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High-Reliability Organizing Fundamentals: The Distinct Dimension of Time

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Abstract:

The manuscript delves into the challenge of establishing order in chaotic, hazardous environments, emphasizing the interplay between human actions and dissipating energy. Identifying which actions resolve or worsen disruptions is complicated, often dependent on timing and context.

The inadequacy in recognizing the capabilities of organized human actions to restore order is highlighted. Oscillatory phenomena, with temporal components, are discussed, distinguishing noise from stochastic waves. The environment, inherently unstable, undergoes self-organization through local feedback loops, a process often unnoticed due to memory deficits and linguistic challenges.

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The temporal dimension is undervalued in response plans for unstable environments, overshadowed by Euclidean space's three dimensions—environmental self-organization's impact, driven by nonlinear feedback loops, challenges predictability. The philosophical exploration of time questions its objectivity and introduces Einstein's theories, emphasizing the limitations of absolute time in nonlinear contexts.

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The discourse advocates a more comprehensive understanding of human responses by distinguishing mechanistic causation from adaptive traits over time. Criticisms of high-reliability organizations lacking temporal consideration hinder comprehension. Incorporating time as a distinct dimension is proposed to enhance understanding of complex environments.

Introduction:

From observation and experience, we know order will eventually come to a chaotic environment. Sometimes, the cause of that order is the dissipation of the initial energy. Sometimes, the cause is human action. More often, the cause is a combination of the two.

The conundrum we face with hazardous environments is determining which human actions help resolve the disruption and which make it worse. It appears that what works and what hurts may depend on timing and context. We have not identified the capabilities of organized human action that bring order to such chaos, nor have we reliably reproduced the methods we have identified.

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Oscillations occurring with a time component form waves that have frequencies. Noise, which does not carry information, is a disorganized pattern of these waves. Stochastic waves carry energy, and their stochastic character means their probability values will unexpectedly change. Environmental stochastic noise describes the ambient noise of the world in which we live. Red noise frequencies have long periods and have greater power to cause forcing functions to which we must respond. Pink noise brings abrupt, catastrophic change.

Our environment is intrinsically unstable. Entry of energy destabilizes the environment even as order emerges from self-organization by local environmental constituents. Humans also self-organize by using self-direction from within the event. The ephemeral nature of local feedback loops that comprise self-organization is not visible to distant spectators, and they are only fleetingly noticed by the actors who must quickly move to the next series of feedback loops. Memory deficits and the failure of words necessary for accurate description impair the ability of individuals to describe their motives and actions.

Those looking for causation or a rational plan of response soon become frustrated. These spectators use their knowledge to fill in the blanks, knowledge similar to knowledge by enactment (1)—untested because it is unquestioned, it becomes privileged over knowledge by acquaintance gained through experience (2). The knowledge and the lessons that were learned in blood are lost. Operators have lost the conundrum.

Though we know it occurs, identifying how we achieve effectiveness in an unstable, dangerous environment continues to vex educators, academicians, and leaders of high-risk organizations outside the military and public safety. This runs into the problem Niko Tinbergen identified with animal behavior: we do not notice the behavior until it happens, and we do not know the individual's mind. Unknown are the antecedents and cognitive-affective processes. However, we can discuss the function of behaviors, described by Niko Tinbergen (3) as achievements, to understand better the defensive cascade that protects the organism. Therefore, it may serve us better to identify the function of our responses to unstable, dangerous environmental change.

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To be clear, the change in the physiological environment of a neonate is of a different proportion than a national emergency. We maintain that the dynamic response is the same.

Time as a valuable dimension for unstable, dangerous environments has been poorly incorporated into response plans and methods to increase capabilities. Instead, we use the three dimensions of Euclidean space for planning and operations. Euclidean space is helpful because it consists of points with measurable distances between two points. Euclidean space provides a structure for organizational charts, rules, protocols, and planning. For tractability, we can treat a curve as linear over short distances. In a dynamic, topological space, local areas are Euclidean spaces. We can apply the rules of Euclidean space with three dimensions over any local space mapped onto a topological manifold. (The shape of a topological space is called a manifold.) Rather than lines, we use relations in a topological space. Relations can be deformed but never destroyed.

