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The Counterintuitive Characteristics of High-Reliability Organizing (HRO): Infrastructures Impair the Implementation of HRO

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Abstract:

Becoming reliable and safe appears straightforward: identify effective traits from high-reliability organizations (HROs) in hazardous environments and adopt them in other contexts. However, adopting HRO principles in less hazardous environments has been limited and often misunderstood. Decades of research and attempts to incorporate HRO practices have not consistently achieved their intended outcomes. This paper, drawing on the extensive experience of its authors, explores the counterintuitive nature of HROs, mainly focusing on the concept of organizational infrastructure.

Typically seen as physical structures, organizational infrastructure can be better understood as relational and context dependent. Infrastructure in HROs supports agency and individual action, fostering an environment where reliability and safety are continuously enhanced through practical engagement and adaptability. Key elements making HRO infrastructure counterintuitive include relational hierarchies, standards, adherence to objective frameworks, information flow, enactment, and improvisation.

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Effective HRO infrastructure is not merely about rigid hierarchies and objective standards but involves adaptive, subjective frameworks that facilitate continuous learning and responsive actions. This infrastructure enables organizations to operate reliably in dynamic and uncertain environments by emphasizing vigilance, communication, and the ability to interpret and respond to emerging threats. The paper elaborates on how these elements contribute to the unique operational dynamics of HROs and the challenges of translating these principles to other organizational contexts.

Introduction:

Becoming reliable and safe – it appears straightforward. Identify organizations having effective operations in a hazardous environment, characterize the traits contributing to that effectiveness, and then another organization adopts those traits. For organizations that operate in markedly less hazardous environments, have any effectively incorporated the characteristics of HRO?

The borrowing of HRO by organizations appears to have been restricted, mainly from the normative frame for preventing system failure. The more salient and relevant principles of HRO seem less visible and often go unnoticed (1). Several decades of research and widespread attempts to incorporate HRO have not meaningfully or consequentially helped organizations reach the promise of HRO.

Outside observers often lack an understanding of extending operations in hazardous situations. Effective HRO characteristics do not agree with what is known; they do not seem right or natural. It may be that such characteristics of HROs appear irresponsible or unsafe to those unfamiliar with hazardous operations. The consequence is mistranslated concepts and misunderstood mechanisms of HRO (1, 2). It seems counterintuitive that we can extend operations solely from the capabilities of individuals using local, immediately available resources. Even more counterintuitive is an organization designed from within that drives individuals to act.

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For several decades, the three authors have applied HRO to various domains, observed organizations implement HRO, and coached many who sought to understand HRO. Some organizations succeeded, some failed, and some implemented mistranslations of HRO. Two of the authors had experience

implementing HRO before its codification:

> Thomas Mercer, RAdm (retired), implemented what came to be called HRO while he was Captain of the USS Carl Vinson. He invited the Berkeley Group to evaluate the performance of his crew. They published their findings, describing the Vinson as "The Self-Designing High-Reliability Organization" (3).
>
> Daved van Stralen, MD, FAAP, worked with Ronal M. Perkin, MD, FCCM, FAAP, to create a PICU, drawing nursing staff from the children's hospital wards. When Karlene Roberts (4) described the PICU as starting with HRO, the editor pointed out that the PICU operated as an HRO before its codification (Karlene Roberts, personal communication).

From practical experience, reflected practice, and extensive discussions with people who sought to understand or implement HRO, we have identified three domains that make HRO counterintuitive: Organizational Infrastructure, Normative Epistemology, and Linear Reasoning. This paper elaborates on *Organizational Infrastructure* as the most substantial influence on making HRO counterintuitive. HRO infrastructure may be a significant determinant in creating the discontinuity between HRO and other organizational methods in management science (5).

Infrastructure:

The common idea of infrastructure is a physical' thing,' a passive physical substrate in the background of how we use the thing. For example, surface transportation infrastructure includes roadways, highways, and railways that serve as a background for moving materials and people around the country. Rather than a physical substrate, we can view infrastructure as a topology of relations between access to places, support for travelers, safety, and so forth. When viewed as relations, infrastructure builds a community. Each mode of transportation occurs in specific contexts and for specific purposes. However, one person's infrastructure can become another barrier (6).

