:*  
"Everyone knows that client concerns should be passed on to the supervisor, but this was not done."
- » "The employee did not notify the supervisor that the client had questioned the result. The procedure and the job description do not include this as a required step."

## Rules of Causation #6

**Solutions that have not yet been implemented are not causes.**

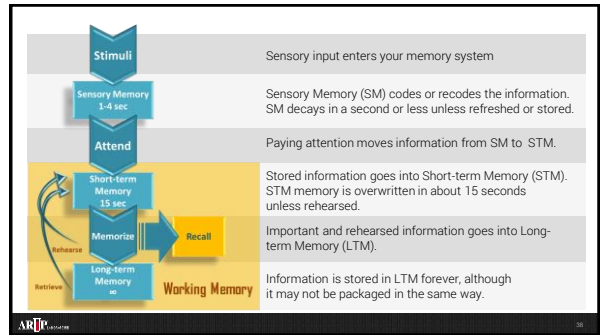
- » *Instead of:*  
There was no script available, so the employee misinformed the client."
- » "There is a great deal of information required when calls like this are received and the employee failed to mention one of the more important pieces of information. We will consider scripting for scenarios such as this one"



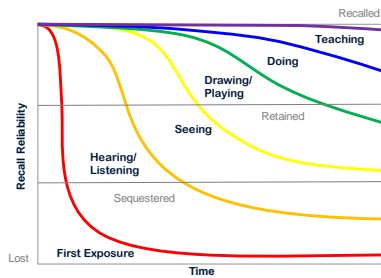
# Human Error

You don't get to safe systems that have human beings in them by yelling at them or asking them to try harder.

—Donald Berwick



# Forgetting Curve



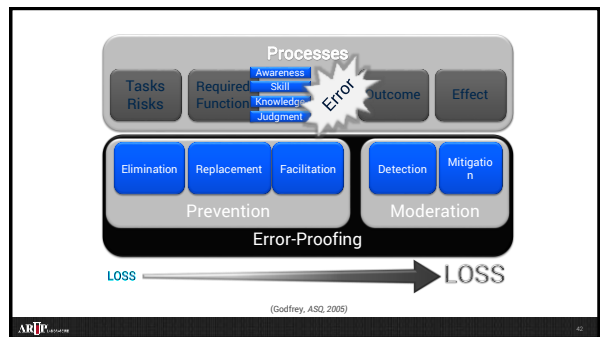
ERROR SOURCE	ERROR RESPONSE
<b>VIOLATION</b> ( <i>complacency, angst</i> ) Hiding errors and erasing evidence Skipping steps to avoid work Sabotage, deliberate error	Separate the employee from the risk of causing harm Evaluate team dynamics, leadership Consider if employee was between a rock and a hard spot
<b>MISTAKE</b> ( <i>judgment, cognition</i> ) Error in choosing between possibilities Acting on assumptions Filing to execute the SOP as it is stated Skipping steps in a search	Rule-based: Coach, role play Knowledge-based: Train or re-train Evaluate SOP, team dynamics, leadership Explore environmental conditions (noise, heat, etc) Consider adjusting workload Consider automation, error-proofing
<b>LAPSE</b> ( <i>memory, attention</i> ) Forgetting a step in a series Failing to notice something (ID that is similar, but not the same!) Forgetting what step you were on Losing track	Develop job aids, memory aids, checklists Reduce distractions, interruptions Reduce task complexity, simplify the task Explore reasons for reduced awareness Assess equipment function and optimize
<b>SLIP</b> ( <i>dexterity, skill</i> ) Task timing off, out of sequence Dropping something Putting something in the wrong place Doing the right thing on the wrong object	Look for patterns and address them individually Evaluate workspace layout, design, ergonomics Consider fatigue as a factor Reduce distractions, enhance awareness

**HUMAN ERROR CONTINUUM**

# Process Design

Every system is perfectly designed to achieve exactly the results it gets.

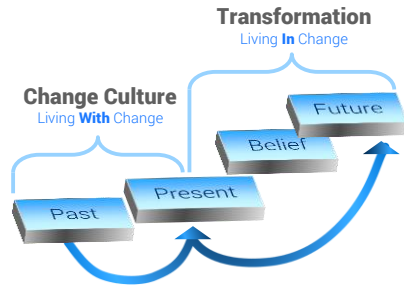
—Paul Baralden



## Culture

If we are to preserve culture we  
much continue to create it.

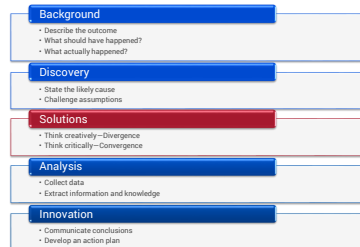
—Johan Huizinga



## Challenge Assumptions

“Your assumptions are your windows on the  
world. Scrub them off every once in a while,  
or the light won’t come in.”

