The Eight Factors of Effective Change

How to Prevent Failing Fixes

2017 International Technical Safety Forum – TRIUMF Labs

Afternoon Workshop

September 2017

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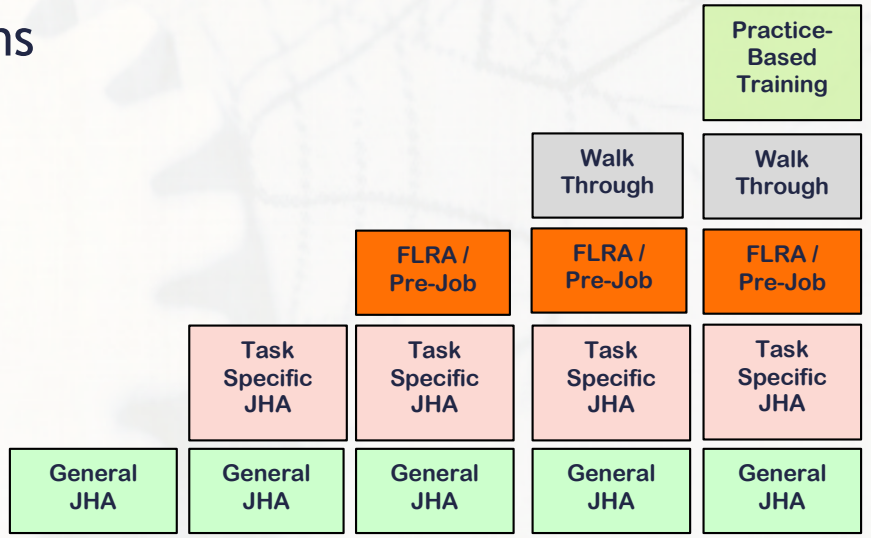
Chief Excellence Officer

Great Systems



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A Need for More Effective Fixes

- Health Affairs in April 2011 revealed that the standard methods hospitals use to detect medical errors fail over 90 percent of the time.
- A five-year study of North Carolina hospitals, published in the New England Journal of Medicine in November 2010, showed that, in 25 percent of all admissions, the medical care harmed patients.
- A 2010 government analysis found that 134,000 Medicare beneficiaries were suffering adverse events every month, many of which were "clearly or likely preventable."

  Medical Errors Harm Huge Number of Patients, Huffington Post, August 2012

- The September 2013 *Journal of Patient Safety* says that between 210,000 and 440,000 patients each year suffer some type of preventable harm that contributes to their death.
- Medicare will track a hospital's error rates and in 2014 will cut payment by 1 percent to hospitals with the highest rates of patient safety issues.

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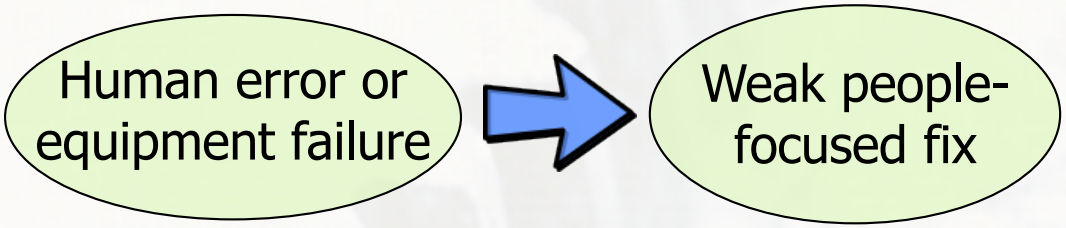
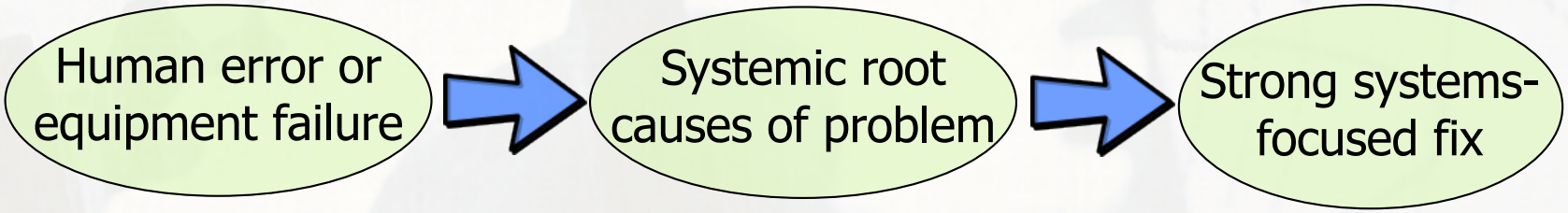
The Psychology of Failing Fixes

- When we write a corrective action against a human error or equipment failure:



- When we write a corrective action against a systemic root cause:



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Too Busy to Change?

Here is Edward Bear,
coming downstairs now,
bump bump bump

on the back of his head,
behind Christopher Robin.

It is, as far as he knows, the only way of coming down stairs, but sometimes he feels that there really is another way, if only he could stop bumping for a moment and think of it.

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Improving Processes in Healthcare

Factors that constrain process improvement results in healthcare.

- Patient care is much more important than process care
- Fear / blame culture makes error reporting and process analysis tough
- Authoritarian leaders resist big system changes
- Outcome measure focus overwhelms a process measure focus
- Non-clinical processes and people are not involved enough

Factors that contribute to process improvement success in healthcare:

- Increasing implementation of EMRs and CPOE
- Use of bar codes and RFID to track meds and patients
- Great examples of success exist for benchmarking
- Need for work system designs that support error-free performance

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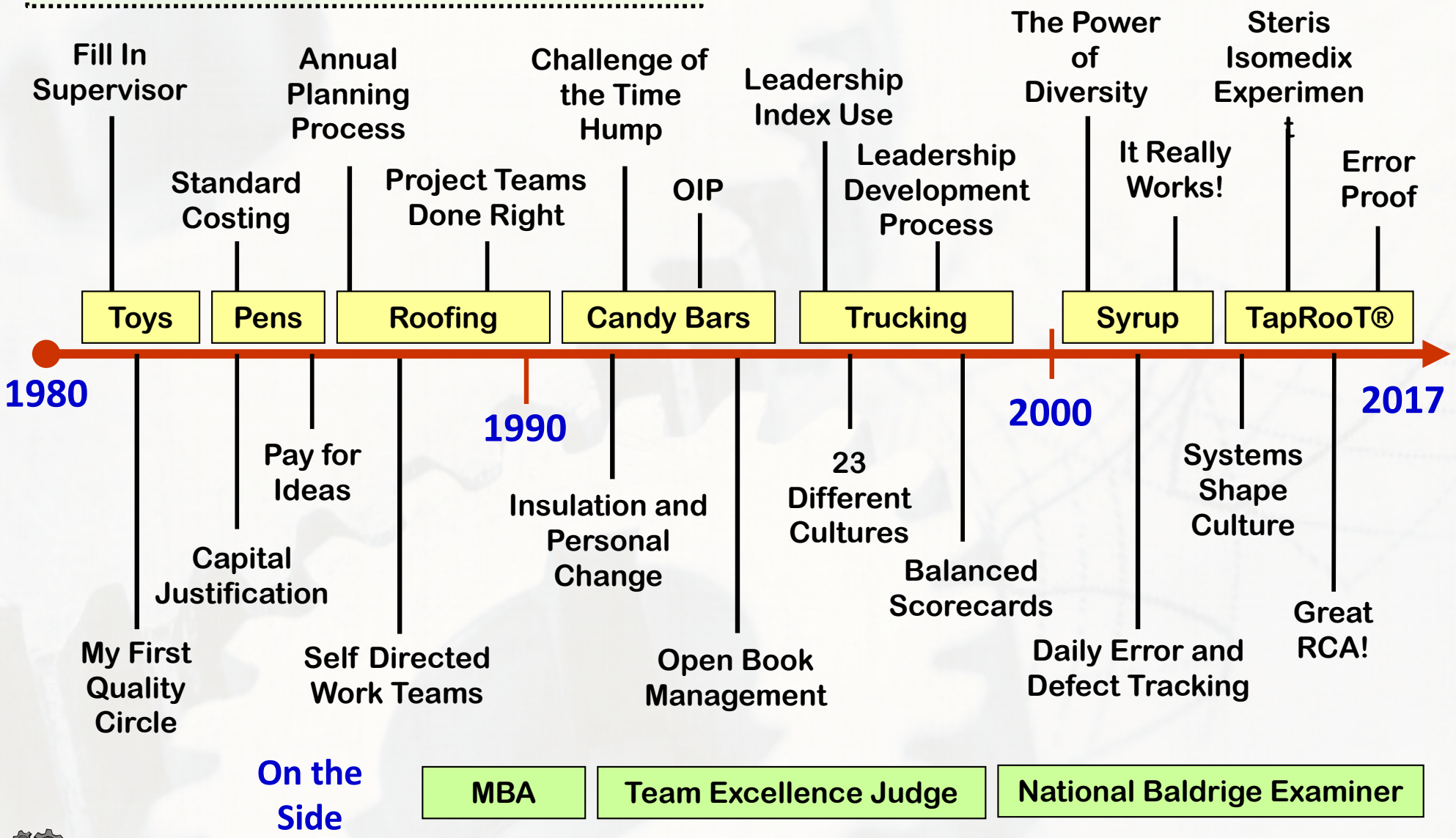
Thirty+ Years of Personal Learning



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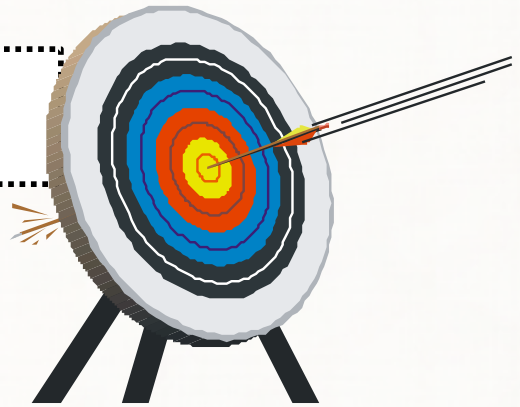
Potential Learning Opportunities



In this session, you will learn how to:

- Explore the factors that required for, and drive, true human behavior change
- Look at examples of mistake proofing applications
- Gauge the manner in which you personally use, or don't use, effective safeguards to minimize process errors
- Better define potential fix impact and the types of fixes needed
- Improve the quality and effectiveness of the corrective actions you develop

How error free would you like to be?

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My Error Proof Motivations

- People are being held accountable to unrealistic goals
- The need for continuous improvement is getting lost
- I don't like wasting time or processing rework
- I want better service and products as a customer
- Shifts from reactive to proactive work cultures are needed

What value do you see in becoming error proof?

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How Much Risk Can We Accept?

RISK ASSESSMENT MATRIX					
	Consequence / Severity				
Likelihood	**Negligible**	**Marginal**	**Major**	**Critical**	**Catastrophic**
Frequent	5	10	15	20	25
Occasional	4	8	12	16	20
Seldom	3	6	9	12	15
Remote	2	4	6	8	10
Unlikely	1	2	3	4	5

Does Your **Potential Fix Impact** equal the **POTENTIAL Severity** of the problem?

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Is 99% Good Enough?

- 2 unsafe landings at O'Hare Airport each day
- 16,000 lost pieces of mail per hour
- 20,000 incorrect drug prescriptions per year
- 50 newborn babies dropped at birth each day
- 32,000 missed heartbeats per person each year
- 2 million books in the next year will have the wrong cover
- 900,000 credit cards will have the wrong information

How often can you go a day without a defect?

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What is the Root Cause?

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A Key Improvement Thought

If leaders knew the cost of the errors that occur EACH DAY …

They would be making VERY DIFFERENT decisions

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Test Yourself!
How Many F's Do You Count?

Count the total number of F's in the paragraph

Finished files are the result of years of scientific study combined with the experience of years

Now count the total number of F's in this paragraph

THE NECESSITY OF TRAINING HANDS FOR FIRST-CLASS FARMS IN THE FATHERLY HANDLING OF FRIENDLY FARM LIVESTOCK IS FOREMOST IN THE MINDS OF FARM OWNERS. SINCE THE FOREFATHERS OF THE FARM OWNERS TRAINED THE FARM HANDS FOR THE FIRST-CLASS FARMS

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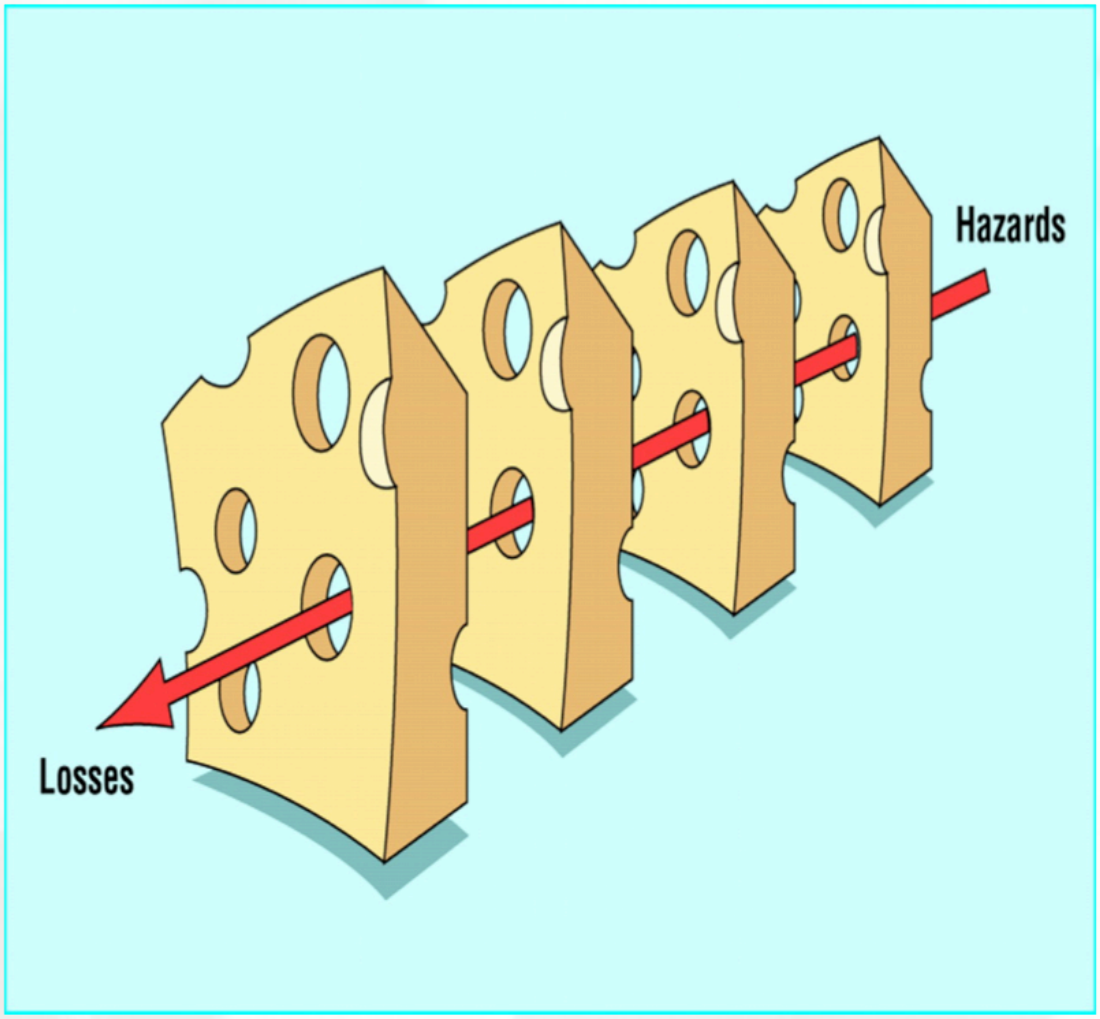
How Effective are Your Safeguards?



Concept based on Reason's Swiss Cheese model

Safeguard Examples

- Checklists, procedures, and policies
- Training
- Pre-shift meetings
- Audits and inspections
- Supervision
- Engineered controls
- PPE
- Verbal communication rules

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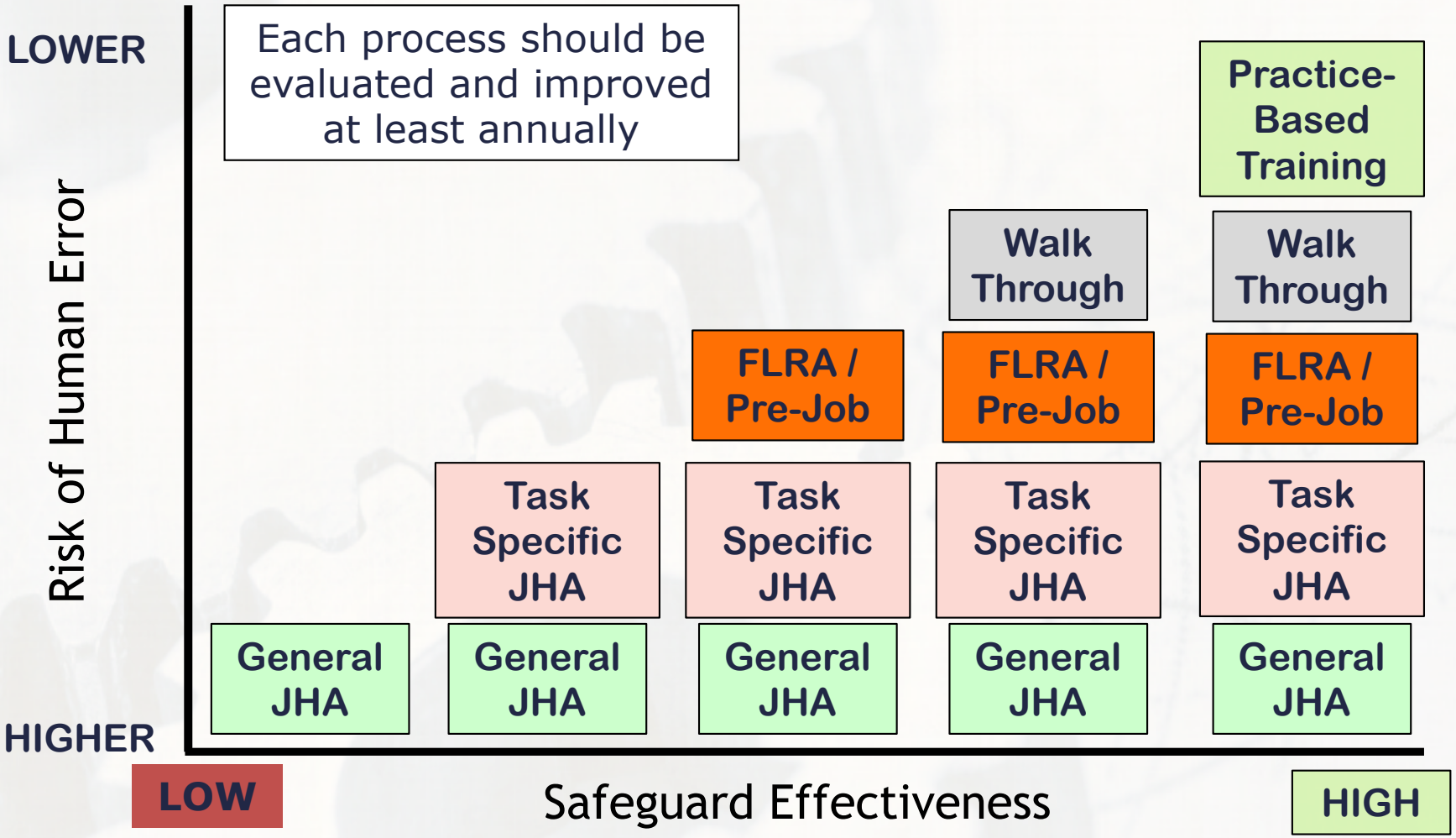
Stacking Safeguards to Reduce Risk of Error



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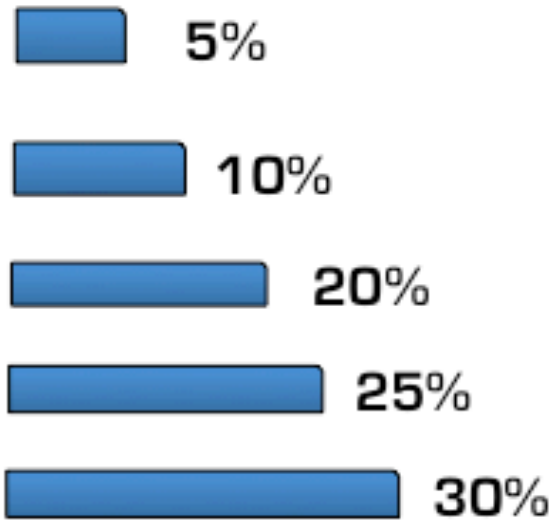
All Fixes are Not Created Equal

STRONGEST

1. Remove / reduce the hazard
2. Remove the target
3. Guard the target
4. Engineered, physical process, or human factors fix
5. Administrative fix
6. Training fix
7. Information distribution
8. Exhortation – be more careful

WEAKEST

Where do most of your corrective actions fall on this spectrum?



Derived from Hadden and Christensen, William R. Corcoran (2007), and the *TapRooT® RCA* book

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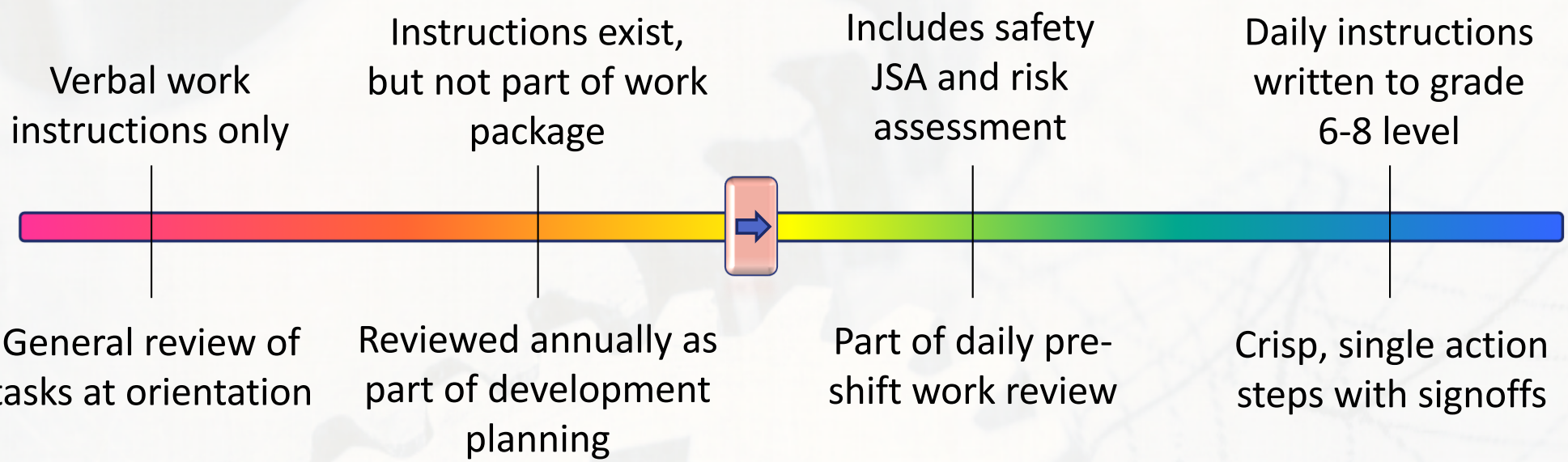
Creating Better Work Packages

Towards Better Work Systems



Effective Work Package Building Codes

- Create simple, picture-based instructions
- Get the instructions close to the work
- Involve users in work package improvement
- Make special instructions OBVIOUS!

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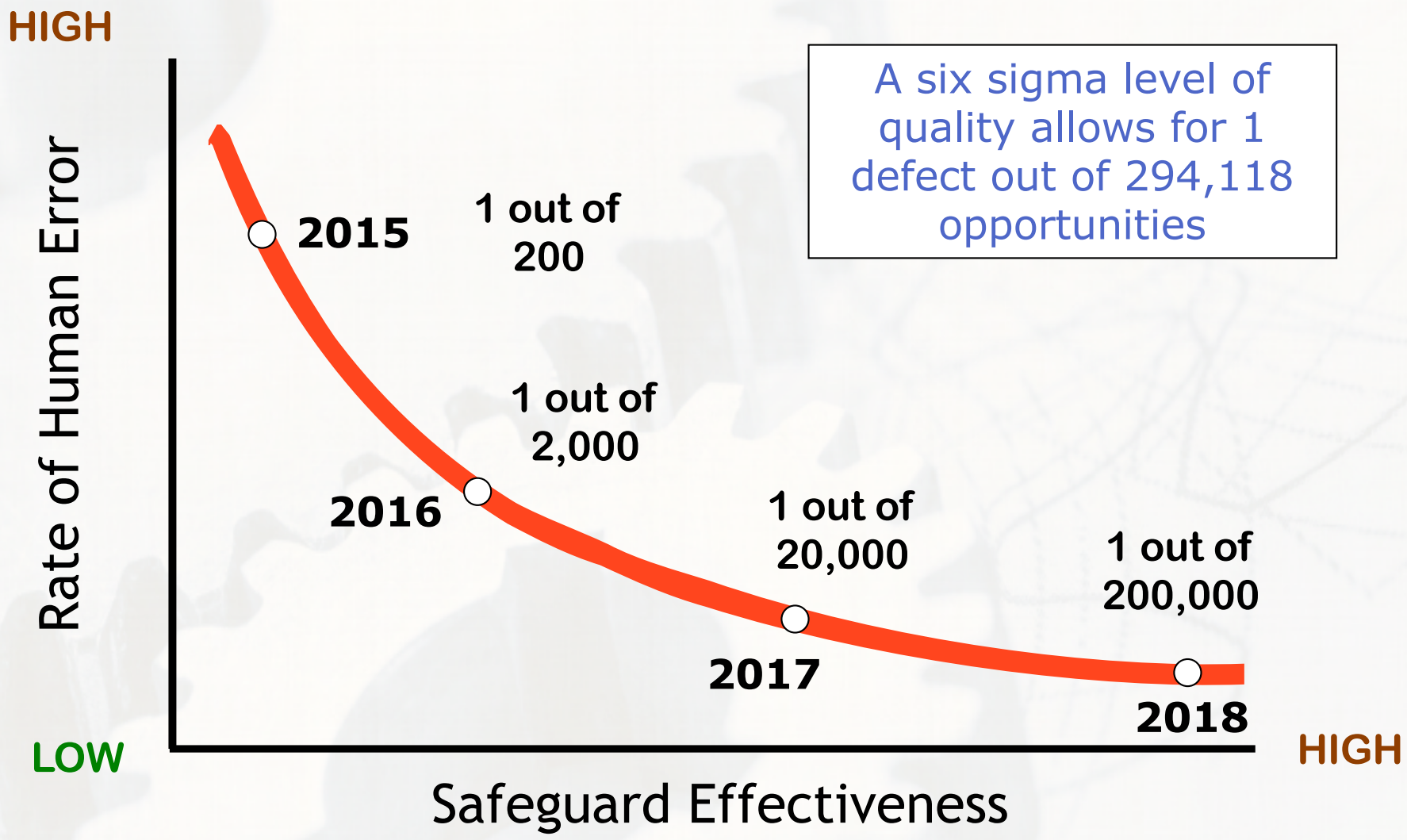
How Good Do We Need to Be?



