

High-Reliability Organizing (HRO): Engagement Matters, Is Personal, and Initiates Enactment

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Abstract

Organizations do not engage. People engage. There are circumstances we encounter when we cannot choose not to act. Unfavorable risk-benefit ratios are not a reason to decline. Lack of Engagement becomes Karl Weick's 'enacted failure by not acting.' Engagement is contextual acting within an unstable environment, and that acting removes constraints on acting. Context is the effect of subtle, nuanced, ephemeral details. Engagement makes use of and strengthens the individual's sense of self-efficacy and internalizes their locus of control. Separated from contextuality are those in positions of leadership. "To engage" becomes the initiator for action. Action becomes the source of learning. Learning and action generate experience.

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Introduction

Organizations do not engage; people engage. For the HRO, *not* engaging and *not* acting ARE failures because there is no enactment. The significance of engagement is enshrined in the public safety directive of *duty to act*. In the operational area, engagement generates information and creates the structure necessary for operations in an unstable environment (1). In organizational science, Karl Weick introduced *enactment* to "preserve the central point that when people act, they bring events and structures into existence and set them in motion" (2).

The relation between engagement and enactment may appear trivial. Weick and one of the authors (DvS) had a 15-year discussion about whether the military and public safety concept of engagement was subsumed by enactment (Weick's view) or whether it was the engagement that initiated enactment (the author's view). A request by the editor (MG) of *Neonatology Today* for an article describing "pragmatic HRO for pandemic COVID" (3) led to a resolution of the debate. For the report, the authors believed

that the contextualized pragmatic stance and the abstract, scientific rationality of the normative stance for HRO were a source of conflict. Weick, on the other hand, identified the two perspectives as forming a gap, but a gap that could only be bridged through the act of engagement (3)

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Neither engagement nor enactment develops from pure thinking. They develop through acting. From the operational perspective, acting is *how* we think. The literature on motor cognition now supports this experience of operators (4, 5). Weick brought to organizational science the perspective that "cognition lies in the path of the action. *Action precedes cognition and focuses cognition.*" "People who act in organizations often produce structures....and opportunities that were not there before they took action" Karl Weick (6).

Engagement makes use of and strengthens the individual's sense of self-efficacy and internalizes their locus of control. Engagement is how a person crosses the gap between proficiency and expertise and builds a sense of moral agency (7, 8) and the authors' experience.

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Delay or the lack of engagement in public safety and military operations is unthinkable. Two of the authors (DvS and SDM) observed what to them was extended evaluation before providing medical care. This was the first difference they observed in emergency responses between public safety and healthcare. Do you need a blood gas to treat a patient in respiratory distress?

Do the eyes or the blood gas drive engagement? Emergency respiratory evaluations incorporate blood gas analysis as part of the

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assessment. Blood gas values are precise, static measurements at a single time point. If the blood gas tells you what to do, you might have done that when you drew the blood. Physical examination has accuracy. Examinations are continuous, allowing us to identify the presence and rate of deterioration and improvement. One of the authors (DvS), observing this delay, developed a visual respiratory evaluation method to support rapid engagement (9). The exam (CRAWL) reduced the time to respiratory treatment and airway intervention and continues to be used in subacute care, EMS (10-12), a local PICU (Merrick Lopez, personal communication), and a special unit in SOCOM (Special Operations Command).

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CRAWL is the acronym of its elements:

- (1) **Color** or hypoxemia,
- (2) **Respiratory** rate and rhythm,
- (3) **Air** entry and inspiratory: expiratory ratio,
- (4) **Work** of breathing, and
- (5) **Level** of consciousness (11).

Lack of Engagement becomes Karl Weick’s ‘enacted failure by not acting.’ Failure to act produces constraints that were not there before they took action. However, the danger is insidious. The act of not acting or engaging generates institutional or organizational knowledge that is difficult to refute (2). For example, the fear of endotracheal intubation of epiglottitis became a routine procedure while creating a PICU (Ronald M. Perkin and one of the authors, DvS).

The problem of engagement by ‘not acting’ and its relation to enactment as ‘enacted constraints’ has impeded the implementation of HRO. Not engaging leads to a failure by not acting. This failure then enacts constraints on thinking and acting. The outcomes of these constraints become beliefs and organizational knowledge. Anyone in conflict with the organization’s knowledge becomes suspect and not trusted. The result is that no one acts outside of accepted organizational understanding (1, 13). The organization measures its safety and reliability with knowledge gained from the consequences of not acting.

Engagement *is* contextuality—the loss of contextuality results in the incomplete translation of theory into practice (3). Failure to acknowledge context also misses the individual’s innate drive to engage in a situation and solve it as a problem. At this point, we can discern engagement as the individual who responds to circumstances due to and from personal knowledge and experience. The salience of a discrepancy or a disruption in their performance draws the individual’s attention.

