

High-Reliability Organizing (HRO): Objectivity and the Loss of Subjectivity

Daved van Stralen, MD, FAAP; Sean D. McKay, Element Rescue, LLC; Thomas A. Mercer, RAdm, USN (Retired)

Abstract:

In dangerous work domains, such as firefighting and military aviation, subjective reasoning, adaptability, and social knowledge play crucial roles alongside technical expertise. However, prevailing views often prioritize objectivity over subjectivity, leading to a skewed understanding of effective practices. Drawing on anecdotes from a Los Angeles City Fire Captain and experiences aboard Nimitz class aircraft carriers, this manuscript explores the interplay between subjectivity and objectivity in High-Reliability Organizing (HRO). It argues that objectivity and subjectivity are not opposing forces but complementary aspects essential for navigating complex and dynamic environments. Through examples spanning from WWII bomber crews to modern-day research in combat zones, the manuscript emphasizes the importance of embracing both perspectives to enhance organizational effectiveness and safety. By recognizing the inherent duality of objectivity and subjectivity, this work advocates for a more nuanced approach to HRO that integrates experiential and experimental empiricism, thus fostering a deeper understanding of organizational resilience and adaptability.

Introduction:

Common themes across work domains in dangerous contexts include subjective reasoning, fear suppression, trust, helping the novice, protecting your partner, recognizing fear in fellow workers, and local leadership (1, 2). These themes are not privileged in today's sciences and characterizations of HRO. Instead, credibility derives from an overly masculinized view, if not a caricature, of the priority of objectivity while diminishing the supposed passiveness of subjectivity (3–9).

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A Los Angeles City Fire Captain described his participation in promotion interviews for a mid-western US metropolitan fire department. This was in the mid-1970s. The department had brought him for candidate interviews for promotion to reduce local bias in the promotional process. Because distinct cultural differences exist between West Coast and East Coast fire departments, he did not know their slang or jargon and was unfamiliar with their operations. During the interviews, he identified applicants with formal knowledge and used the proper terms for the department's equipment, policies, and procedures. However, the captain noted that these candidates lacked adequate operational knowledge and the ability to develop adaptive contingent solutions. On the other hand, he found candidates who did not give formal “prope” information but accurately described their operations and demonstrated their adaptability to unexpected contingencies. The distinction is vital to those who work in dangerous contexts.

Some who read this anecdote would emphasize those candidates with higher cognitive abilities and mastery of policies and protocols. Others would emphasize the importance of adaptability and practical problem-solving. The former approach has greater objectivity, while the latter relies on subjective judgments.

Objectivity is independent of contextuality and individual perspectives to provide standardization and easy reproducibility. Faithful to facts, objectivity more correctly describes the world. Value-free objectivity is strengthened by rationality and reason (10). The absence of personal bias facilitates communication and translation of information to other areas. Finally, objectivity supports metrics and measurability—objectivity makes experiences quantifiable.

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During the 1970s, the Los Angeles City Fire Department averaged one to three firefighter line-of-duty deaths yearly. For the fire captain, knowing how to operate and adapt within dangerous contexts had greater importance than mastering technical terms and procedures. Operational capabilities save more lives than mastery of concepts and procedures.

In their probation year, firefighters learned subjective reasoning, understanding how information has value to the individual and its context in space and time. They learned from anecdotes, not the kind dismissed by outsiders, but instead placing rich experience into context. This social knowledge, not easily shared with outsiders, creates a culture that protects its members as it strengthens them. These are a culture's hidden social parts, poorly visible even when directly observed.

We too quickly mistake subjectivity as a loosening of standards to accommodate individual taste, pleasure, and even a person's emotions. As a *preference* in judgment, subjectivity does contain

elements of emotion and feeling, sensations that enhance, rightly or wrongly, a person's sense of intuition. But subjectivity also includes a person's attitudes and values, forming the foundation for decision-making under uncertainty. Subjectivity's strength lies in adapting attitudes and values to a fluctuating environment (11, 12).

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This highlights the instrumental use of objectivity, that is, using objectivity for purposes other than problem-solving. A person may focus on their greater "objectivity," bolstering their perspective against the perspectives the others rather than the substance of their argument. What makes this easy to do is contextual values and disagreement on the strengths of different options (10, 12).

HRO emerged from operations in dangerous contexts. As an identified entity, HRO developed in the Nimitz class aircraft carriers of the Pacific Fleet of the US Navy (below). The nature of the experiences and environment will limit visibility into the liminal operating environment of an HRO. The power of subjectivity is less visible, contributing to the privileging of objectivity when HRO is translated to other domains.