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What's Your Potential for Error?

Your HEPI consists of five factors …

• Degree that work environment shifts	1 2 **3** 4 5
• Degree that scope of work shifts	1 2 3 4 **5**
• Shifts in team experience levels	1 2 **3** 4 5
• Amount of blame culture that exists	1 2 3 4 **5**
• Degree of task complexity	1 **2** 3 4 5

HEPI = Human Error Potential Index

HEPI = 18 / 25 – 72%

As your HEPI increases, process waste levels also increase

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What Does It Take to Be Error Proof?

- How many hours can you go without making a mistake?
- What % of the time is human error the root cause of a problem?

"95% of the problems are caused by systems, not people." – W. Edwards Deming

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Thoughts on Human Error and Performance

Human error is rarely
a root cause

Few people really want to
make mistakes

Faulty systems account for
90% or more of errors

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What is Mistake Proofing?

- **Poka-yoke** – Japanese term for 'fail safing' or 'mistake proofing'
- Any mechanism in a lean process that helps an operator avoid (yokeru) mistakes (poka).
- Formalized as a concept and practiced by Shigeo Shingo as part of the Toyota Production System

Examples:

- Trapped key interlocking – can't remove key if car is not in 'Park'
- 3.5 inch floppy disc – right corner was shaped different to prevent the disc from being inserted upside down

Source: Wikipedia, the free Encyclopedia – January 2010

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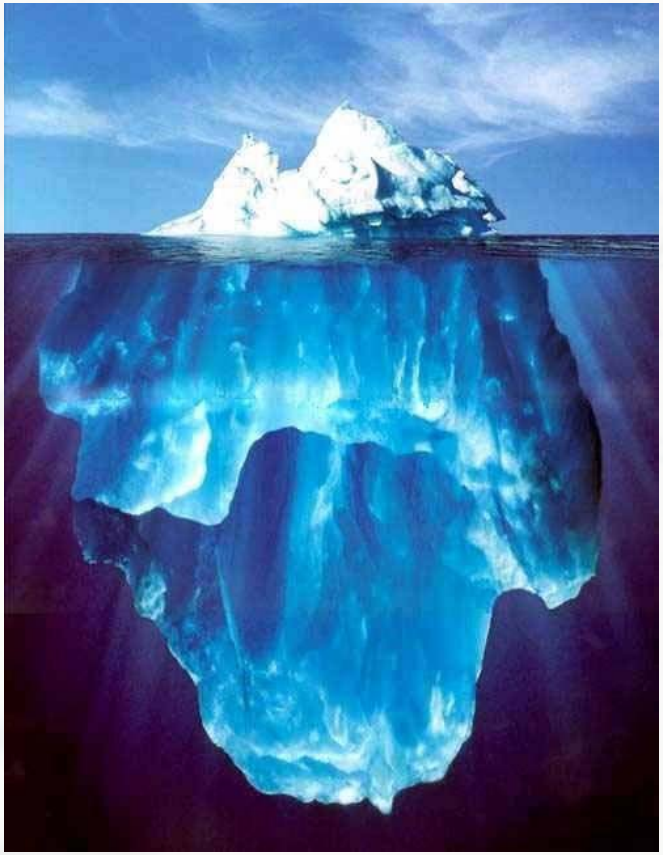
Errors versus Defects

DEFECT: Product that deviates from specification or does not meet customer expectation

ERROR: Any deviation from an intended process

All defects are created by errors

Defects are only the tip of the iceberg



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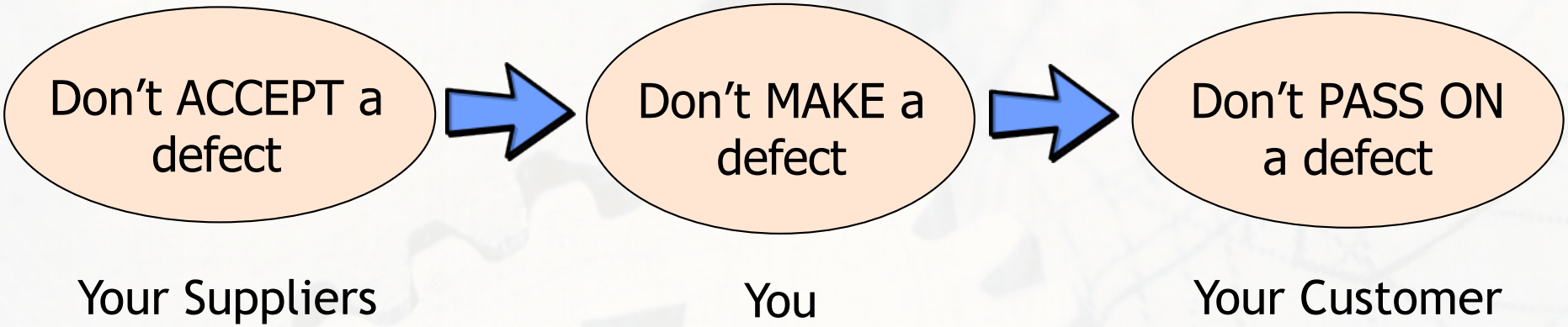
3 Rules of Error Proofing

- A error proofing system should take into consideration these three simple rules:



- Ideally, design the product or service so that it can't be assembled or performed incorrectly!!

Source: 'Poka-Yoke, Improving Quality by Preventing Defects, Shigeo Shingo, 1986

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Shingo's Zero Defect Strategies

Prevent errors from becoming defects	Level Five	Zero defects
Don't pass defects on	Level Four	Defects do not leave the process
Don't let defects recur	Level Three	Decrease defects
Strive for no complaints	Level Two	Defects do not leave the company
Lots of defects, lots of complaints	Level One	Defects leave the company

Source: 'Poka-Yoke, Improving Quality by Preventing Defects, Shigeo Shingo, 1986

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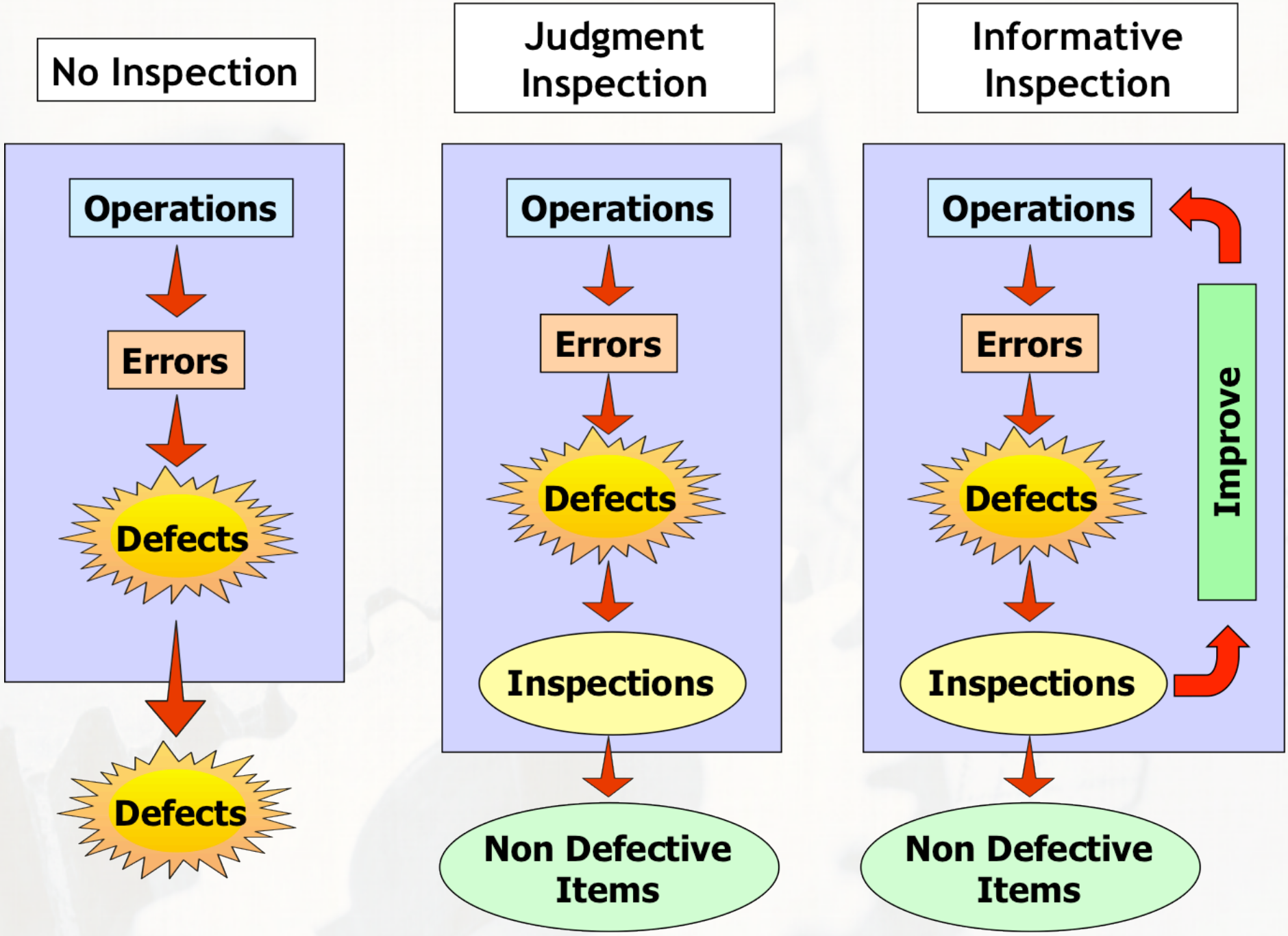

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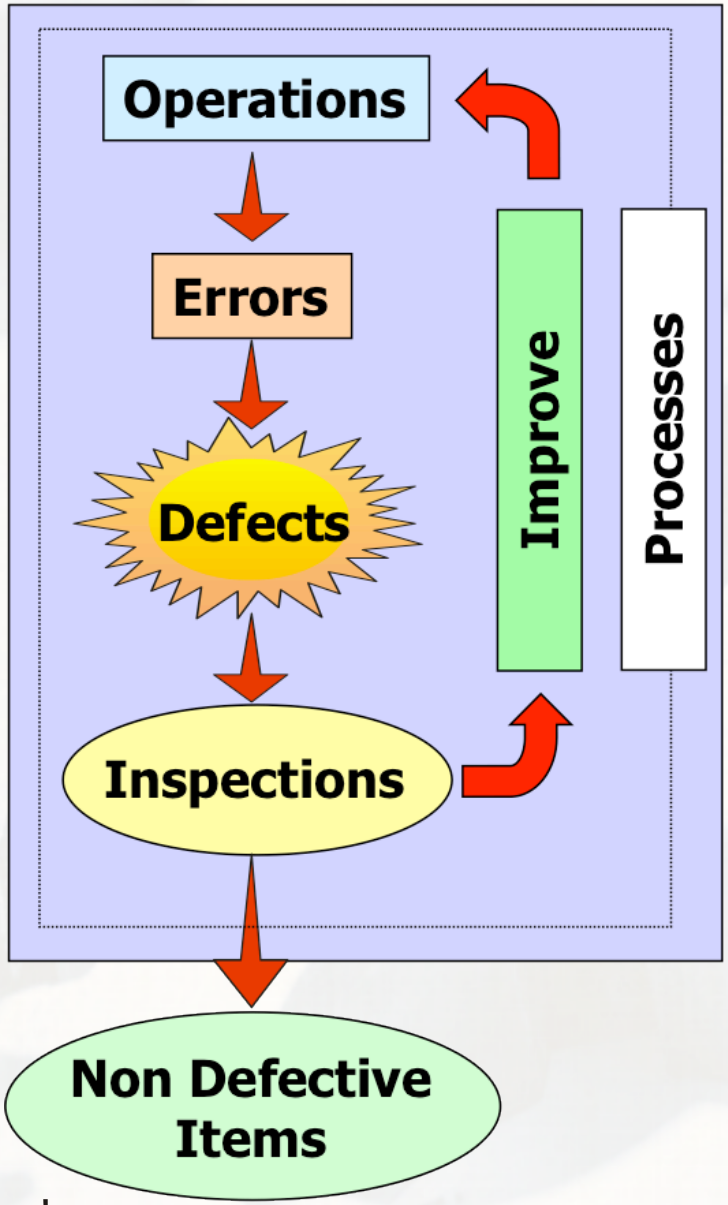
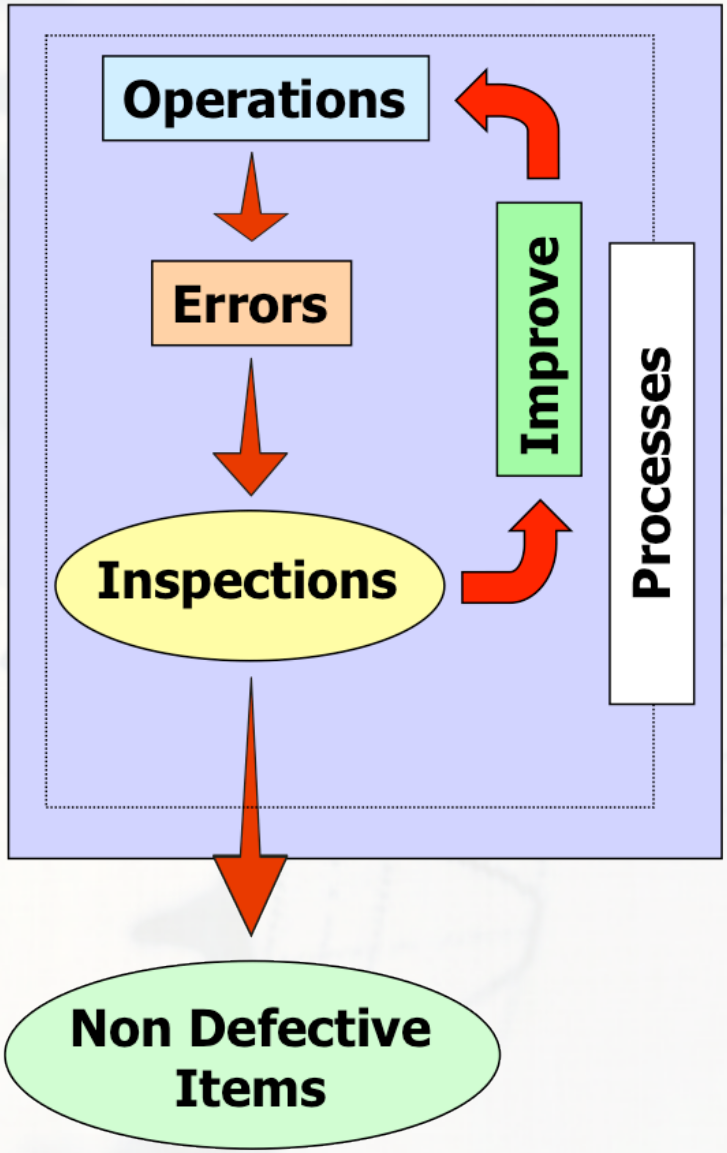
Source: 'Poka-Yoke, Improving Quality by Preventing Defects, Shigeo Shingo, 1986

Self Checks Within Process



Source Inspection



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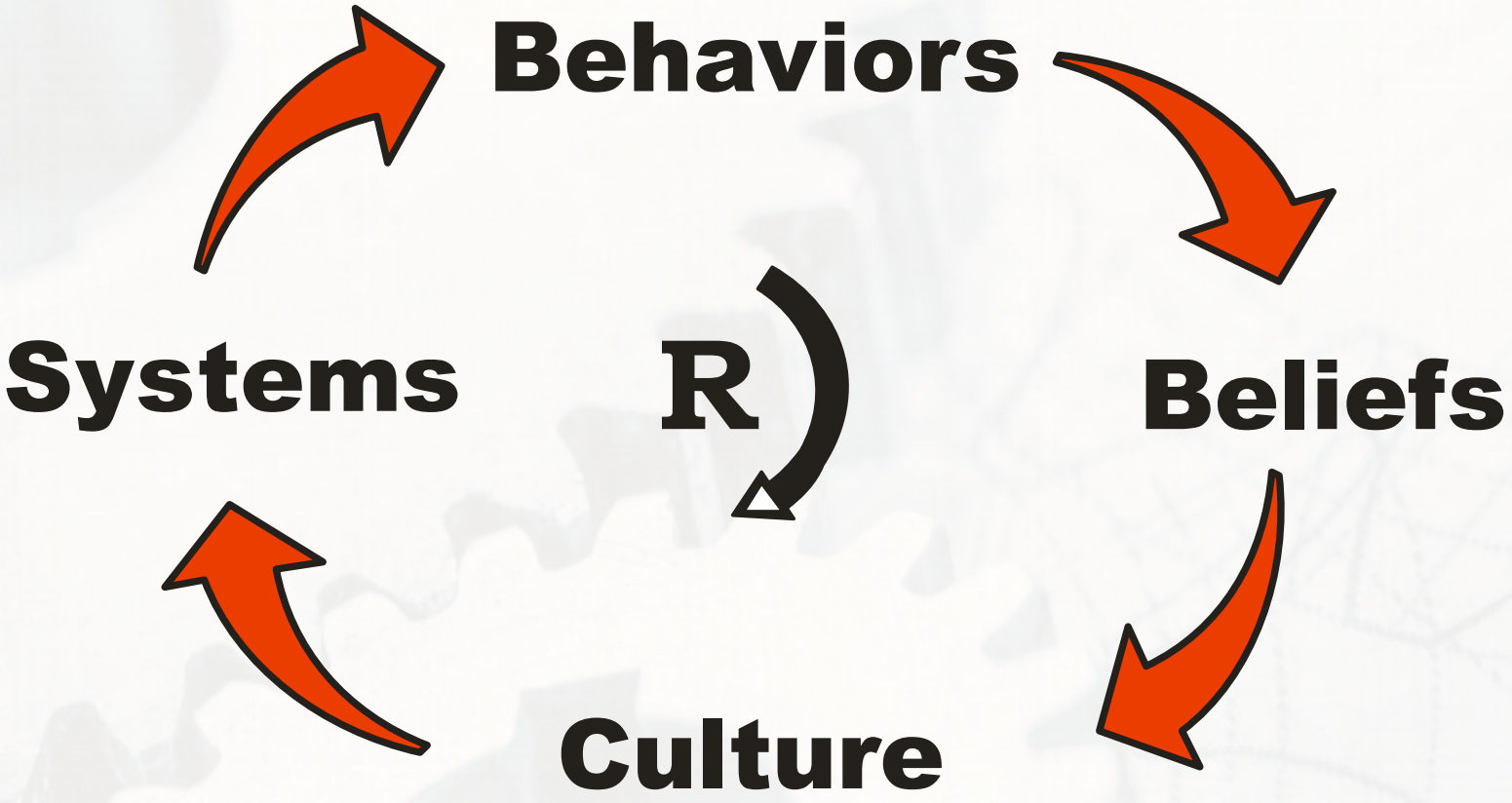
Source: 'Poka-Yoke, Improving Quality by Preventing Defects, Shigeo Shingo, 1986

The Culture Loop



At what rate is your process excellence culture gaining or losing momentum?

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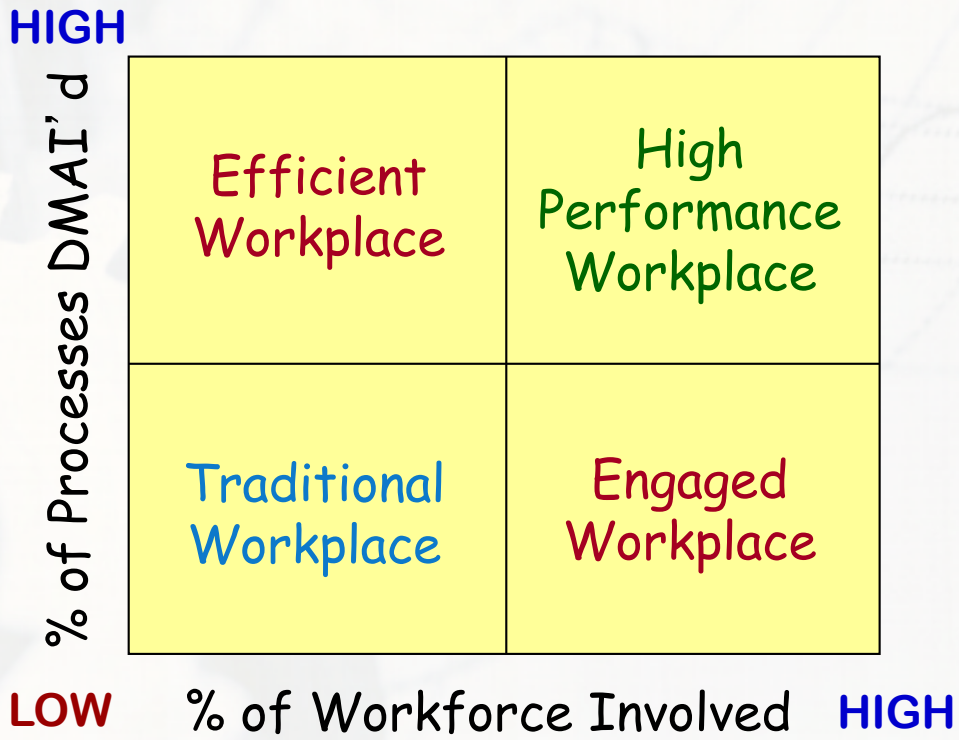
What's Holding Us Back?

- We have not learned from the past
- We don't see all work as a process
- We aren't using our problem solving tools
- We only engage a small percentage of our people
- We can't find time for improvement



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The Key to Proactive Improvement

The goal of proactive improvement is to find and analyze high leverage errors and defects!

How do you find key waste, such as errors and defects?

Fix the root causes of defects, errors, and failures

Capture key process errors and defects on a daily basis!!

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The Proactive Path to Error Proof

PROACTIVE

REACTIVE

- Mistake proof key work systems, including non-standard work
- Track, trend, and tackle daily process errors and failures
- Use Pareto analysis of audit findings to identify key process-based errors
- Map key value streams – make system changes to address non-value added tasks
- Complete GREAT reactive problem analyses – learn and improve from our mistakes!

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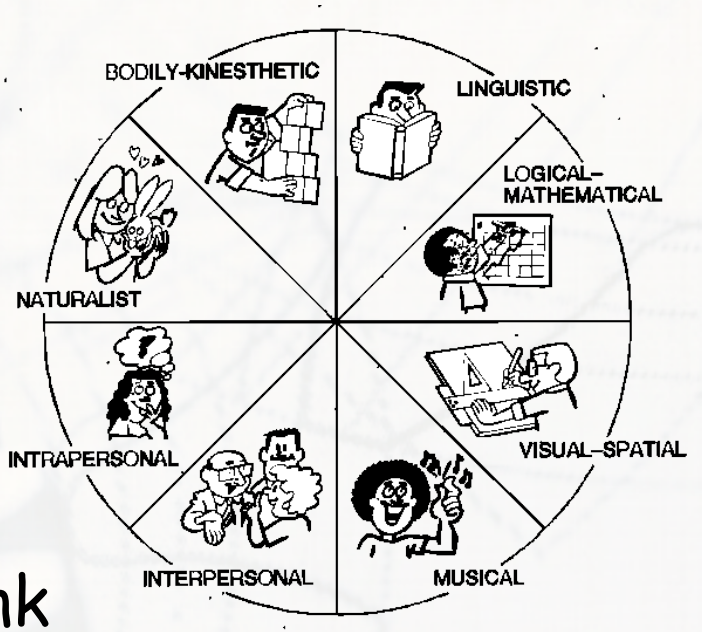
Exploring the Eight Cognitive Processes

- What are the eight cognitive processes we use daily?
- How do these processes affect the potential for errors?



"If you get to the point where you think you know it all, you're going to stop learning." – John Wooden

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Eight Cognitive Processes

Memory **Awareness** **Communication**

Reasoning

Perception

Judgment **Emotion** **Planning**

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Forgetting the Weaknesses of Memory

- How often do you relay on memory as a safeguard?
- What factors affect recall speed and accuracy?
- How can we make our memory more effective?

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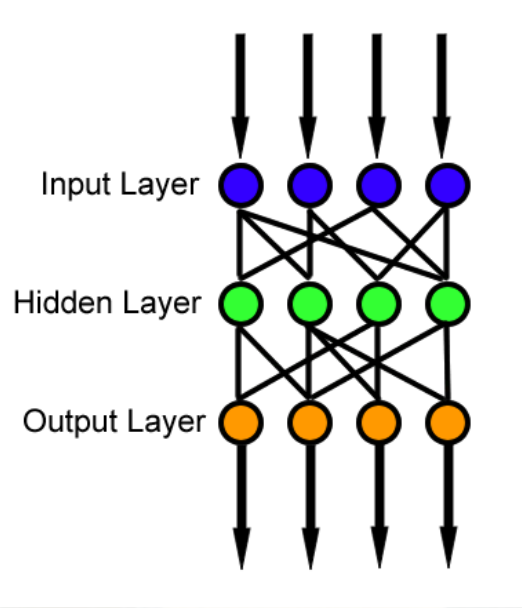
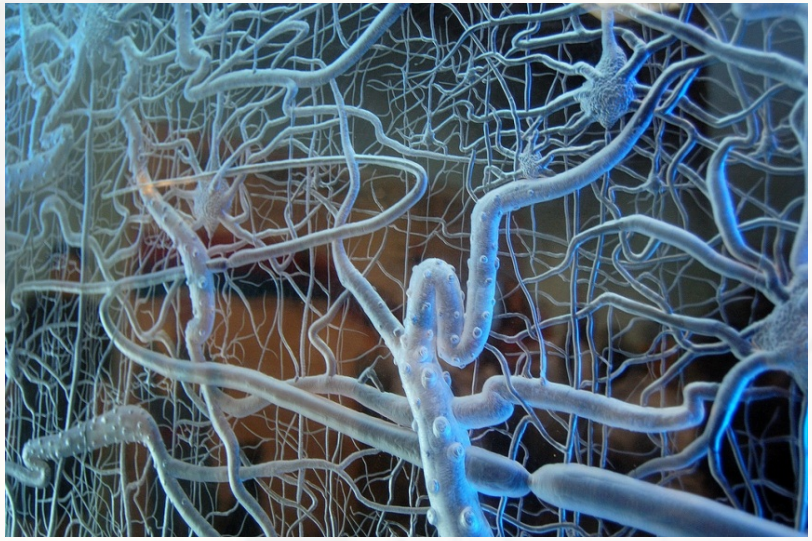
Creating Long Term Memory Pathways

Long term memory occurs when you have created **neural pathways** for storing ideas and information which can then be recalled up to years later.





