Pascual, M. D. (2026). Overcoming Hedonic Adaptation in Operations Management.
Journal of Small Business Strategy, *36*(4). https://doi.org/10.53703/001c.172810

articles

Overcoming Hedonic Adaptation in Operations Management

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Keywords: Safety Culture, Hedonic Adaptation, Operational Leadership

https://doi.org/10.53703/001c.172810

Journal of Small Business Strategy

Vol. 36, Issue 4, 2026

This study investigates the psychological drivers of safety non-compliance in repetitive operational environments, positioning hedonic adaptation—a biological mechanism of perceptual habituation—as the primary root cause of risk normalization. Building upon a foundational competency study within a public water and sanitation utility in northern Argentina, an inductive, mixed-methods empirical design was executed, analyzing observational audit data across five operational field crews (N ≈ 100 workers) alongside qualitative focus groups with multi-level management. Empirical findings reveal a critical operational paradox: while crews exhibit high compliance in verbal operational communication (85.4%) and physical tool care (77.6%), severe normalized deficiencies emerge in personal protective equipment (PPE) usage (37.4%) and safe site behaviors (37.1%). To overcome this sensory habituation, a three-pronged strategic framework is proposed, integrating biological awareness training, routine-disrupting operational interventions, and coaching-oriented supervisory leadership. The study's primary original contribution lies in bridging cognitive psychology with operations management and intellectual capital frameworks, establishing that sustaining long-term operational safety in routine environments requires actively managing human attention thresholds rather than relying solely on administrative enforcement.

Introduction

Industrial safety has evolved from a mere administrative compliance burden into a recognized strategic pillar of operational efficiency, organizational resilience, and continuity (Chase et al., 2019; Christian et al., 2009; Krajewski et al., 2021; Zohar, 2010). Modern operations management emphasizes that safeguarding frontline personnel is intrinsically linked to productivity and long-term performance (Slack & Lewis, 2015). However, across high-risk utility sectors—such as drinking water and sanitation services—a persistent barrier hinders continuous safety performance: the gradual erosion of protocol compliance in highly repetitive tasks (Reason, 1997; Starbuck & Milliken, 1988). Despite continuous regulatory auditing and training investments, field crews routinely develop normalized risk habits over time (Vaughan, 1996).

At the heart of this inquiry lies a central theoretical tension: Why do operational crews possessing high technical competency and clear internal communication channels systematically exhibit severe non-compliance with basic safety protocols? Conventional safety and operations literature often attribute safety deviations to administrative oversight, procedural deficiencies, inadequate training, or worker negligence (Neal & Griffin, 2006; Slack & Lewis, 2015). In contrast, I posit that the fundamental driver in routine work environments is cognitive and biological rather than procedural. Specifically, repeated exposure to familiar tasks triggers hedonic adaptation—an evolutionary, neurological mechanism through which the brain attenuates sensory responsiveness to predictable stimuli to prevent overload (Diener & Tay, 2022; Heller et al., 2024). When operations become routine, safety protocols lose their perceptual contrast and recede into background noise, causing critical hazards to normalize (Wang & Zhang, 2023). Viewed through the lens of intellectual capital (Nonaka & Takeuchi, 1995; Pascual, 2022; Senge, 2006), hedonic adaptation represents a dynamic failure: human capital retains theoretical safety knowledge, but structural capital (formal rules) becomes an empty shell, and relational capital legitimizes non-compliant habits across the work unit.

While safety climate and behavioral compliance have been broadly studied, bridging cognitive adaptation theory with operations management—particularly within public

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utility providers in Latin America—remains an underexplored area of inquiry. Grounded in empirical field observations from a public water and sanitation utility in northern Argentina, this study addresses two central Research Questions:

1. How does hedonic adaptation manifest as a psychological mechanism to erode risk perception and create gaps between operational communication strength and safety compliance in routine field operations?
2. What structured, multidimensional strategic intervention can effectively reintroduce perceptual contrast, disrupt routine habituation, and sustain safety compliance in repetitive work environments?

To answer these questions, the General Objective of my study is to formulate and evaluate a Strategic Intervention Plan that transforms occupational safety from a passive, administrative obligation into a conscious, dynamic value capable of resisting sensory habituation. To achieve this, I pursue three Specific Objectives:

- **Diagnostic Objective**: Evaluate empirical field compliance patterns across operational crews ($N \approx 100$ workers across 5 crews) to establish baseline behavioral deviations in Personal Protective Equipment (PPE) usage and site safety.
- **Theoretical Objective**: Identify the psychological and organizational mechanisms that link routine task execution with risk normalization through the lenses of cognitive adaptation and intellectual capital distortion.
- **Intervention Objective**: Formulate a synergistic three-axis strategic plan—combining biological awareness training, routine-breaking operational practices, and coaching leadership—to achieve a targeted 50% reduction in safety compliance deviations over a six-month horizon.