Environmental self-organization from nonlinear local feedback loops changes the context of any circumstance. The feedback time of local loops dictates the rate of change within any context. Long time lags describe a slowly changing system. Short time lags can accelerate change because each change occurs within a shorter time. Feedback loops between the system and the environment alter the direction change, with short time lag feedback loops altering the trajectory much quicker. The future becomes less than predictable to the consternation of those using the structure of Euclidean space.

Time and changing context generate frames of reference that differ based on a person's position. Does time have a frame of reference? Is time objective, and does it have an absolute value to which we can compare other time measurements?

Objective time is linear and unidirectional, evolving in the same sequence of past, present, and future. Objective time is homogeneous, elapses uniformly, and is quantitative. Independent of events and individuals, objective time is absolute and universal.

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Isaac Newton asked if we could determine the absolute velocity of the Earth through the ether that pervades space. This restricted Principle of Relativity (Newtonian Relativity) relies on absolute time. In this relativity, the motion of bodies amongst themselves is the same—they are only moving only concerning each other. Because the system itself is moving, everything appears the same. There is no acceleration—Euclidean space conflicts with the idea that our frames of reference can move at different speeds.

Time in Newtonian Relativity and Euclidean space is a prothetic process, a quantitative continuum that we add to. We discriminate prosthetic-process categories based on our sensitivity to differences (1). Context changes as elements change in time. When time differences are negligible, we can disregard the effect of time on context, making it possible to decontextualize a situation or process. This supports the use of decontextualized concepts and theories.

The Special Theory of Relativity described frames of reference that moved at different speeds. To develop the Special Theory, Albert Einstein demonstrated that there was no *absolute* time. Instead, time is a separate dimension. This changes Euclidean space into Relativity space. Time is relative just as space is—space-time.

The General Theory of Relativity combines matter-energy and space-time from the Special Theory through their interactions. This interaction creates the force of gravity in the Euclidean space. As time passes, the approach's reference frames (mass) dilate with speed, and clocks run slower. Then, as it moves away, time contracts with speed, and clocks run faster.

We do not imply that this happens during a crisis. We want to point out that absolute time, as a prothetic measure, does not work well with nonlinearity. Further, Newtonian physics and Euclidean space restrict function and constrain the adaptability of any system.

HROs operate in unstable and dangerous environments *because* time has a dimension in those environments. Autocorrelation, internal feedback, creates environmental energy frequencies, red noise, with forcing functions that people and a system must respond to or cause abrupt, destructive change. When noise occurs at a specific frequency, 1/*f* or f^{-1}, it causes abrupt, severe change—red or pink noise, resulting from feedback with various time lags change context. Time as a dimension has broad, penetrating influences in these environments.

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Time as a dimension and context also influences how we perceive, think, and communicate about the environment. Understanding time and context affects our focus on the cause of our responsive behaviors and actions and how we adapt to these events.

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As discussed above, we can explain the function of responding. Following Tinbergen's questions regarding animal behavior, we can *proximate the cause* of the response using mechanistic explanations based on how the structures of individuals and the organization work. We can explain the *ultimate function* of an emergency response as adaptation—that is, to have or develop traits that contribute to the survival of the individual, system, and organization in the current environment. This differentiates two distinct levels of analysis: the *proximate* causation developed within a human lifetime and the *ultimate* causation that continues over lifetimes, an evolutionary level (3).

We propose that the dimension of time has not been fully identified and characterized as an integral of unstable, dangerous environments. Also, time is missing as a dimension in analyzing human responses to these events. Further, the human response to these events must be distinguished between the mechanistic immediate causation at the point of contact from adaptive traits developed over years of experience. As Scott A. MacDougall-Shackleton stated, arguing across levels of analysis creates false debate (3).

In this article, we present examples of the effect of time and context on response to dangerous contexts and the effect of arguing across levels of analysis. Next are examples of how context and time as a dimension influence our emotional response, time preference, epistemology and philosophical stance, logic and reasoning, problem characterization and problem-solving, and analysis.

Social and Task Cohesion in Dangerous Contexts:

To demonstrate the influence of time and context on scientific studies, we open with an academic criticism of a US Army study of combat troops during the Iraq War. The researchers entered zones close to combat areas. They sought to identify specific determinants of successful unit performance: social cohesion (the strength of interpersonal bonds among members) versus task cohesion (a shared commitment to the unit's mission).