To create these pathways, you must make a deliberate attempt to **encode the information** in the way that you intend to recall it later. This encoding process is called "**active learning**".

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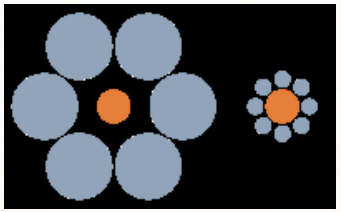
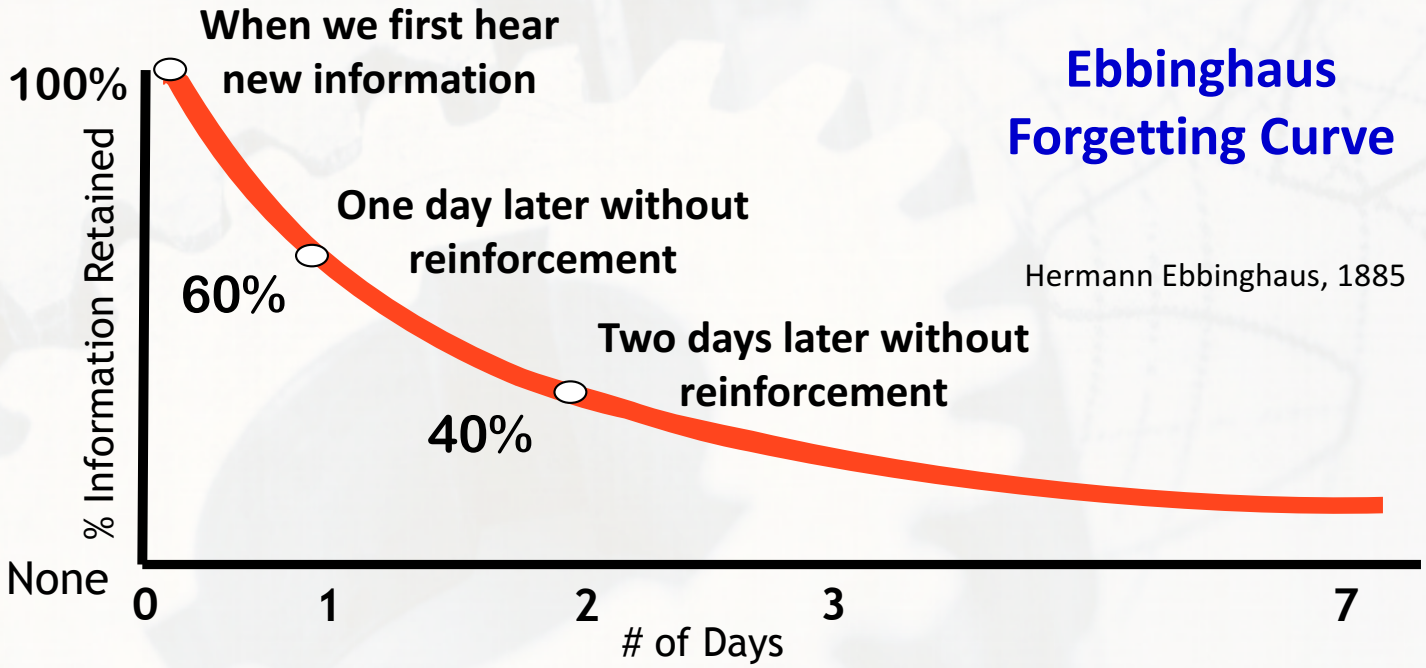
How Memory-Based are You?



How do we use our memory to minimize human error?

- Meaningful organization
- Chunking and mnenomics, such as HOMES
- Visualize and relate
- Engage multiple senses
- Rehearse, teach the concept to others
- Use visual and auditory cues



Ebbinghaus Forgetting Curve

Hermann Ebbinghaus, 1885

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How Aware are You?

- Decision Speed?
- Decision Accuracy?
- Physical fatigue?
- Fit for duty?

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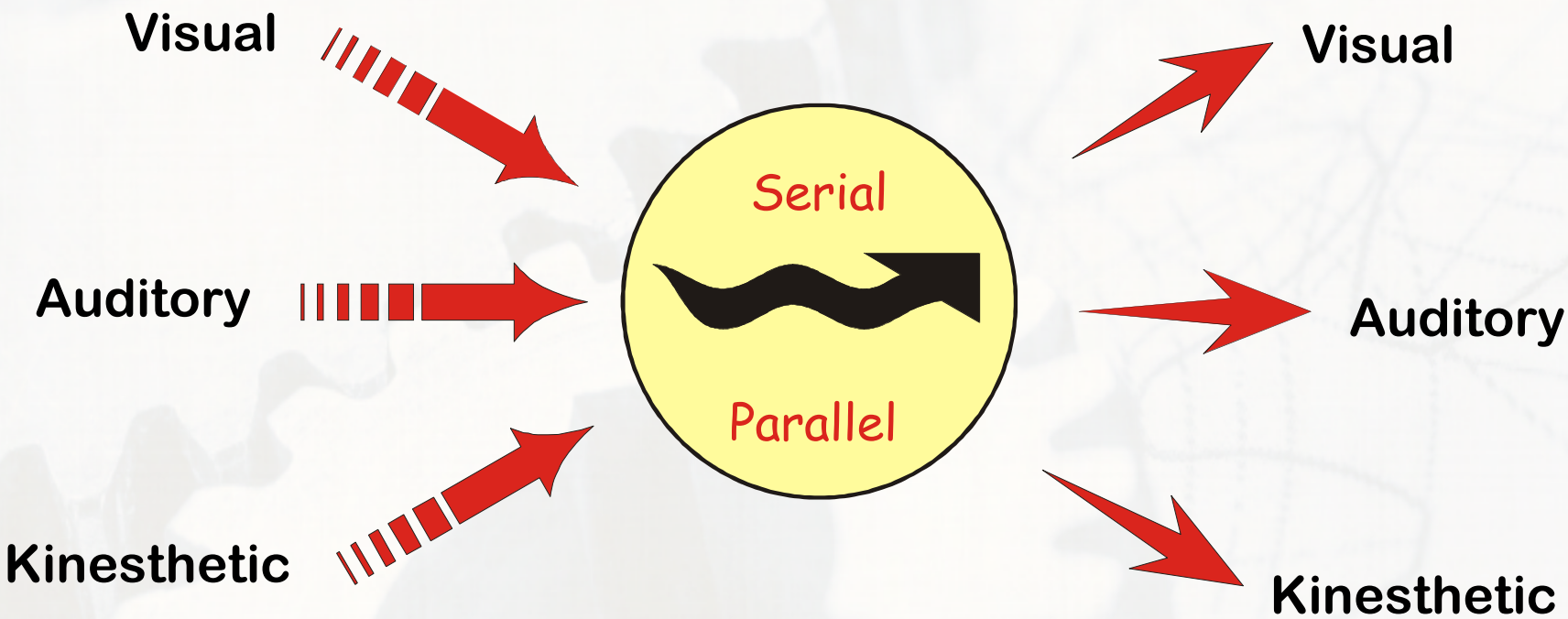
Are We Failing to Communicate?

Preferred Sensing Modality	Preferred Thinking Style	Preferred Mode of Expression



What are your preferences?

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What Your Communication Preferences?

The Three Perceptual Channels

AUDITORY
Spoken words, sounds...
what is **heard** and **said**

KINESTHETIC
Emotions, actions,
movement, taste, smell...
what is **felt**

VISUAL
Printed materials, facial
expressions, body language...
what is **seen**

V _____

A _____

K _____

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The Map is Not the Territory

Real maps differ from their territories by:

- Topography
- Weather
- Encounters / experiences

Personal maps differ from their territory by:

- Values
- Moods and emotions
- Mental models

Personal maps are more different to experience and read

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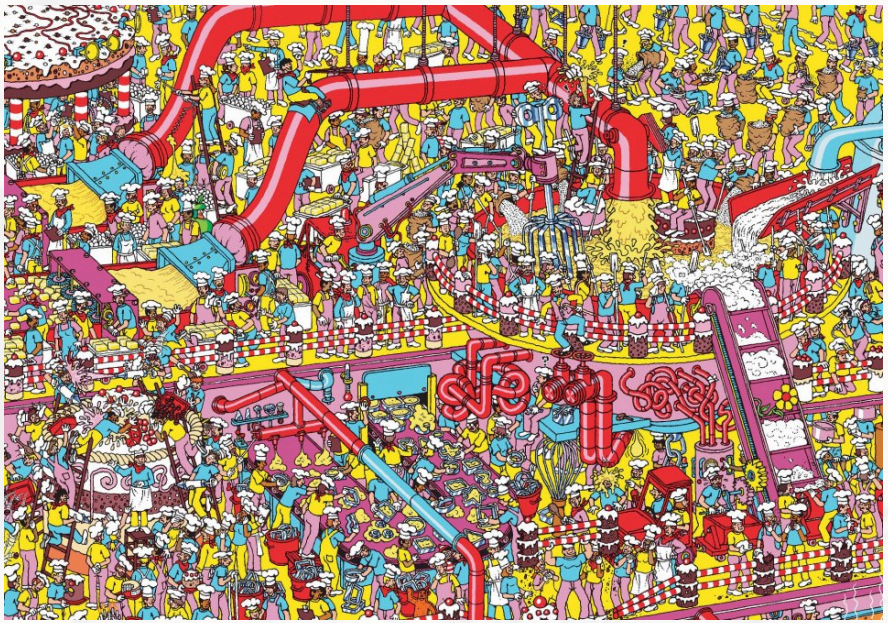
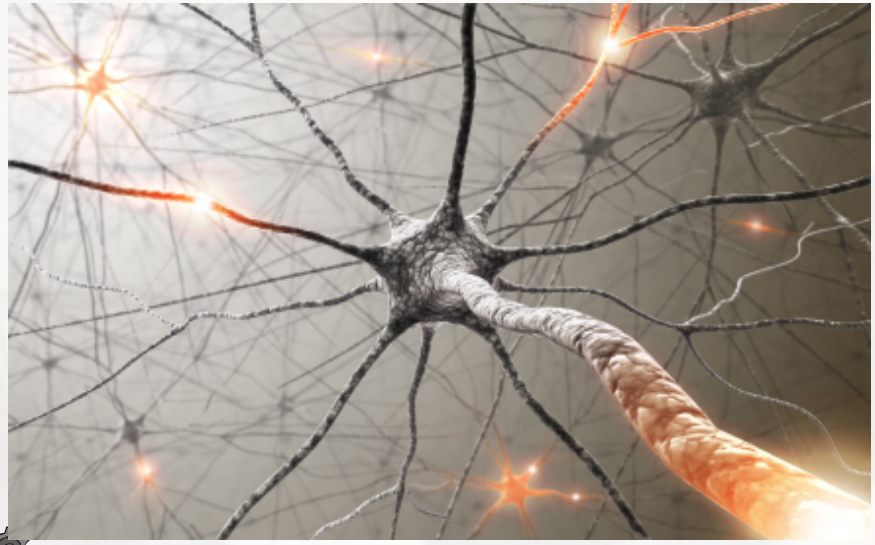
How are You Processing That?

- Serial versus parallel thinking
- Elliot Jacques – Ability to look forward into time
- Gardner's Seven intelligences





- Mind speed and OODA loops
- Right versus left brained thinking
- Myers Briggs, DISC, True Colors

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Do You See a Pattern Here?

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Get a Grip!

- Emotional intelligence – Daniel Golman
- Impact of emotion on cognition – decision speed and accuracy
- Which brain is in use – limbic system or neocortex?

Stay out of fight or flight' mode to help minimize human errors

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A Daily Dose of Rationale

- By understanding rationale, we can understand behavior
- Problem solving skills help clear hurdles to getting results
- How do each of the seven intelligences apply to rationale?

If we understand rationale, we can design away the excuses

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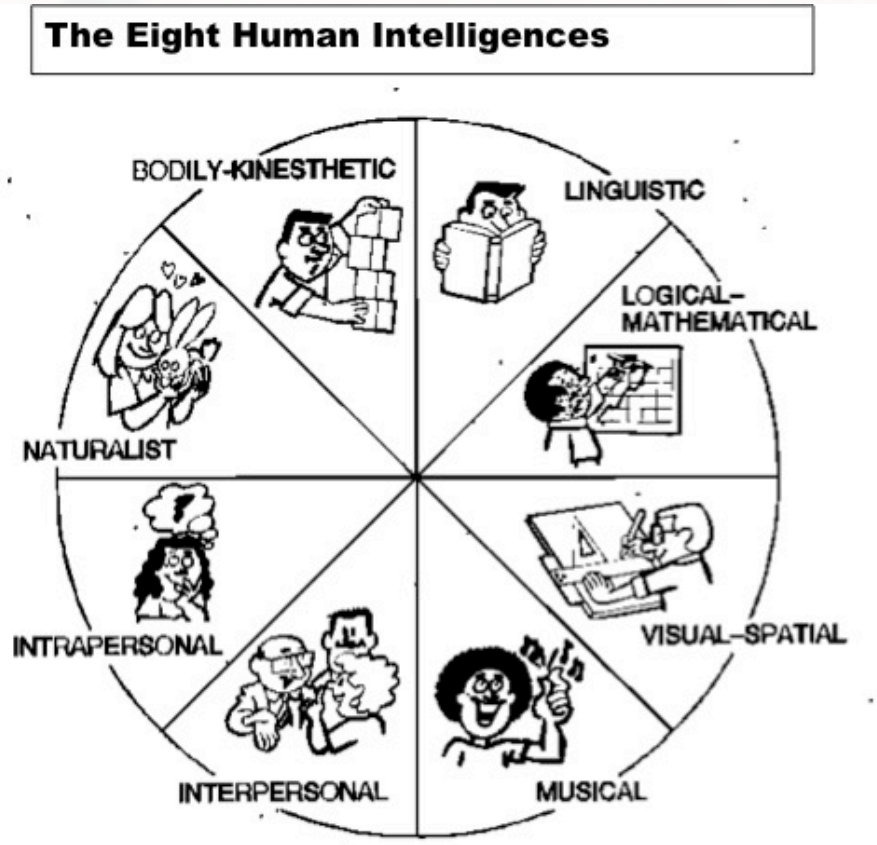
I'll Let You be the Judge of That

- How do our other cognitive abilities affect our judgment?
- How well do you see systems and the longer range picture when making choices?
- How do the seven intelligences apply to this cognitive ability?



Source: "Accelerated Learning for the 21st Century", Colin Rose and Malcolm J. Nicholl, 1997

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Get Your Mind Right

- What types of exercises do you use to condition your brain?
- How do diet and hydration levels affect human error rates?
- What is your Sleep Quality Index?

"If you get to the point where you think you know it all, you're going to stop learning." – John Wooden

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Maintain Your Brain

- **FEED** it – Nutrition and hydration matter – GIGO applies to your brain too!
- **EXERCISE** it – Neuroplasticity can both activate and reshape neural networks
- Mental fitness comes through proper brain nutrition and exercise
- Failing to exercise existing neural networks will result in their atrophy
- **REST** it – Sleep quality plays a key role in overall brain function

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Feed Your Brain

- Nutrition and hydration matter – GIGO applies to your brain too!
- The brain represents only 2% of the body weight, yet it receives 15% of the cardiac output, 20% of total body oxygen consumption, and 25% of total body glucose.
- If the brain is left without glucose, it can lead to hypoglycemia, which can result in loss of consciousness.
- 20 % of the energy used by the human body is consumed by the brain.

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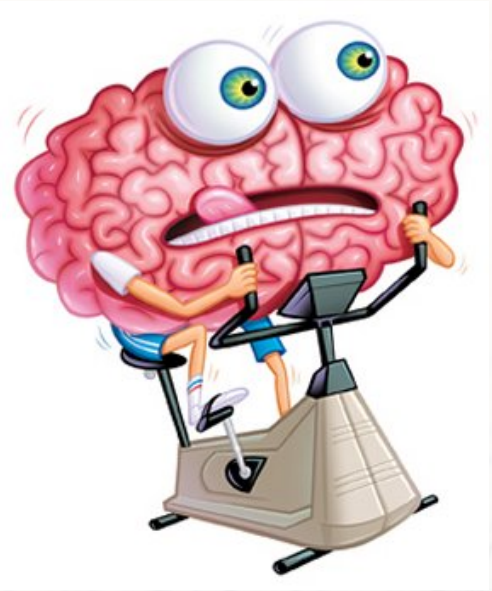
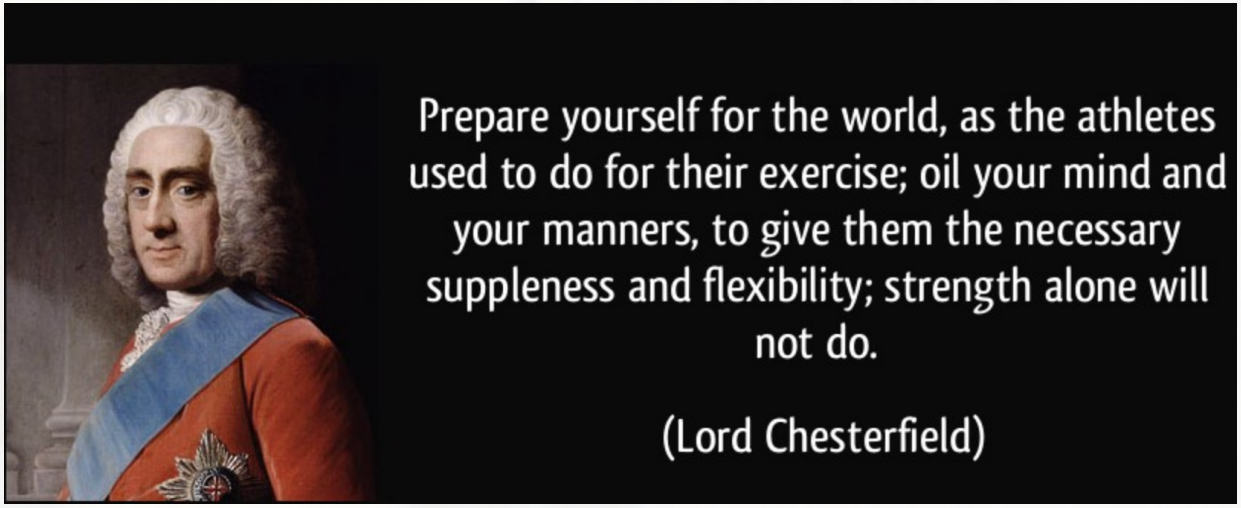
Exercise Your Brain!

- What percent of your life do you spend asleep?
- What level of sleep quality do you get nightly?
- How do you optimize sleep quality and duration?





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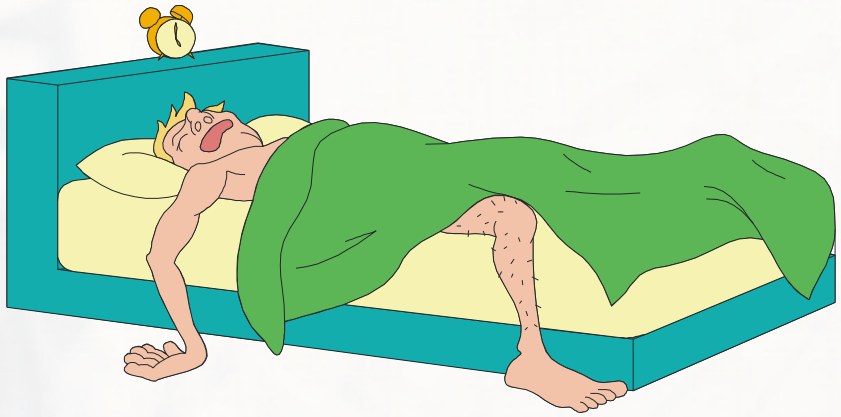
Rest Your Brain



- What percent of your life do you spend asleep?
- What level of sleep quality do you get nightly?
- How do you optimize sleep quality and duration?

"Never go to sleep without making a request to your subconscious." – Thomas Edison

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Our Need for Value Added Sleep

- We invest 33% of our personal time in sleeping
- Sleepiness costs us $100 billion annually
- More than 100,000 auto crashes are sleep-related
- Sleep revives and recharges our body
- Sleep value can be compromised

How much value added sleep do you get on average?

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The Sleep Process

- 80% of adult sleep is NREM sleep (4 stages)
- REM sleep involves high physical and mental activity
- Sleep cycle = 80 min of NREM + 10 min of REM
- This cycle is repeated 3 to 6 times nightly
- Both stages of sleep are needed

How many cycles do you go through each night?

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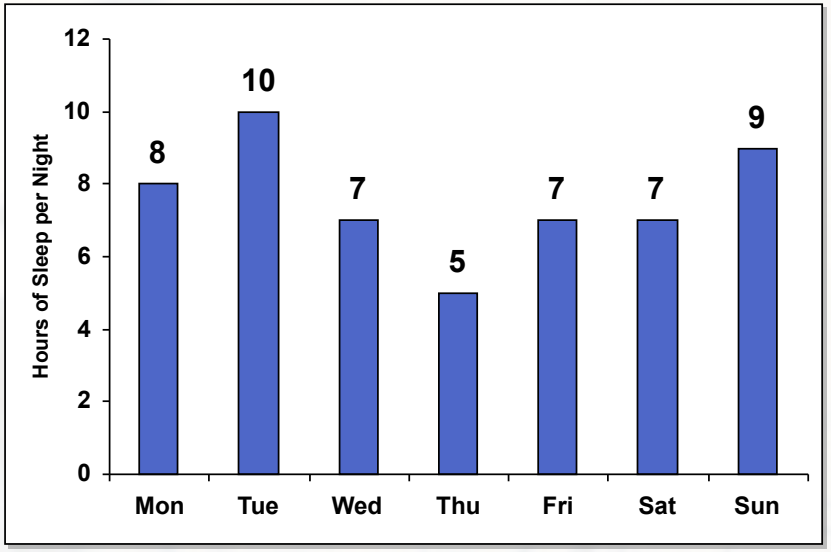
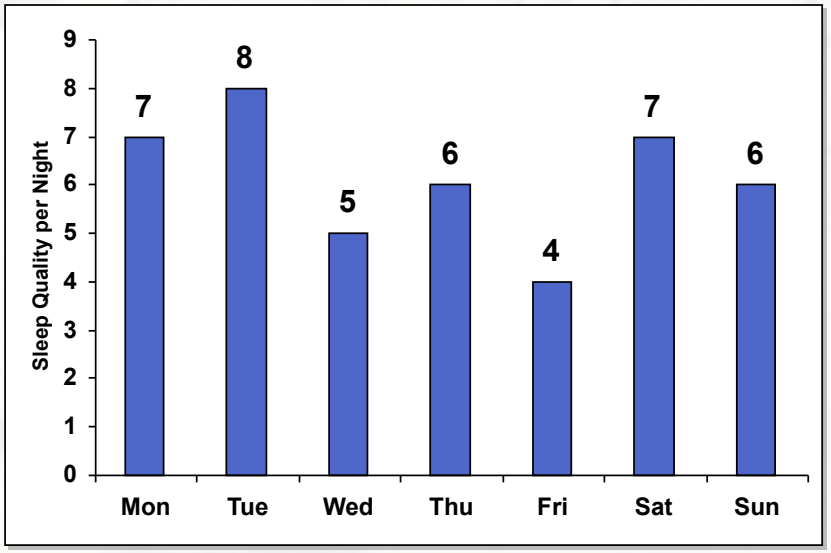
What is Your Sleep Quality Index?

Step One: How much sleep do you get each night?



SQI = Hours X Quality %

Step Two: What was the quality of your sleep?
(on a scale from 1 to 10, with 10 being great!)



