2014

# Toward a Theory of Practical Drift in Teams

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# TOWARD A THEORY OF
# PRACTICAL DRIFT IN TEAMS

by

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A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major Program in Psychology
in the College of Sciences
and in the Burnett Honors College
at the University of Central Florida
Orlando, Florida

Spring Term, 2014

Thesis Chair: Eduardo Salas, Ph.D.

# ABSTRACT

Practical drift is defined as the unintentional adaptation of routine behaviors from written procedure. The occurrence of practical drift can result in catastrophic disaster in high-reliability organizations (e.g. the military, emergency medicine, space exploration). Given the lack of empirical research on practical drift, this research sought to develop a better understanding by investigating ways to assess and stop the process in high-reliability organizations.

An introductory literature review was conducted to investigate the variables that play a role in the occurrence of practical drift in teams. Research was guided by the input-throughput-output model of team adaptation posed by Burke, Stagl, Salas, Pierce, and Kendall (2006). It demonstrates relationships supported by the results of the literature review and the Burke and colleagues (2006) model denoting potential indicators of practical drift in teams. Research centralized on the core processes and emergent states of the adaptive cycle; namely, shared mental models, team situation awareness, and coordination. The resulting model shows the relationship of procedure—practice coupling demands misfit and maladaptive violations of procedure being mediated by shared mental models, team situation awareness, and coordination. Shared mental models also lead to team situation awareness, and both depict a mutual, positive relationship with coordination. The cycle restarts when an error caused by maladaptive violations of procedure creates a greater misfit between procedural demands and practical demands.

This movement toward a theory of practical drift in teams provides a conceptual framework and testable propositions for future research to build from, giving practical avenues to predict and

prevent accidents resulting from drift in high-reliability organizations. Suggestions for future research are also discussed, including possible directions to explore. By examining the relationships reflected in the new model, steps can be taken to counteract organizational failures in the process of practical drift in teams.

**ACKNOWLEDGEMENTS**

I would like to express my sincere appreciation to all of those who have mentored me throughout my undergraduate experience. First and foremost, I owe much of my current and future successes to Dr. Eduardo Salas for beginning my career in research by providing countless opportunities (and obstacles) to learn from that few students see before graduate school. I am grateful for your effort in making me a researcher, and for having the confidence in me to handle whatever I may be juggling. Thank you for articulating what I could only conceptualize, and most of all, for the constant reminder that nothing worth having comes easily.

Thank you to Dr. Carol Saunders and Dr. Dana Joseph for all of the helpful insight and advice that you have given throughout the course of this thesis. The time you have given to read drafts, have meetings, and provide feedback does not go unnoticed.

I would also like to thank Dr. Mark Neider for his guidance and for teaching me to think critically. Working in your lab is where I found my potential and realized what I want in a graduate program. You are the perfect example of what every advisor should be and your dedication to your students' success shows in everything you do.

Also, a special thank you to the graduate students who have given me immeasurable advice in all facets of my personal and professional life: Nastassia Savage, Alyssa Hess, Joanna Lewis, Adam Emfield, and Ashley Hughes. You are all destined for greatness and I would not be anywhere near where I am today without you all.

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# INTRODUCTION

April of 1994 was supposed to be a time of peace after warfare; moving on from Operation Desert Storm, and ending casualties resulting from combat. Instead, 26 men and women of the American Armed Forces and its allies lost their lives in a friendly fire shoot-down of two UH-60 Black Hawk helicopters (Snook, 2000). This left many to question the cause of the accident. The United States Military has a reputation for precision and elite intelligence. Pilot error is a questionable explanation for such a disciplined organization.

On February 1, 2003, the United States Space Shuttle Colombia disintegrated upon reentrance of the Earth's atmosphere, claiming the lives of all seven crew members. The physical cause of the accident was determined to be from seven months prior when a piece of debris ripped off of the heating tank during launch, damaging the Thermal Protection System. This tragically caused the shuttle's infrastructure to melt from the inside-out, breaking apart across the southern coast of the United States almost immediately on reentrance. This technical cause was reported to be in conjunction with organizational issues NASA had been experiencing; including situational constraints, shifting priorities, and the evolution of designed procedures (Colombia Accident Investigation Board [CAIB], 2003). The damage seemed unpredictable; though this event was preceded by similar misfortunes, including the Apollo 1 test-capsule fire in 1967 and the Challenger disaster in 1986.

On April 20, 2010 the explosion of the *Deepwater Horizon* drilling rig began what is arguably the worst environmental disaster in history, when four million barrels of oil emptied into the Gulf of Mexico. This infamous disaster is known as the BP Deepwater Horizon Oil Spill.