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Three academicians pointed out that the research findings did not comport with knowledge developed from a scientific methodology away from combat. We start with some of the criticisms of the findings and methodology. Next, we present some responses from one of the original researchers.

The criticism comes from Robert MacCoun, Elizabeth Kier, and Aaron Belkin in their paper, "Does Social Cohesion Determine Motivation in Combat? An Old Question with an Old Answer" (4).

> "Their findings are intriguing because they appear to contradict long-standing research in organizational theory and sociology on the relationship between cohesion and

performance, as well as more recent studies of unit cohesion and military effectiveness."

"They provide no evidence for the representativeness of the interview quotes they cite as evidence for the reliability or validity of their measures [and] no indication that these quotes are statistically representative. Their methodology fails to meet social science standards for causal inference (e.g., ruling out causal rival factors)."

"[The authors] must be congratulated for having completed a brave research project. Under dangerous conditions, they conducted over eighty interviews with Iraqi Regular Army prisoners of war, US combat troops, and journalists embedded with coalition forces."

"There is broad agreement among social scientists that people are often unable to reliably and validly perceive and report on the causes of their behavior. People are not fully aware of the causes of their behavior."

"Every scholar recognizes the important distinction between correlation and causation. To determine whether two phenomena are causally related, there are straightforward guidelines that scholars adopt."

Thomas Kolditz, one of the original authors, responded to this criticism in his paper, "Research in Extremis Settings Expanding the Critique of 'Why They Fight'" (5).

"Previous work by the author that was based on data collected in combat has been criticized based on its ability to generalize to research done in routine, peaceful settings. A small team … [had] deployed to the active war zone in Iraq to witness, record, and report on the human dimension of combat."

"Noncombatant civilian scientists are usually treated as elites, well cared for, and confined to relatively safe rear areas and after-the-fact research methods."

"Interviews were conducted in the active combat zone with infantry soldiers who were fully armed and prepared to engage the enemy without notice. Owing to the rapid advance to Baghdad and beyond, no one in the sample had eaten hot food, showered, or received mail in the thirty days prior. Each soldier or marine interviewed had at least one member of his organization wounded or killed in the preceding thirty days—several uniforms still bore bloodstains left by the evacuation of comrades—dark blotches over the chalky-white salt from daily living in 112-degree heat."

"On the basis of that report, a small group of political scientists have criticized the publicly released portion of the team's work as "unscientific" [reference above]. In addition, they characterize our findings as inconsistent with some earlier noncombat studies…Much of the criticism directed at the methods used in our work focuses on the inability to compare the team's work with existing laboratory or field studies or to generalize the team's findings across a number of settings."

"Research involving human participants conducted in safe, peaceful settings will not necessarily generalize to combat; combat findings may differ from those developed elsewhere."

"Is [it] scientifically appropriate to assume that the extensive work done in peaceful settings will necessarily generalize to combat? Raising such a question does not devalue social science research but instead raises healthy skepticism about the application of research findings from one context (peacetime) to another, profoundly different context (combat)."

"'Is [it] scientifically appropriate to assume that the extensive work done in peaceful settings will necessarily generalize to combat? Raising such a question does not devalue social science research but instead raises healthy skepticism about the application of research findings from one context (peacetime) to another, profoundly different context (combat).'"

"Empirical work relevant to combat should ideally be conducted in situ, under circumstances where death must be actively avoided. Leadership researchers have referred to such situations with a unique term: *in extremis*, or 'at the point of death.' Soldiers, law-enforcement personnel, mountain-climbing guides, firemen, and extreme-sport coaches live and work in in extremis settings—circumstances where outcomes mean more than mere success or failure at task performance but instead, involve life or death."

Misunderstandings versus Different Levels of Analysis

A concern for leaders in an HRO is an undue emphasis on the normative stance at the expense of the pragmatic stance (6, 7). This emphasis impairs the "organizing" component of HRO and can remain covert in an untested system. HRO, conventional organization management, and all reliability, safety, and resilience programs perform well in stable environments. What differentiates HRO from other programs is its origins within dangerous contexts, the capability to modulate abrupt disruptions, horizontal translation between industries, vertical translation within an organization, and, most significantly, the ability to extend an organization into uncertain or treacherous environments.