The remainder of this paper is organized as follows: Section 2 details the theoretical foundations, synthesizing literature on hedonic adaptation, loss of perceptual contrast, and intellectual capital management. Section 3 outlines the specific operational and behavioral objectives set for the intervention. Section 4 presents the inductive, mixed-methods research design and empirical setting. Section 5 analyzes empirical field audit findings from five operational crews, highlighting the contrast between communication strength and safety non-compliance. Section 6 outlines the proposed three-axis strategic plan, implementation roadmap and key theoretical contributions, managerial implications, and directions for future research. Finally, Section 7 provides the conclusion of this study.

Theoretical Foundations

To understand why experienced field crews systematically fail to comply with safety protocols despite demonstrating high operational communication performance, safety management must look beyond administrative enforcement (Christian et al., 2009; Zohar, 2010). This section establishes an interdisciplinary theoretical framework connecting cognitive psychology, organizational safety climate, and intellectual capital management.

Core Concepts: Hedonic Adaptation and Occupational Risk

Hedonic adaptation was originally conceptualized by Brickman and Campbell (1971) and later expanded by Diener et al. (1999) to explain the psychological treadmill dynamic (the human tendency to return to a stable baseline of affect following significant positive or negative events). While classical literature focuses on subjective well-being and life satisfaction (Diener & Tay, 2022; Frederick & Loewenstein, 1999), extending this concept to occupational safety introduces a novel, cognitive perspective on worker behavior. In high-risk operational settings, hedonic adaptation describes how repeated, safe exposure to hazardous environments attenuates human emotional and cognitive responsiveness over time (Heller et al., 2024; Wang & Zhang, 2023).

Traditional industrial safety paradigms have historically relied on domino theories (Heinrich, 1931) or structural-procedural frameworks (Krajewski et al., 2021; Reason, 1997). These approaches primarily attribute non-compliance to technical failures, inadequate oversight, or individual operator error. However, such models often treat non-compliance as a moral or motivational defect rather than a natural byproduct of cognitive architecture. Integrating hedonic adaptation complements traditional safety climate literature (Neal & Griffin, 2006; Zohar, 2010) by explaining why experienced workers—despite possessing complete procedural knowledge and technical competence—gradually diminish their compliance with Personal Protective Equipment (PPE) and risk control protocols.

Cognitive Mechanisms: Perceptual Habituation and Risk Normalization

The transition from conscious vigilance to normalized non-compliance operates through three distinct biological and psychological mechanisms:

1. **Sensory Archiving and Energy Optimization**: The human brain operates as an energy-saving processor, filtering out static or repetitive environmental inputs to prevent sensory overload (Frederick & Loewenstein, 1999). When workers are initially exposed to high-risk environments, safety gear and protocols serve as high-contrast novelties that trigger conscious risk evaluation. Over time, execution of tasks without negative consequences (incidents or injuries) leads the central nervous system to archive these visual and tactile safety cues, relegating them to the operational background ("what shines becomes background").
2. **Loss of Perceptual Contrast**: As sensory archiving occurs, workers cease to evaluate hazard severity on an objective scale. Instead, conscious attention responds almost exclusively to operational novelties or acute disturbances. In predictable work environ-

Table 1. Intellectual Capital Dimensions and Hedonic Adaptation Distortions

Intellectual Capital Dimension	Baseline Asset Definition	Distortion Driven by Hedonic Adaptation
Human Capital	Explicit knowledge, technical skills, and safety qualifications (Alles, 2012).	**Cognitive Latency**: A gap opens between stored theoretical knowledge and active situational awareness. Technical competence remains high, but its conscious application decays during routine tasks.
Relational Capital	Shared norms, peer interactions, and collective safety culture (Edmondson, 2012; Neal & Griffin, 2006).	**Peer Normalization**: Uncorrected individual non-compliance becomes socially legitimized within field crews, embedding routine deviations into collective commonsense.
Structural Capital	Formal policies, written procedures, and safety auditing systems (Reason, 1997; Slack & Lewis, 2015).	**Empty Shell Rules**: Static compliance documentation becomes decoupled from daily practices, leaving administrative procedures intact on paper but ineffective in the field.

ments, the loss of perceptual contrast creates a cognitive blind spot toward ongoing, chronic risks.