It has resulted in eleven casualties and colossal damage to the Gulf's habitat and ecosystem. The explosion resulted from a series of faulty safety provisions that were caused by poor decision making, ignoring procedural checks and balances, and making fatal compromises ("National Commission", 2011).

These world-recognized disasters all implicate a systematic drift in designated procedures; a failure so dangerously imperceptible, that an organization as thoroughly refined as the U.S. Armed Forces has been victimized—a frightening reality. This underhanded phenomenon is known as practical drift—the unintended, systematic adaptation of routine practice from written procedure (Snook, 2000).

In a vast oversight by the scientific community, this phenomenon has lacked direct, empirical research, forming a gap in expedient literature. The International Civil Aviation Organization (ICAO, 2009) suggests that practical drift may be controlled *reactively* by analyzing errors after they have occurred, avoided *proactively* by analyzing operations and identifying current risks before approaching failure, or prevented *predictively* by recognizing precursors. While the goal of this stream of research is to *predict* the occurrence of practical drift, all information to this date has been gathered *reactively* in response to accidents. Because this area of study is still in its infancy, all of the factors involved in the process have yet to be uncovered. This thesis begins the process of preventing practical drift *proactively* by attempting to uncover these unknown variables and establish an introductory model to be expanded upon by future interdisciplinary research. This study is an effort to close the vast gap in research with a solid foundation that encourages subsequent investigation. The results are the first of its kind, theorizing a model of fit for the process of practical drift. The main focus is to further understand practical drift in teams that operate in high-reliability contexts, and to develop a theoretical model incorporating what is known about practical drift with variables of team adaptation. Relationships depicted in the model will be presented as testable propositions to stimulate future research. The lack of research on practical drift has resulted in wide unfamiliarity of the concept. Accordingly, a detailed description of the theory leads this review.

## Practical Drift

Each organization creates and enforces protocols to ensure standardized employee actions and appropriate procedures. Many organizations assign roles to each member and each team in pursuit of a common goal. In some cases, the task of one team must be completed successfully in order for another team's task to be successful. These highly interdependent teams must follow the protocol and set procedures to ensure the successful achievement of shared goals. Oftentimes, employees will stray from the originally designed procedure by altering their methods to meet the various demands of situational circumstances (Stolte, Vogt, & Weber, 2010). In some industries, straying from standard protocol could result in innovation and reassessment of current methods; but in high-reliability organizations, the consequences can be dangerous and potentially fatal (Feldman & Pentland, 2003). Due to the particularly destructive concern, this research centralizes on high-reliability organizations, those in which risk is high and highly interdependent teams are tasked with strict (often lengthy) procedural protocol; yielding a tightly coupled system. Further discussion of 'coupling' is provided in a later section (see pages 11-12).

Any operational deviation has the potential to result in catastrophe. A slight lapse can have unideal consequences, but an undetected evolution of accepted practice can be much more treacherous. As the steps of a maladapted practice solidify into a completely different method, a poorly redesigned process with a false sense of security is enforced. This evolution of procedure to a maladapted practice is referred to as practical drift.

In Scott A. Snook's publication of *Friendly Fire* (2000), he introduces the term 'practical drift' and credits it as a key factor in the accidental shoot-down of United States Army Black Hawks by United States Air Force F-15s in Iraq following the Gulf War (see page 1). Practical drift, also described as procedural drift (Johnston, 2003), is defined as "the slow, steady uncoupling of practice from written procedure" (Snook, 2000). Any separation from a standardized process that is long-lasting, gradual, and unintentionally progressive toward a certain path can be classified as a case of practical drift (Stolte et al., 2010). This path dependence characterizes the pattern, making it more likely to reoccur and habituate (Pentland, Feldman, Becker, & Liu, 2012). Practical drift is essentially the process of solidifying a maladapted, routine practice that transpires when procedural demands do not match situational demands continuously. Overtime, many written procedures go unused and are unnoticeably eliminated from everyday routine; personnel find more efficient ways to complete tasks independently in their local situations, effectively eliminating the reliance on others; each local adaptation adding up and interplaying to create a new standard. The gradual development of this new locally adapted practice is practical drift.

Snook's Theoretical Matrix of Practical Drift (Figure 1) demonstrates the progression of drifting procedure while taking into account conditional context. The vertical axis represents the level of interdependence between the units[1] involved. The horizontal axis represents the shift in cognitive paradigm from rule-based to task-based. The circling arrows at the center are essential to exhibit the progressive and continuous pattern of the model, signifying the temporal aspect of practical drift. The quadrants labeled as 'stable' are such because the logic of action yields practice that matches the level of interdependence required by the situation (Snook, 2000). The matrix will be used as a guide to explain the process of practical drift in detail.