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We can learn from industries operating in dangerous environments but not through studies conducted in a controlled laboratory (8, 9). Laboratory research constrains the ability of the subject to respond, which does not represent the actual world environment. Neither can a researcher mimic a live-or-die circumstance (8). Field research incorporates the heterogeneity of populations and practices, group expertise, and the spaces and concepts created by science (10). Field experience identifies gaps between theory and practice (11), the effect of granular, local influences, manifestations of stress and fear, and the local effects of threats (6).

"Predicting what would happen to the first human beings to climb that high [27,000 feet] was therefore literally a matter of life or death—here inaccurate models could kill" (9). The gap between a protected study environment and a dangerous field environment appears minor to those in the protected environment. Today, efforts to reproduce the sensation of existential threat are unethical.

While the above interchange comes from differences in belief systems, we also saw this in mountaineering when scientists in the first half of the 20th century applied the physiology of high-altitude ballooning to that of high-altitude mountain climbing (12). Information supporting sudden collapse at high altitudes came from aviation tests in pressure chambers (9, 13, 14). In 1862, a meteorologist and his assistant reached 26,000 feet and became paralyzed, unable to release the gas valve. The assistant finally reached the valve with his mouth, and they descended but not until after reaching 30,000 feet. The second incident in 1875 led to the deaths of two passengers. The scientist survived. That balloon also reached 30,000 feet.

High-altitude mountain climbers knew the stories, but the stories belonged to the scientists, not the climbers. The climbers' empirical experience differed from the scientists' empirical studies. Mount Everest climbers had acclimatized without oxygen, attained the exact altitudes as the balloonists, and could still climb without oxygen (15). Somervell (16) described an accident with the oxygen apparatus: the climber did not become immediately unconscious. The apparatus was then disconnected and repaired. The scientists had warned that they could not reach such heights without oxygen, but the climber stayed conscious despite the sudden loss of oxygen.

This is not an esoteric discussion. Behaviors and skills developed in dangerous contexts do translate well to stable environments. *The reverse does not happen*. The difficulty is the mistranslation by people whose knowledge is limited to that by description. The significant difficulty is describing the experience at the granular level in a way that outsiders can understand and appreciate.

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Bertrand Russell (2) addressed this as the difference between knowledge by acquaintance and knowledge by description. We are acquainted with an object when we "have a direct cognitive relation to that object," that is, direct awareness of it. We know an "object answering to a definite description, though we are not acquainted with any such object." "An object is 'known by description' when we know that it is 'the so-and-so,'" i.e., when we know that there is one object, and no more, having a certain property, and it will generally be implied that we do not know the same object by [an] acquaintance."

One function of our HRO series in Neonatology Today is to improve the description of the HRO environment and the nature of the cognition necessary to engage the problem within that environment.

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Our Emotional Response

When instability and danger become existential threats, the threat is expected to elicit phenotypic survival behaviors. As adaptations are shaped by selection for survival utility, fear responses escalate as a function of proximity to danger (17). Stefan Bracha's (18) "Neuroevolutionary Time-depth Principle" "takes into account factors such as the relative role of natural disasters and non-conspecific anthropophagic predators, versus the role of human conspecific (thus mostly non-anthropophagic) predators in driving selection of fear-circuitry-related allele variants (and possibly of relevant gene dosages) in the human genome."

We can, therefore, conclude that the emergency survival behaviors we observe and experience are common to all humans. This also means the practical survival and adaptive behaviors observed in members of an HRO are also available for all people.

Human stress, fear, and threat responses drive safe and effective engagement of environmental threats. The *executive functions* integrate, from opposite ends of the brain, perception, hastily created plans and motor activity. During a crisis, the hypothalamic-pituitary-adrenal (HPA) axis enables survival behaviors by releasing cortisol to "disarm" the executive functions. Novelty, uncertainty, and uncontrollability in executive functions cause stress responses. Fear reactions at the subcortical level maintain a safe distance from threat. Threat reflexes rapidly initiate protective behaviors. However, these same responses, when unmodulated, can harm the individual, distorting thinking as *situational cognitive distortions*. The prevalence of unmodulated stress and fear makes them appear unpreventable if not expected. This is the inherent vice of stress and fear. By describing their function and location in the brain, we can identify these behaviors to begin modulation for effective responses to threats (19).