The individual identifies and responds to the early herald of failure. The individual decides to engage in the state of covert, compensated failure. There is always sufficient contextual ambiguity that the individual can pass on a contextual discrepancy or operational disruption. Leadership and a Lessons Learned program can develop staff into the “leader-leader” necessary for the HRO (14, 15).

More challenging to change is a culture of enactment by not acting. A social environment that impedes engagement through language and attitudes leads to constriction (16). The individual then has limited capacities of thought, narrowing of feelings, and decreased stress capacity.

In the final analysis, it is not “commands” from outside that drive engagement, but when something that was once irrelevant to the person becomes relevant abruptly.

The Loss of Contextuality

Engagement is contextual acting within an unstable environment, and that acting removes constraints on acting. Through engagement, enactment produces structures and opportunities (1, 6). It is this contextuality that reveals areas for improvement and which drives Lessons Learned (13). The enactment of ‘failure by not acting’ is not visible, therefore, not amenable to Lessons Learned. More insidious is the loss of contextuality when we fail by not acting.

Engagement by ‘not acting’ and ‘enacted constraints’ soon separates the organization from the organization’s context. The operation environment of an HRO contains forcing functions and abrupt crises of varying magnitudes (17). What works now may fail later; what failed before may work now. The HRO continually learns and adapts. Nevertheless, the loss of contextuality places the organization and its leaders at risk for “conceptual arrest” – the Lesson Learned is a concept, an abstraction that has not yet been contextualized. That is, learning and understanding do not progress through experience-concept-context-application.

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Context distinguishes practice and experience from theory, abstractions, and concepts. A fundamental problem of gap analysis develops from excessive reliance on abstractions and concepts to interpret experience. When we apply concepts to situations, we act in the top-down direction – from the abstract to the contextual. Abstractions can readily be applied to cases in various contexts with little ability to verify fidelity to the situation (18). The conception “becomes a means of arrest far more than a means of advance in thought” William James (19). ‘Conceptual arrest’ occurs when the organization accepts concepts independent of the ability to use the concepts as contextual actions (13, 18). Abstractions and concepts not tested in context, that is, the operational environment can be dangerous and can kill (20).

Decontextualized Leadership

Separated from contextuality are those in positions of leadership. Context is the effect of subtle, nuanced, ephemeral details. Two individuals standing side-by-side will have different experiences. During a discussion of these details with the authors, Karl Weick observed that “micromanagement is details without the context.”

The reduced influence of context allows the increasing power of abstractions and concepts, particularly tightly coupled concepts with linear connections. For example, when discussing responses to stress and fear, the authors commonly encounter the belief that these responses follow a fixed, linear progression; are distinct and discrete from each other; cause irrational actions and panic; and cannot be modulated except by rigorous training. These beliefs do not fit the authors’ experience, whether the person is in public safety, the military, or a civilian (12, 15, 21-29).

The sense of mastery gained from the study of theory and concepts contributes to a greater influence of knowledge by description. This comes at the expense of knowledge by acquaintance. Theory and concepts inform discussions of complex science and chaos with the inclusion of the cliché “the fog of war.” People function and operate in complex environments, chaotic situations, and through the fog of war. That is what Engagement is.

Shifting Baselines

New individuals joining an HRO may not become aware of engagement as integral to operations against forcing functions and abrupt crises. This unfamiliarity contributes to the shift in baseline knowledge and experience over time (30). The organization’s lexicon shifts from engagement and operational performance to abstractions, concepts, and mastery of academic literature. This unnoticed shift in baseline leads to the loss of history, memory, knowledge, and capability.

Mastery of concepts no longer serves operations. Instead, operations must conform to concepts. “When I joined the fire department [1948], the purpose of administration was to serve the firefighters. Today [1977], the purpose of the firefighter is to support the administration,” William Corr ‘mentoring’ one of the authors

“Autocorrelation, when the past influences the present or from interactions with other systems, makes the system more susceptible to feedback loops. Even minor or mundane extraneous noise signals will allow the system to achieve resonance.”

(DvS). Corr was the author’s fire captain, LAFD, and WWII US Navy veteran, South Pacific Theater. Knowledge by description, whether as mastery of concepts or for administrative purposes, has a long history of usurping knowledge by acquaintance.

Engagement can inform description to extend knowledge and understanding. What makes the translation difficult is the nature of linguistic elements that form the lexicon between those operating in unstable and structured environments. Command authority becomes expressed through policies, protocols, rules, and algorithms. Reliance on analogy, metaphor, and cliché generates less rigor when discussing plans and actions.

These baseline shifts carry distinct risks to the HRO:

- The auditing policies, protocols, rules, and algorithms to achieve conformity
- Substitution of analogy and metaphor for concise, objective descriptions
- Application of clichés as thought-terminating devices

Auditing. Engagement comes from the individual in situations challenging the organization’s knowledge and understanding. Without a known path, people will make errors, but these are errors from changed circumstances (1, 31) and at the boundaries of knowledge and performance (32). Such operational errors are corrected through continuous engagement as one corrects oneself through learning by doing. Operational errors are *correctable errors of accuracy* made during periods of uncertainty and ambiguity. We must not confuse these transient, correctable errors for the more consequential *errors of precision* that occur during periods of stability and certainty (1).