Pacific Fleet Nimitz Class Nuclear Aircraft Carriers:

During the roughly 30-year period from WWII through the Vietnam War, the Pacific Fleet had conducted most of the US Navy's combat operations, making death a part of operations and creating "rules written in blood." The exigencies of combat made it imperative for everyone to identify effective actions and retain what they learned. Safety is vital even during wartime, and accidents are investigated. Safety in combat has an additional function: avoidable operational loss causes unaffordable shortages of men and planes and increases vulnerability to enemy activity. This gives meaning to the adage "Safety through operations and operations through safety."

Early in the Vietnam War, US Navy Aviators engaged Surface-to-Air Missiles (SAM) for the first time. Because their training officers were WWII and Korean War veterans, they had no training for engaging or avoiding SAMs. Some aviators flew low to avoid them and were hit by ground fire. Other aviators flew high, which markedly decreased accuracy, leading to return missions. Effective aviators learned to watch the SAM approach and wait for the radar

to lock on the jet, confirming that the aviator was targeted. Then, the aviator waited to maneuver with the SAM sufficiently close so that the aviator could outmaneuver the missile. This was an interactive combination of objective and subjective characteristics (13, 14).

During this time, nuclear aircraft carriers began joining the fleet. Captains of a US Navy aircraft carrier are nuclear trained and, by act of the US Congress, must be aviators. They now serve a three-year tour in carrier command after a nominal six years of prior qualifying assignments. In addition to the eighteen months of nuclear power and Naval Reactors training, the program includes a two-year tour as the Executive Officer of a nuclear carrier and command of a conventionally powered deep draft vessel. This brought together three independent, otherwise disparate domains within a single individual: 1) aerial warfare experience with initiative, improvisation, and flexibility; 2) nuclear propulsion engineering experience with rigor, detail, and conformity to procedures; and 3) previous aircraft squadron and large ship command of complex operations and organizations in demanding circumstances (13). HRO, as codified by the UC Berkeley HRO (High-Reliability Organizing) Project, emerged from the Nimitz class nuclear aircraft carriers of the US Navy's Pacific Fleet (1, 15).

Nuclear training in engineering and nuclear safety theory gave these Captains a greater appreciation of highly reliable operations and expanded their leadership capabilities. The nuclear propulsion engineers' training and professionalism helped form the basis for increased safety awareness and reliability of operations throughout the carrier and embarked air wing. HRO had emerged on the nuclear aircraft carrier by merging the emergency-type responses of aerial combat with the control-operator functions of a nuclear reactor.

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Liminality and Subjectivity:

New members of an organization learn how to operate in the liminal zone through experience and social learning. WWII American bomber crews arriving in the theater of operations were insecure and defensive. They were overly self-assured in action, though some were remarkably diffident (16). About their tenth raid (the airmen had entered and remained in liminality):

"the man had experienced fear and by now knew that he could deal with it; he found that care and skill and coolness in the pilot and crew had a real bearing upon the question of his return; he saw that his crew and his airplane could withstand catastrophe; he developed an 'esprit de corps' in regard to his squadron, and was now really part of it. He developed for the first time a sense of his responsibility to his mates and to formation. At this stage...the men were effective, careful, fighting men, quiet and cool on the ground and in the air. They attained a sort of tranquility in spite of their anxiety. *They had very little need for defensive mechanisms of any sort to deceive themselves or anyone else.* [Author's emphasis.] They talked easily and quietly" (16).

In the early months of World War II, a psychiatrist joined a B-17

crew on a mission “to a distant target in enemy-occupied Europe.” He observed a crew of diverse personality types in action, everyone wounded, the plane badly damaged, and flying alone, with a successful return to England in doubt (16):

“It was striking that the emergency did not tend to increase the differences in the reaction patterns of the differing personalities; rather, they came to act in much more similar fashion than usual... The reduction of all personality types to a common reaction pattern appears to be a matter deserving contemplation.”

About 80 years later, three mental health academicians entered the operational environment during combat operations (17, 18). Their research findings were criticized because they did not comport with knowledge developed from a scientific methodology developed away from combat. Three academic sociologists criticized the study’s findings:

“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” (19).

The privileging of objectivity over subjectivity leads to a rigid, normative stance for HRO, washing out its strength (20). The inability or failure to appreciate the HRO operating environment makes invisible the details and methods that give HRO its function (1, 21, 22). The result is a divide between the subjectivity-based mechanism of HRO and the objectivity-based teaching and design of HRO. Liminality has blurred the two methodologies, preventing HRO characterization as a duality of subjectivity and objectivity.