When we view the highway as infrastructure in this manner, we begin to recognize and analyze new, emergent properties. Infrastructure as relations creates multiple levels of analysis. In the highway model, a road is analyzed differently by highway construction architects and designers, safety engineers, law enforcement, travelers, farmers and ranchers, and the transportation industry. This is true of every system and organization, and we benefit from different levels of analysis. What can be missed from the non-HRO frame is that "Failure to identify levels of analysis ... can create false debates" Scott A. MacDougall-Shackleton (7).

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An organization's infrastructure design favors the top-down approach readily developed from an outside view. This works well for organizations operating in a stable white noise environment [See Table 1]. For the HRO, the infrastructure forms partially from the outside view in its reliance on codifying a framework of guiding principles. However, when practical engagement dominates, reliability is more assured, and practice adjusts to circumstances'

Table 1. Patterns and Characteristics of Noise (7)

Color	Structure	Variance	Distribution
White	No frequencies dominate. Flattened spectrum. Spectral density has equal amounts of all frequencies	Data *decreases* variance Forms Gaussian curve	Gaussian distribution Elements fully independent No autocorrelation
Red	Low frequencies dominate. Long-period cycles	Data *increases* variance Forms power distribution	Power law distribution Elements *not* independent Mutual / reciprocal relations
Pink	The midpoint of red noise The slope is precisely midway between white and brown (random) noise.	Data *continuously increases* variance. Distinguishes pink noise from reddened spectra	Power law distribution No well-defined long-term mean No well-defined value at a single point

flux (1). The organization's infrastructure, to a degree, decides who 'owns' a problem. The "attribution of problem ownership significantly affects individuals' ability to get the help they need (6).

Organizational Infrastructure:

More commonly identified as shared physical structures for the operations of organizations and society, infrastructures may better be understood by how society uses the infrastructure. This "inverted" approach demonstrates how infrastructure emerges for people in practice and is connected to activities and structures. The organization uses infrastructure as a set of techniques and classification systems to apply science, technology, and problem-solving to connect people with activities and structures. Infrastructure is the invisible glue that holds the system together (9).

"More commonly, people consider infrastructure a passive background substrate that is rationalistic, mechanistic, and about artifacts. Because a well-operating infrastructure guides operations yet is invisible, we do not recognize how infrastructure creates our real-world domain."

Infrastructure connects domains, facilitates operations in a complex environment, and supports knowledge work. In this way, we can integrate into the environment; we have context. What emerges is an open and integrative system (6, 10). We use infrastructure to operate in the actual world.

More commonly, people consider infrastructure a passive background substrate that is rationalistic, mechanistic, and about artifacts. Because a well-operating infrastructure guides operations yet is invisible (6), we do not recognize how infrastructure creates our real-world domain. We overlook the limitations of understanding large-scale systems or other parallel and interacting infrastructures. A change in context, such as a forcing function or abrupt change, can make visible conflicting, competing, or obstructive infrastructures (10-12)

Susan Leigh Star and Karen Ruhleder described the properties of infrastructure: "embedded; transparent; having reach or scope; is learned as part of membership; has links with conventions of practice; embodies standards; is built on an installed base (and its inertia); becomes visible upon breakdown; and is fixed in modular increments, not centrally or from an overview" (6).

Karl Weick describes HRO infrastructure as enabling enactment – "to actively connect individual/actor to ambiguous situations by how actor interprets the situation." Enactment is "collective in spirit but tends to be individualistic in execution." For the HRO, infrastructure supports agency and action by the individual (13). HRO leaders create contexts, making it safe for others to speak up, act, and seek to improve reliability and safety (14).

The infrastructure for an HRO seems counterintuitive for maintaining control over operations. However, because it is relational and responsive to context, infrastructure can emerge from human interactions at a different, less visible level.

Elements of *organizational infrastructure* that make HRO seem counterintuitive include:

- Relations and hierarchy
- Standards
- Adherence to objective frameworks
- Information flow
- Enactment
- Improvisation

Relations and Hierarchy:

Infrastructure is relational between individuals and between organized practices and actions. "Analytically, infrastructure appears only as a relational property, not as a thing stripped of use" (6). Hierarchies are structured relations of authority constructed as an Euclidean frame with points connected by lines of authority.

Bureaucracies use hierarchy as an infrastructure to hold together people, operations, and systems. These hierarchies can become naturalized in other domains to become standards of practice and infrastructure. When we encounter similar hierarchies in diverse domains, we can readily believe in the power of these infrastructures and that these structures are standard structures. Dissent against the hierarchy or infrastructure becomes suppressed (15).