Individuals audit conformance to policies, protocols, rules, and algorithms. Joe Martin, LAFD fire captain, was considering command of the EMS QA section of a major fire department. He contacted one of the authors (DvS) who worked with him as a fire Rescue Ambulance paramedic. The concern of the author was the loss of context by the auditors. They may come to view their work as protecting the fire department – that is, protecting the department from paramedics. If so, it was the author’s experience that auditors develop a ‘guard mentality,’ guarding the department’s reputation, and the paramedics would develop a ‘prisoner men-

“Prevented are classical logic, rigid models, and tightly coupled concepts. Without a Gaussian distribution, we become limited in comparing our situation with a reference class or predicting an accurate trajectory. Uncertainty is a fundamental cause of psychological stress.”

tality,’ protecting themselves from the department while avoiding notice by their officers. The author found Zimbardo’s (33) study of prisoners and guards enlightening when working with staff providing QA by staff authority.

Patrick Bolton and Mathias Dewatripont (34) describe three main types of authority: line authority, staff authority, and functional authority:

- *Line authority* comes from the owners through the chain of command and follows an organizational chart reflecting superior-subordinate relationships.
- *Staff authority* advises and supports line executives and managers, for example, in quality audits, legal counsel, finance, and human relations.
- *Functional authority* gives line personnel authority to act in a particular function or situation.

Martin’s colleagues argued against him taking the assignment, as

none respected the QA section. Upon assuming command of the

“Though not entropy, we consider uncontrolled behavior as a form of red or pink noise. Human behavior interacts with the entropies of energy and information to create forcing functions. We cannot predict how someone will behave in a confusing situation or under threat,”

section, Martin focused on preventing the guard mentality – the mission of the QA section was to support the field paramedics. In his first year with QA, the program became a respected section.

Analogies and metaphors. When encountering novel or uncertain situations, we anchor thought and reduce stress through analogy and metaphor. They also have utility in descriptions – such as for power when we used horsepower to describe the power of a car’s engine. However, analogies and metaphors do not serve to extend understanding when such stories almost entirely occupy the discussion. Identifying internal ‘logical’ links to other analogies and metaphors does not make a valid argument. Yet this approach has moved from informal talks to more formal presentations. In these situations, using analogies and metaphors may represent a lack of experience from engagement.

Clichés. “All season” operators with outdoor experience know that a “slippery slope” can be ascended, descended, and traversed. If necessary, a route can be found that circumvents the slippery slope. However, the slippery slope cliché has become a common reference to ethics or risk management, acting as a thought-terminating cliché that asserts certitude and stops discussion (16). What does slide down the slope is the extension of our under-

“On the other hand, structures exposed to entropic dissipating energy must remain within a specified range for continued operations. The system fluctuates in response to these environmental forcing functions, with variance increasing with the power of the forcing functions.”

standing.

The Engagement Imperative

There are circumstances we encounter when we cannot choose *not* to act. Unfavorable risk-benefit ratios are not a reason to decline. The uncertainty means we will operate without a plan. Failure has become a genuine option. This describes the realm of engagement for individuals in an HRO but also presents the difficulty of HRO implementation. We are compelled to act, yet

organizational factors impede, impair, and even prevent action.

Risk and risk management are common elements when discussing HROs, being defined in proactive and reactive terms. They take on a different meaning during active interaction with a hazard. In engineering, risk derives from the magnitude of harmful consequences and the probability of an event causing them (35). Initially developed for financial investment, risk management refers to identifying, analyzing, and accepting or mitigating risk or uncertainty. The International Organization for Standardization (ISO) has published standards for risk management known as the ISO 31000 family of standards (36). (The ISO intentionally adopted initials that do not match those of its three official languages.)

Describing how HRO works in practice but not in theory, Todd R. LaPorte and Paula M. Consolini rarely used the term risk. For them, HRO is “an organizational process colored by efforts to engage in *trials without errors*, lest the next error be the last trial.”

Engagement as “trials without errors” is not a business model. That is, the business sense of ‘error’ is a measure of deviation from the norm or what is accepted. For the HRO, error uncovers a change in circumstance, identifies the boundary of knowledge, and forms our zone of performance (32). We cannot choose to engage based on risk assessments. That is, the risk outweighs the benefit.

Engagement is driven by the idea that “failure *is* an option.” We operate “without a plan” by relying on the brain’s cognitive functions (24, 37, 38). We take advantage of stress-induced constraints and fear circuitry behaviors to overcome the inherent vice of stress and maladaptive fear-circuitry behaviors (22, 39). The vital HRO characteristic of modulating amygdala-driven behaviors is significant (24, 27, 39, 40).