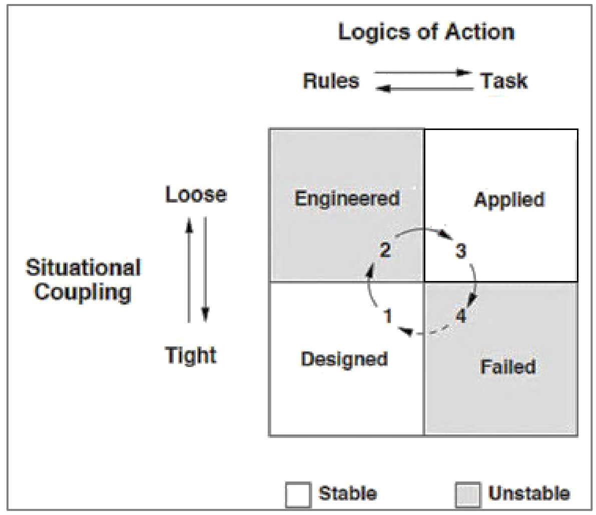

Figure 1. Snook's Theoretical Matrix of Practical Drift

Quadrant 1 represents the design phase of a procedure. In the design of rules and procedures, creators often account for worst-case scenarios to manage all risks and avoid being liable for any errors (Leemann, 2011). Developing an extensive protocol seems understandable when the consequences of failure have the potential to be fatal; nobody wants to be blamed for an accident caused by lax rules, so most err on the side of over-inclusion (Snook, 2000). Rules are thus created in a comprehensive manner to account for all potential risks. Extensive procedures are developed with tightly interwoven systems in effort to create as many fail-safes as possible (Macey, 2011). Teams in high-reliability organizations rely heavily on each other's

[1] The term 'unit' is used so as not to restrict the process of practical drift to solely individuals, teams, their relationships to the organization, or each to other. This study focuses specifically on practical drift in teams.

actions for goal completion; so the error of one team produces a chain-reaction across all other teams to unhinge all planned fail-safes (this comes later in quadrant 4).

Progression to quadrant 2 represents personnel abiding by written procedure as it has been designed, even though daily circumstance rarely calls for each step and procedure included in the extensive list of demands. The worst-case scenarios these rules are based upon are typically not encountered on a regular basis. As personnel experience on the job increases, the unnecessary requirements become more apparent (Snook, 2000). In short, the rules in their entirety do not apply to the operational environment. This unfit model creates an unstable dynamic that creates role strain as personnel are faced with fulfilling procedural demands or situational demands. This results in adaptation that solidifies as practical drift in the progression to quadrant 3.

The third quadrant marks the shift from following the rules, to adapting the rules in reaction to situational demands. The strain between what is called for and what is necessary causes the instability in quadrant 2, creating a need for adaptation (Snook, 2000). Teams need to adapt constantly in order to match the dynamic nature of modern demands (Burke, Stagl, Salas, Pierce, & Kendall, 2006). Personnel develop adapted methods of goal completion that are more apt to the everyday norm. This quadrant is stable because there is no pressure to change—the situational demands and the adapted practice are in sync and functioning efficiently. At this point, routine formation happens very rapidly and the adapted practice becomes first-nature (Gersick & Hackman, 1990). Each day without an incident, the modified practice becomes reinforced, stored, and solidified as procedural memory (Cohen & Bacdayan, 1994). Defense

Nuclear Facilities Safety Board member R. Bruce Matthews (2005) points out that this downtime is critically misleading to personnel, positing that the habitual use of a modified routine leads to the erosion of organizational formality by diminishing system control. At this point in the process, fail-safes set in place to mitigate accidents will not work properly because they depend on all interdependent teams following designed procedures (Snook, 2000). Operators are unaware of how close they are to system failure as practice moves further away from protocol—imperceptibly distancing them from their safety net with each adaptation. If an emergency were to occur, would all personnel be where they are supposed to be, doing what they are supposed to be doing? Emergencies do not occur every day, though this is what the procedures were designed for. Unfortunately, progression to the unstable forth quadrant in Snook's (2000) Matrix ensues when these "stochastic" events do occur and system failure results. This is where what seemed to be an efficient adaptation is revealed to be maladaptive.

When emergency situations arise, team member interdependence correspondingly increases and coordination becomes essential to team functioning (Orasanu, 1994). As the situation requires more interdependence, the designed procedure that was originally intended to mediate risks is unpracticed and unfamiliar, inconveniently, when it is needed most. Events that spark these failures are rare, but will eventually arise and display all technical errors as mistakes align (Perrow, 1984; Reason, 1990; Stolte et al., 2010). When the inevitable event occurs, personnel are forced to assume that interdependent others are abiding by designed procedure, even though they themselves often abide by their local adaptation (Snook, 2000). This failed assumption is what history has shown to result in catastrophe—including friendly fire shoot-downs, space shuttle disasters, and oil rig explosions.