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We now see how infrastructure binds members of the organization into a hierarchy of superiors and subordinates, creating the relations of subordination and dependence. Organizations with a bureaucratic infrastructure, more common in stable environments, use infrastructural relations for control and privileging of authority, impersonal relations, and privileging of objectivity over subjectivity. Infrastructure also tacitly directs member interaction (16-19).

Social order shapes and is shaped by infrastructure. In every organization, there is social interaction between supervisors and line staff. The social interactions that inform infrastructure are not of social niceties or "leader-follower." Instead, the interactions are predicated on concrete situational details known to line staff and schema-driven knowledge from supervisors (1, 20, 21).

In the non-HRO, infrastructure too readily privileges objectivity and the values of obedience and conformity (2, 22). Bureaucratic

control supports objectivity with reciprocal support from objectivity to explain the benefits of bureaucracy and rigid hierarchy. Centralized decision-making infantilizes the decision processes of subordinates, further supporting objectivity, bureaucracy, and rigid hierarchy (19).

HRO infrastructure maintains continuous vigilance of process discrepancies and disruptions that herald early system failure. Such vigilance necessitates observation and communication, but the acceptance of unwanted or disconfirming information is more significant. The non-HRO's infrastructure, which has low trust, impedes the flow of information until it reaches a degree that it cannot be suppressed (18, 23-25). Sustaining this on an organization-wide basis involves an infrastructure with more open and fluid relations, enabling the organization's independent reliability and safety operations (enactments) (14).

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Standards

Infrastructure *creates* standards described above and *relies on* standards – even in extreme circumstances. The authors conducted after-action interviews of fire and EMS responders to a terrorist shooting (26). The interviewees initially reflected on the "standardized" dominant account, such as using a specific triage scoring system. We ensured each interview team had one member with extensive experience in live-or-die situations. The experienced interviewer identified that the dominant "infrastructural" account was often impractical. The interviewer would then query more closely, discovering a second "standard" infrastructure, particularly for triage, shared across line workers in EMS, fire, and police. "Description is essential for sensemaking and organizing, but acquaintance is critical for perceiving details and cues that begin to clarify ambiguity" Karl Weick (20).

We structure information using standards. The standards we use and how we use them become the infrastructure of our practice. In this way, standards influence behaviors. When naturalized across domains, these standards can control behavior across infrastructures (27, 28).

Organizations also control behaviors and performance through work audits. For this, managers in an organization select metrics and methods that interpret the data collected. Agencies also collect data from the organization for various purposes, including regulation, finance, and certification. The infrastructural use of this information makes some behaviors and aspects of work more visible and others less visible. In this way, the infrastructure and its influence on behaviors remains unchallenged (15).

Different infrastructural regimens view events and name the elements and processes differently (11), such as mortality and disaster survivability (29). Government agencies focus on survivability and reducing death *after* the event. Survivability describes the effect of the environment on mortality as comorbidity or impeding connecting necessary medical care to the victim (30). Medical care focuses on reducing mortality and death *due to disease*.

Technology and cultural artifacts influence naming, categories, and standards. Problem-solving is an example. Herbert Simon and Allen Newell (31) identified ill-structured and well-structured problems as having distinct methods to reach a solution. A well-structured problem has clear goals and processes for solutions. Such problems are readily solved in a series of steps, a process Simon and Newell termed an "algorithm." An ill-structured problem is a problem without a clear goal and is unclear as to what the problem-solver can do.

Because ill-structured problems do not have a clear goal, algorithms are unavailable. People have limited time and knowledge, yet they must learn while problem-solving, the process they call "heuristics." People must make inferences from the available information, contingently ignoring part of it while using partially relevant information when they do not know which part is relevant (32, 33). This 'heuristic search' is to learn and make discoveries during the process, producing a more accurate search within a complex environment (34).

"The 'sensed' situation, or the situation used for management, will not exist for later review. Only the "monitored" situation will; that is, the situation that can be described to others, used for documentation, and learned from. No two situations are identical. The actual world drives reality, not perception. Scientists developed models for use in the field. Predictions with inaccurate models and communication with imperfect descriptions will kill."