Engagement can start abruptly, compelling a person to act or investigate. Direct action may start before adequately identifying threats, acquiring sufficient knowledge to act, or knowing what will work. Or circumstances may draw out the initial engagement allowing the certainty of information and the expectations of bystanders to change, if not multiply, and conflict. Time branches rather than forming a path. George Orwell (41) describes these changes of information, and even the degree of the threat, after he was told that an elephant was ravaging the bazaar and asked to “please come and do something about it.” “A story always sounds clear enough at a distance, but the nearer you get to the scene of events, the vaguer it becomes.”

In the HRO, the engaged individual identifies discrepancies and disruptions as early heralds of failure. Engagement, then, becomes the conduit necessary for the identification and engagement of early heralds of failure (42). “HRO may be a trajectory of engagement that fuses now with the experience of then into simultaneous inquiry and redescription,” Karl Weick (personal communication).

Engagement is not simply doing something or choosing a protocol. Engagement operates at several levels. The novelty differs from the novice to the veteran. The meaning will shift from “just getting through” to the development of moral agency (43). Team formation changes from hierarchy to reciprocal support toward a shared objective. Regardless of the various ways to discuss engagement, only a few elements support engagement, and a few impair engagement.

In one author’s experience (DvS), the starkest difference between the fire Rescue Ambulance (RA) medics on scene and healthcare professionals in the hospital was how RA medics decided and acted but kept an eye on the effectiveness of the action. The medic’s only monitoring was responses to their actions. Circumstances,

the environment, and the patient always changed. On the other hand, healthcare professionals evaluated the patient and decided on an action but did not continuously monitor the effectiveness of the action. An RCP recently described this during an activity to adjust the mechanical ventilator for better patient phonation and comfort. "Some doctors come in, say the orders, then leave. We do not see them again."

"Operators must continue operating and controlling the system in a totally new and unprecedented environment and adverse conditions. Coming up with an unprecedented plan is strongly culturally driven," Najmedin Meshkati and Yalda Khashe (31)."

Without an appreciation of engagement, we lose the meaning of evaluation, decision, action, and observation. Our interactions with failure make visible the early heralds of that failure. Visibility facilitates earlier engagement of subsequent incidents. To respond earlier, however, is to respond to ambiguous signals. While much is made of "weak" signals, these are more likely early, subtle, nuanced, and even punctuated signals in an emergency. These signals' salience, meaning, and relevance are lost to outsiders.

An angry father demanded hospital admission for his wife, who was in labor. Over the 12 hours of repeated visits, her cervix had yet to dilate. The obstetrics intern requested one of the authors (DvS, at the time, a third-year medical student) to accompany him, concerned the father would become physically violent. They were in the labor and delivery area.

The father's voice became loud and stern with increasing urgency while standing face-to-face with the intern, imperceptibly closing in on the intern. That was not the danger. In the author's fire rescue ambulance experience interacting with "human stress failures," people talking and yelling do not rapidly become physical. The individual becoming quiet is when they are most likely to attack physically. You want to keep them talking with some logic to *their* words, not necessarily logical for you. The actual danger was the intern inadvertently touching the father, who had been taking small steps closer while leaning in. Had the intern inadvertently touched the father, the father would have felt justified in hitting. The urgency in the father's voice indicated the level of force that would ensue.

As the father moved, the intern would take small steps backward, his voice developed a nervous crackle, and his words became less organized. The solution was to have the father move back without physical contact. The author, standing alongside the intern who faced the father, leaned slightly with his shoulder coming between them. The father stepped slightly forward. The intern backed up. The author did not move. Next, the author slightly twisted his shoulder toward the father. The intern and father kept arguing. The author twisted his shoulder forward again. The father took a slight step back. The author took a slight step forward. The father's tone quieted. He began listening to the intern, whose voice was becoming more confident, and his words were more structured. The father took a larger step backward. Then he

began accepting what the intern said.

As the intern and author walked away, the intern remarked, "I guess I didn't need you after all."

Effective engagement is often not visible.

Engagement is Individual

Signals from the environment are ambiguous and contain uncertainty (44). High-Reliability Organizations (HRO) work in this world of practice rather than theory (35). Engagement bridges the gap between theory and practice, moving theory into the practical world to create the *practical domain of engagement* (3, 45-47). This article describes practical actions for engagement when encountering an outlier, discrepancy, or disruption.

In the 1970s, Los Angeles Fire Department Drill Instructors (DI) told fire Rescue Ambulance (RA) recruits, "When you arrive on scene, you're 'It.'" That is, the senior partner and the recruit would handle everything on the scene, not leaving until all unstable problems were made stable and citizens were treated and either made safe or transported to the hospital. The medics would work alone, without radio contact, unless they requested other units. Fire and police units only responded at the RA's request, except for shootings when the RA would be dispatched along with responding police units. The Fire Department would provide support, but the two medics were in charge.

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RA recruits, including one of the authors (DvS), worried they would not know what to do when they found themselves approaching a medical emergency or rescue alone or when they might encounter violent individuals. The DIs told the recruits to engage. Do something. To engage may be only calling for help. That is OK. The recruits must make themselves safe, then the citizens safe. But the recruits had to do something.