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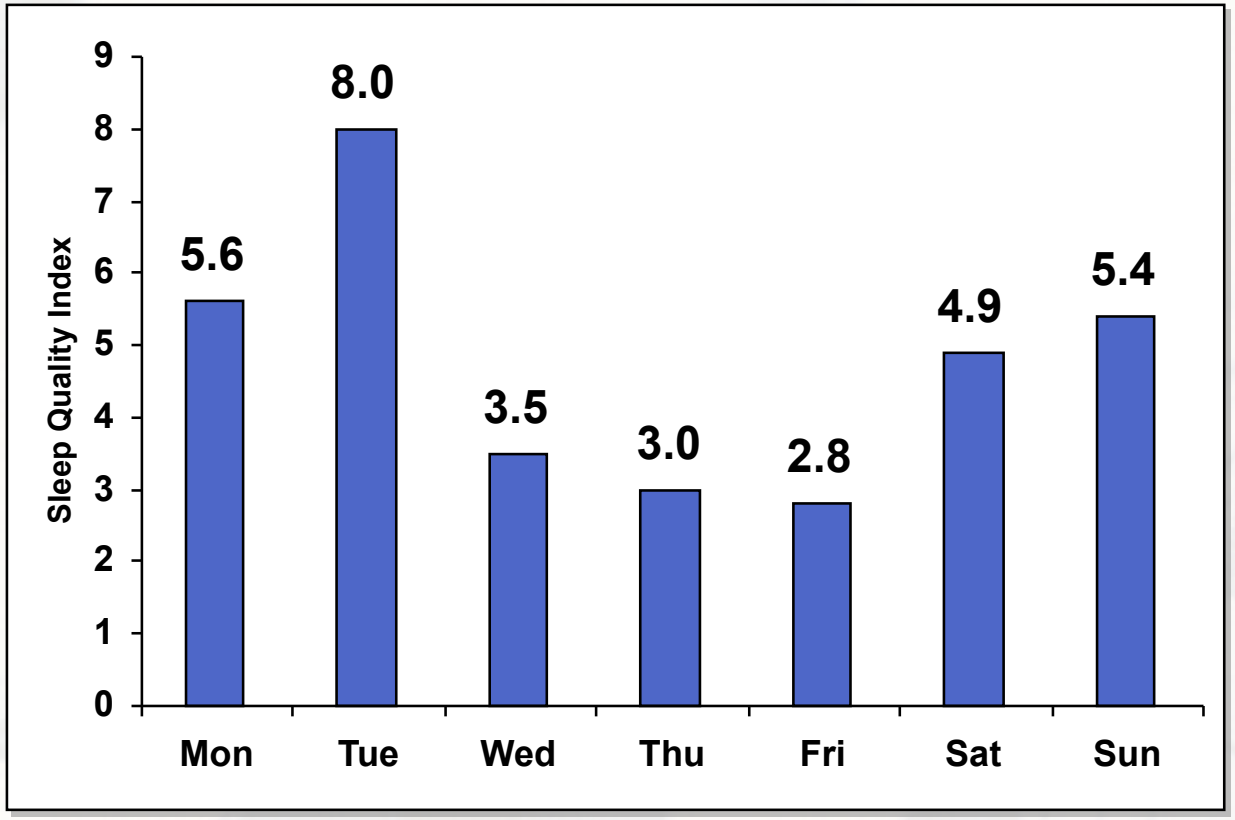
Charting Your SQI Over Time

SQI = Hours X Quality %



To Improve: Shoot for 8 hours of sleep a night

Try to improve your average SQI percent

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Getting More Value Added Sleep

- Avoid alcohol and caffeine before bedtime
- Go to sleep and get up at the same time each day
- Avoid heavy meals or spicy food before bedtime
- Create a comfortable sleep environment
- Exercise regularly
- Avoid watching the clock

How is your current sleep quality index trending?

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Step Up Your Fixes to Escape Reactive World

- What are your favorite fixes?
- What factors cause most corrective actions to fail?
- How might we assess the potential impact of our fixes?

"If you always do what you've always done, you will always get what you've always got." – Henry Ford

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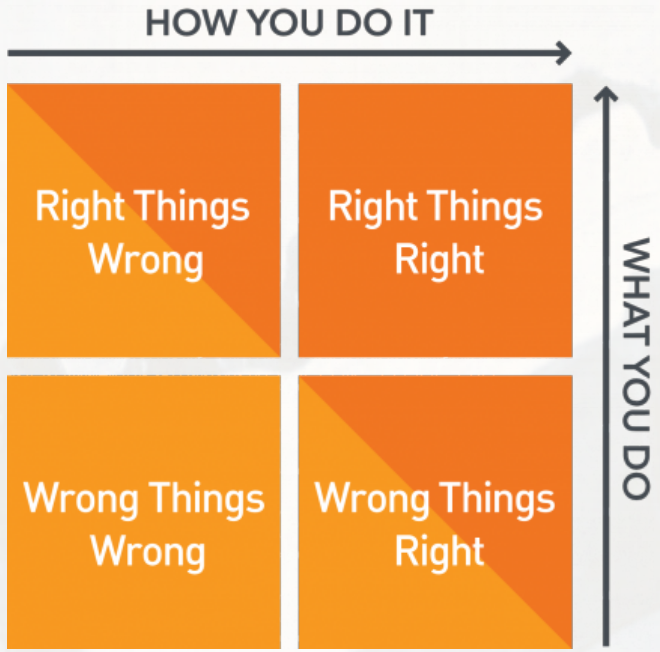
Why are We Trying The Same Fix Again?

Doing Things Right

Single Loop Learning

A thermostat that works



Doing the Right Things

Double Loop Learning

A thermostat that asks why before it works

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Why Our Fixes Fail

- Over half of the root causes identified are not root causes

Do you think HUMAN ERROR can be the root cause of a problem?

Do you think EQUIPMENT FAILURE can be the root cause of a problem?

- A high percentage of our fixes are only quasi-safeguards

The right HUMAN ACTION must happen for the safeguard to work

How many mistakes a day do humans make?

- We have limited time to spend on solving problems

We limit the scope and number of fixes that can be approved by budget, not potential severity

Hundreds of hours analyzing often yields only one or two weak fixes – policy change and more reminding

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What's a Systems Change … Really?

Which is easier to fix, people or systems?

- Few would argue that it is hard to get people to change, but …
- Systems change just costs too much – or does it?

What are we often trying to fix, people or systems?

- A high percentage of our fixes focus on trying to change people – reminding, discipline
- Redesigning systems force people to act differently

Systems shift cultures!

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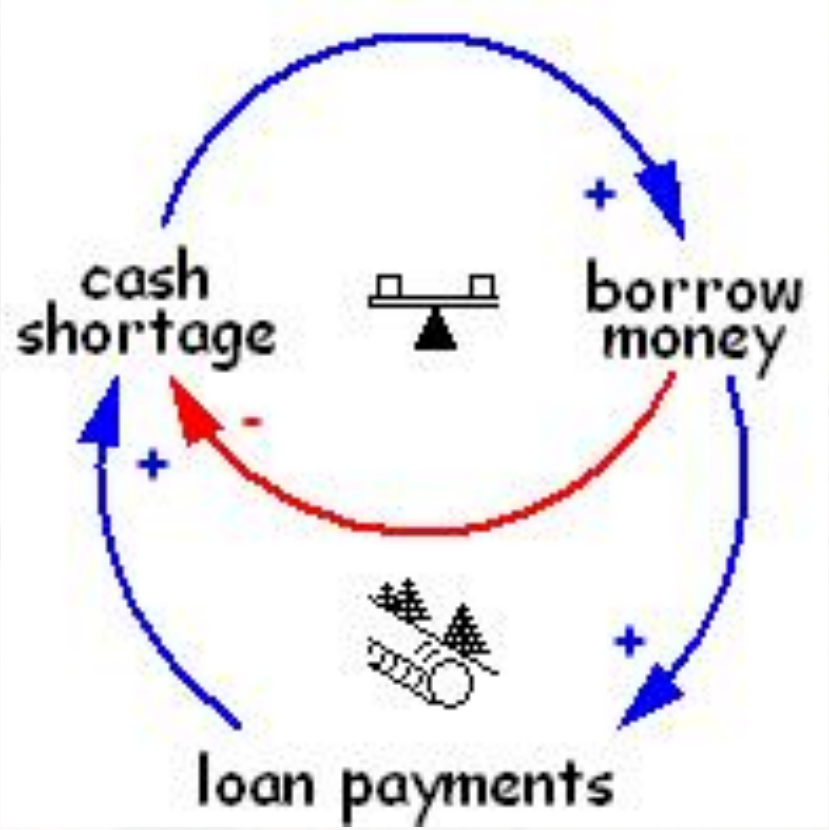
How Often Do Your Fixes Fail?

- Most organizations are unaware of their true daily error rates
- Fix effectiveness is often gauged by lack of incident reoccurrence – dumb luck
- Delays exist between fix implementation and system response
- Other system changes can offset the positive impact of a fix



How do you know if a fix works or not?

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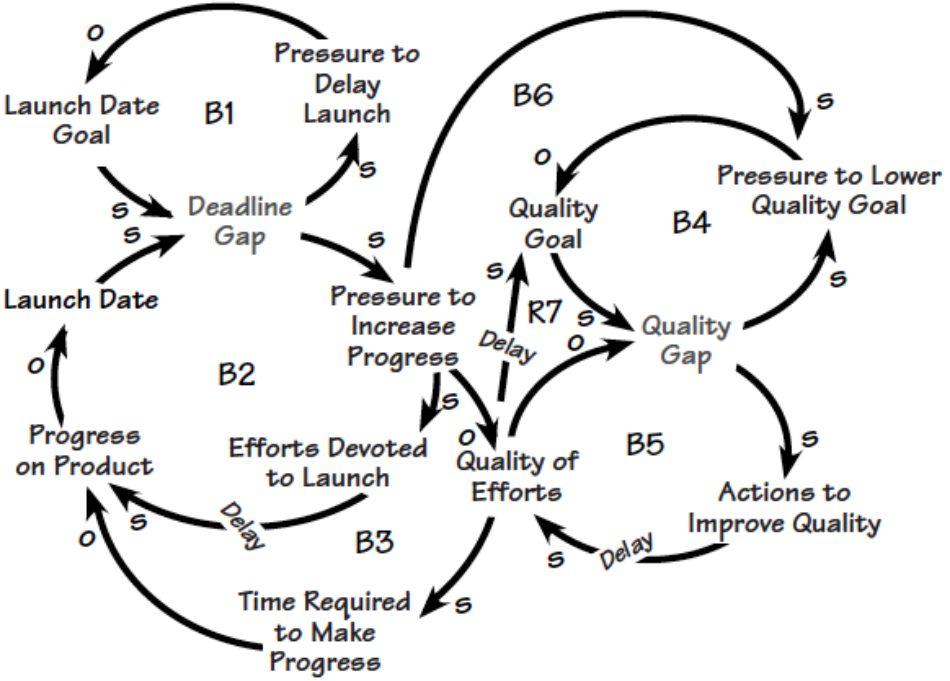
Evidence of Failing Fixes

- Small problems don't go away – instead, we budget for them
- We design work systems to quickly address daily issues
- Departments exist to manage problems like rework or complaints
- Reinforcing the existing rules is a favorite fix for internal problems
- People are surprised when a 'mistake free' day occurs



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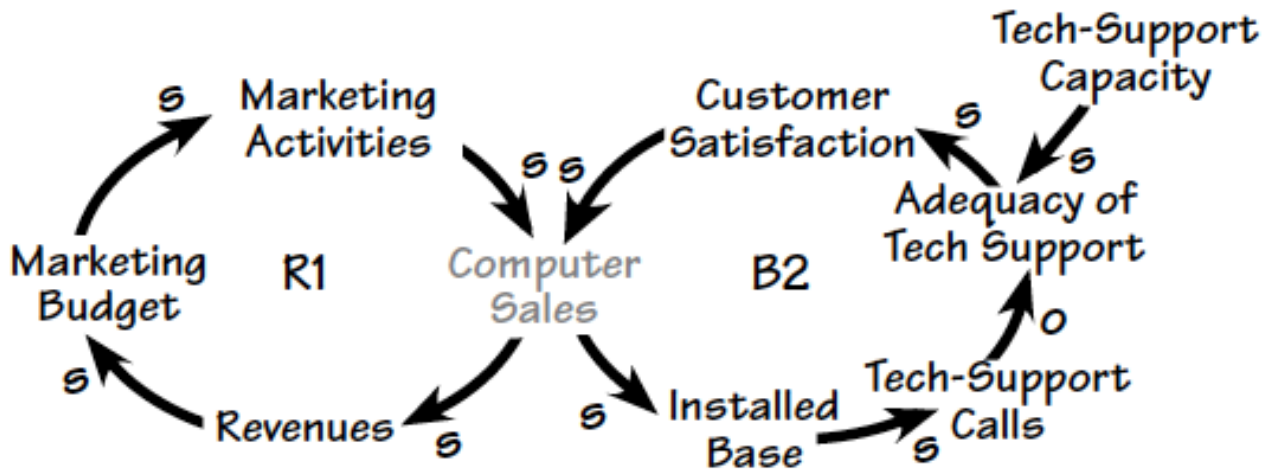
It's the Systems, Silly ...

LIMITS TO COMPUTER SALES



More sales lead to increased revenues and a rise in the marketing budget (R1). However, as sales grow, the installed customer base expands, along with calls for technical support (B2). If the technical-support capacity does not increase fast enough to meet the growing demand, the adequacy of that capacity drops, leading to lower customer satisfaction and sales.

Source: Systems Archetypes III, Daniel H. Kim, Pegasus Communications, 2000

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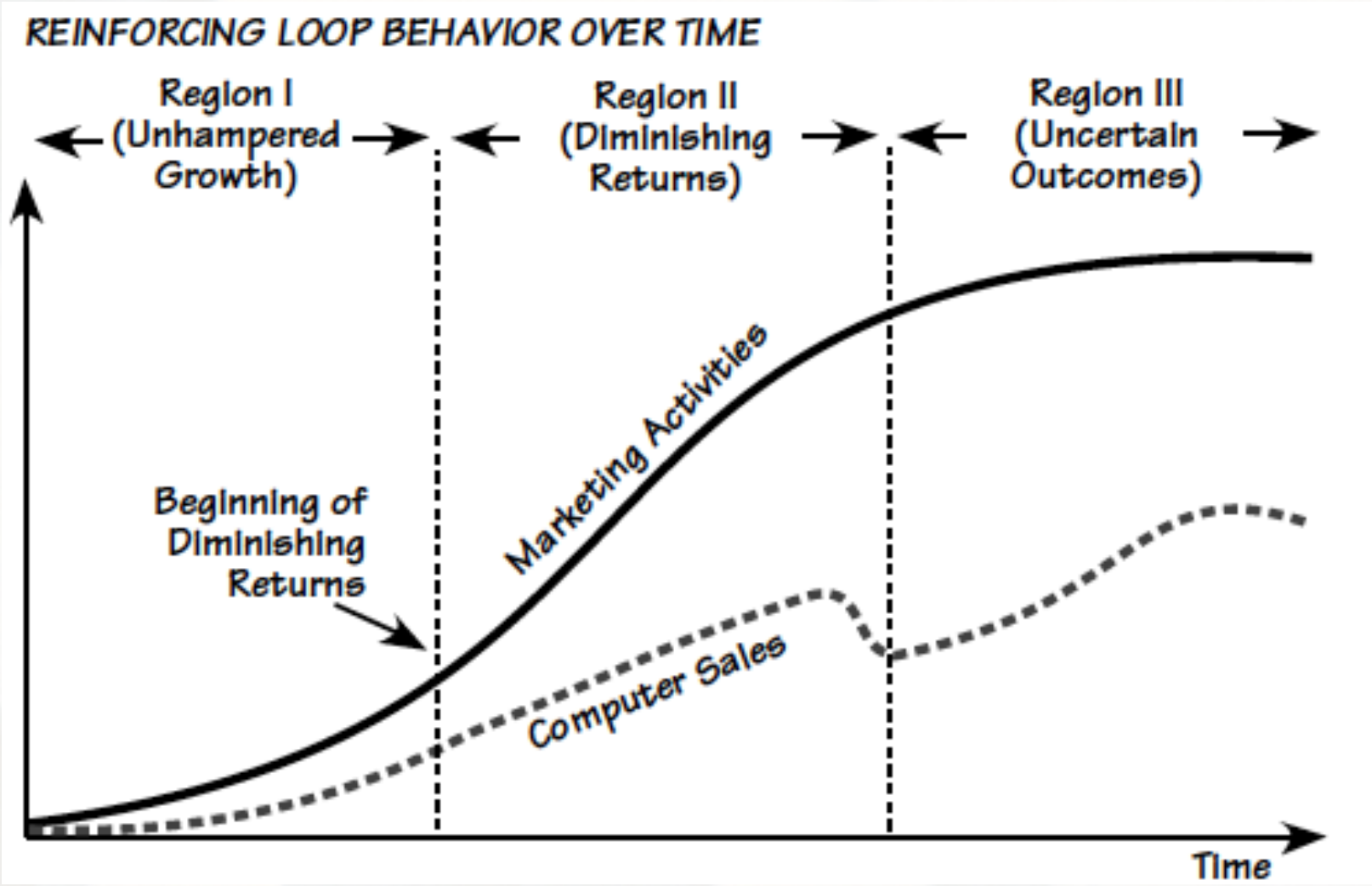
What is Really Affecting Sales?



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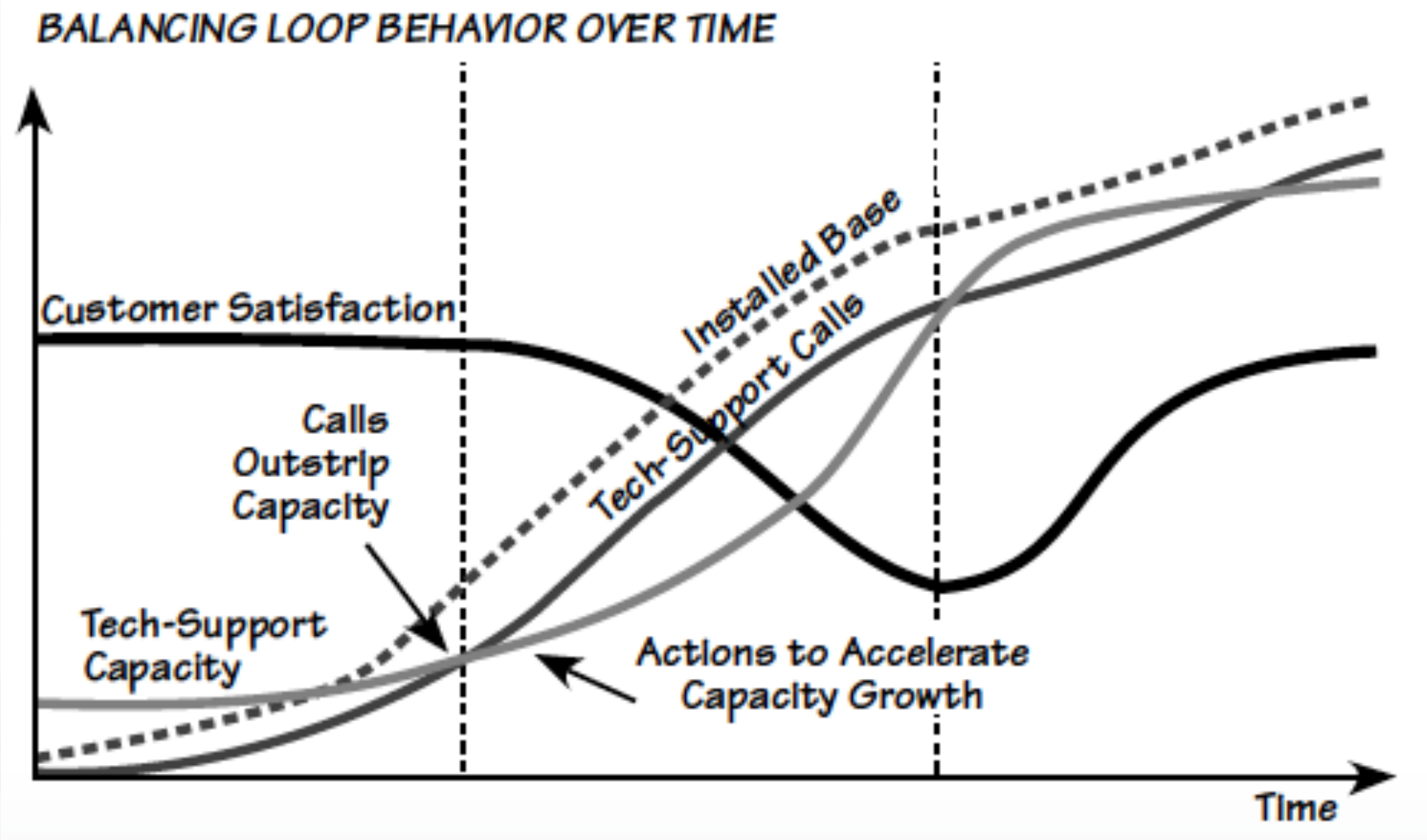
What Really Needs to Change?



Source: Systems Archetypes III, Daniel H. Kim, Pegasus Communications, 2000

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Why Effective Fixes Matter

- Any fix costs time and money to put in place

  Have you ever spent 100 hours on a problem, only to end up with a modified policy … new rules?

- We have limited time to spend on solving problems … but we waste it
- Effective fixes create time for proactive efforts … but are your fixes failing too often?
- Error free processes are safer and more effective
- Effective fixes improve customer service and quality

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Creating a Great Corrective Action Burger

The 'Three Sentence' approach can be used to write a more well-rounded corrective action

First Sentence	**Describe the system change to be made and its expected impact on the causal factor(s)**
Second Sentence	**List 2-3 key features of the change to help identify how this fix will minimize future CF occurrences**
Third Sentence	**Describe the key approaches that will be used to roll out / deploy the fixes once they have been developed**

You can also add implementation verification and effectiveness validation sentences as dressing!

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Assessing Potential Fix Impact

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Are All of Your Root Causes Being Fixed?

Are your fixes specific or systemic?

Does your 'fix mix' address the potential severity of the problem?

Will all of your fixes actually get fixed?

	Not enforcing walkthrough rules	More accountability is needed	Not enforcing LOTO policies	More accountability is needed	LOTO process needs improvement	No checklist for doing LOTOs	LOTO process is not audited	Detectors are not labeled	Detectors are not in sight of controls	Detectors are easy to confuse
Elevate key LOTO policies to checklist level			X		X	X				
Add walk through requirement as a step in each key LOTO checklist	X				X					
Require one or more signoffs on each LOTO checklist step		X			X					
Attach checklist to all work packages when LOTO is required	X		X		X					
Audit checklist use (1) 100% at supervisor level and (2) monthly as part of safety walk through			X		X		X			
Use team meeting to stress (1) why checklists are necessary and (2) how checklists are completed	X		X		X	X				
Trend and visually post compliance results in work area	X		X		X					
Label all key equipment per site labeling specs								X	X	X
Survey team to gauge degree of compliance with all key site policies and address as needed	X		X							

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Measuring Potential Fix Impact

Calculate a score for EACH corrective action that is defined

To What Degree …	LOW ---------- HIGH
Is each corrective action specific?	1 2 3 4 5
Is the corrective action measurable?	1 2 3 4 5
Has accountability for completion been defined?	1 2 3 4 5
Has a return on investment been considered?	1 2 3 4 5
Have timeliness factors been considered?	1 2 3 4 5
Has a means of verifying effectiveness been identified?	1 2 3 4 5
Have unintended consequences been anticipated?	1 2 3 4 5
Have all applicable root causes been addressed?	1 2 3 4 5

Total Score: ☐

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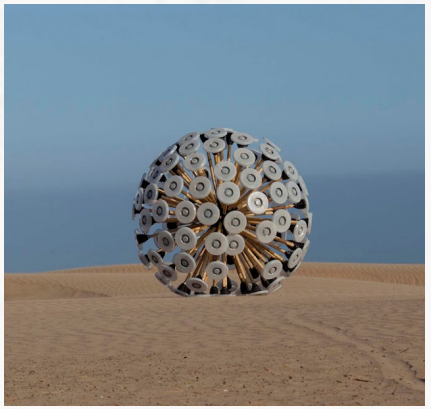
How to Step Up Your Fixes

- Review a list of your most recent root causes and corrective actions – what patterns exist?
- Use examples of well and poorly written corrective actions to define standards
- Expect ‘fix mix’ strength to match potential problem severity
- Strive for creative, engineered fixes – 1 passive = 5 active
- Use daily error and defect trends to help gauge corrective action impact
- Reduce the holes in your current safeguards before adding new cheese slices



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Example Fix That Will Fail #1

A Maintenance Supervisor cut his right hand on an insulation covering band at Tank #514. This injury occurred while attempting to kneel down to read and inspect a data plate on a valve that was being assessed for replacement at Tank #514. The injured party did not notice the raised edge of the insulation band. In removing his gloves, the injured removed a layer of hand protection. The injury required 4 sutures.

Root Cause: Attention LTA

Lesson Learned: This injury could have been avoided by approaching the work in a slightly different fashion. The injured could have recruited the assistance of the contractor supervisor to write down the valve data as the injured party inspected the valve data plate. This would have eliminated the need for the injured party to remove his gloves while kneeling.

Recommendation: Conduct a safety meeting with all Metal Shop personnel and nested metals contractors for a review of this event and the lessons learned in investigating the incident.

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Example Fix That Will Fail #2

Two contractors were removing a deck plate adjacent to the convection section. Contractor #1 was using a pry bar to lift up the deck plate after the tack welds that were holding it had been burned off. Contractor #2 was using his left hand to hold the deck plate up when the pry bar slipped and allowed the deck plate to drop and pinch the left hand index and middle fingers. Both contractors were wearing proper PPE. No treatment was required.

Root Cause: Attention LTA – JSA was found to be adequate, was being followed, and matched the field conditions. Handling of materials is a normal construction practice.

Lesson Learned: Any piece of deck plate that needs to be removed along the convection section will have a hole cut in it and held with a piece of #9 wire or use of a wedge where possible. This will prevent using hands to hold the deck plate.

Recommendation: Same as Lesson Learned.