The authors never heard shouted anger during an incident in their respective fields. Nevertheless, the first trauma resuscitation witnessed by one of the authors (DvS) not only had yelling but later ridicule by one service toward another. One of the authors (DvS) observed negative behavior toward colleagues in healthcare from early experience in 1982 through this current year of publication, 2024.

One of the authors (DvS) served on a Los Angeles City Fire Rescue Ambulance (RA) in the 1970s. During this period, he worked in teams of two without firefighters (unless they were called) or police (except for shootings) and no radio communication once they left their rig. They received training for responses to an assault, *“Novelty, uncertainty, and uncontrollability in executive functions cause stress responses. Fear reactions at the subcortical level maintain a safe distance from threat. Threat reflexes rapidly initiate protective behaviors. However, these same responses, when unmodulated, can harm the individual, distorting thinking as situational cognitive distortions. The prevalence of unmodulated stress and fear makes them appear unpreventable if not expected.”*

“Rescue 66, take an assault with assailant on scene.” The medics knew they would likely arrive on the scene 5-10 minutes before the police.

- A husband did not like the medical treatment for his dying wife. He jumped up to get a gun, telling the medics, “Then I’ll make you do it.” Everyone in the room ran out, telling the medics where he kept his gun. After ensuring everyone left, including his partner, the author looked at the husband, his face – anguish made physical, “Let me help her.” The husband said, “OK.” She survived, awakening *en route* to the hospital. The husband hugged the author.
- An angry crowd vigorously attacked the driver in a car accident. He had an angulated, clearly fractured femur. Without time for a police or fire response, the medics extricated the victim amidst the violence, placed him on the RA gurney, laid their bodies across the patient for his protection, and moved to the RA. The crowd punched the medics, not the patient. As they drove away, a man held on to the RA door, punching the author in the head.
- Unless the medics were in an active fight, once they left the RA, they did not return until they had resolved the problem. This required calming a crowd as they approached and leaving with the crowd having good relations. Developing good relations as they gathered information and began treatment was the norm. Leaving an angry crowd endangered any RA team responding to a later incident. Again, the medics had to approach calmly and leave with calm bystanders.

Despite internalizing these characteristics, the author found that supervisors believed the author would cause trouble with patients, families, and staff. This reflects the experience of Kolditz described above: time as a dimension, and greater context granularity impede translation experiences in dangerous contexts. This leads to the mistranslation of knowledge by an acquaintance to knowledge by experience, making it difficult for outsiders to learn.

Time Preference:

Within the environment, time is present through red noise forcing functions, pink noised abrupt catastrophes, feedback loops with the environment, and local self-organizing systems. The greater the presence of time, the more likely interruptions will change the local context—each change representing a change in available information.

We would benefit from a broader view of the environment to identify and obtain this information. With each interruption, we renew our sensemaking. In an actively changing environment, sensemaking becomes the “ongoing attempt to reconcile the continuity of experience with the discontinuity of understanding” (25).

Each interaction produces information; thus, the more we probe, the greater the information we obtain. Multitasking and task shifting increase our ability to garner information in highly contextual environments. As well, we welcome interruptions because we recognize interruptions represent changes.

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Edward T. Hall (20), an American anthropologist, developed the concept of high and low context to describe cultures by the degree they find necessary information within the environment. “High context” cultures are those cultures where the environment, or context, contains necessary information. High-context cultures depend on local information or identify information from the environment.

The cultures also have different preferences for how they orient themselves toward time, perceive time, and allot time. “Polychronic time” is preferred by “high context” cultures, while “monochronic time” is preferred by those in “low context” cultures where environmental context carries less information (21)

A polychronic time system takes a broader view of time because time is not seen as a tangible resource. There is little pressure to complete tasks within a time block. A monochronic time system treats time as a commodity. Time preference is about *how* people allocate time to tasks rather than how quickly those tasks are done (22).

Multitasking in a polychronic time system differs from the standard concept of a person performing two or more tasks simultaneously. The individual readily integrates different activities, working on several tasks by (1) multitasking and (2) task-switching.