As vague and ambiguous as this seems, the order "to engage" became the initiator for action. The action became the source of learning. Learning and action could then generate experience. While some individuals may have twenty years of experience in a field, it may be the same year, year after year. That is not engagement. For the Fire Rescue Ambulance crews, every year became a different year. That is the product of engagement.

Some people reach a sufficiently high level of expertise that they become the expert who is the standard for others and a source of knowledge under challenging circumstances. These experts develop excellent intuition and have effective habitual responses to various situations. The risk is "doing the same year, year after year."

Because the trajectory of a response cannot be predicted, every response was treated by RA medics as if it could abruptly deteriorate. This repeated approach of thinking and acting as if the situation was new improved existing skills while extending the

RA's range of skills (46). Other actor's domains involved in the response, firefighters, police officers, nurses, and physicians, became teachers and sometimes mentors in real-time as the RA medic continued the process of learning to understand and perform better. In effect, RA medics compared their performance to those working around them. Often the greatest improvement was gained from constructive feedback after a bad choice on the scene or a bad outcome. The result was a more effective performance during live-or-die situations.

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After one of the authors (DvS) finished his probationary period, he had command of the RA at a traffic collision impeding rush hour traffic. This was during the initial expansion of EMT services within the fire department and the introduction of paramedic services in the state. The author's driver was a new firefighter with only first-aid training. The firefighter reported that the driver had no injuries. A cursory evaluation of the driver supported that conclusion. Access to the patient prevented obtaining a blood pressure.

Further, the firefighter believed the team, working with tow truck operators on the scene, could quickly pry the vehicle door open. [At that time, in that area, tow trucks commonly arrived at an accident scene to tow disabled vehicles.] He explained that calling for a physical rescue assignment (a ladder truck, two engines, and a battalion chief) would needlessly block the road during rush hour. It would take about 30 minutes for a vehicle carrying the “Jaws of Life” to arrive on the scene. A paramedic RA was at least 20 minutes away, with no guarantee of availability.

The patient began turning gray and stopped talking, an early sign of a heart attack that may have led to the accident or could have occurred after the accident. Unable to open the vehicle door, the author called for a physical rescue assignment.

The RA transported the patient to the hospital, where he died 14 hours later from a heart attack.

That evening the fire captain thanked the author for his work. The captain stated that because the author was the most qualified RA medic the fire department had for the call, the department would support him and everything he did. The captain then asked what the author would do differently next time. The captain provided several reasons for each different decision point. The captain then explained why it's OK to call out too much equipment; it is not an overreaction. It is not a “crying wolf.” There is no crying wolf in the fire department because a delayed response will kill, while a response can be canceled anytime.

The captain repeated that the author was the department's most qualified RA medic for the call. He added that other medics were more capable and others were more experienced, but they were not available. So, the author was the most qualified RA medic for that assignment. The depart-

ment would stand behind the author and his actions.

The captain finished with, “There are a thousand things that happen on the scene. You can only see a hundred. You can only act on ten. I may see a different hundred. I may act on a different ten. That doesn't mean I'm better than you; only that I'm different,” Captain, Fire Station 11, LAFD, personal communication.

Even if engaged side by side in unexpected events, people experience the incident differently and have different forms of sensemaking. “This remains, to me, one of your more powerful, rich experiences. One can dwell on its implications for a long time.” Karl Weick, personal communication.

Every individual in healthcare is the most qualified person to help – at that time. And we will do well to support them.

“This is the process of becoming an expert – thinking and acting as if each situation was new, identifying how every situation can abruptly deteriorate, and comparing one's performance to the performance of adjacent domains. Comparing an organization's performance to expert performance is the part of a Lessons Learned program that is often overlooked or misunderstood (13, 48).”

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To extend PICU care into pediatric subacute care, one of the authors (DvS) asked staff to observe all paramedic responses to the facility – if that could have been performed. Next time, the staff would do it. Advancing to the Emergency Department and then the PICU, the subacute staff would evaluate if that care could be provided in the subacute. Soon, bedside staff treated acute respiratory failure with hand ventilation, temporary placement of a mechanical ventilator, then a discussion with the on-call pediatrician. Calls to 9-1-1 transfers to the ED and admissions to the PICU rapidly decreased (49, 50). An unexpected finding occurred when families requested that their child not be weaned from the ventilator. These children had become more active – and began smiling (51). This is the direct extension of medical care through engagement, from the Los Angeles City Fire Department Rescue Ambulance through the PICU to a nursing home, to enhance the lives of profoundly disabled children.