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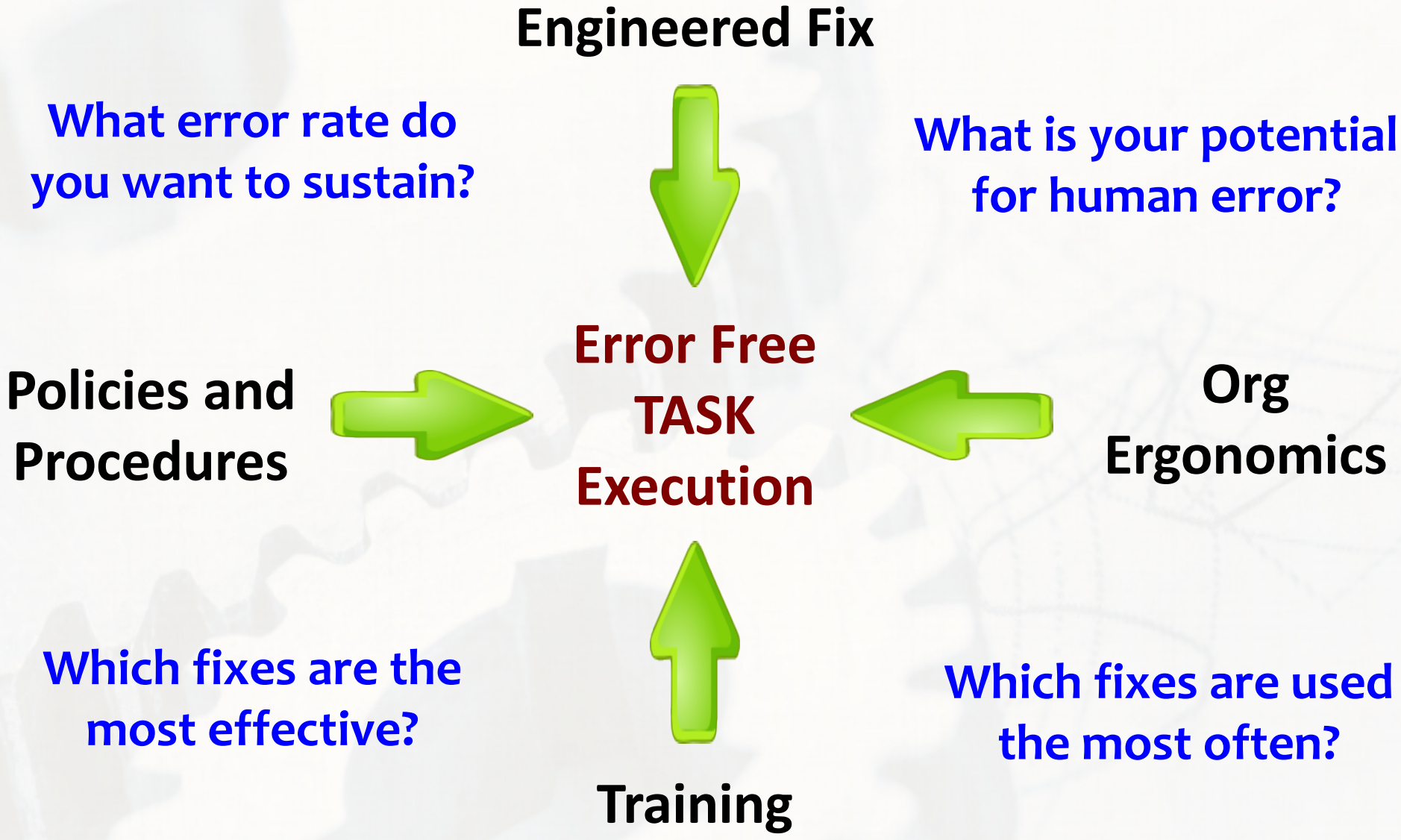
What Error Rate Do You Want to Sustain?



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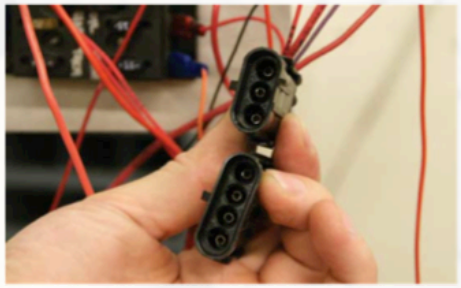
Key Approaches for Reducing Human Error

Skill-based training certificates for all people

Effective behavior enforcement

Well designed and used checklists

Effective daily job preparation



Effective human engineering on the job

What best practice approaches can be used in these five areas?

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Team Exercise #1

What's Affecting Your Corrective Action Effectiveness?

How Effective are Your Fixes?

10 minutes group work
2-3 minute / team report

- Rank order the eight factors from 1 (high) to 8 (low) from a personal perspective
- Compare your individual rankings to those of the others in the group – what differences exist?
- Reach consensus in your group as to what you feel the top three factors are

BE CREATIVE, HAVE FUN, and ACHIEVE THE GOAL!

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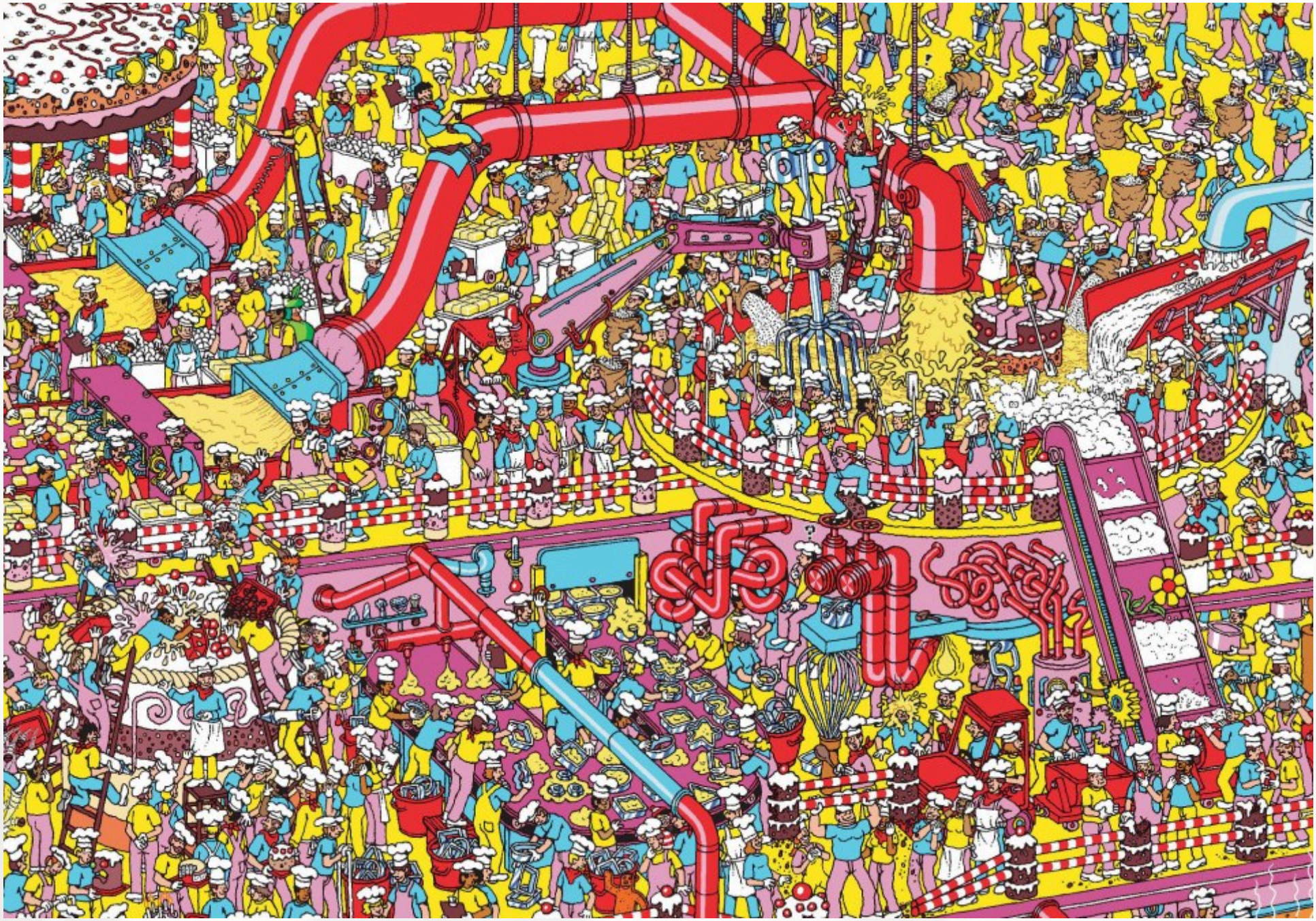

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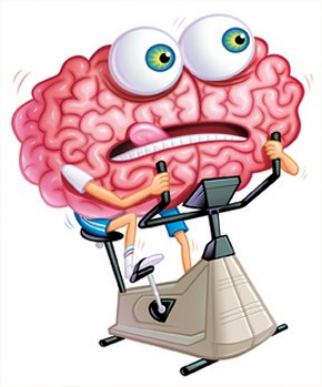
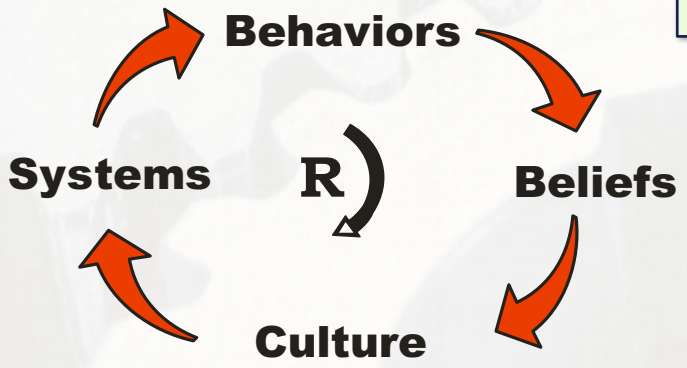
The Five P's of Perfection

The Foundational Power of Paper

Be Prepared



Using Processes to Guide People



Positive, Purpose Driven Culture

Perfect Practice Makes Perfect

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The Foundational Power of Paper

- What are some key work instruction design flaws?
- How can we get information closer to the work?
- How much information is needed to improve performance?

How much do we count on memory to prevent human error?

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A Clinical Example of Process Improvement

- In the *Checklist Manifesto*, Dr. Atul Gawande cited the work of Peter Provonost and the Keystone Initiative in early 2000's Michigan
- ICU staff must execute 178 different tasks during a day per patient
- 80,000 CL infections per year in United States alone – 4% infected after 4 days
- 2004: Explored the use of simple checklists across five Sinai-Grace ICUs for central line and ventilation procedures
- Required monthly visits by senior executive owners to listen and help solve problems, such as disinfectant soap supply chain issues
- Dec 2006: Checklist use helped save $175 million and 1,500 lives in 18 months – a 66% reduction in CL infection rates

What processes need checklist use to help avoid memory errors?

How do we motivate people to consistently use checklists?

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Best Practice Work Instruction Design

Instructions are used DURING work to reduce the risk of relying on memory

- Use small words and short sentences
- Write instructions at a 5-6 grade level
- Use check boxes and initial lines to increase accountability
- Limit of one action per step
- Be specific, quantitative, and clear
- Specify instruction use requirements on the document

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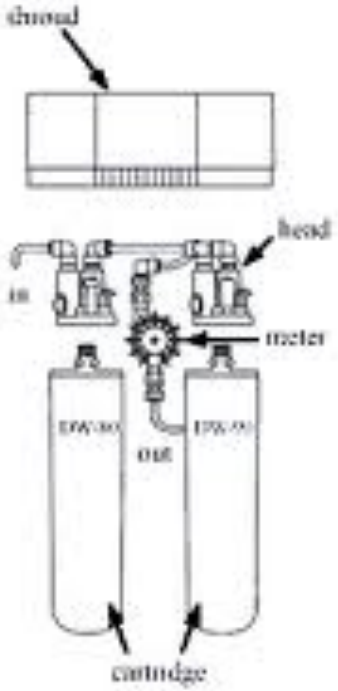
Work Instruction Examples

Sample pre-execution checklist

- Proficiency of METL tasks assessed by leaders.
- CLS refresher training for 1st Brigade soldiers completed.
- Coordination with maneuver medical platoons accomplished.
- PMCS of 5,000-gallon tankers completed.
- Fuel-handler training accomplished.
- Lessons learned from last CTC rotation integrated into TSOP.
- Coordination with MP platoon accomplished.
- Integration of HETs from the Heavy Equipment Transport Company accomplished.
- Support required from MSB established.
- Support for air medical evacuation (MEDEVAC) established.
- Prerequisite training for reaction force accomplished.
- Reconnaissance completed.
- Deployment training accomplished.
- Rehearsals conducted at all levels.

Figure 4-25.



Change AP-DWS1000 Filter:

1. Turn off water source to filter
2. Open faucet to relieve pressure
3. Lift red tabs, turn cartridge to left and pull down
4. Insert new cartridges into heads and turn right until red tab clicks in.
5. Reset meter to original setting (with 1000 at top)
6. Turn on water
7. Run water until clear.

Can you think of examples where poor instructions resulted in a human error or equipment failure?

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Example Job Hazard Analysis Form

Sequence of Basic Job Steps	Potential Hazards	Recommend Action or Procedure*
1. Position pallet for material to be stacked on.	1. Pallet placed too close to the line may be a tripping hazard when walking back and forth to the machine.	1. Leave ample space between pallet and clipline. Keep pallet in marked area not in the walking aisle.
2. Pick up cut pieces of lumber from the bins.	2. Wood pieces dropping in to the bin from the clipline could cut or pinch fingers.	2. Wear gloves and keep hands clear of the belt line so material dropping into the box will not strike hand. Never try to get stuck material from the line unless power is shut off.
3. Walk around to the side of the pallet to stack material.	3. Projecting sharp corners on pallet (strike feet on corners).	3. Assure clear path between pallet and clipline. Remove lumber and other small material in the walkway.
4. Lean over pallet to stack material.	4. Injury to back while holding material in hand.	4. Wear back belt and bend knees to keep pressure on the legs, not the lower back. Do not twist when placing the material.
5. Place material on pallet.	5. Slivers from wood pieces. Back or shoulder injuries from reaching too far with lumber pieces.	5. Wear gloves. Only reach to the halfway mark on the pallet. When side is full, walk around to the other side and begin stacking.

Job safety analysis

Safety information for sampling and testing

Names of personnel

Title of job or task Sample the local wetland water

Task	Hazards	Controls
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

Phone numbers:
Colleague:
Supervisor/Manager:
Emergency response: 000

Required Personal Protective Equipment (PPE):

Other Information: See your Supervisor/Manager for other information

Contributors: Names of those undertaking this JSA

Date:

JSA Number:

How is the collected information used to improve performance?

How does the design of the form affect its potential effectiveness?

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Getting Information Closer to the Work

Instructions in notebook

Instructions in PDA

Instructions on job aid

Checklist in hand

Ease of retrieval is improved

Memory loss impact is reduced

How much do you rely on memory to minimize human error?

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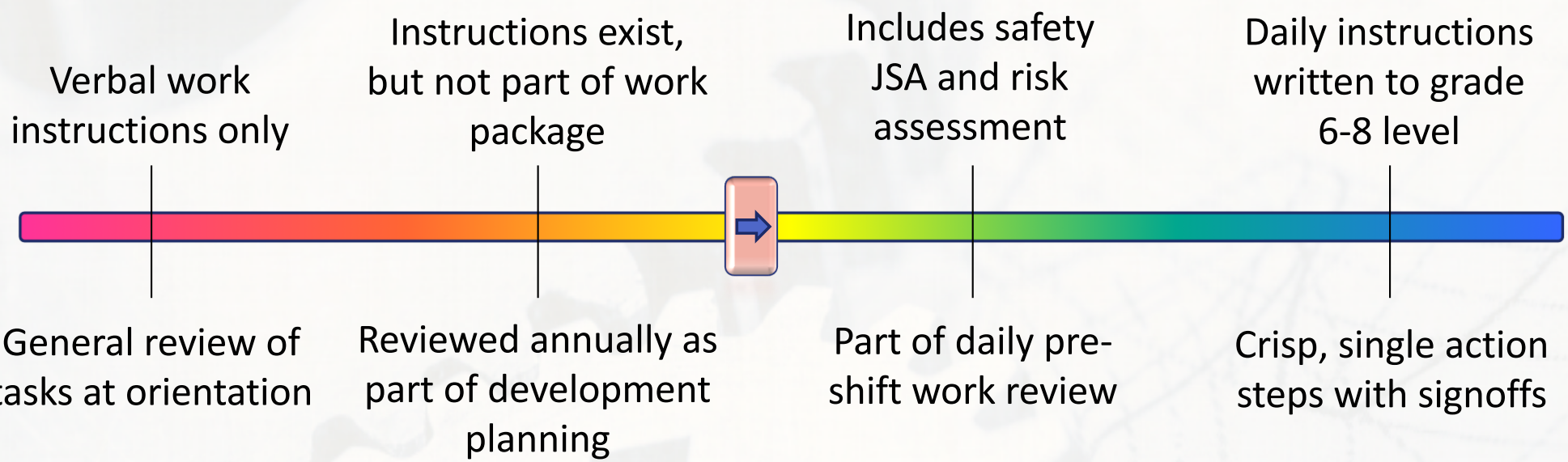
Creating Better Work Packages

Towards Better Work Systems



Effective Work Package Building Codes

- Create simple, picture-based instructions
- Get the instructions close to the work
- Involve users in work package improvement
- Make special instructions OBVIOUS!

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Perfect Practice Makes Perfect

- What are the key training packages that we rely on?
- What percent of course time do you devote to practice?
- How do we enhance our training AURA?

"Perfect practice makes perfect."
– Rick Pitino, NCAA and NBA Basketball Coach

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Three Impact Areas

HOW we train

WHERE we train

WHAT we train

Awareness **Understanding** **Retention** **Application**

"Provide the greatest learning in the least amount of time."

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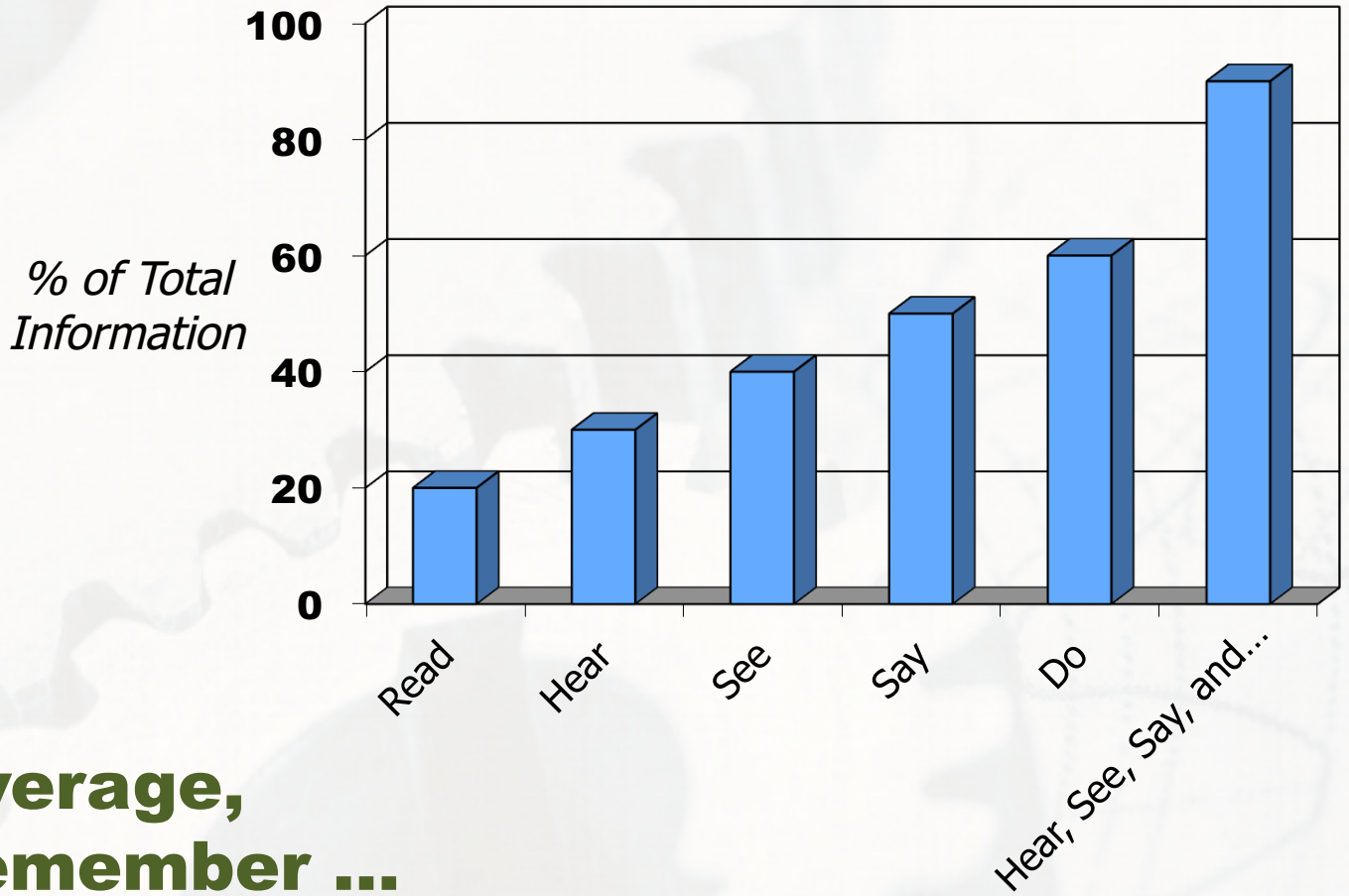
Exploring the Training Half Life



On average, we remember ...

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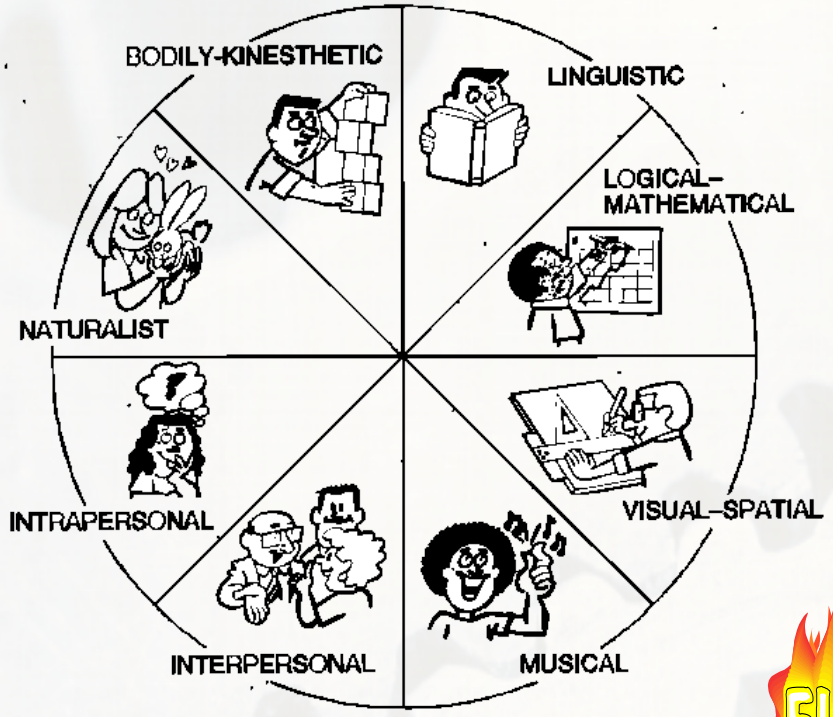
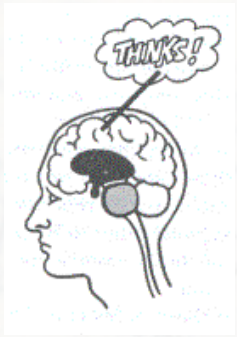
Learning Styles and Neural Pathways

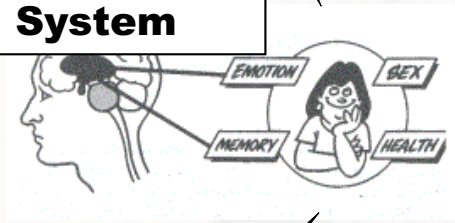


Which of the eight intelligence areas do you score strongly in?

Is your information reaching the neocortex where learning occurs, or are your trainees in defense mode?



Limbic System



Neocortex

Reptilian Brain

Source: "Accelerated Learning for the 21st Century", Colin Rose and Malcolm J. Nicholl, 1997

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Error Proofing Your Training System

Here are some common training system gaps that you should be on the lookout for:

- Certification requirements have not been defined for each job
- Low percentage of course time devoted to skill practice
- No trainer assessment, certification, or development process
- Weak, or no, skill demonstration–based competency testing process
- Limited chances for skill re-certification or further skill development

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Certification Process Pieces

PowerPoint Presentations

Used to gain an overview of the job and its requirements

Procedure Review

Used to review key job work instructions, hazards, and customer requirements

Flash Cards

Used for self-study of skill proficiency test concepts

Position Observation Checklists

Used by supervisor and team member to assess work practices

Skill Proficiency Tests

Used to gauge understanding and 100% retention of key work practices

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Example Position Certification

Filler Operator Certification Requirements

- 80 hours of training time on job w/ certified peer
- 200 hours of time on job following peer training
- Skill proficiency test score (90% first pass / 100% second pass)
- 75% or better score on Position Observation Checklist
- Personal procedure review and update time
- Accident free for past six months / good attendance

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Position Observation Checklist (POC) Example

Position Observation Checklist -- Case Coder / Palletizer

Employee Reviewed: _____

Reviewed by: _____ Date: _____

Please rate the current skill level of the above individual based on your observations of his or her performance on the job. Use the scale provided to note the level of skill proficiency that you feel exists. After completing the review, add up the circled numbers to obtain the subtotals and a total job skills score.