3. **Normalization of Risk**: At the organizational level, this habituation feeds into the normalization of deviance (Starbuck & Milliken, 1988; Vaughan, 1996). In the persistent absence of adverse feedback (injuries or operational stops), minor violations—such as unfastened helmet straps or missing protective eyewear—lose their signal value. Unchecked non-compliance shifts from an observed violation into an accepted, implicit standard of operation.

Intellectual Capital Distortion in Safety Management

To bridge individual cognitive habituation with collective organizational performance, hedonic adaptation must be evaluated through Knowledge Management and Intellectual Capital frameworks (Nonaka & Takeuchi, 1995; Pascual, 2022). Intellectual capital within operational environments comprises three interdependent dimensions—Human, Relational, and Structural Capital—each experiencing specific distortions under cognitive habituation.

Intervention Logic: Counteracting Adaptation

Because cognitive habituation is an evolutionary mechanism rather than a behavioral flaw, organizational interventions that rely solely on punitive enforcement or administrative reminders are fundamentally flawed. As illustrated by Senge's (2006) "Shifting the Burden" system archetype, administrative sanctions address only the surface symptom (e.g., missing PPE) while leaving the underlying cause—perceptual habituation—untouched, often leading to increased worker cynicism and procedural decoupling.

A sustainable solution requires a proactive intervention framework built on three strategic levels:

- **Biological Awareness**: Educating operational personnel on human cognitive habituation mechanisms, transforming safety awareness from external compliance into internal self-regulation.
- **Operational Variety (Routine-Breaking)**: Systematically reintroducing perceptual contrast into daily routines via task interruptions, varied briefing methods, and interactive hazard identification (Wang & Zhang, 2023).
- **Coaching Leadership**: Shifting frontline supervision from passive compliance auditing to participatory coaching, establishing psychological safety (Edmondson, 2012) and continuous reflection in field execution.

Research Objectives

To operationalize the theoretical framework and systematically mitigate risk normalization in utility field operations, I outline one overarching General Objective and three analytical Specific Objectives:

General Objective

The general objective is based on formulate, deploy, and evaluate a Strategic Intervention Plan that transforms occupational safety from a passive administrative obligation into a dynamic, conscious value by actively managing hedonic adaptation in repetitive operational environments.

Specific Objectives

To achieve this transformation, the initiative progresses sequentially through the following specific objectives:

1. **Empirical Baseline & Diagnostic Analysis**: Quantify pre-intervention safety compliance across field crews to establish a behavioral baseline, isolating execution gaps between operational communication capabilities and actual safety protocol compliance (specifically in PPE usage and field risk controls).
2. **Pedagogical & Behavioral Re-alignment**: Design and execute a specialized education module ("Conscious Safety") focused on the biological and cognitive drivers of risk normalization, targeting 100% crew participation in the initial deployment phase to recalibrate perceptual alertness.

3. **Field Reinforcement & Supervisory Coaching**: Implement a field reinforcement framework for frontline supervisors—integrating routine-breaking practices and participatory dialogue—to reduce audit non-compliance observations ("To Improve" ratings) in PPE usage and safe behaviors by 50% over a six-month evaluation period.

Methodology

Research Design and Paradigm

To investigate how cognitive habituation drives risk normalization in high-risk operational settings—and how a multi-axis intervention can counteract this decay—this study adopts an inductive, explanatory mixed-methods single-case study design (Creswell & Creswell, 2018; Eisenhardt, 1989; Yin, 2018). Case study research is especially suited for operations and safety management inquiries that examine "how" and "why" contemporary phenomena occur within real-world, complex organizational contexts where boundaries between behavior and context are closely interwoven (Krajewski et al., 2021; Yin, 2018).

The methodology follows a convergent mixed-methods strategy (Creswell & Creswell, 2018). Quantitative behavioral audit data (structured performance metrics across six compliance categories) are combined with qualitative field data (auditor contextual logs and focus group insights from management). This methodological triangulation strengthens construct validity, allowing me to diagnose both the quantitative extent of safety non-compliance and the qualitative cognitive mechanisms (hedonic adaptation) driving routine risk normalization.

Case Selection and Sampling Strategy

In line with case-based research traditions in operations management, sampling was non-probabilistic and governed by purposive intensity sampling (Patton, 2015; Saunders et al., 2019). This approach selects organizational contexts where the target phenomenon—repetitive, high-risk operational tasks performed under routine conditions—is present in its most concentrated form. The study was conducted within a state-owned public utility company providing drinking water distribution and sanitation infrastructure across a province in northern Argentina. Field operations managed under the Technical Management and Personnel Management divisions served as an empirical setting.