- Multitasking divides focus among many tasks, using very short periods, if not instantaneously. This is not simultaneously or at the same time.
- Task-switching is to shift attention or move back and forth between tasks within the same time block.
- Granularity refers to the length of time units used and the level of detail.

People who use monochronic time tend to focus on one thing at a time with a commitment to schedules and promptness. They do not like interruptions in their work. Individuals working in polychronic time are more receptive to interruptions, often change plans easily, and will feel comfortable doing many things simultaneously (23).

Monochronic time is linear, tangible, and divided into blocks of time, much like an economic approach. A monochronic time system operates one at a time, segmenting time into precise, small units. Time is scheduled, arranged, and managed. Monochronic time emphasizes planning and the establishment of schedules (24).

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The characteristics of polychronic systems contain elements of HRO: vigilance for interruptions and multitasking. Polychronic traits support sensemaking and can be lifesaving. Karl Weick found, "A thread among many discussions of sensemaking is that the process boils down to managing interruptions and recoveries, discontinuity and continuity, differences and sameness across situations." Sensemaking is an ongoing attempt to reconcile the continuity of experience with the discontinuity of understanding (25).

> "One of the more heart-breaking moments of the Mary Pang fire was an incident with a rookie firefighter who was part of the hose crew working above the second-floor fire. The rookie's fire helmet fell off, and when he leaned down to pick it up, he felt how hot the concrete floor was. He said to himself, but to no one else, 'I have to remember to ask my Captain when we get back to the station why concrete gets hot. I didn't know that it did.' We now know that fire was burning under them. And in one sense, the rookie knew this. But in another, he did not know what to make of the strange clue, and he did not ask immediately what the strange clue meant. This points to one of the most crucial aspects of sensemaking: we need other people to do it successfully.
>
> The IC [Incident Commander] thought he was sending firefighters in on the bottom floor of a one-story building. He was sending them in on the second floor of a two-story building. The first floor beneath them was completely engulfed with fire. The fire burned out supports in a wall that was holding up the second floor, the second floor collapsed, and four firefighters fell into the first-floor inferno and lost their lives," Karl Weick (26).

Epistemology:

For scientific research, we follow scientific rationality, decontextualize the problem, use a white noise-controlled environment, and then use the Gaussian curve for statistical analysis. This is an information-sensitive process. That is, increasing information reduces variance. This gives us evidence-based medicine.

The effect of time through feedback loops and auto-correlation creates red noise. Elements are *not* independent, and numerous, mutual, or reciprocal relations exist. Data *increases* variance, forming a power law distribution rather than the Gaussian distribution. A pink noise frequency provides no well-defined, long-term mean or well-defined value at a single point. Data *continuously increases* variance.

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Physicians also resist medical care learned from the field that can help make healthcare more effective and efficient. Several experiences from one of the authors (DvS) are:

Oral fluids for respiratory secretions. In 1974, a pediatrician at Children's Hospital of Los Angeles advised fire RA medics that low humidity contributed to pediatric asthma deaths. This humidity is more common in summer. He recommended giving the patient a glass of cold water to drink. The author used oral fluids several times after a patient failed to respond to bronchodilators. The improvement obviated the need for transport in each patient. In an arid environment, enteric fluids prevent "airway clearance impairment" pneumonia and markedly lessen the severity of bronchospasm. His patients do not need mucolytics and mechanical devices for secretion mobilization (27). Despite almost 50 years of experience supported by the recent science of mucin rheology, physicians remain opposed to this intervention.

Shortly after arriving to [the] PICU, [patient] demonstrated difficulty clearing her thick secretions, and her O_2 saturations dropped to the 40s. She was hand-ventilated and then required intubation for respiratory failure. [From a recent admission history to the Pediatric Intensive Care Unit.] In the pediatric subacute facilities, these children respond to fluids and are not transferred to the PICU (27).