Simon and Newell (31) used the term "algorithm" for decision-making in Artificial Intelligence. They used well-structured and ill-structured problems to differentiate human thinking from Artificial Intelligence (computer thinking). Computers and humans could solve well-structured problems. For ill-structured problems, humans used heuristics which computers could not use.

Artificial intelligence worked to make computers operate like human thinking. From this research, the field of cognitive psychology developed (35). Computers became a metaphor for cognitive scientists to understand human thinking (36), using easily understood algorithms as thinking models. As a result, algorithms are the method often proffered to work with complex situations and a large amount of information for decisions. The effectiveness of heuristics is now considered counterintuitive.

For tractability, superiors in the hierarchy will convert an ill-structured problem to a well-structured problem through linearization of the curve or de-contextualization. The system then becomes susceptible to errors from the frame problem, "what does or does not change after an action" (59). The well-structured

problem is amenable to rules, protocols, decision trees, and algorithms, forming a hierarchy for decisions and who decides. The danger is loss of information and context, with the operator becoming a spectator (50, 60), unable to interact in real-time with the environment. Methods to solve the ill-structured problem become counterintuitive to leaders.

Definitions come up short in the turmoil of the liminal space. Descriptions of how something is used, an action performed, or a situation experienced all carry meaning. Actions support knowledge during the discovery of what works and what does not. This forms a continuous reciprocal cycle generating Shannon information and requisite knowledge. Each step creates a "different" situation. The "sensed" situation, or the situation used for management, will not exist for later review. Only the "monitored" situation will; that is, the situation that can be described to others, used for documentation, and learned from. No two situations are identical. The actual world drives reality, not perception. Scientists developed models for use in the field. Predictions with inaccurate models and communication with imperfect descriptions will kill (37).

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Objective Framework

It makes sense to adhere to an objective framework for an infrastructure. Faithful to facts, objectivity more correctly describes the world. Value-free objectivity is strengthened by rationality and reason (38). Because objectivity is independent of contextuality and individual perspectives, it can better support standardization and reproducibility. The absence of personal bias facilitates communication and translation of information to other areas. Finally, objectivity supports metrics and measurability—objectivity makes experiences quantifiable.

It is difficult to develop standards and maintain a stable hierarchy when the context of operations is in flux. Maintaining control from a central frame is more difficult when context drives behaviors and operations. Karl Weick (39) describes "the gap between discrete concepts and continuous perceptions." Susan Leigh Star (15) describes the "mismatch between classifications and standards on the one hand, and the contingencies of practice on the other" when "local circumstances of their activities do not match the prescribed categories or standards." HROs direct their members' attention to "failures, simplifications, operations, resilience, and expertise," a " partial infrastructure" supporting operations (39).

Weick and Star describe it as not a rigidly objective infrastructure but an adaptive infrastructure incorporating subjective characteristics. However, as described above, non-HRO infrastructures privilege objectivity and the values of obedience and conformity (2, 22). Bureaucratic control supports objectivity by reciprocating support from objectivity, which explains the benefits of bureaucracy and rigid hierarchy (19).

HROs will develop the cognitive infrastructure that enables adaptive learning and reliable performance (40), processes dependent on subjectivity to adapt to environmental flux. HRO infrastructure makes impermanence, the ability to adapt, possible through an infrastructure based on subjectivity rapidly: 'faith' 'guesses' 'unknowable' (41).

"The computational perspective favors discrete data for statistical analysis. Increasing data will narrow variance, a characteristic of white noise environments. The HRO, on the other hand, must interpret data and information in an environment where increasing data and information will increase variance. This change in perspective shifts the HRO infrastructure away from an objective framework, described above, to the adaptive, subjective framework."

Information Flow

Just as the highway infrastructure moves vehicles, the organization's infrastructure moves information. Infrastructure is self-organizing, responding to local circumstances. Information is communicated through lexical elements, which are small elements that form the words used to communicate. For example, the face and facial expressions comprise the lexical elements actors use in their art. In dangerous contexts, lexical elements may include eye movement (gaze-signaling made visible by a fully visible sclera (42)), body stance, and hand motions.

We see the lexical elements of body language when we examine children.