	Degree of Skill Proficiency LOW ---------- HIGH					
PERSONAL SAFETY						
Consistently uses safe lifting techniques	1	2	3	4	5	
Wears protective equipment as required	1	2	3	4	5	**Total**
Knows the potential hazards that exist in the work area	1	2	3	4	5	
Knows the location of emergency equipment and evacuation routes	1	2	3	4	5	
FOOD SAFETY PRACTICES						
Can explain the importance of good manufacturing practices	1	2	3	4	5	
Able to identify critical control points in their work area	1	2	3	4	5	**Total**
Able to explain how product quality is measured	1	2	3	4	5	
Can explain the key requirements that customers have of our product	1	2	3	4	5	

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Skill Certification Best Practices

Certifications are used to help emphasize the need for demonstrated skill success

- Minimize use of lecture in favor of practice time
- Use Position Observation Checklists to gauge skill proficiency
- Require time on job to demonstrate expected work behaviors
- Link certification requirements to EACH job description
- Identify what needs to be 100% committed to memory
- Use computer-based training (CBT) for compliance or awareness needs only

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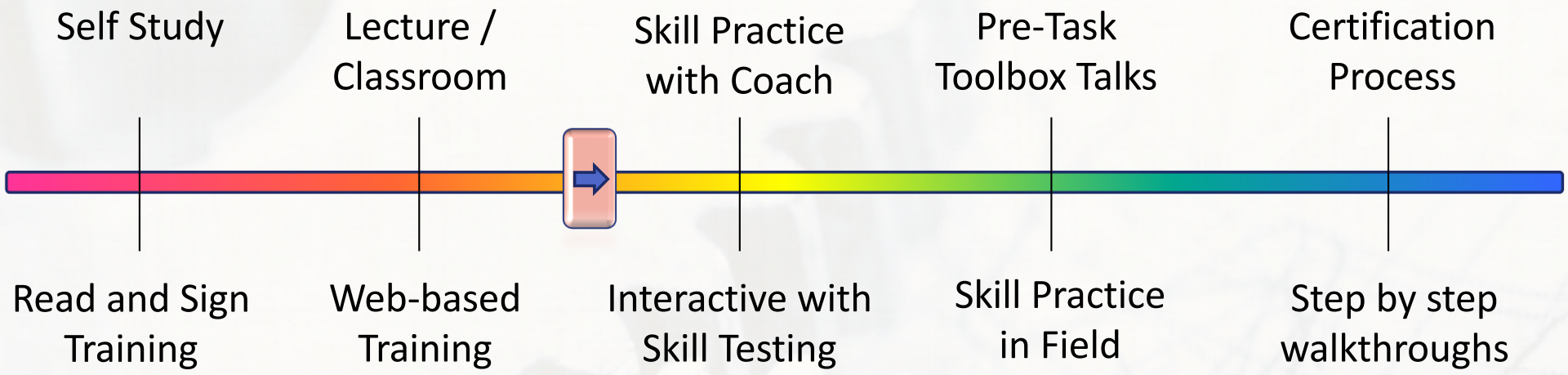
Training Effectiveness Spectrum

Towards Better Work Systems



Training System Building Codes

- Match prep style to team skill mix
- Team lead keeps the big picture in mind
- Add prep detail and layers as risk increases
- Engage the entire team in planning

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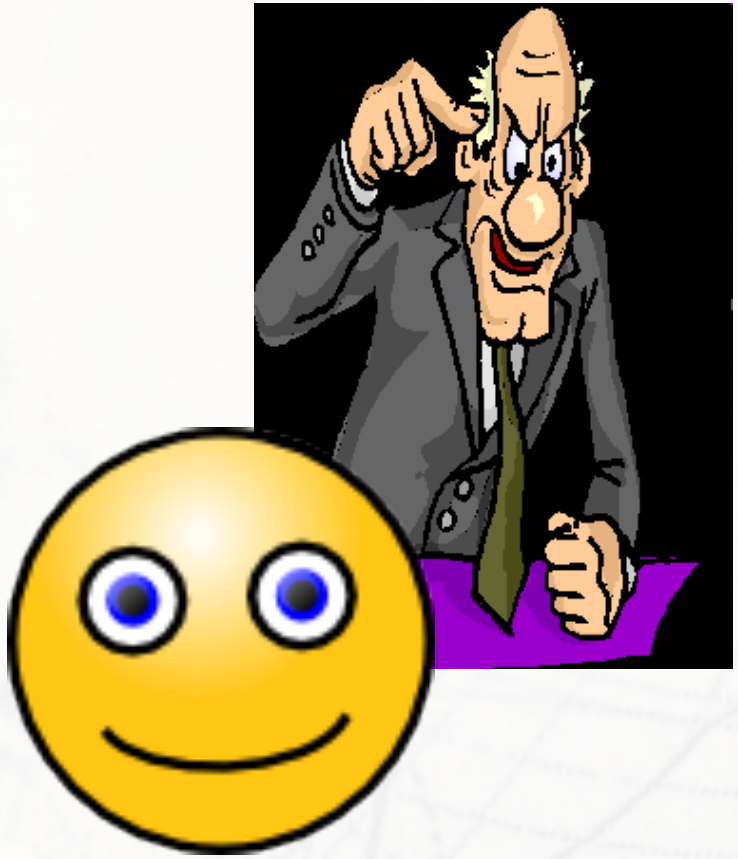
Developing a Positive, Error Proof Culture



- What rules are key for creating an error proof culture?
- What are the key reasons people use to break the rules?
- How do we positively enforce the right things daily?

"The prevailing system of management has destroyed our people." – W. Edwards Deming

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What is Really Being Reinforced?

- **Audits**
- **Formal recognition**
- **Informal recognition**
- **Pre-job briefs**
- **Training**
- **Letters and e-mails**
- **One-on-one coaching**
- **Work package contents**
- **Signs, labels, and alarms**
- **Discipline**

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The Enforcement Matrix

	INFORMAL	FORMAL
POSITIVE	**Daily, consistent, positive, and meaningful thank you / feedback**	**Monthly Give Aways, 100 Point Clubs, Profit Sharing**
NEGATIVE	**Beratement, no positive feedback, limited communication**	**Discipline for errors, poor job assignments, pay cuts / layoffs**

- What % of your enforcement actions fall into each square?
- Which square contains the most effective enforcement strategies?
- How was your current enforcement culture shaped over time?
- How can leaders learn to enforce rules differently?

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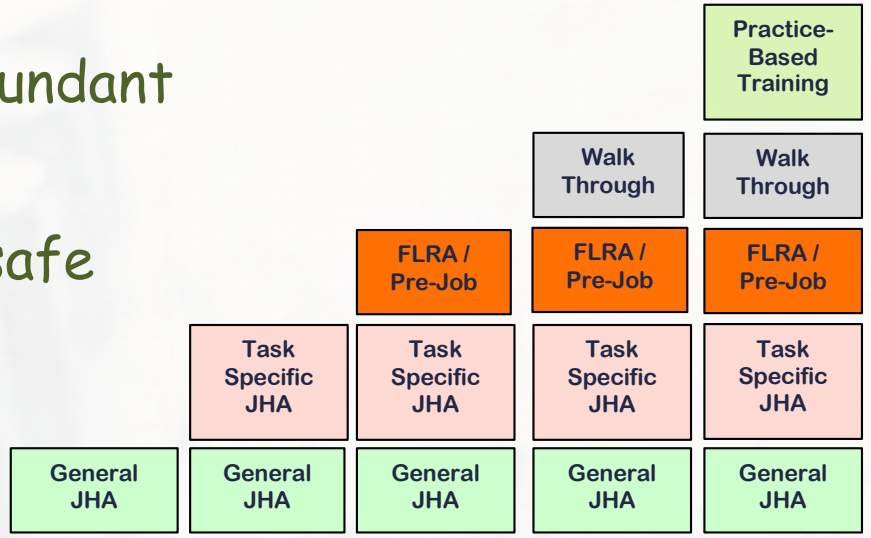
Layers of Enforcement Example

PROBLEM: A job site was having an abundant number of near misses on stairways

ROOT CAUSE: Plant policy regarding safe use of stairways was not being consistently enforced



Actions Taken TO IMPROVE:

- Managers given 'Safe Climber' cards to randomly give out ($1 value)
- Stairway use JHA written and posted at top and bottom of stairwells
- All employees urged to give immediate feedback to violators and report
- Hand sanitizers installed at the top and bottom of each stairwell
- Annual hazard training modified to include 5 minutes of safe stairway practice

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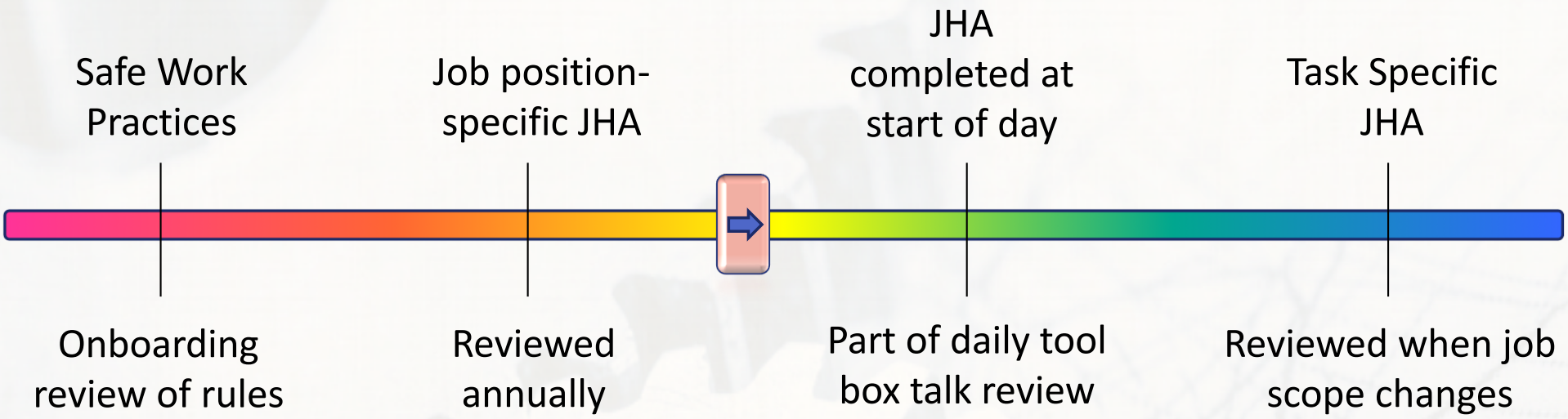
Reinforcing Safe Work Behaviors

Towards Better Work Systems



Effective JHA Building Codes

- Create task specific JHAs before work
- Teach ‘effective JHA design’ skills
- Review and update JHAs annually
- Engage users during tool design and review

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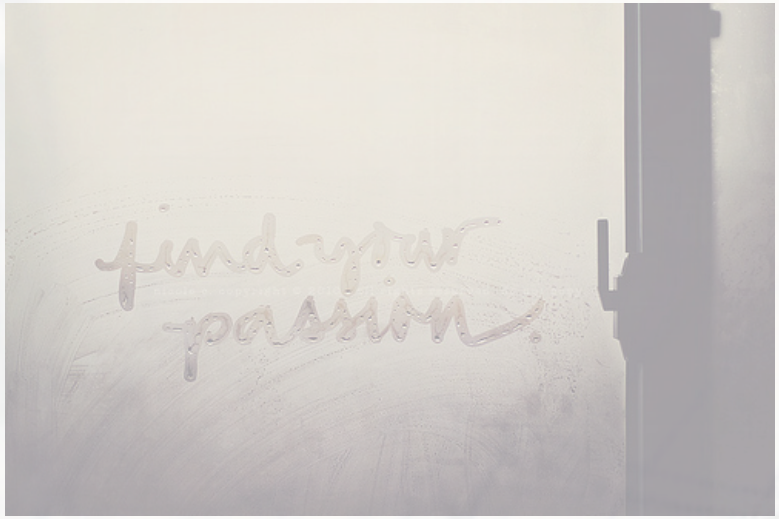
Enforcing Through Relationships

95% or more of effective positive enforcement is INFORMAL



Enforcement Through Stronger Relationships

- Do you know what types of work your people do each day?
- Do you know their preferred communication styles?
- Do you know what their daily work 'headaches' are?
- Do you know what their personal development needs are?
- Do you have action plans for addressing their key needs?

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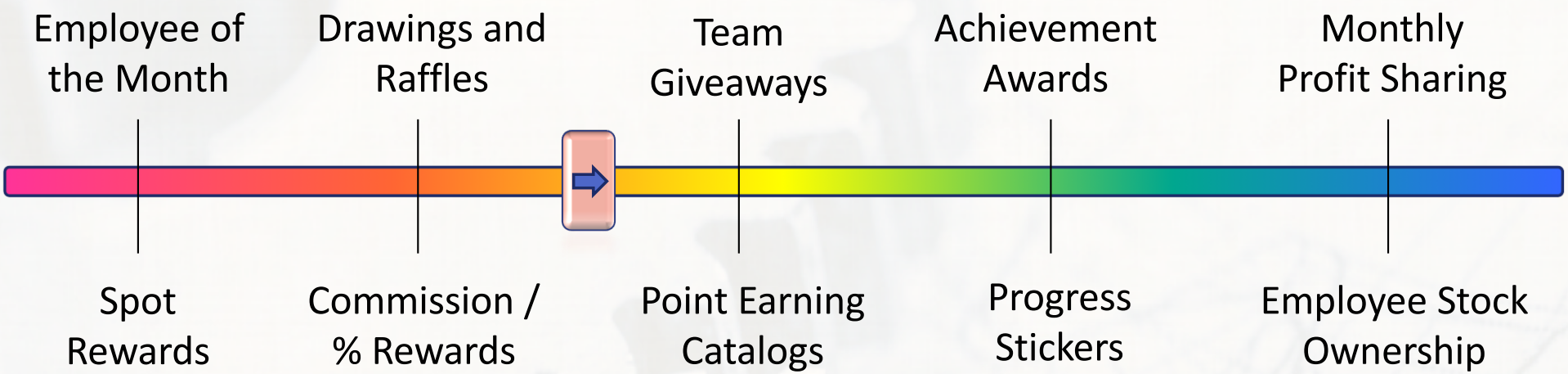
The Formal Recognition Spectrum



Recognition System Building Codes

- **Recognize the right people**
- **Reward the right tasks and behaviors**
- **Refresh the process annually**
- **No 'one winner' systems**

Designing Better Work Systems

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Rule Enforcement Best Practices

Multiple approaches to rule enforcement are needed to send a clear, consistent message

- Each rule needs to be clearly defined – expectations and consequences
- Rules must be clearly, consistently, and regularly communicated
- Audits, training, and job prep are also used to reinforce rules
- Positive reinforcement works better than negative reinforcement
- All leaders must use a consistent approach to rule enforcement
- Discipline should only be used for ‘one off’ situations

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Be Prepared

- What is the purpose of formal job preparation?
- What activities are part of effective job preparation?
- How do our job preparation activities help minimize errors and risk?

"An ounce of prevention is worth a pound of cure." – Benjamin Franklin

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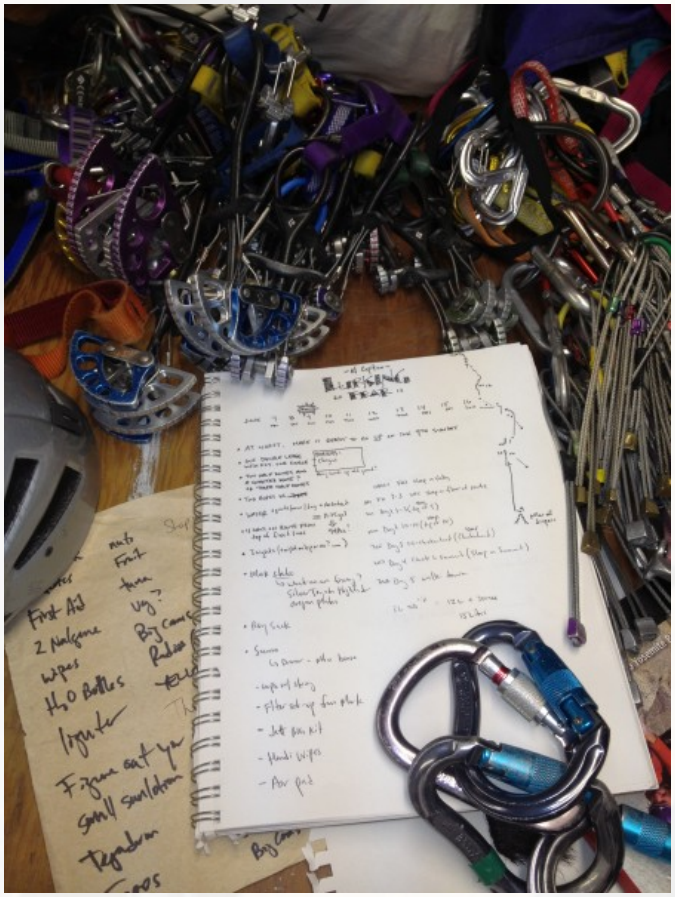
Fail to Plan, Plan to Fail



Where do you require checklist use to help guide your job planning efforts?

Basic Date 9/15/70 Changed _____

1-11

62:19

HOUSEKEEPING

1 Unsnap LMP's HSB And Stow Next To CDR's HSB On Floor Velcro. Unsnap CDR's HSB

2 Unstow 70mm Film Bag - RHSSC

3 Install 16mm Camr Wedge - ISA

4 Remove Stowage Bags From Drink Bags - ISA Back Pocket

5 Position 2 Interim Stowage Straps (RHSSC) On Horizontal Handhold, 02 Module

6 Tape Broomclip On AOT

7 Tape Crash Bar

8 Remove Pages 1-19 and 1-21 from LUNAR SURFACE CHECKLIST, Tape Above CB Panels

9 Position UTILITY LIGHTS On Back AOT Guard

10 Transfer EMU Maintenance Kit From CDR Helmet Bag To ISA Back Pocket.

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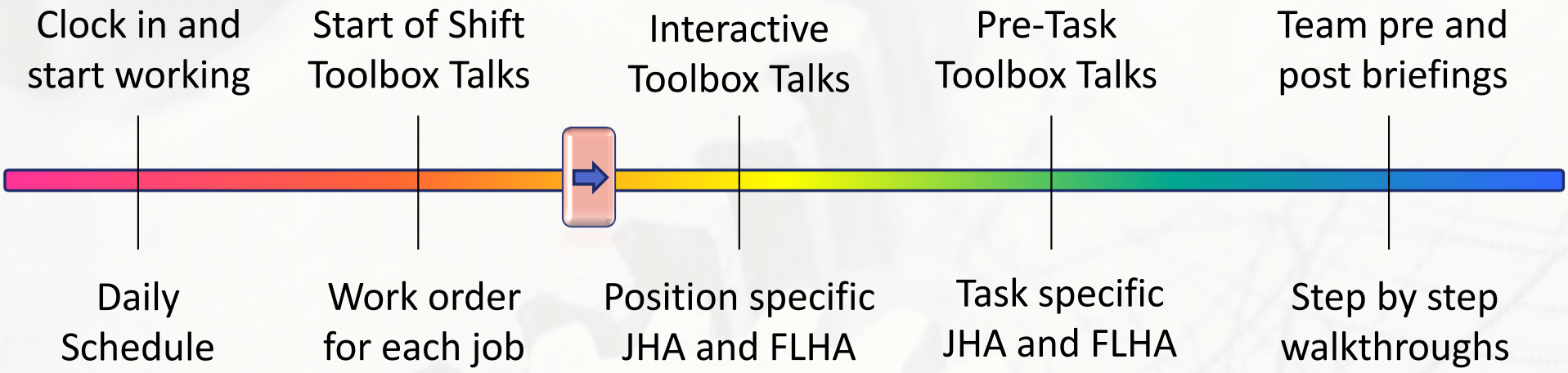
Daily Job Preparation Spectrum

Towards Better Work Systems



Daily Preparation Building Codes

- Match prep style to team skill mix
- Team lead keeps the big picture in mind
- Add prep detail and layers as risk increases
- Engage the entire team in planning

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Conducting Effective Pre-Task Reviews

- Have a plan – use some form of agenda to guide the meeting
- Provide everyone with a visual agenda
- Involve everyone – assign an agenda item to each participant
- Use emotion and humor appropriately to provide emphasis
- Use questions and repeat back to help ensure the message is understood
- If jobs change scope, take time to hold a new briefing

Job preparation approaches help reduce memory reliance and increase rule enforcement

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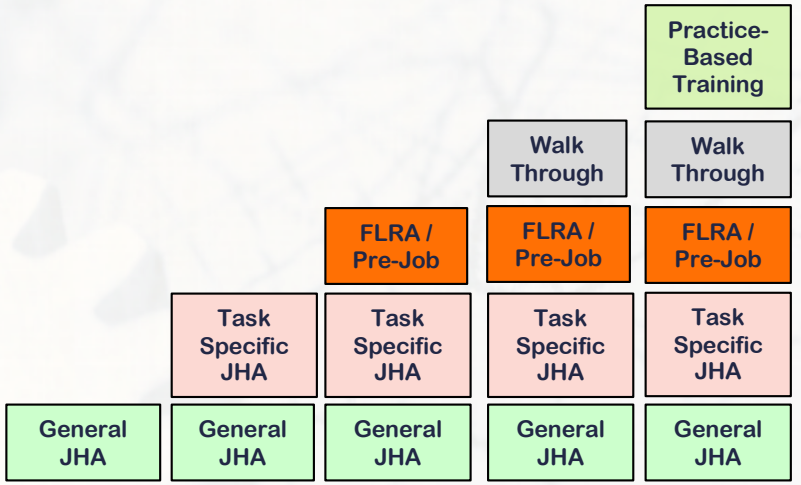
Elements of Effective Job Preparation

Job preparation approaches should be designed to match the expected task risk level

- Pre- and post-job meetings
- Checklist and cue card use
- Simulations
- Team facilitation training (leaders) and group dynamics training (all)



What is the likelihood of human error?

What is the potential impact of human error?

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Work Group Meeting Survey Example

Meeting Content

To what extent do your work group meetings …

Circle the appropriate #

LOW ---------- HIGH

Include a review of performance against key measures	1	2	3	4	5
Use graphs to make trends more visible	1	2	3	4	5
Include a variety of agenda topics	1	2	3	4	5
Include a review of the key project list and a project status update	1	2	3	4	5
Provide you with a chance to add new projects to the list	1	2	3	4	5
Include a review of things that have happened elsewhere in the company	1	2	3	4	5
Make a good use of the time that is invested to hold the meeting	1	2	3	4	5
Include brief training sessions on job skills or procedures	1	2	3	4	5
Include some fun exercises at time to help build teamwork	1	2	3	4	5

Content Delivery

To what extent do your work group meetings …

Circle the appropriate #

LOW ---------- HIGH

Allow for plenty of two way communication	1	2	3	4	5
Involve more than one person as a presenter or trainer	1	2	3	4	5
Use visual aids to help illustrate key points and trends	1	2	3	4	5
Avoid simply reading information - focus is on discussion instead	1	2	3	4	5
Avoid arguments and complaining - focus is on improvement	1	2	3	4	5

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Using Processes to Guide People

- How do our process designs and work environment affect the potential for human error?
- How can we redesign the work to minimize or eliminate these errors?
- What are some key techniques for designing error free workplaces?

What are the common daily human errors we see?

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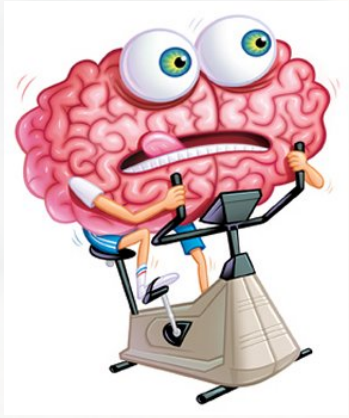
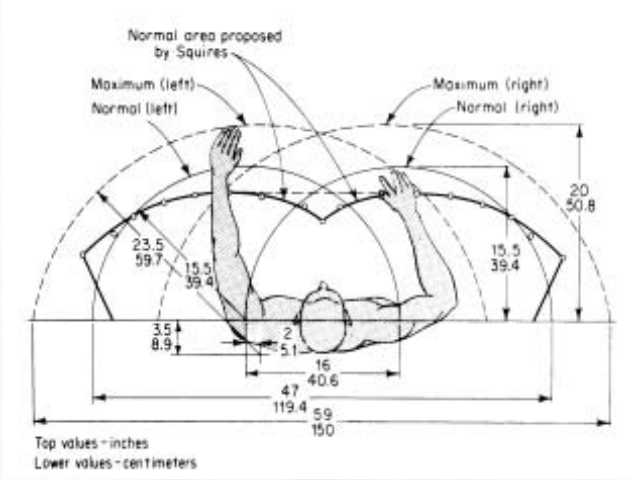
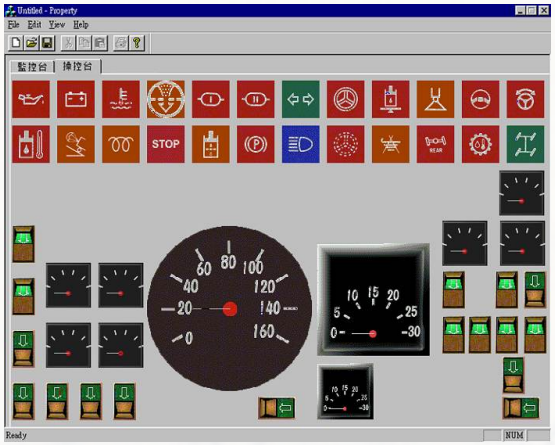
Key Human Engineering Factors



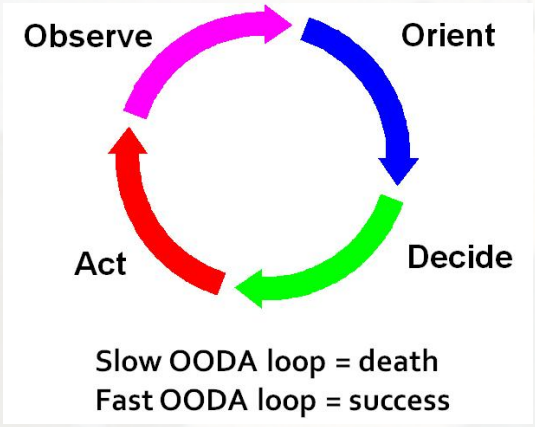
Cognition– How the brain works



Conditions –Work environment matters!