Mask ventilation for a breathing patient. The author administered mouth-to-mouth resuscitation to an infant, adolescent, and adult out of the hospital. He also observed mouth-to-mouth resuscitation given by lifeguards and bystanders—no patient ever vomited from mouth-to-mouth resuscitation. Vomiting only occurred after commencing bag-valve-mask ventilation (BVM). This influenced the author's method of teaching BVM and mechanical ventilator adjustment to provide comfort for patients receiving home mechanical ventilation (28–30). EMS medics show no interest in this method. Physicians react quite strongly, if not passionately, against this approach. None of the physicians had information about administered mouth-to-mouth resuscitation to a patient. Special groups in SOCOM and the Special Forces of six NATO armies rely on this method.

Agitation, fear-escape, and anger-aggression. In the 1970s, during one author's fire RA tenure serving in South Los Angeles, phencyclidine (PCP, angel dust) had become an epidemic. In Los Angeles County, PCP-positive samples increased from 36 to 145 for the same two-month period from 1975 to 1976 (31). LA Fire Department RAs continued the same response with two medics on the RA without fire or law enforcement assistance. The number of "officer needs help" calls to assist the rescue increased from occasional to 2–3 requests per rescue per day. Within about six months, the RA crews dramatically reduced requests for police support.

Through shared experience, the medics built on their experience with patients showing agitation, fear-escape, or aggressive assault. The medics used all their methods while amplifying their actions. They turned all lights off, asked people to leave the area, and made it quiet. Then, they restrained the patient loosely as they routinely did for agitated patients, wrapping the patient loosely in a hospital bed sheet.

What made this remarkable was the effect of phencyclidine on the patient in the antemortem behavior as described by the LA County Coroner (32): "aggressive and threatening behavior, diminished fear, disorientation, and confusion. Since PCP is an analgesic as well as an anesthetic, a user can exert seemingly incredible strength, be harmed, and not know he has been hurt."

The author continues to effectively use this approach for behavior problems in children with neurological deficits from chronic conditions and infants. He teaches the parents and staff the difference between agitation, fear-escape, and anger aggression: how to respond to each, their causes, appearance, and prevention of escalation from agitation to anger aggression. In this manner, the author distinguishes between reversible and more syndromic behaviors. Parents quickly learn these methods. Bedside staff who have observed this also adopt it. Physicians and EMS medics have shown no interest.

Movies and television impede the incorporation of HRO methods into organizations. In 1975, one of the authors (DvS) noticed that family and bystanders on the scene had begun to act differently when medics arrived. They provided less information and had to be spoken to specifically. They stood back, not participating in care or moving the patient. Rather than ask about the patient's condition, they asked about the medical equipment. RA medics advised the author to watch the television show *Emergency!*

After watching a few shows, it became easy to identify those who watched *Emergency!* In medical school, people, particularly men, tended toward some form of intimidation. As film writing and storylines changed, intimidation and physical action replaced observation and thought. This remains a problem.

"Movies and television impede the incorporation of HRO methods into organizations."

Looking back at the criticism of the US Army study on social and task cohesion, we find another twist. The criticism uses "Hollywood depictions of war" for support, specifically, the Internet's "Movie Cliches List*."* The authors support their criticism further, referring to the "boys-becoming-men-together" and the male bonding clichés—"breaking boundaries, going outside the law to effect moral order as personal loyalty."

One of the authors included the effect of movies on people's behavior in healthcare. One medical student took it to heart. He reported back after a year that if he could identify which movies the resident watched, he would know how the resident would act.

An adolescent was newly admitted to a subacute care facility and dependent on mechanical ventilation. He began to struggle, crying for his father. One of the authors (DvS) entered the room and began hand-ventilating the patient. An RCP followed, shouting to the patient, "Calm Down! Just Calm Down!" The author looked at the RCP and asked if that had ever worked. "No." "Then why do you say it?" queried the author. This patient had been on antipsychotic medication under the care of a psychiatrist for depression and such outbursts. Then, this happened again. A different RCP was in attendance. As the author and RCP entered the room, the patient said he could not breathe while again crying for his father. After hand-ventilated calmed him and re-adjusted the ventilator, he stated he was fine and did not need his father. The difference in response is most likely between movie experience and actual experience.

Theory and Practice

Operators in the field develop their logic of practice built upon contextual relations entwined with people and work (33). For Zundel and Kokkalis (11), the absence of practice within theory is how theoreticians see theory-making as themes in terms of a priori scientific assumptions, the *scientific subject domain*. The theory would move into the practical world by including engagement of practice, closing the gap between theory and practice to create the *practical engagement domain*. The significance of engagement in practice derives from the attitudes taught to military and public safety rookies—always engage in some way, even if to evacuate the area.