This change in care, the mechanical ventilator as an enhancement of life, came through an expert performance developed by engagement of routine events. But the excellent intuition and effective habitual responses of experts can also decrease engagement by the expert and those subordinates who rely on the expert. That, and the above method of acquiring expert performance,

Table 1. VUCA-2T (27)

Volatility	A rapid, abrupt change in events
Uncertainty	Lack of precise knowledge, need for more information, unavailability of the necessary information
Complexity	A large number of interconnected, changing parts
Ambiguity	Multiple interpretations, causes, or outcomes
Threat	Impaired cognition and decision-making
Time Compression	Limitations acquiring information, deciding or acting before consequential changes

Table 2. Liminality (27)

Conventional Operations	Liminal Operations
Familiar	Threshold of Transition
Structured	Passage for travel, but not traveling
Knowledge by description	Gaps in knowledge (54)
Hierarchical support	Alone
Standards	Learn by doing
Known rules	Old rules do not apply
Familiar relations	New rules unknown
Prevent Failure	Consequence driven

have been identified by K. Anders Ericsson et al. (52). engagement can develop expert performance. At the same time, the failure to engage leads to the loss of expert performance.

Engagement in a VUCA-2T environment (Table 1) or within the liminal zone (Table 2) is not well described in the academic literature. When it is described, it may come under criticism as not derivative from science (5, 53). When described as personal experience, engagement risks derision as “anecdotal” (the authors’ personal ‘anecdotal’ experience).

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One of the authors (DvS) described this plight with Bob Bea, Professor Emeritus, Civil Engineering, University of California, Berkeley (55). He responded:

“Our [dangerous] work has termed this *interactive-real-time assessment and management of risks*. This approach was completely overlooked until the early 1990s. We were taught that there was only *proactive* (before operations) and *reactive* (after) – and that was it. And we thought we could capture all of the risks with the proactive approaches - and then provide adequate defenses if ‘justified’ – but we were missing some really major risks that were fundamentally unpredictable and unknowable.”

Bob Bea, 08/30/2005, personal communication

Engagement as *interactive real-time risk assessment and management* is more than doing things or following a protocol. Engagement is the projection of thought into the stochastic environment, thinking during abrupt change, generating information from uncertainty, and creating a structure where there was none.

Attention Initiates Engagement

We engage our attention every time we observe a discrepancy from what we expect or a disruption of activity. Physical engagement is the active search for alternative actions and better solutions amid a changing environment (56). The brain resets attention, reframes the situation, and changes from achieving a goal to performing specific tasks (57). The locus coeruleus-norepinephrine system (LC-NE) mediates selective attention for salient stimuli while silencing irrelevant stimuli. The brain can encode and filter salience (58).

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When detected below the level of consciousness, this attention reset creates an uncomfortable feeling of dread, worry, anxiety, etcetera. Objectively articulating the circumstances without subjective interpretations, along with physical investigation, can identify the source of the discomfort. Without a reference, the feeling can drive vigilance for early heralds of failure. This can be difficult for the novice to appreciate. One of the authors (DvS) asked a resident physician to monitor a child in the PICU closely. Then the resident asked, “Monitor for what?” Thinking this was obvious, the author responded, “If I knew what to monitor for, I wouldn’t ask you to monitor.” Those with experience in dangerous contexts understand the author’s frame of reference, while those without such expertise appreciate the resident’s frame. This demonstrates the necessity for us to articulate both the expected, unexpected and the novel discrepancies and disruptions that may occur.

High-Reliability Situations (HRS) arise as outliers from routine and mundane events. HROs maintain vigilance for these outliers, considering such discrepancies as early heralds of failure or the initial presentation of disruptive processes (3). These early heralds are readily missed as the system compensates. This compensated state will be missed unless staff are taught what is salient or relevant. To generate vigilance in staff, we describe this as the *covert, compensated state*. When unrecognized, the HRS becomes visible in the *overt, decompensated state*, which too easily devolves into cascading failure.

A 'noisy' frequency, an element in the system with long periods from internal feedback or autocorrelation, may become a forcing function against the system. This low-frequency, rare events have a greater influence on the system than more common, high-frequency events with less spectral density (59). Regardless of size, these disturbances and disruptive processes are normal environmental variations but are seen at different scales (59).

“The alternative is to presume an environment described by Gaussian distributions where outliers can be disregarded at certain standards of deviation due to randomness and independence of data: the randomness of inherent processes and the independence between outcomes of those processes.”

The operator in an HRO views outliers as the initial presentation of change, an indicator of what can become possible. The alternative is to presume an environment described by Gaussian distributions where outliers can be disregarded at certain standards of deviation due to randomness and independence of data: the randomness of inherent processes and the independence between outcomes of those processes. This is the basis of the fire Rescue Ambulance crew's approach described above – the trajectory of a response cannot be predicted; every response was treated as if the patient could abruptly deteriorate.

The Individual

You can do it. As mentioned earlier, one of the authors (DvS) learned that when he arrived as a fire Rescue Ambulance medic, he was “*It.*” He and his partner would resolve the situation. But the various spoken and unspoken elements underscored he could do it, though alone on the scene, he was not. When the author's Fire Captain, William Corr, observed a momentary pause by the author before engaging in a situation, he would say, “*You can do it.*”

- Speaking at the welcoming program for new medical students, one of the authors (DvS) spoke after a series of faculty, medical students, and administrators spoke. Most speakers included warnings about the difficulty of medical school. The author started with the phrase, “*You can do it.*” For the next few weeks, students approached the author to say he was the first person to tell them they could do it.
- An assistant fire chief told one of the authors (DvS) about his experience as one of the first county paramedics. The medical director for the program (Thomas Zirkle) was also a battalion chief for his department. His first paramedic response

was for a cardiac arrest. It was the paramedic's father. He looked up and saw Dr. Zirkle, who looked at him and said, “*You can do it.*” The paramedic successfully resuscitated his father.