Unit of Analysis and Sample Justification

The primary unit of analysis comprises five operational field crews (N = 5). Case and crew selection followed four criteria:

1. **Task Homogeneity & Repetitiveness**: All crews perform identical, highly standardized municipal water supply maintenance, underground pipeline repair, and heavy excavation tasks subject to daily routine.
2. **Structural Uniformity**: Each crew comprises 1 frontline supervisor and approximately 20 operational field technicians, representing a total population of n = 105 frontline workers across the 5 crews.
3. **Baseline Qualification**: All participating workers possessed identical formal technical qualifications and required regulatory health and safety certifications prior to data collection, isolating cognitive adaptation from skill or training deficiencies.
4. **Managerial Sample (n = 14)**: To complement field observations, a purposive sample was established across leadership tiers: Area Managers/Department Heads from Technical Management (n = 6) and Safety/HR Specialists and Field Supervisors (n = 8).

Data Collection Timeline, Instruments, and Procedures

Data was collected over a 6-month continuous period (July to December) to capture baseline operational routines, shift patterns, and seasonal variations in utility maintenance activity. Empirical evidence was gathered through three distinct data collection streams:

Environmental Health and Safety (EHS) field inspectors conducted unannounced, direct observations during active field operations. Audits evaluated six operational dimensions: Operational Communication, Proper Use of PPE, Tool & Asset Care, Safe Conditions & Behaviors, Training, and Signage. Performances were evaluated using a standardized 3-point ordinal scale: Good Compliance (BC = 3 / 100%), Acceptable (AC = 2 / 66.6%), and To Improve (TI = 1 / 33.3%).

Data Reliability, Validity, and Analytical Rigor

To ensure construct validity, observational consistency, and analytical replicability (Eisenhardt, 1989; Yin, 2018), specific methodological controls were implemented:

Inter-Rater Reliability and Observational Verification

To prevent individual observer bias and verify consistency across field evaluations:

- Audits were conducted by paired EHS inspectors.
- Inspectors underwent pre-deployment calibration training using standardized rubrics and operational descriptors.
- Periodic cross-audits were performed where paired teams swapped assigned crews.

Construct Validity and Data Triangulation

Construct validity was established by triangulating quantitative audit scores, qualitative field logs, and manager focus group outputs (Yin, 2018). Converging evidence across independent sources ensured that observed PPE compliance gaps were caused by cognitive/perceptual habituation rather than material unavailability or technical incompetence.

Table 2. Data Collection Streams and Methodological Objectives

Data Stream	Data Source & Sample	Instrument / Protocol	Focus & Objective
1. Quantitative Field Audits	5 Operational Crews (n = 105 technicians)	Standardized 3-point compliance rubric	Measure empirical compliance rates in PPE and risk control.
2. Qualitative Field Notes	On-site EHS Inspectors	Open observation logs and semantic notes	Capture worker justifications and contextual work pressures.
3. Managerial Focus Groups	Managers & Supervisors (n = 14)	6 semi-structured focus group sessions	Identify structural bottlenecks and supervisory styles.

Table 3. Consolidated Field Compliance Baseline by Category (%)

Evaluated Dimension / Category	Crew 1	Crew 2	Crew 3	Crew 4	Crew 5	Average
Operational Communication	70.0%	88.9%	83.3%	91.7%	93.3%	85.4%
Tool & Machinery Care	82.2%	66.7%	61.1%	77.8%	100.0%	77.6%
Worksite Signage & Markings	60.0%	66.6%	60.0%	60.0%	53.3%	59.9%
Safety Training Execution	33.3%	33.3%	66.6%	66.6%	66.6%	53.3%
Proper Use of PPE	33.3%	33.3%	38.9%	33.3%	48.1%	37.4%
Safe Conditions & Behaviors	35.6%	33.3%	38.9%	33.3%	44.4%	37.1%
Overall Crew Average	**52.4%**	**53.7%**	**58.1%**	**60.5%**	**67.6%**	**58.5%**

Data Analysis and Empirical Results

Synthesis of Main Non-Compliance Patterns

Across the five monitored operational field crews (n = 105 frontline workers), empirical field audit data reveal a distinct dual-performance structure. While operational units demonstrate high proficiency in verbal coordination and physical tool maintenance, they exhibit severe, systematic non-compliance in personal safety execution and worksite risk controls.