A practical domain of engagement illuminates the study of the problems of transferring academic work to organizational practice. A practical domain, as a pragmatic stance, recognizes the overlapping and loose coupling of concepts necessary to complete a task. The practical domain of engagement (as acts of learning by doing in context and being aware of consequences) is not an outcome of rational deliberation and cannot be objectified for theory-making (11).

Engaged action comes from insight and immediate feedback, with negative feedback marking the safe boundary of performance and positive feedback generating growth. All feedback generates information. "Mistakes" indicate a change in circumstances (34) or interference from the environment (35).

> "HRO, as an abstract representation of work done out there, a representation by academics, is the very object that has been turned into a normative frame, a frame you want to replace with a more pragmatic frame." Personal communication from Karl Weick

The gap between theory and practice can be closed by informed practice, that is, by understanding theory and scientific rationality to support practice rather than guide practice. Engaging situations in context bridges the gap by using theory to improve care for practical outcomes (11).

"Engaged action comes from insight and immediate feedback, with negative feedback marking the safe boundary of performance and positive feedback generating growth. All feedback generates information. 'Mistakes' indicate a change in circumstances or interference from the environment."

Logic and Reasoning:

The scientific method uses classical logic closely related to the study of *correct reasoning,* making this the presumptive correct logic for science (36). However, as noted in the vignettes above, our experience belies classical logic as correct reasoning. Classical logic can impair the extension of a discipline.

> At the beginning of the author's (DvS) experience with long-term ventilation, he followed the goal of weaning the child from the ventilator following blood gas evaluation for O_2 and CO_2. One day, a child's grandmother beseeched an LVN to ask if the doctor could leave her grandson on the ventilator. She liked that he smiled, and he had never smiled before. The difference in ventilator management by blood gas versus smile created logical inconsistency with staff from various PICUs. The child's affective response contradicted scientific rationality and logic, along with standard respiratory care references that mechanical ventilation was difficult for a patient to tolerate.

Logical pluralism reflects the possibility that other logic can offer solutions (37). Given the same premises but with different interpretations of "valid," nonclassical logical operators can lead to different logical consequences. What one system captures as valid differs from what the other system captures.

Induction and deduction

Logic supports empirical science. Empirical science develops by evidence from the senses or builds from experience. Logical inference extends evidence in knowledge creation while distinguishing truth from falsity. The ability to prove or disprove the properties of knowledge is fundamental in our use of knowledge. This lies at the heart of inductive and deductive reasoning and influences the selection of formalized logic systems.

Inductivism and inductive reasoning build knowledge from observation, but knowledge is not truth in inductivism. Conclusions from inductive reasoning are plausible rather than having the certainty of truth we see with deductive reasoning. The strength of inductive reasoning comes from the relentless pressure to confirm the plausible conclusion, described by Leonhard Euler (38) in George Pólya (39):

> "[Observations] will lead us continually to new properties which we shall endeavor to prove afterwards. The kind of knowledge which is supported only by observations and is not yet proved must be carefully distinguished from the truth; it is gained by induction, as we usually say…Indeed, we should use such a discovery as an opportunity to investigate more than exactly the properties discovered and to prove or disprove them; in both cases, we may learn something useful."

"Inductivism and inductive reasoning build knowledge from observation, but knowledge is not truth in inductivism. Conclusions from inductive reasoning are plausible rather than having the certainty of truth we see with deductive reasoning. The strength of inductive reasoning comes from the relentless pressure to confirm the plausible conclusion."

Conclusion:

Time has a dimension. There is something more that corrupts understanding of HRO than a pragmatic versus normative stance or a gap between theory and practice. While it is easy to blame movies and television, something more fundamental is present: the incorporation of time as a distinct dimension into a relativity space.

What the criticisms of operators have in common is a frame of reference that has no time dimension. It is not hard to add the dimension of time. We list that in this article and will develop it in subsequent articles. Reviewing the differences in environment, fear-stress-amygdala, and cognition, we find the fallacy of conforming HRO into Newtonian science and Euclidean space.

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