- Another one of the authors (TAM) was departing the ready room for his first Vietnam combat mission. The captain of his aircraft carrier (a Korean War Naval Aviator) told the aviators, “*You can do it.*”

“*You can do it*” may be the mantra that initiates and drives High-Reliability Organizing.

Colonel John Boyd, a US Air Force tactician, proposed a method of action and feedback through an OODA Loop (Observe, Orient, Decide, and Act) by looping back from the action to make a new observation (60). The use of Boyd's OODA Loop in EMS and pediatric critical care by one of the authors (DvS) (61, 62)2006</date></pub-dates></dates><pub-location>Dallas, Texa</pub-location><publisher>American Medical Director's Association (AMDA had brought his work to the attention of Karlene Roberts, part of the UC Berkeley HRO group.

Karl Weick described the utility of Boyd's OODA loop if we were to start with *action*, the Act phase (personal communication). Acting is the first step in engagement and is the active part of Weick's sensemaking; acting is also the initiator of Weick's enactment, and acting can create both visible and correctable failure through looping. The latter is critical in HRO to oppose failure from *not* acting, a failure that is invisible, not detectable, and not correctable.

The linearity and sequencing of rules and plans produce the appearance of reason and logic, while these rules and strategies are created apart from concrete reality. The expert following the rules performs poorly (43, 63-65). We must guard against false protective mechanisms such as abstractions, regulations, false confidence, or self-admiration.

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When engaging the HRS, individuals contextually shift their values from conformity and obedience for stable environments to initiative and creativity for the HRS. It is the shared duty of workers in dangerous contexts to precept the novice for safety and performance, whether during routine times or operations (27). How we treat subordinates can create the expert we will later defer to for deference to expertise.

Self-efficacy, internal locus of control, and increased stress capacity enable the individual to engage in the HRS. Decision-making with reciprocal feedback keeps the operator close to events,

generates information, identifies relevance, and gives meaning. Our perceptions help us recognize whether a response was due to our actions, giving us a sense of agency (66). Without action, we do not gain that sense of agency, and it is this sense of agency that supports expert performance.

“In healthcare, we direct our expert performance to support and treat our patients. The individual begins to make a difference – improvement is from the individual’s judgment and actions rather than algorithms.”

In healthcare, we direct our expert performance to support and treat our patients. The individual begins to make a difference – improvement is from the individual’s judgment and actions rather than algorithms. *Moral* agency gives meaning to one’s actions, either internalized by the individual or interpreted for the individual by a leader. Patricia Benner (67) described *moral agency* as a result of the individual acting independently, then observing that their actions made someone’s life better. With that knowledge comes responsibility for the care provided (8). Benner placed the development of moral agency at the crossing of the gap between simple competence and the richness of expertise.

To view expert performance without moral agency is to view healthcare as a skill independent of treating a person. In our view, healthcare actions are *engagements* bounded by Aristotle’s practical wisdom (prudence) (68). (Prudence is first of Aristotle’s Four Cardinal Virtues: prudence, justice, temperance, and fortitude.) Practical wisdom is the wisdom for *the particular*, and actions are taken *for the good of the community*. In this specification, when we treat for the good of the patient and accommodate the patient’s environment, we are using practical wisdom.

There are several ways to understand what happens next. Engagement comes from the individual. We cannot assume that the individual will recognize and internalize how their actions have improved the patient’s life. Some leaders, colleagues, and organizational cultures impair this internalization. Subtle isolation remains a method to control, discipline, or remove a member of the organization. An unfortunate consequence is constricting the individual’s emotions (16). Healthcare as a working environment contains elements that can over-consolidate with stress-induced and fear circuitry disorders and related amygdala-driven disorders (39). In a person with constricted emotions, these disorders can consolidate with environmental stressors and generate clinically severe anxiety disorders.

“Healthcare as a working environment contains elements that can over-consolidate with stress-induced and fear circuitry disorders and related amygdala-driven disorders (39).”

HRO-engaged leadership develops different outcomes. Sense-giving by the leader guides the novice for effective action and later interpretation of the experience (69). Distinguishing effectiveness from outcome helps the novice to take responsibility for the action rather than the result. This separation reduces the influence of bad outcomes on the individual’s self-esteem (28). Recognition of one’s part in care, and acknowledgment by others, frames actions in a way that increases the development of moral agency (8). Self-efficacy and locus control internalization develop under-engaged leadership guidance (40). The outcome of engagement under the engaged leader results in the internalization of HRO and the development of passion.