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The duality of subjectivity and objectivity is similar to the problem of light having characteristics of *discrete* mass (photon) and *continuous* wave (electromagnetic radiation), the wave-particle duality of light. Either approach partially explains the nature of light but at the expense of the other. Albert Einstein’s resolution of this duality of light led to his winning the Nobel Prize in Physics in 1921. The duality of subjectivity and objectivity arises from the two contradictory interpretations of reality. To paraphrase Einstein, subjectivity and objectivity separately do not fully explain

how we can accurately observe and interpret the environment, but together they do.

The *discrete* concepts of categorizations and cognitions from objectivity combine with the *continuous* interpretations of the environment from subjectivity to produce the objective-subjective duality of HRO. According to Albert Einstein and Leopold Infeld (23),

“Duality can confound us, or it can lead us to more elegant models of sensemaking. As with theories of light, Einstein describes how ‘It seems as though we must use sometimes the one theory and sometimes the other, while at times we may use either. We are faced with a new kind of difficulty. We have two contradictory pictures of reality; separately, neither of them fully explains the phenomena of light, but together they do.’”

Empirical Knowledge: Objective and Subjective

Spectators claim the practice of HRO is anecdotal (as a pejorative) and is not empirical, meaning not developed through experimental design. We look to the work of Frances Bacon and Ronald A. Fisher to differentiate empirical knowledge as *experiential empiricism*, knowledge gained through experience, and *experimental empiricism*, knowledge gained by experiment.

HRO operates in the environment and not a laboratory. The two sources of empirical knowledge are at different levels of analysis. Arguing across levels of analysis creates false debate (24). The mistaken belief that the two views are related or the privileging of *experimental empiricism* leads to inaccurate models that can be deadly when not tested in the HRO environment (25).

“Spectators claim the practice of HRO is anecdotal (as a pejorative) and is not empirical, meaning not developed through experimental design. We look to the work of Frances Bacon and Ronald A. Fisher to differentiate empirical knowledge as experiential empiricism, knowledge gained through experience, and experimental empiricism, knowledge gained by experiment. Arguing across levels of analysis creates false debate. The mistaken belief that the two views are related or the privileging of experimental empiricism leads to inaccurate models that can be deadly when not tested in the HRO environment. Somehow, empiricism has shifted from knowledge developed through experience to knowledge reasoned by experimental design.”

Somehow, empiricism has shifted from knowledge developed through experience to knowledge reasoned by experimental design. Frances Bacon described how we gain empirical knowledge from inductive reasoning and sensed experience. (Sensed experience is not an everyday experience.) In the inductive process, we correct and extend our sensed data into facts that describe underlying physical, causal mechanisms of that experience. Empiricism extends our knowledge beyond the data that generated the data and facts. We can then test these theories by drawing out new predictions to confirm or reduce uncertainty about the theory (26).

Ronald A Fisher (27) introduced experimental design and statistical analysis in his 1935 book *The Design of Experiments*. Fisher advised that we design to randomize the subject to double restrictions:

“An essential condition of experimentation is that the experimental material is known to be variable, but it is not known, in respect of any individual, in what direction his response to a given treatment will vary from the average.”

“If single factors are chosen for investigation, it is not because we anticipate that the laws of nature can be expressed with any particular simplicity in terms of these variables, but because they are variables which can be controlled or measured with comparative ease.”

We test for the results' significance through statistical analysis and calculate the comparisons' precision between the two groups. In his words:

The Test of Significance

“It is usual and convenient for experimenters to take 5 percent, as a standard level of significance, in the sense that they are prepared to ignore all results which fail to reach this standard, and, by this means, to eliminate from further discussion the greater part of the fluctuations which chance causes have introduced into their experimental results” (27) [*p* value of 0.05, pages 15–16].

Precision of the Comparisons

“To form a preliminary opinion on the strength of the evidence, it is sometimes useful to consider how many similar comparisons would have been equally plausible from the start. Thus, in comparing the best with the worst of the ten tested varieties, we have chosen the pair with the largest apparent difference out of 45 pairs, which might equally have been chosen. We might, therefore, require the probability of the observed difference to be as small as 1 in 900, instead of 1 in 20, before attaching statistical significance to the contrast” (27) [*p* value of 0.001].