Controls – Look, feel, location



Slow OODA loop = death
Fast OODA loop = success

JOB SITE	FOOT-CANDLES
Haul Roads and Industrial Highways	0.5-1
Airports	0.5-2
Parking Areas	1-5
Excavation	2
Railroad Yards, Switching	2
Industrial Yards/Material Handling	5
Quarries and Open-Pit Mining	5
General Construction	10
Sports Fields/Recreation Areas	10-50
Loading and Unloading	20
Piers	20
Explosives Handling	30

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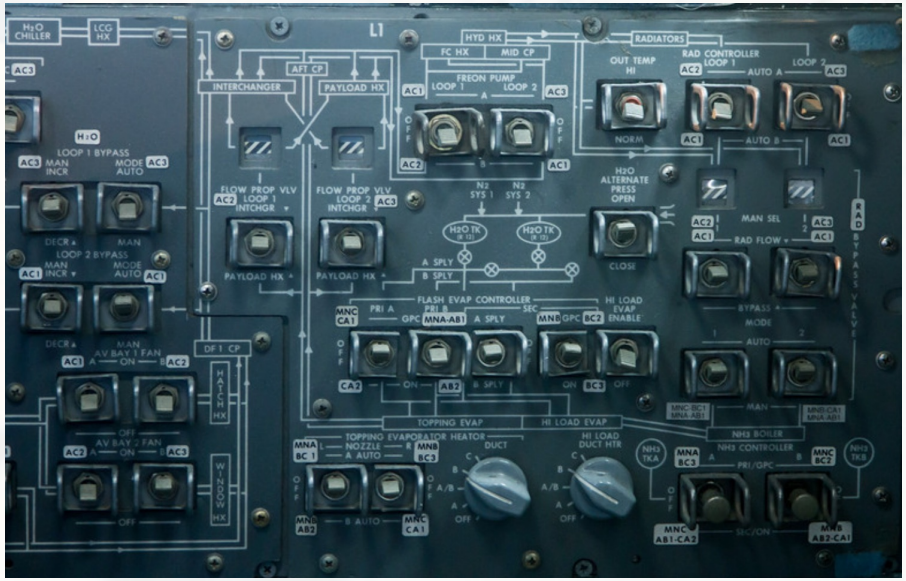
Examples of HMI 'High Error' Systems

Heavy lift crane controls

Tank farm hose connections



CLAP Triangle example

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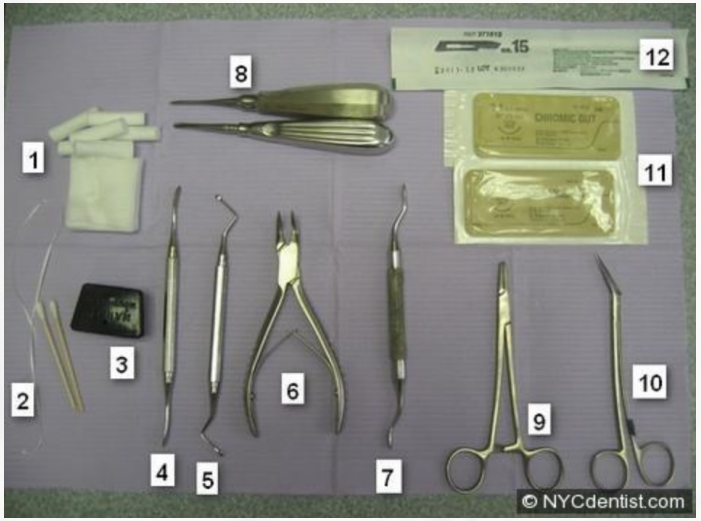
Where Proprioception Really Matters

Speed Well in Bar



Dental surgical tray

Overhead bridge crane controls

Courtroom stenographer

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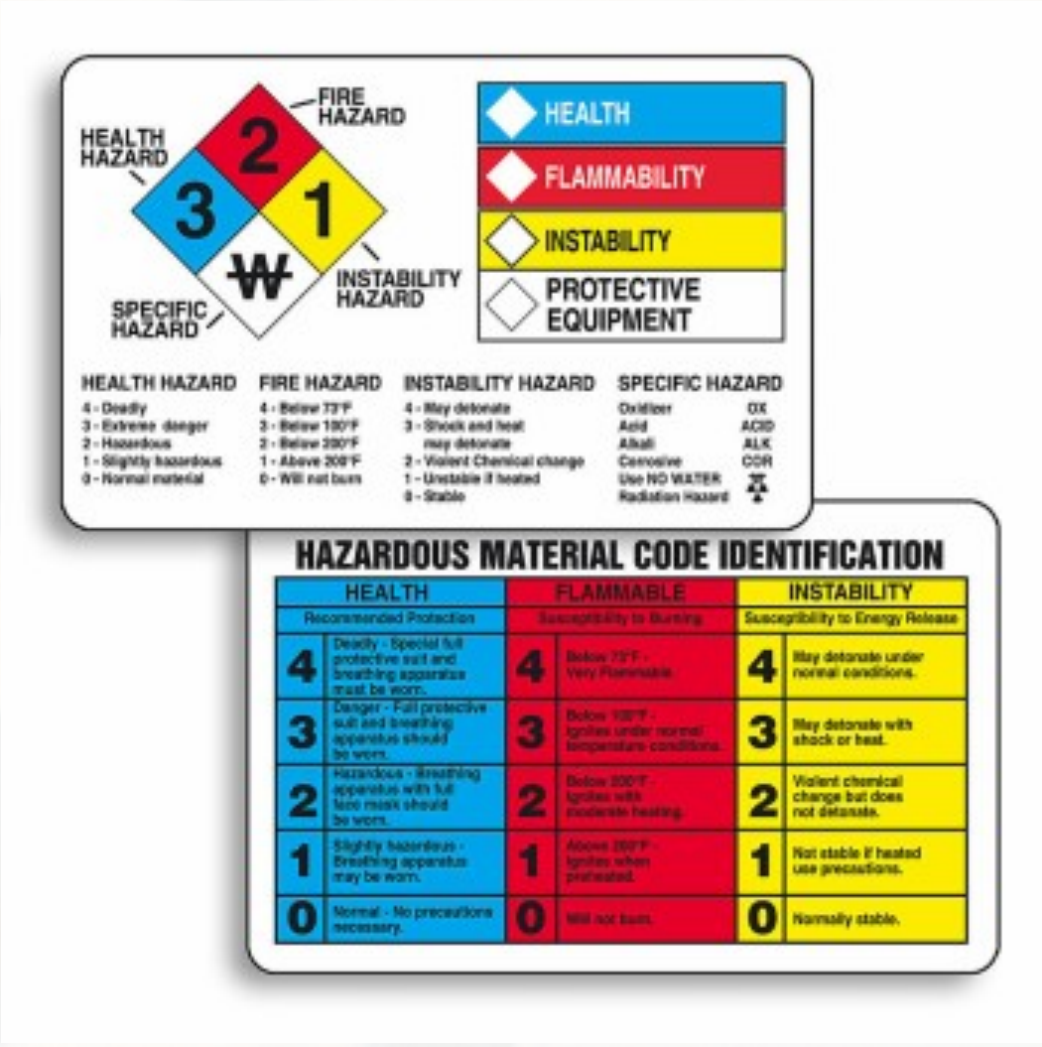
Job Aids Help Reduce Human Error

- Job aids should be easy to access
- Job aids must be well designed
- Use of job aids must be well enforced
- Job aid use must be required by policy
- Begin by using job aids on high risk work



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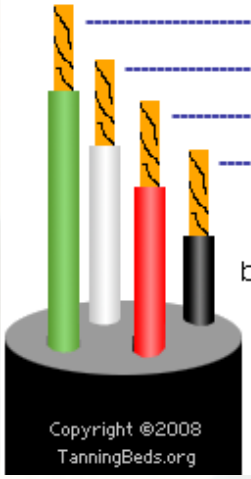
Color Coding to Reduce Human Errors

Red	ELECTRIC
Yellow	GAS-OIL-STEAM
Orange	COMMUNICATION-CATV
Blue	WATER
Green	SEWER
Fluorescent Pink –	TEMPORARY SURVEY MARKINGS
White	PROPOSED EXCAVATION
Purple	RECLAIMED WATER

Color Codes For 4 Wire Tanning Beds

Main power cord coming from tanning bed



These are 240V, and often 30A, needing #10 wire. The beds electronics are actually 120V. This is why you need the neutral wire, and it must be #10, to carry the load for both HOT wires. This is also why you can NOT combine the ground and neutral wires or risk a fire!

Your bed may be different, this is for reference only.

How have you seen color coding used to prevent human error?

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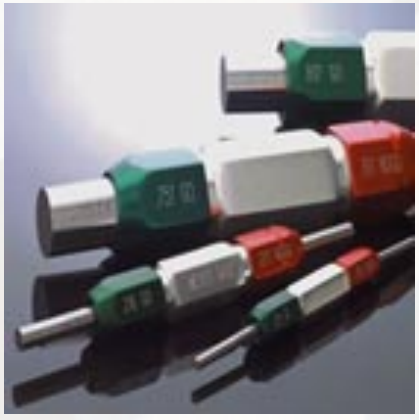
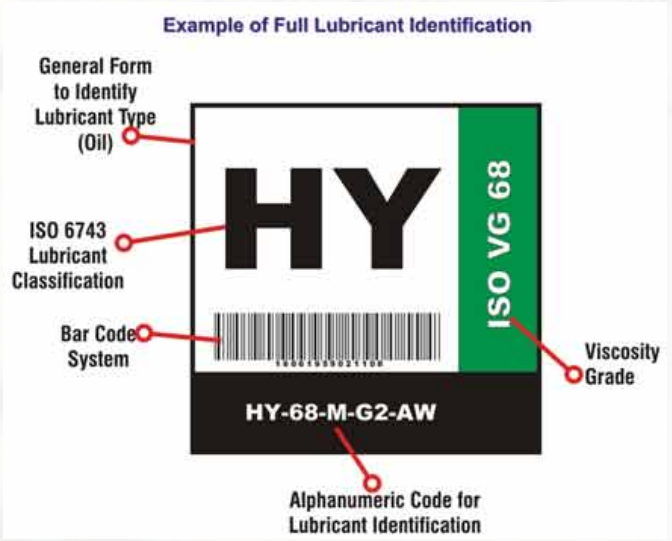
Engineering Out the Potential for Error





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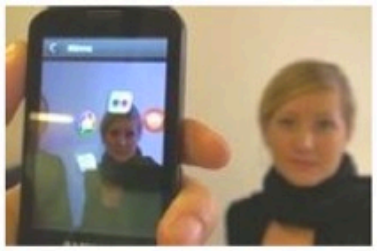
The New Human Machine Interface

Next Generation HMI is the Future of Electronics



Voice, Gesture and Facial Recognition

- Voice control of home systems
- Gestures to change TV stations
- Facial security to unlock electronics

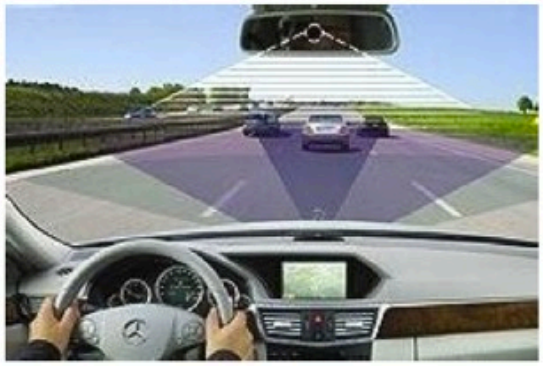


Image Recognition

- Advanced Driver Assistance Systems **(ADAS)** used to detect pedestrians, vehicles, traffic signs

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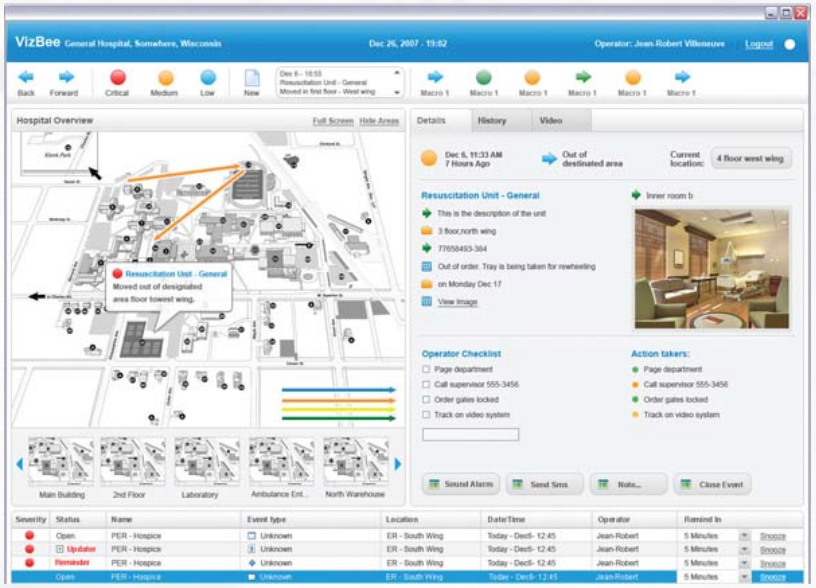
Possible RFID Applications

- Tracking physical asset location and movement
- Real-time PPE use compliance checking
- Tracking human asset location and movement
- Setting and controlling security perimeters and safe work zones
- Capturing time-based data for use in optimizing asset utilization



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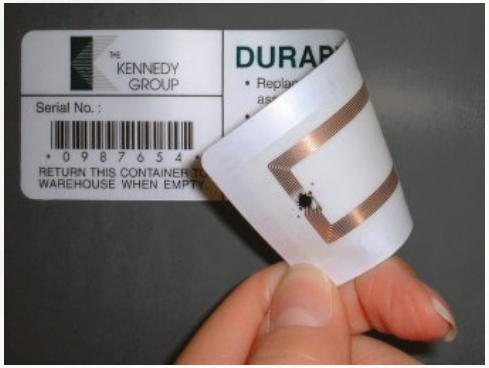
Active versus Passive RFID Applications



Passive RFID: $.05 to $5 / tag

Active RFID: $15 to $100 / tag

	Active RFID	Passive RFID
Tag Power Source	Internal to tag	Energy transferred from the reader via RF
Tag Battery	Yes	No
Availability of Tag Power	Continuous	Only within field of reader
Required Signal Strength from Reader to Tag	Very Low	Very High (must power the tag)
Available Signal Strength from Tag to Reader	High	Very Low

	Active RFID	Passive RFID
Communication Range	Long range (100m or more)	Short or very short range (3m or less)
Sensor Capability	Ability to continuously monitor and record sensor input; data/time stamp for sensor events	Ability to read and transfer sensor values only when tag is powered by reader; no date/time stamp
Data Storage	Large read/write data storage (128KB) with sophisticated data search and access capabilities available	Small read/write data storage (e.g. 128 bytes)

190588

Source: www.cisco.com

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Managing Assets with Lean Data Capture

Bar Coding

Quick Response Codes

RFID Bands

Easy to use app interfaces

Implants

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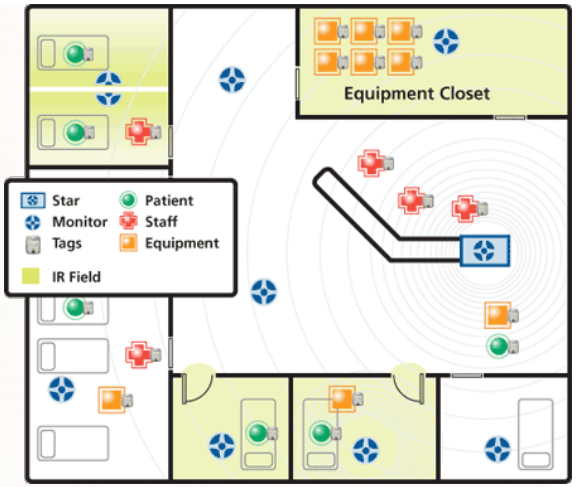
Tag You're It! At Celebration Health



- Operating room staff at Celebration Health Hospital in Orlando, FL wear RFID tags to track their movements and time management.
- "There was nervousness at first about being tracked," says Ashley Simmons, performance manager at the hospital. "But over time as we showed it was not being used punitively, they adapted very quickly and got into their normal routines."
- Based on the feedback received, Simmons says that staff have been located too far from each other and patients, and that the workplace environment is to be modified to improve communication.
- Staff are given access to their performance data and provide input on what their ideal routine would be in the support of shift redesign
- The most advanced wearable trackers include sensors for motion, sound, and infra-red to support patient safety, security, and behavior pattern analysis.

Source: "Happier, more productive … would tagging help your business?"
Kieron Monks, CNN, December 3, 2014

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Organizational Ergonomics Best Practices

The best approach for minimizing human error is to engineer out the risk

- Standardize control layouts and shape coding
- Remove the impact of work environment factors – lighting, temperature, noise
- Improve error detection approaches
- Reduce task complexity to skill level if possible
- Match screen displays to the process / form being transacted
- Use color coding, icons, and creativity to engineer out risk

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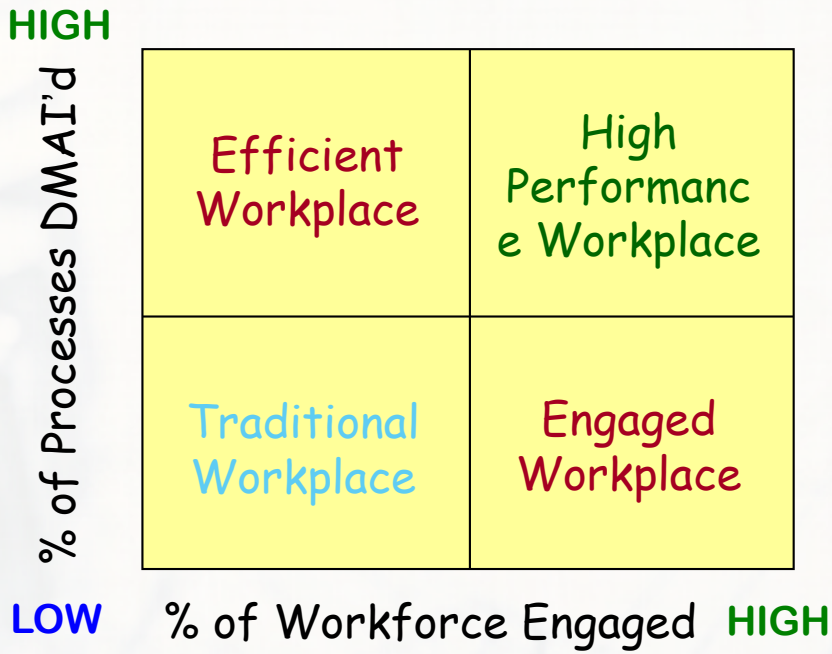
The Daily Process of Error Proofing



- Who are we going to engage in our error proofing efforts?
- Which processes are we going to focus our error proofing efforts on?

"If you get to the point where you think you know it all, you're going to stop learning." - John Wooden

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Three Approaches to Improvement

Reactive Problem Solving

- Select the problem to be solved
- Find the root causes of the problem
- Find and test fixes to eliminate the root cause
- Implement corrective actions

Process Improvement

- Select the process to be improved
- Map the 'as is' process and find NVA activities
- Create the new process design
- Standardize the new process

Problem Prevention

- Measure to understand the system
- Track key daily errors and process counts
- Find root causes of high frequency errors
- Change the system to eliminate root causes

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The Key to Error Prevention

Every process owner should be responsible for tracking and trending process performance and process waste on a regular basis, and for using that information to improve those processes.

Use the TapRooT® root cause analysis process daily to analyze your highest risk human errors

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Operator Checksheets | **Database records** | **Transaction records** | **Timekeeping records**

Daily Syrup Production Summary — 021

				Volume:				Productivity $/case	Productivity $/bottle	Productivity Hrs/Th
Date:	21-Jan-04	Prod:	750 P	7,252	bottles	959.8	cases	0.51	0.068	36.7
Shift	Days		750 G	38,068	bottles	3,299.8	cases	0.50	0.043	36.3
Supervisor	Kevin		50 ml	2,000	bottles	16.7	cases	43.28	0.361	2418.0
			.5 G Sauce	5,400	jugs	900.0	cases	0.57	0.095	42.4
			Rework	2,160	bottles	180.0	cases	1.15	0.096	81.1

966 Borders / WM Six Packs

1 int'l batch - GER (1)

Lost Time: Case Coder -- 5 min used to adjust case coder print quality -- 021404
Changeover -- 46 min used to change from 750 P to 750 G
Batching -- 24 min lost due to high brix batch / no test before transfer

Other Costs: $118 - Make Borders six packs

Quality: Hold -- One batch of 750 GER Vanilla for high brix -- 021435
Hold -- 367 cases of 750 SF Vanilla for suspect pH -- 021407-9
Rework -- Inspected 180 cases of SBX 750 product
120 cases of rework to be processed

Safety: No injuries
0 on light duty
0 out on injury

People: 0 tardy
0 absent
70% perm. Hours
8.8 hours of setup time

Daily Performance Dashboard

January 2006 Performance Summary for Injection Molding Department

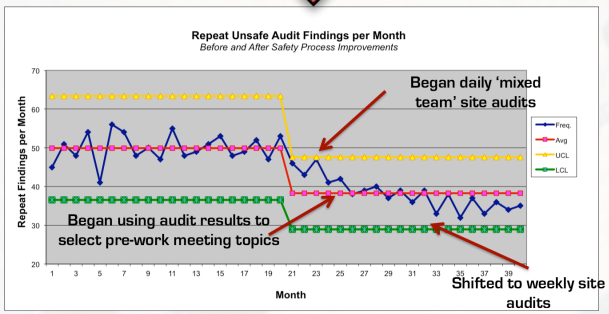
Avg. Labor Cost per Hour = $12.50 | Avg. Production per Day = 441 | Std. Pounds per Hr. = 450 | Mat'l $ / # = $0.140

	BASE DATA						PERFORMANCE RATIOS and LEVELS								
Date	Total Man-Hrs	Total Pounds	Total Scrap #	Total Rework #	Downtime Minutes	Labor Cost	OSHA Accidents	% Output Gain	Labor $ per M #	Mat'l $ Spent	Downtime %	Total $ per Pound	Dept. Effy. %	Scrap %	Rework %
4-Jan	65	28,600	50	1,500	5	$813	0	-0.2%	$28.41	$4,221	1.0%	$0.176	98%	0.17%	5.0%
5-Jan	71	31,000	150	3,000	10	888	0	-1.0%	28.63	4,781	2.1%	0.183	97%	0.44%	8.8%
6-Jan	58	25,140	200	4,500	15	725	0	-1.7%	28.84	4,178	3.1%	0.195	96%	0.67%	15.1%
7-Jan	62	27,500	50	500	0	775	1	0.6%	28.18	3,927	0.0%	0.171	99%	0.18%	1.8%
8-Jan	63	27,200	250	750	10	788	0	-2.1%	28.95	3,948	2.1%	0.174	96%	0.89%	2.7%
11-Jan	71	31,240	125	2,700	20	888	0	-0.2%	28.41	4,769	4.2%	0.181	98%	0.37%	7.9%
12-Jan	59	25,960	175	1,400	10	738	0	-0.2%	28.41	3,855	2.1%	0.177	98%	0.64%	5.1%
13-Jan	60	25,400	300	7,500	25	750	0	-4.0%	29.53	4,648	5.2%	0.213	94%	0.90%	22.6%
14-Jan	66	29,510	75	600	5	825	1	1.4%	27.96	4,226	1.0%	0.171	99%	0.25%	2.0%
15-Jan	65	28,420	225	1,400	15	813	0	-0.9%	28.59	4,206	3.1%	0.177	97%	0.75%	4.7%
18-Jan	63	27,600	300	1,000	15	788	0	-0.7%	28.53	4,046	3.1%	0.175	97%	1.04%	3.5%
19-Jan	70	30,950	175	5,600	20	875	0	0.3%	28.27	5,142	4.2%	0.194	98%	0.48%	15.2%
20-Jan	59	24,800	450	8,500	35	738	0	-4.7%	29.74	4,725	7.3%	0.220	93%	1.33%	25.2%
21-Jan	62	26,830	250	4,300	5	775	2	-1.9%	28.89	4,393	1.0%	0.193	96%	0.80%	13.7%
22-Jan	63	27,460	100	6,500	0	788	0	-1.2%	28.68	4,768	0.0%	0.202	97%	0.29%	19.1%
25-Jan	67	29,700	25	1,250	0	838	0	0.5%	28.20	4,337	0.0%	0.174	99%	0.08%	4.0%
26-Jan	61	26,750	325	2,400	20	763	0	-0.6%	28.50	4,127	4.2%	0.183	97%	1.10%	8.1%
27-Jan	60	26,250	300	5,300	5	750	0	-0.8%	28.57	4,459	1.0%	0.198	97%	0.94%	16.6%
28-Jan	68	30,100	110	3,200	15	850	0	0.4%	28.24	4,677	3.1%	0.184	98%	0.33%	9.6%
29-Jan	70	31,500	25	500	0	875	0	2.0%	27.78	4,484	0.0%	0.170	100%	0.08%	1.6%
Totals	1,283	561,910	3,660	62,400	230	$16,038	4	-0.7%	$28.54	$87,916	2.4%	$0.185	97%	0.58%	9.9%
Avg.	64	28,096	183	3,120	12	813									
05 Avg.	65.5	27,904	193	3,200	13.5	825									
Jan '05	66.3	25,867	201	3,343	15.1	847	5	-11.5%	32.74	4,118	3.1%	0.192	87%	0.68%	11.4%

Performance Summary Spreadsheet

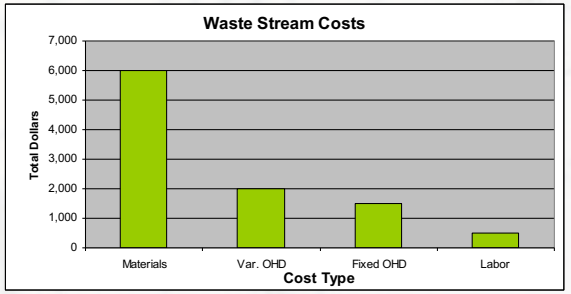
Date	Duration	Location	Error, Defect, or Failure	Action Taken	Product
1-Oct	12	Filler	Filler overflowed	Adjust probes / clean up	750 G
1-Oct	14	Bottle Coder	Coder not printing consistently	Adjust coder setup	750 G
2-Oct	8	Filler	Filler overflowed	Adjust probes / clean up	750 G
2-Oct	5	Bottle Coder	Coder not printing consistently	Adjust coder setup	750 G
3-Oct	9	Filler	Filler overflowed	Adjust probes / clean up	750 G
3-Oct	8	Capper	Cap grippers need to be changed	Change gripper	750 G
3-Oct	7	Line	Broken bottle on accumulator	Clean up mess	750 G
4-Oct	17	Naturals	Wait time between naturals	Wait	750 G
4-Oct	19	Naturals	Wait time between naturals	Wait	750 G
4-Oct	28	Naturals	Wait time between naturals	Wait	750 G
4-Oct	40	Naturals	Low brix naturals batch	Recirculate / wait	750 G
4-Oct	11	Line	Broken bottle on accumulator	Clean up mess	750 G
8-Oct	15	Capper	Missing caps on bottles	Adjust capper - first two batches	750 G
8-Oct	15	Box Coder	Setup problems - int'l cases	Improve coder setup process	750 G
8-Oct	10	Box Coder	Resetup to run 20 more GDR cases	Resetup box coder	750 G
8-Oct	8	Line	Broken bottle on accumulator	Clean up mess	750 G
8-Oct	33	Labeler	XYZ back panel problems	Adjust 2nd labeler	750 G
9-Oct	10	Box coder	Setup problems - int'l cases	Improve coder setup process	750 G
9-Oct	10	Capper	Missing caps on bottles	Adjust capper #4	750 G
9-Oct	8	Capper	Missing caps on bottles	Adjust capper #6 - change gripper	750 G
9-Oct	14	Labeler	Flag problems w/ Alpha label	Adjust photoeye / label slower	750 G
10-Oct	16	Capper	Missing caps / bottle vibration	Adjust timing	187 G
10-Oct	28	Filler	Stuck limit switch	Fix limit switch	187 G
10-Oct	5	Filler	Bottle spills	Clean up line	187 G
11-Oct	20	Labeler	Wrinkles w/ Kava labels	Slow down line to correct	750 G
11-Oct	7	Box Coder	Switch from Kava to Taiwan	Improve coder setup process	750 G

Error Tracker Database



Trend Lines w/ Control Limits

Use TapRooT® to find and fix the root causes of high leverage errors



Error Breakdown Paretos

	Perf. Area	Compl. Quarter	Person Resp.	% Comp.	Status To-Date
Purchase / begin using outside flammables storage unit	Safety	3	Bob	75	Permits are being obtained / POs issued
Reduce decibel level in filling room and operations office	Safety	4	Bob	75	Capital request has been issued
Install barrier posts in front of transformer by Spec. Projects	Safety	2	Bob	100	Posts have been installed
Install / begin using bulk sugar dispensing system	Safety	1	Brian	100	System now in use
Provide monthly safety training	Safety	Ongoing	Kevin	50	Draft curriculum proposed to committee
Implement training certification process	People	1	Kevin	65	Drafts completed - prepare notebooks next
Create personal development plans	People	2	Kevin	35	Will follow annual reviews
Install formal performance recognition process	People	1	Kevin	60	Team formed to address company approach
Install finished goods bottle washer	Quality	1	Bob	95	Need depends on success with suction
Continue to improve Supplier Management Process	Quality	2	Collin	100	First phase complete - will reassess in Q4
Obtain HACCP certification for second syrup line	Quality	1	Victor	80	Pre-audit conducted - lots to do now
Make changes to improve inventory accuracy	Quality	2	Kevin	100	Committee has completed intial work
Make improvements to reduce back order frequency and cost	Quality	Ongoing	Kevin	O	Trends are reviewed weekly / causes being addressed
Define quick changeover procedures for product changes	Cost	2	Kevin	60	Changeovers now a team effort - not just mtc.
Install fourth packing station / additional conveyors and taper	Cost	2	Bob	H	Will be part of 2006 syrup line improvements
Improve functionality of accumulation table before capsulator	Cost	3	Jim	H	Will be part of 2006 syrup line improvements

Key Improvement Project List

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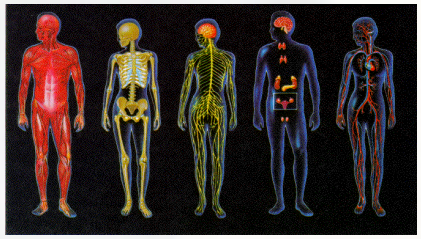
All Processes Have Vital Signs!