This shift from the external influence of rules and algorithms to the internalization of judgment and moral agency underscores the growth from novice to expert veteran. Comments that may motivate veterans likely intimidate novices. Telling novices why they engage, based on the veteran’s internalized experience, makes little sense to the novice. In our experience, focusing on how engagement helps will more likely support the novice to engage.

The Five Characteristics of HRO

The five well-known characteristics of HRO have become an accepted hallmark of describing an organization as an HRO (70). Less is discussed on whether the five characteristics are goals alone or methods to reach the goal of HRO. When viewed as structures for engagement, the characteristics can guide the organization toward the goal of HRO. Considering these as attitudes makes the five principles better understood and accessible (14).

“Attitudes influence behaviors; in this way, attitudes can create a bias for action for immediate engagement, even if that engagement takes the form of observation or notification. Attitudes make the five HRO characteristics personal.”

Attitudes influence behaviors; in this way, attitudes can create a bias for action for immediate engagement, even if that engagement takes the form of observation or notification. Attitudes make the five HRO characteristics personal. We have found that framing the five principles as derivations from attitudes increases understanding of their purpose and acceptance by members of the organization, from the senior-most official to the most recently hired on the line.

Executives and administrators often struggle with “preoccupation” and “failure.” They do not see the purpose of always thinking of failure, and they do not want their employees preoccupied, or focused, on any one thing, let alone failure. However, if executives and administrators do not want failure, what are they doing to identify and engage early signs of failure? Do they have the plan to bring events to a resolution rapidly?

While there is good information on the “servant” and “transformative” leader, in the HRO, leaders also defer to expertise. The physician who developed the sentinel event program for The Joint Commission advised two authors (TAM and DvS) that physicians had difficulty deferring to non-physicians. One author, a retired US Navy Admiral, pointed out that command consists of those duties

you cannot delegate. The other author (DvS) then described three duties a physician cannot readily delegate: diagnostic authority, prescriptive authority, and surgical procedures. Otherwise, physicians can defer to the expertise of the non-physician.

“Positioned as attitudes, we see how the five principles develop from experience and then frame the processes necessary to reach High-Reliability Organizing. The five principles describe natural, effective, adaptive responses to adversity and hostile environments.”

Positioned as attitudes, we see how the five principles develop from experience and then frame the processes necessary to reach High-Reliability Organizing. The five principles describe natural, effective, adaptive responses to adversity and hostile environments. If we assume that attitudes drive behaviors, carefully distinguishing this from creating behaviors, the five attitudes are reasonably close to behaviors. Our beliefs do not change the environment; our attitudes do.

Preoccupation with Failure

What is the individual's attitude toward failure or system vulnerability? What is your attitude toward a discrepancy or system disruption? The individual will first identify and respond to the outlier as an early herald of failure or engage the state of covert, compensated failure.

Reluctance to Simplify

What is the individual's attitude toward working with complex situations? What is their drive to investigate? Individuals act within the context of events to identify the details and sort through the ever-present complexities.

Sensitivity to operations

What is the individual's attitude toward changing work priorities without notice? What is the individual's attitude toward maintaining normal work assignments during a large disturbance? This is situational, allowing for continuous adjustment to the operation. Individuals notice and respond to anomalies and outliers rather than disregarding them as random events.

Karl Weick (personal communication) added this principle because organizations would disrupt, if not stop, their strategic operations due to the distraction of a tactical situation. He also noticed that organizations that failed did not adjust their plans in real-time for changes at the operational level.

“Operations also include enactment. Sensitivity also means being aware of your own impact in displacing, shaping, and creating what you think is merely external and out there: ‘I need to be sensitive to my impact.’” Karl Weick (personal communication)

Commitment to Resilience

What is the individual's attitude about stopping when engaged? What is the individual's attitude toward working on a problem without a known solution? Individuals will continue enactment as engaged acting, which maintains or regains a stable state in a

dynamic situation.

Deference to Expertise

What is the individual's attitude toward the knowledge of those who have less experience or are lower in the hierarchy? Individual superiors defer to the local knowledge of subordinates, recognizing that in dynamic, contextual situations, information must be updated and beliefs revised. Individuals may have the necessary knowledge from experience outside the organization or the situation itself.

“Being natural does not imply being adaptive or effective. The organization can form engagement to enact failure by not acting. The HRO forms engagement into enactment to create reliability, structure, and new opportunities.”

Conclusion

The well-known five characteristics of HRO describe not only engagement but the HRO's support for personal engagement. Engagement is an innate human drive in response to abrupt local environmental changes. Being natural does not imply being adaptive or effective. The organization can form engagement to enact failure by not acting. The HRO forms engagement into enactment to create reliability, structure, and new opportunities.

Engagement for the novice is to “do something.” Doing something makes the novice part of the problem and part of the solution. With experience from engagement, the novice bridges the gap between proficiency and expertise while also developing a sense of moral agency.

It is through individual engagement, rather than commands from the outside that the work of an HRO gets done.

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