> In humans, the eyes have a social function that supports cooperative social interactions (42). One of the authors has used gaze signaling as a paramedic to deter physical aggression and as an intensivist at the bedside for patient care. PICU staff often complained of parents' queries regarding the cardiac monitor numbers. He pointed out that everyone looked at the monitor when entering a patient room, signaling to parents the importance of the monitor. He encouraged staff to look at the child and then touch the child on the leg upon entering the room, signaling the importance of the child.
>
> For children with intellectual disability, watching the face and eyes helps identify if the child hits for attention. The child's face is turned away from the examiner, but eye gaze, identified by the sclera, is directed to the examiner. It is this bidirectional look that helps identify hitting for attention.
>
> The hands can be a threat, making them a focal point for adults who restrain a child or a child's gaze. When a child dysregulates (becomes agitated), the hands and feet draw attention, thereby the target for restraint. Because of leverage,

the child attempts to escape, commonly misinterpreted as aggression, and fights with what some call "superhuman" strength. The author instructs staff to lightly hold above the knee and elbow so that the child touches the adult rather than the adult touching the child.

For children with intellectual disability, the examiner refrains from moving the hands while sitting sufficiently close to allow the child to touch the examiner. When the child touches the examiner with a hand or foot, the examiner can gently take the child's hands for the examination.

HRO operators have a distinct language and lexicon, allowing them to engage the abovementioned situations described by Weick and Star – the gap or mismatch between concepts and a hazard. Actions taken during engagement generate Shannon Information, which is the change from uncertainties to certainties. Claude Shannon's Information Entropy describes how choice, acting to change uncertainty to certainty, creates information (43).

The organization processes this information from a computational versus interpretive perspective (44). Generating Shannon's Information benefits from using heuristics through the nearness of information between the old problem-solution and the new problem (45). Leaders and spectators far from events would view heuristics as fraught with misleading conclusions and errors.

Bayes' Theorem, commonly referred to, should only be used to update *epistemic* or model-parameter uncertainties. These uncertainties occur due to the model's imperfections and are fundamentally 'information sensitive,' increasing information reduces uncertainty (Bob Bea, Professor Emeritus, Civil Engineering, University of California, Berkeley, personal communication).

The uncertainties within forcing functions or abrupt changes are not 'information sensitive," imperfections that we can reduce with Bayes' Theorem. Such uncertainties are inherent to entropy in an open system. Such uncertainties are fundamentally "information insensitive." Information is used less to create a better model than it is to guide actions.

"Improvisation plays off knowledge, experience, and the immediate past responses to actions, incorporating common sense and tacit knowledge. Improvisation as a knowledge-based tactic or strategy for an event transcends rules and experience. Physical actions taken to initiate improvisation initiate thinking and learning by doing. You cannot improvise unless you have taken some action, initiating motor cognition for thinking while acting."

The computational perspective favors discrete data for statistical analysis. Increasing data will narrow variance, a characteristic of white noise environments. The HRO, on the other hand, must interpret data and information, but in an environment where increasing data and information will increase variance (8). This change in perspective shifts the HRO infrastructure away from the objective framework described above to the adaptive, subjective framework (19).

The proud announcement of being "data-driven" works well in the white noise environment of typical organizations. However, data and information can confuse interpretations in red or pink noise environments (46-48). These are the situations where reliability and safety are paramount and when line staff engaged in an incident develop and refine their interpretations.

For the HRO, engagement in the face of ambiguity and uncertainty initiates enactment. From enactment, we have a suitable vocabulary to discuss agency (13). Technology, processes, and relations are woven into our thoughts and work. The resulting infrastructure regimes then influence how we see and name things (11).

Enactment

HROs enact a new environment. HROs not only change the individual and organization but also the environment. The organization must enter an uncertain, ambiguous environment for this to happen. With events in flux, the plan will always be to improvise (30). Enactment rests on the action of individuals who join others in this improvisation.

The HRO infrastructure accurately highlights potential threats, the mechanism of the threat, and possible trajectories of the threat. In vague, uncertain situations, individuals will have information that is incomplete or in pieces. They may not know the salience of their local knowledge, but an infrastructure of description facilitates the rapid transport of information.

"Failure is to quit too soon. Improvising does not respond well to expectations or rigid objectives and goals. Improvisation continues because 'failure is an option.'"

To describe in this manner is to describe with accuracy rather than precision. The informant identifies elements of uncertainty and ambiguity and separates interpretation and persuasion. The latter two are essential, but they are important independently of description. Such an infrastructure uses human elements, which Weick characterizes as 'faith,' 'guesses,' and 'unknowable.' An infrastructure that drives action makes enactment possible (13).