Human Body

Dental Office

Food Plant

- Heartbeats / minute
- Blood pressure
- Respirations / minute
- Body mass index
- Years of age

- Revenue / office hour
- Visits / office hour
- Complaints / M visits
- OOPs errors / M Visits
- Staff retention rate

- Pounds / minutes
- Cost / pound
- OSHA accident rate
- Non-conformance rate
- Retention rate

A process scorecard shows the vital signs for that process (1-2 ratios per KPA)

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Example Error Tracker Database

ICU Pharmacy Error Tracking Database - January 2015

Note: This database is used to track late deliveries (LD), order errors (OE), and NVA / lost work time (LT)

Date	Duration	Location	Error Type Captured	What went wrong?	Cause Code	Error Code
4-Jan	15	ICU Pharmacy	Tube system down / not working	Use alternative means to deliver	TD	LT
4-Jan	10	ICU 2	Late delivery of "list med type"	Tube did not send - hand deliver	TR	LD
4-Jan	22	ICU 6	Late delivery of "list med type"	Tube did not send - hand deliver	TR	LD
4-Jan	15	ICU 3	Late delivery of "list med type"	Tube did not send - hand deliver	TR	LD
4-Jan	35	ICU Pharmacy	Excess wait for order approval	Multiple pages to get approval	EW	LT
4-Jan	0	ICU Pharmacy	Order did not have two signatures	Pharmacy was short staffed	SS	OE
4-Jan	7	ICU6	Late delivery of "list med type"	Pharmacy was short staffed	SS	LD
4-Jan	17	ICU Pharmacy	Go out and collect tubes	Tubes were not returned to phamacy	NT	LT
5-Jan	19	NICU	Late delivery of "list med type"	Tube did not send - hand deliver	TR	LD
5-Jan	28	ICU 1	Late delivery of "list med type"	Tube did not send - hand deliver	TR	LD
5-Jan	19	ICU Pharmacy	Go out and collect tubes	Tubes were not returned to phamacy	NT	LT
5-Jan	21	ICU Pharmacy	Go out and collect tubes	Tubes were not returned to phamacy	NT	LT
6-Jan	23	ICU Pharmacy	Go out and collect tubes	Tubes were not returned to phamacy	NT	LT
6-Jan	30	ICU Pharmacy	Go out and collect tubes	Tubes were not returned to phamacy	NT	LT
6-Jan	31	ICU Pharmacy	Go get meds from Central Pharmacy	Meds not available in ICU Pharmacy	NM	LT
6-Jan	19	ICU Pharmacy	Go out and collect tubes	Tubes were not returned to phamacy	NT	LT
7-Jan	25	ICU Pharmacy	Tube system down / not working	Use alternative means to deliver	TD	LT
7-Jan	6	ICU 4	Late delivery of "list med type"	Tube did not send - hand deliver	TR	LD
7-Jan	11	ICU 7	Late delivery of "list med type"	Tube did not send - hand deliver	TR	LD
7-Jan	0	ICU Pharmacy	Wrong dosage of "med type"	Prescription was hard to read	UO	OE
7-Jan	0	ICU Pharmacy	Order did not have two signatures	Pharmacy was short staffed	SS	OE
7-Jan	16	ICU 5	Hand deliver to avoid late delivery	Tube did not send - hand deliver	TR	LT
7-Jan	28	NICU	Hand deliver to avoid late delivery	Tube did not send - hand deliver	TR	LT

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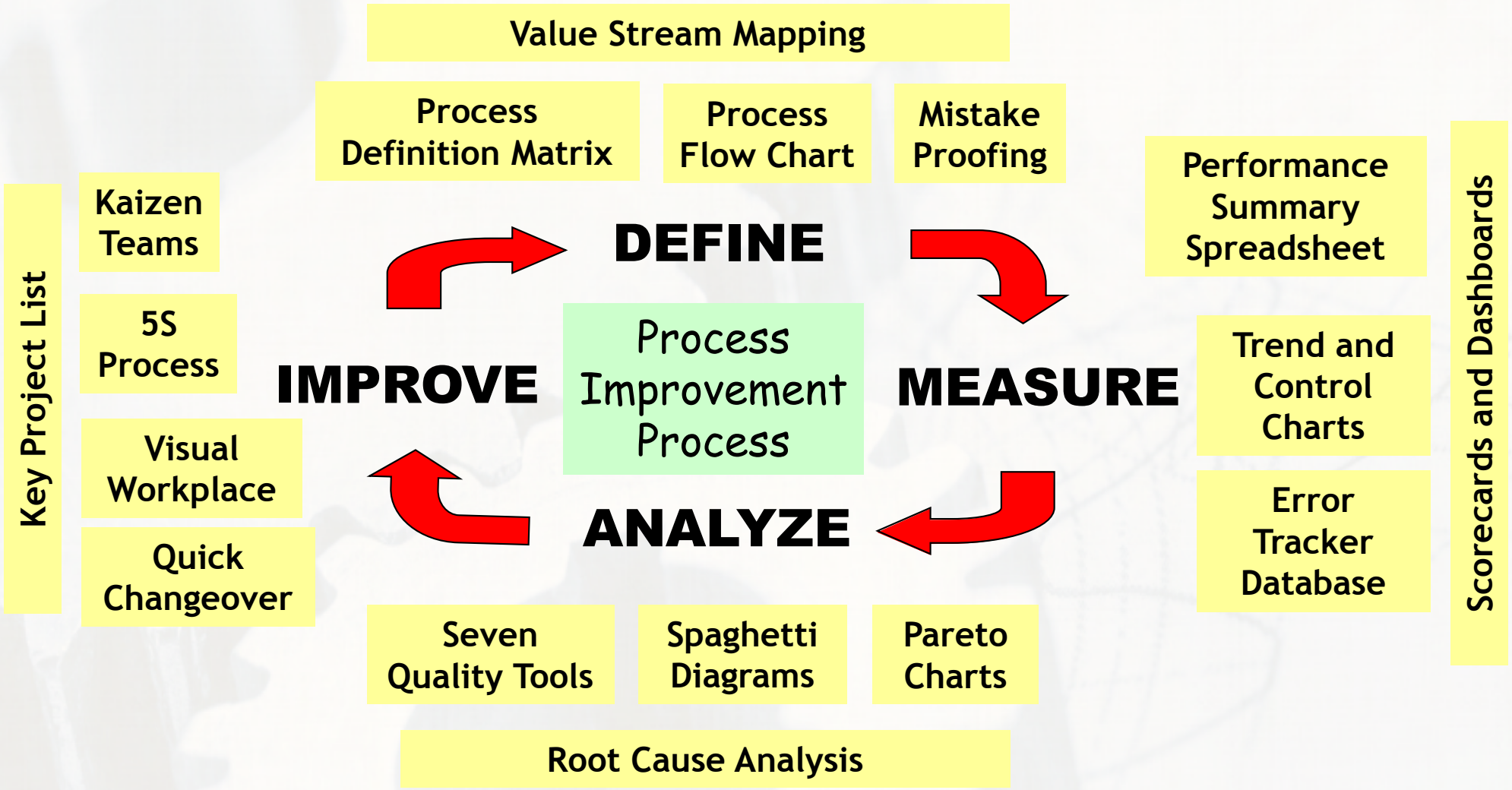
The Process Improvement Process



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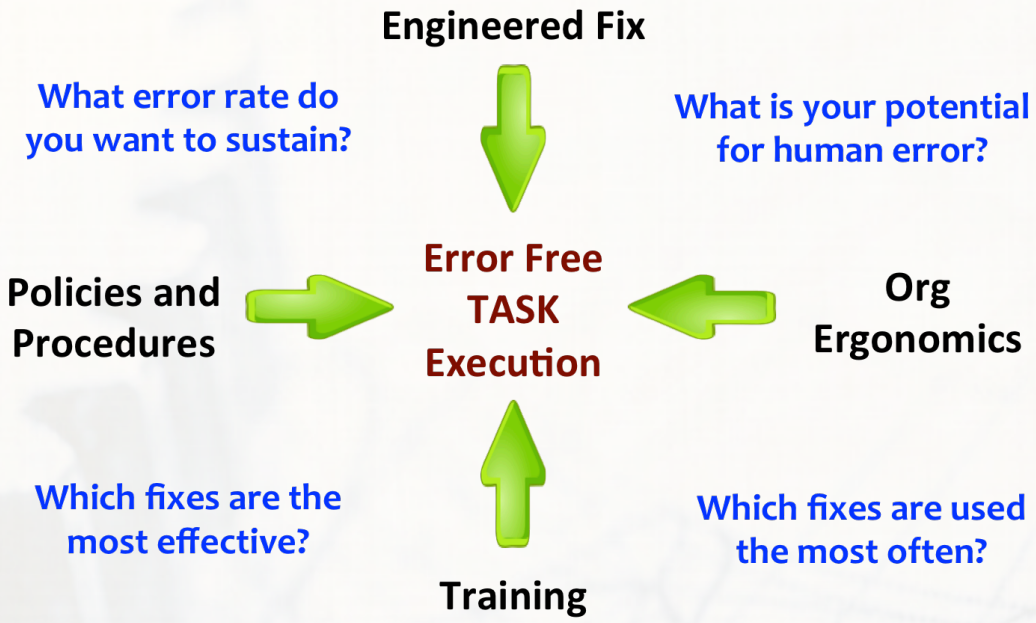
Planning to Become More Error Proof



- What are your favorite fixes?
- What factors cause most corrective actions to fail?
- How might we assess the potential impact of our fixes?

"If you always do what you've always done, you will always get what you've always got." - Henry Ford

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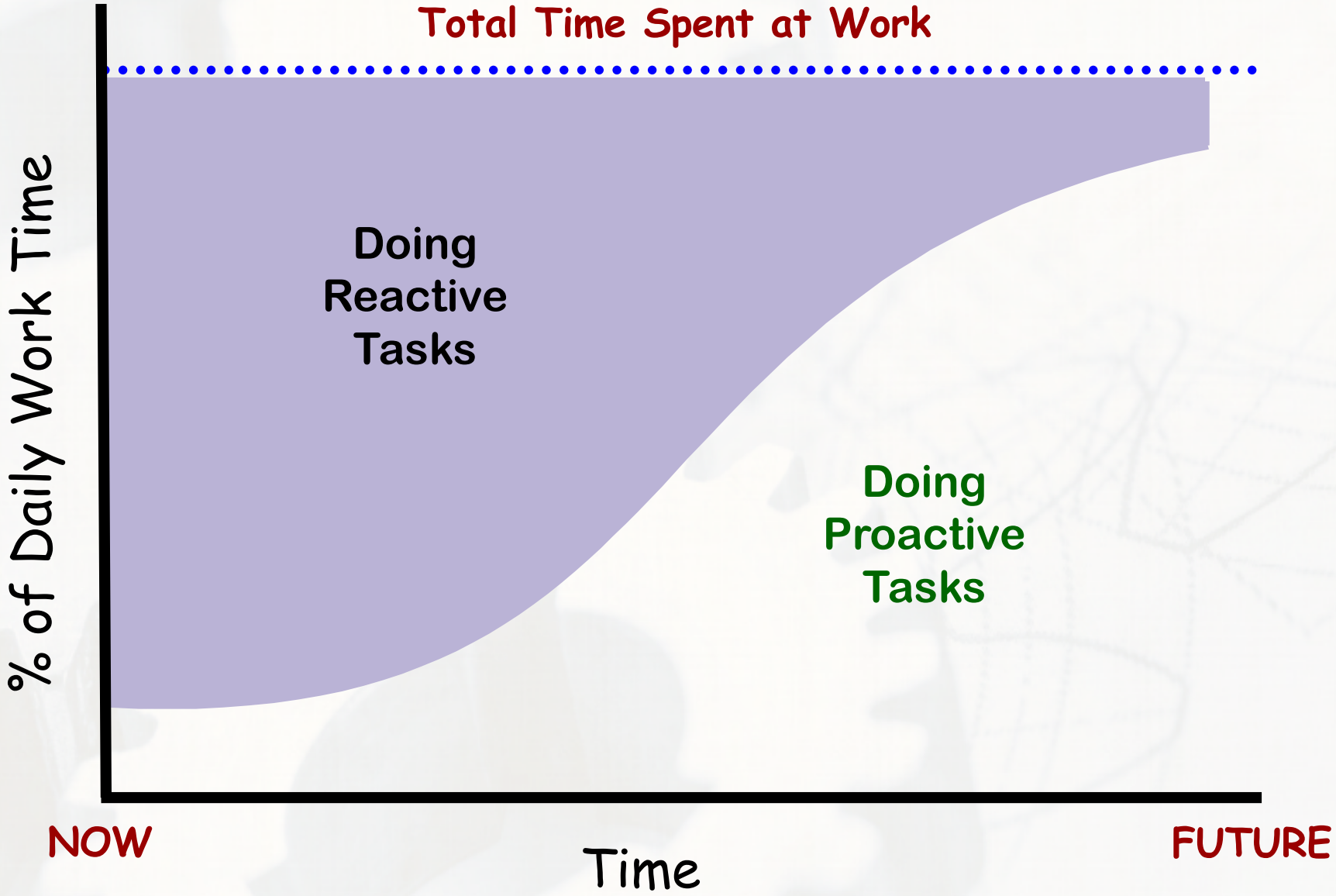
Shifting Mindsets



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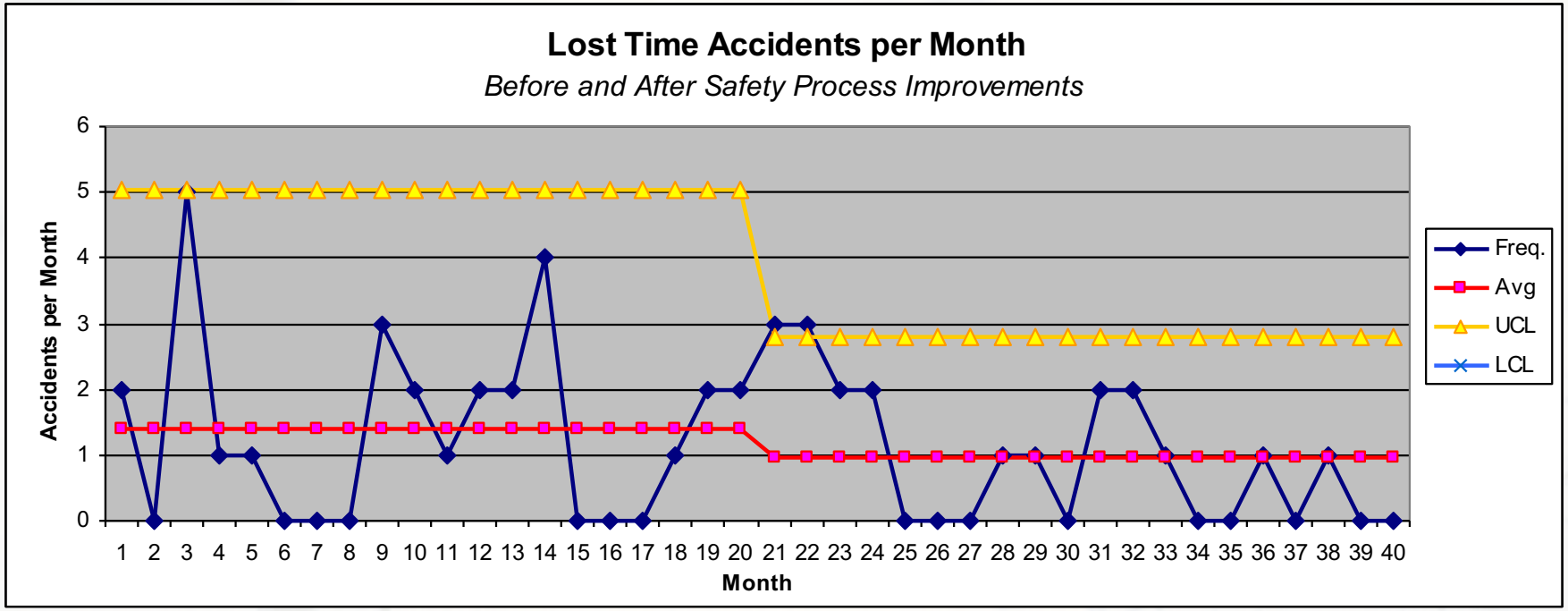
What Should Happen When You Improve?



System Changes

- Cross-functional Safety Committee formed / redesigned agenda
- Monthly safety audits began to be conducted
- Began using TapRooT® process on all reportable incidents
- Improved safety recognition process for all work teams
- Changed supervisor safety improvement responsibilities

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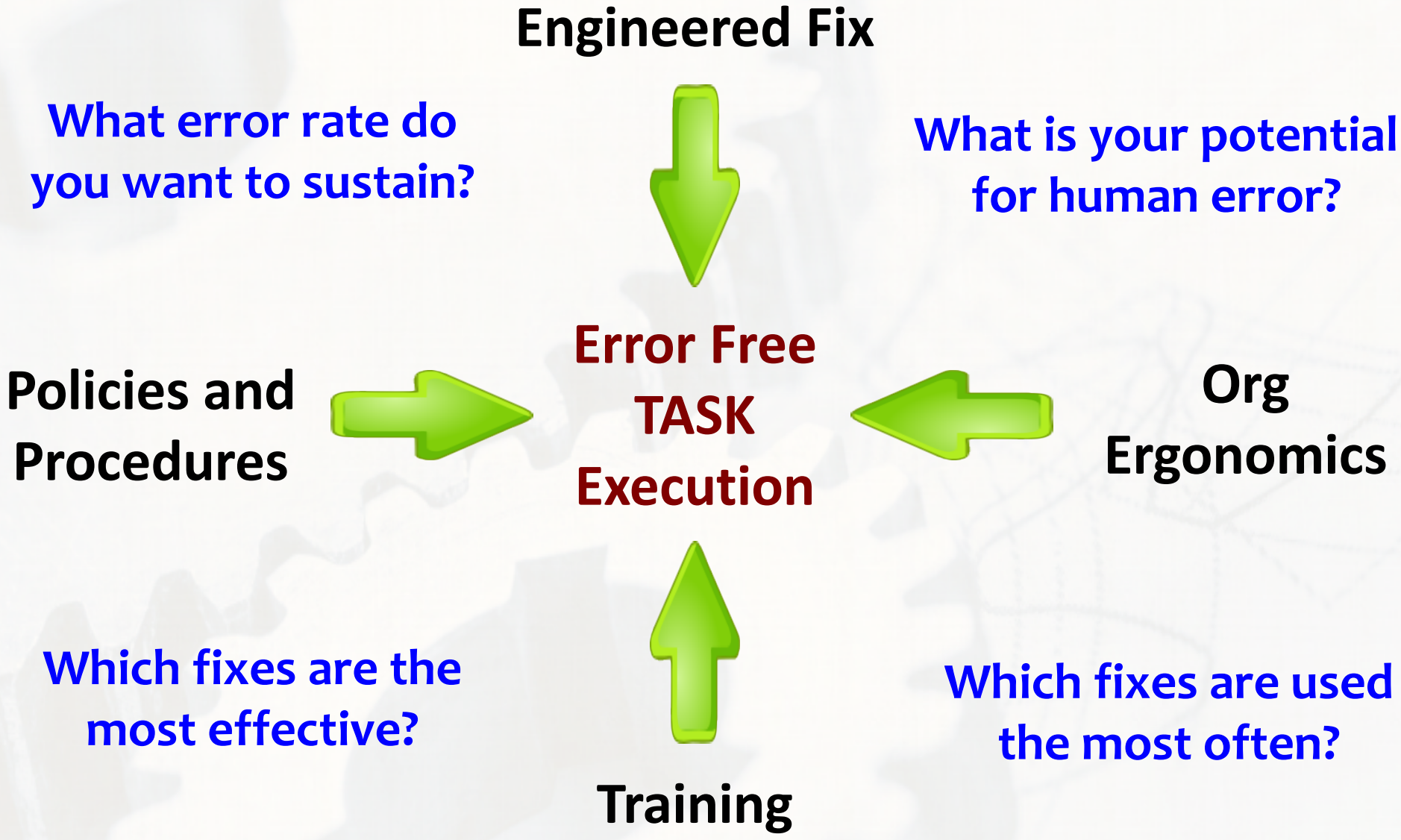
What Error Rate Do You Want to Sustain?



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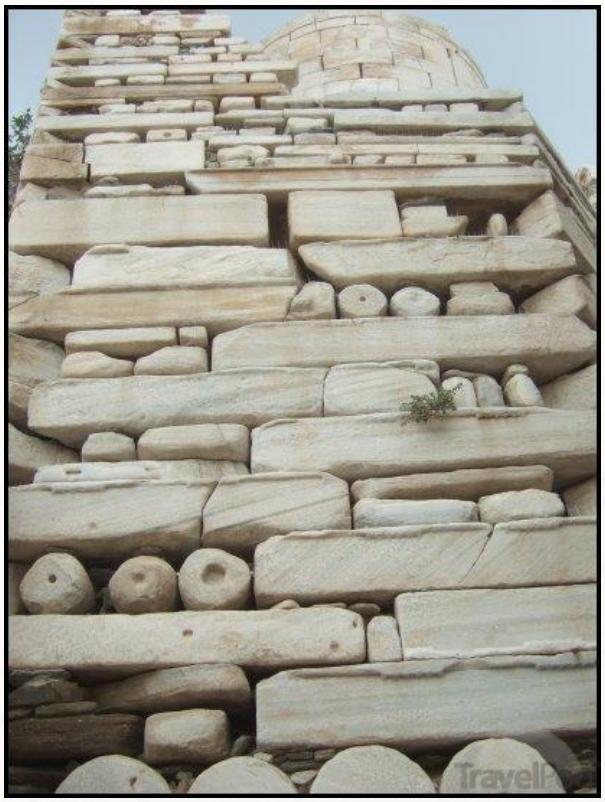
Eight Key Error Proofing Practices

- Provide effective daily work packages
- Lead quality job prep huddles each day
- Utilize task specific job hazard analyses
- Know where your problems are – track and trend key errors daily at the process level
- Deliver effective on the job training (OJT)
- Enforce effective personal protective equipment (PPE) use
- Use audits and observations to help spot daily ‘at risk’ behaviors
- Lead well-planned, thorough investigations



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Strategies for Improvement

How do you systematically improve performance at your facility?

- Rounds and Audits
- Leadership Camps
- Improvement Teams
- Supervisor Training
- Kaizen Blitzes
- Weekly Blitz Calls
- Annual Meeting
- Improvement Tool Use
- Annual Surveys
- Mid-Year Meeting

Do formal RCA on all process non-conformances

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Reducing Daily 'At Risk' Behaviors

PROACTIVE

REACTIVE

- Mistake proof key work systems, including non-standard work
- Track, trend, and try to reduce daily 'at risk' behaviors at the process level
- Use Pareto analysis of observations to identify areas needing improvement
- Implement effective corrective and preventive actions
- Execute GREAT reactive problem solving – learn and improve from your mistakes!

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Team Exercise #2
Planning for Future Error Proofing

Action Plan for Future Error Proofing

How will you use what you have learned today?

- What key insights, tools, or best practices do I want to try using NEXT WEEK?
- Of these actions, which ones need to be addressed first?
- What is the urgency level for achieving action plan completion?

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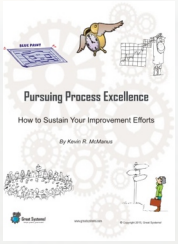

Pursuing Process Excellence

- 150 pages of ideas and examples that will help you accelerate and sustain your process improvement efforts
- Over 25 examples of 'best practice' assessment tools that leaders can use to encourage and support high performance work
- 12 team exercises that can be used to begin applying each concept as it is learned

Vital Signs Measurement

- 128 pages of ideas and examples to help you make your existing measurement systems more meaningful
- Over 30 examples of 'best practice' measurement tools and techniques that leaders can use to promote high performance work
- 14 team exercises that can be used to begin applying key concepts as they are learned

Error Proof

- 162 pages of strategies and dialogue questions to help you stop daily goofs for good
- Over 100 proven best practices that you can use to help error proof your key work processes
- Can be paired with the 100 page workshop workbook that contains 13 team exercises to help you begin applying key ideas

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