— Isaac Asimov



## Lateral Thinking

Making the simple complicated is  
commonplace; making the complex simple,  
awesomely simple, that’s creativity.

—Charles Mingus

## Lateral thinking techniques

- Generating Alternatives
- Suspending Judgment
- Fractionating
- Reversing
- Brainstorming and Stimulating
- Focusing and Polarizing
- Finding Connections



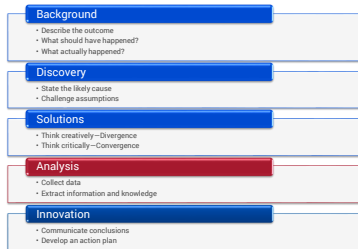
## Imaginative Thinking

The intuitive mind is a sacred gift and the rational mind is a faithful servant. We have created a society that honors the servant and has forgotten the gift.

—Albert Einstein

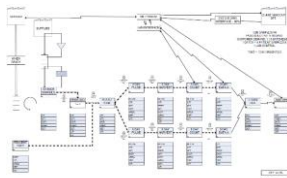
## Intuitive techniques

- Observing
- Analogizing
- Pattern Matching
- Imagining
- Abstracting
- Chunking
- Body Thinking, Empathizing
- Modeling, Playing
- Transforming
- Synthesizing



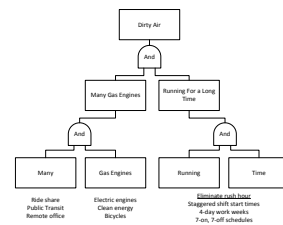
- **Find the problem**
  - » Curiosity, why?
- **Generate ideas**
  - » Brainstorm and test
- **Judge**
  - » What kept it or will keep it from working?
- **Regenerate**
  - » How about...?
- **Implement**
  - » All systems go

## Define the Ideal Future State



LYMPHOIDE PROLIFERATION FUTURE STATE MAP #112011

## Consider All Points of View



### Uncover Failure Potential

What might be the outcome of...?	Will this disrupt operations?	Is it likely to fail?	Will we actually complete?	Score (product)
Low morale in remaining staff	1	0	0	0
Insufficient resources to meet demand	4	3	2	24
Wrongful termination lawsuits	1	2	2	6

**INTERPRETATION**  
The project threat to the organization is low morale, closely followed by wrongful termination lawsuits. While resource issues may be a threat, there are measures in place to mitigate the risk.

**HOW TO:** Multiply scores ACROSS and rank

### Rank Solutions

What are we trying to do?	How might we achieve this?	Option Scores					Importance Ratings
		Importance (1-5)	Change in relative resources	Change in effort/expense	Relative impact to market fit	Feasibility	
Customers	Reduce price point	2	3	1	4	42	0=Not important
	Reduce packaging	4	2	1	1	10	1=Somewhat important
	Reduce size	2	2	1	1	28	2=Important
Shareholders	Reduce cost	2	2	2	2	40	3=Critical
	Reduce budget	4	1	2	3	64	Option Scale
	Reduce operations	3	2	2	2	36	4=Does not satisfy
<b>INTERPRETATION</b>		Single top option scores are close, but "strong" is more heavily weighted toward the problem requirements and "strong" is more heavily weighted toward operations. The budget requirement is most likely to be met (score of 4) and an industry first is the least likely to be met (score of 2).					5=Fully satisfies

**HOW TO:** Multiply option scores by importance scores  
 • Sum solution scores down  
 • Sum requirement scores across

### Assign Responsibility

PROCESSES STEPS	Who is doing it?	Who is responsible for it?	Who is accountable for it?	Who is consulted for it?	Who is informed for it?	Who is involved for it?	Who is impacted by it?
Which position is the best fit for...?	1	1	1	1	1	1	1
Which position is the best fit for...?	1	1	1	1	1	1	1
Which position is the best fit for...?	1	1	1	1	1	1	1

**HOW TO:** Score each cell individually—one point for each "yes"  
 • Sum cell scores for each entity ACROSS and rank  
 • Consider outliers

**Background**

- Describe the outcome
- What should have happened?
- What actually happened?

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**Solutions**

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**Analysis**

- Collect data
- Extract information and knowledge

**Innovation**

- Communicate conclusions
- Develop an action plan

### Blocks to Innovation

- Pursuit of Order
- Fear of Failure
- Winning at all Cost
- Failure to Incubate
- Judging Instead of Generating

### INNOVATION "BLOCK"-BUSTERS

#### Break the Rules

- Pre-empt Your Competition
- Use All Available Assets
- Redefine Winning
- Cooperate and Collaborate

## Summary

1. Know what you know; know what you don't know
2. Determine causes and challenge assumptions
- 3. Think creatively, then think critically**
4. Innovate
5. Act



*A company comprised of the University of Utah and its Department of Pathology*