The empirical data reveals three primary structural patterns:

- **The Communication–Execution Divergence**: Strong operational communication (85.4% global mean) does not translate into compliant safety behaviors.
- **Physical Asset Preservation vs. Self-Protection**: Crews maintain high compliance in machinery maintenance (77.6%) compared to personal protective measures (37.4%).
- **Cross-Crew Uniformity in Critical Safety Deficits**: Behavioral failure is pervasive across the department rather than isolated to a single underperforming unit.

Comparative Quantitative Audit Results

Field audit records gathered across the N = 5 operational crews evaluate compliance across six operational dimensions. Table 3 reports raw percentage compliance indices.

Qualitative Field Audit Observations

Qualitative notes recorded by Environmental Health and Safety (EHS) field inspectors document specific non-compliance events.

Discussion

The empirical evaluation of field operations reveals a striking operational paradox. Rather than indicating negligence, this behavioral decoupling demonstrates that occupational non-compliance in high-repetition environments stems from hedonic adaptation.

Theoretical Contributions and Implications

Reframing Hedonic Adaptation as a Primary Driver

The primary theoretical contribution of this study lies in extending the concept of hedonic adaptation into industrial operations management. In highly repetitive, predictable operational environments, the human brain prioritizes cognitive processing efficiency by filtering out static environmental stimuli (Frederick & Loewenstein, 1999). PPE and worksite warning protocols transition from high-contrast safeguards into sensory "background noise."

Intellectual Capital Distortions

This research demonstrates how individual cognitive habituation propagates upward:

- **Human Capital Distortion**: A gap opens between stored knowledge and active situational awareness.
- **Relational Capital Erosion**: Uncorrected deviations become integrated into the crew's shared mental models, transforming individual non-compliance into

Table 4. Regulatory Audit Performance Under Standard Ordinal Rating

Evaluated Dimension	Crew 1	Crew 2	Crew 3	Crew 4	Crew 5	Average	Status
Operational Communication	58.0%	88.9%	92.0%	92.0%	92.0%	84.6%	BC/AC
Tool & Asset Care	89.0%	67.0%	78.0%	78.0%	100.0%	82.4%	BC/AC
Worksite Signage	60.0%	67.0%	60.0%	60.0%	53.0%	60.0%	AC/TI
Proper Use of PPE	33.0%	33.0%	44.0%	33.0%	67.0%	42.0%	TI
Safe Conditions & Behaviors	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%	TI

Table 5. Summary of Qualitative Field Inspector Logs

Target Area	Identified Empirical Deviations	Auditor Observations
Proper Use of PPE	• Partial/inconsistent wearing• Omission of specialized protection	"PPE worn during setup but removed during routine task execution" (Crew 3).
Safe Behaviors	• Standard protocol bypasses• Omission of site hazard scans	"Trench entry executed without prior soil stability verification" (Crew 4).
Worksite Signage	• Late/incomplete perimeter setup• Incorrect positioning	"Cones and warning tape remained stored inside the vehicle during roadway work" (Crew 3).

Table 6. Three-Axis Strategic Intervention Model

Intervention Axis	Core Operational Mechanism	Practical Action Items
Axis 1: Training	Biological Awareness Workshops	Execute "Conscious Safety" workshop series covering brain habituation.
Axis 2: Operations	Restructuring Field Routines	Implement dynamic, participatory daily safety talks and task-stoppage protocols.
Axis 3: Leadership	Coaching Transformation	Roll out supervisory coaching modules and cascading peer-mentorship.

socially legitimized operational norms (Vaughan, 1996).

- **Structural Capital Neutralization**: Administrative procedures degenerate into "empty shells"—formal compliance mechanisms that maintain regulatory legitimacy on paper but lose execution efficacy in the field (Reason, 1997).

Implications for Practice

Case-Specific Strategic Interventions

The empirical diagnostic informs a three-axis strategic intervention model:

Conclusion

Industrial safety management stands at a critical paradigm shift. As this study demonstrates, non-compliance in highly repetitive operational settings reflects a predictable biological habituation process—hedonic adaptation. The fundamental insight is that safety in routine operations cannot be sustained through static compliance; it requires continuous, proactive management of the human attention threshold. By reframing safety as a dynamic cognitive resource, organizations can design adaptive work systems that respect, anticipate, and continuously recalibrate human cognitive architecture.

Submitted: July 10, 2026 CST. Accepted: September 23, 2026 CST. Published: November 20, 2026 CST.

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