The Objectivity-Subjectivity Dichotomy

What academicians and professionals consider “objective” is often a selection from their subjective perspective. During a panel discussion at an international reliability and safety meeting, a retired police sergeant described his interactions when an incident began accelerating toward a physical fight. Not only did he reduce conflict through his rapid responses to how bystanders responded to his actions, but he also initiated cooperation from the group.

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A consultant on the panel corrected him, giving the consultant's objective perspective of the volatile and dangerous situation. The objective perspective diminished the sergeant's initiative and skilled, improvised actions, working alone under the pressure of physical threats.

It seemed that the sergeant's perceived reality of threat developed from continuous negotiations between the bystanders and the sergeant following the local conventions and structures. Changing perceptions would have influenced negotiations and reduced the sense of threat. The consultant viewed the encounter from the basic tenet of *Social Constructionism* that “reality” is an outcome we experience through negotiations between people within a social context. The threat then becomes a possible reality outcome from such negotiations.

The moderator introduced the panel's topic with a presentation on the neuroscience of fear and threat behaviors. The moderator then interpreted the described fear and threat behaviors and the methods that modulated the sergeant's behaviors while calming the crowd. The consultant countered with recommendations that the sergeant could have socially negotiated the same result. The moderator asked if the sergeant could have created a new social construct by negotiating with a fist or a gun. There appeared to be some confusion of abstract, objective concepts with concrete, contextual information.

Alfred North Whitehead (28) had concern for “concrete facts [presented] under the guise of very abstract logical constructions.” For example, the reviewer strongly recommends strict application of an abstract concept to a specific situation. We create “the accidental error of mistaking the abstract for the concrete.” He described this as “an example of what might be called the ‘Fallacy of Misplaced Concreteness.’”

“The misplacing and fixing of abstractions is a big issue. Misplaced concreteness is the problem, and your [one of the authors, DvS] emphasis on moving, flow, trajectory, reduces ‘severe concreteness.’ I’m studying a disaster that sank the container ship *El Faro*. As they are entering the eyewall of hurricane Joaquin, without knowledge of winds and at 4 AM in darkness, the captain says, ‘This is a typical winter day in Alaska’ and sticks to his route straight toward the eye. Ship (790 feet long) capsizes 3 1/2 hours later, drowning all 33 crew. Typical day is a severe abstraction.”

Karl Weick (personal communication)

Using abstractions for concreteness is a fallacy more likely relied on at a distance with the moving trajectory of events reducing severe concreteness (Karl Weick, personal communication). The ship captain, a veteran of Alaska winter weather, was now navigating in a tropical hurricane thousands of miles distant from the area of his experience (29).

“Using abstractions for concreteness is a fallacy more likely relied on at a distance with the moving trajectory of events reducing severe concreteness (Karl Weick, personal communication)... The distance of a spectator from events, whether space or time, also increases the spectator’s feeling of objectivity.”

The distance of a spectator from events, whether space or time, also increases the spectator's feeling of objectivity. Following Whitehead's concern about substituting abstract constructions for concrete facts, we question the presentation of *subjective* information "under the guise of *objective*, abstract logical constructions." This accidental error of mistaking subjectivity for objectivity might be called the "Fallacy of Misplaced Objectivity."

Misplaced objectivity, over time, creates an ideology asserting that objectivity opposes subjectivity, thus denying the possibility of mediation between the two (4). Objectivity as a cognitive trait has become linked with autonomy, an affective trait (30), a linkage we disagree with because autonomy is contextual. We discuss in this article the subjectivity of contextuality.

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Conclusion:

Objectivity and subjectivity in the HRO act as a duality. We cannot understand one without the other. We cannot use one without the other. Because of fluctuating events, we develop knowledge with inductive processes through experiential empiricism as we rely on knowledge developed through experimental empiricism. These are not contradictions or paradoxes. They function as dualities.

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H. Stefan Bracha, University of Hawaii'i at Mānoa, United States Department of Veterans Affairs

Adrian Wolfberg, Ph.D., Senior Program Officer at the National Academy of Sciences National Academy of Sciences

Errol van Stralen, Ancora Corporate Training

Corresponding Author



Daved van Stralen, MD, FAAP
Associate Professor, Pediatrics
Department of Pediatrics
Loma Linda University School of Medicine
11175 Campus Street
CP-A1121
Loma Linda, CA 92350
Email: DVanStra@llu.edu



Sean McKay
Executive Partner / Director, Disruptive Rescue & Austere Medicine
Element Rescue - Response Solutions within Nonlinear Complex Environments
Greenville, South Carolina, United States



Thomas A. Mercer
Rear Admiral
United States Navy (Retired)