Of significant importance is how individuals interpret their environment. Weick describes enactment as particulars, specifics, and situations. He describes institutions as wholes, narratives, schemas, and generics. "HRO does not simply link enactment to institutions. HRO adopts the embedded act [defined by context] as a foundational structure." "*Enactment is about knowing and learning*" (13).

Improvisation

Improvisation plays off knowledge, experience, and the immediate past responses to actions (49), incorporating common sense and tacit knowledge (33). Improvisation as a knowledge-based tactic or strategy (50) for an event transcends rules and experience (51, 52). Physical actions taken to initiate improvisation initiate thinking and learning by doing. One cannot improvise unless one has taken some action, initiating motor cognition for *thinking while*

acting.

Improvisation is learning by doing, motor cognition, reciprocal decision-making, self-organizing interactions, and acting to think, imparting a flavor of retrospective sensemaking (53, 54). Improvisation is a form of self-organization that involves interacting with the environment and colleagues on a local level. Nevertheless, not all improvisation is appropriate. The order gained through improvisation may benefit some organizations under some conditions and be a liability under other conditions (28).

Improvisation draws on experience, immediately available knowledge, and local information. It is an ongoing exercise that belies the common concept of "error" and "failure" as terminal events. Instead, error marks the boundary of information, knowledge, and performance. Failure is to quit too soon. Improvising does not respond well to expectations or rigid objectives and goals. Improvisation continues because "failure *is* an option."

Improvisation as part of the infrastructure changes the methods for decision-making and initiating action. How individuals interpret their environment will support or impair enactment by the organization and subsequent improvisation. HRO infrastructure, somewhat like slow self-organization, enables individuals to enact through improvisation – *without a plan* (30).

> "Sensemaking implies that key organizational events happen long before people even suspect that there may be some kind of decision they have to make. Decision-making is incidental; sensemaking is paramount. To focus on decision is to miss most of what it means to reduce uncertainty and most of the ways emergent organizing attempts this reduction," Karl Weick (55).

Conclusion

What makes HRO counterintuitive? The discontinuity between the environment and practices of the HRO with organizations operating in stable environments impairs the visibility of what brings effectiveness to the HRO. The proximity of adversity and threats distracts from the affective processes that drive engagement and the cognitive processes that continue reasoning under stress.

We have described some infrastructure elements and how some structures come about. The underlying causes are the common cognitive and affective processes that interfere with engagement and enactment: Motivated reasoning, blind spots, and common sense.

Motivated reasoning is the spontaneous default mechanism for a person to defend their prior attitudes and actively challenge arguments incongruent with their firmly held beliefs. People are unaware of their use of motivated reasoning, which comes from motives to achieve an accurate conclusion or maintain a specific conclusion (56).

A person strongly holds their desired conclusion even if it involves rejecting disconfirming evidence (56-58). Rather than emotion or identity, this is reasoning toward a preferred conclusion, forming impressions, determining beliefs and attitudes, evaluating evidence, and making decisions (56, 59). Analytical sophistication and education do not reduce the presence of motivated reasoning (60).

"*Blind spots*" develop following public commitment to a model or process," a process described by Karl Weick (61). The professed attachment is to scientific "detached objectivity," but this comes at the expense of informed, experienced operators. After administrators publicly commit to a structural system, they will not entertain the possibility that the goal has not been reached. Safety and reliability then become a blind spot in the organization.

Common sense is often incorrectly used to justify a social position or statement (33). Facts that disconfirm a known rule or order are less convincing and less supportive of the rule or order. The individual is less likely to accept explanations and will instead view them as conflicting with current knowledge (62). Contributing to the decreased acceptance is the priority of scientific concepts and models over practical experience (63).

The counterintuitive nature of HRO may derive from the desire to have achieved a goal using a system, but not one created for goal achievement; to have an aspirational identity or image of a completed program, but the program exists because failure is always an option; and to conform to scientific identity, yet operations occur in a mess, fluctuating environment. It is the identity that people, particularly leaders, hold of themselves – as successfully creating a program that does not fail.

> "People are in a complex *reciprocal* relationship with *their environments." "*Organizations enact their own environments." But, by changing the world, "they have then become the authors of their own problems." Karl Weick (44)

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