To summarize, quadrant 1 represents the design phase of procedures, quadrant 2 represents units following designed procedures in a practical setting, quadrant 3 represents units creating and reinforcing adapted methods, and quadrant 4 represents system failure. Natural response to correct a mistake is overcorrection (Dekker, 2011). This means adding to the written procedure, effectively restarting the process as the distance increases between procedural demands and practical demands. Written procedure is revisited and redesigned under the premise of a recently failed system. After this history of dramatic failures, it should be apparent that creating tighter procedures is not the best option. There are an infinite number of responses to the infinite number of events that could arise in daily operations; rule-makers are unlikely to account for or incorporate a procedure for each possibility. The procedures of teams in high-reliability organizations should not be so heavily reliant upon each other when it is not necessary because they will eventually purge excess effort that is blocking the effectiveness of daily operations.

Organizations utilize teams to accomplish more complex tasks that would be ineffective or impossible to accomplish individually. Team members depend on each other to achieve shared goals while being adaptive and dynamic (Salas, Dickenson, Converse, & Tannenbaum, 1992). Teams that operate specifically in dynamic environments, such as those in high-reliability organizations, must have a special skill set to achieve successful performance. These unique teams are known as *action teams* and they require the ability to quickly respond to and influence the situation in which they interact (Marks, Zaccaro, & Mathieu, 2000). The key to effectiveness in action teams is the ability to "dynamically adapt" with performance conditions as they change (Coovert, Craiger, & Cannon-Bowers, 1996; Kozlowski, Gully, McHugh, Salas, & Cannon-Bowers, 1996; Marks et al., 2000). As teams are a focal point of high-reliability organizations, the emphasis of this research is on how practical drift occurs in teams.

To end the maladaptive cycle of practical drift in teams, its components must be first understood. Empirical research is necessary to determine the procedure—practical environment fit that produces the most effective setting for team performance; because the less apt the procedures are to the environment, the more likely personnel will adapt them and risk causing a disaster (Snook, 2000). The goal of this study is to uncover variables involved in this process in teams of high-reliability organizations in effort to find measurable indicators and to provide avenues for future research of predicting and preventing this maladaptation.

# METHOD

This research is the first of its kind, cross-referencing practical drift with adaptation literature to offer an introductory investigation of potential variables in the process of practical drift in teams of high-reliability organizations, and to develop an initial model demonstrating relationships among the variables. The model is influenced by the Burke and colleagues (2006) model of adaptive team performance and it reflects progress toward a theory that explains the process of practical drift using coordination and shared mental models to support the effect of procedural—practical demand fit on this form of maladaptation.

Research began with a review of organizational safety theories to gain an understanding of the nature of human error in the workplace. This was followed by an interdisciplinary literature review of empirical and theoretical research of high-reliability organizations along with the components in the process of practical drift. This was then integrated with the results of an additional literature review of adaptive team performance. Relevant literature was collected from the University of Central Florida library collections and online databases including PsycINFO, Business Source Premier, ABI/INFORM Complete, JSTOR, DTIC, and HFES using the keywords *practical drift*, *procedural drift*, *high-reliability organizations*, *human error, workplace accidents*, *tight-coupling, loose-coupling, interdependence, routine formation*, *procedural memory, safety climate*, *team processes, adaptation, adaptive team performance, team performance measurement, shared mental models,* and *coordination* in varying combinations. For the purpose of this research, practical drift was only analyzed in the context of organizations that can be classified as 'high-reliability' due to the particularly destructive nature previously noted; all other literature collected in the search was excluded from this examination, along with other various irrelevant material.

With the information collected, an understanding was developed of practical drift, how it occurs, and its implications. This was then integrated and illustrated in a conceptual model depicting the mediating relationships of shared mental models and coordination on the effect of procedural—practical demand fit and maladaptive violations of procedure. The final step was delineating propositions that reflect the relationships exhibited in the model.

# LITERATURE REVIEW

## Organizational Safety Theories

Perrow (1984) described high-risk organizations as those that are made up of interdependent, formal systems with the potential for catastrophe in the event of system failure. He posits that these interdependent systems are so complex and intertwined, that operations cannot be monitored with accuracy; a single input can offset chain reactions that quickly disseminate to affect numerous components, making direct cause and effect untraceable. He states bureaucracy as the controlling force in an organization, arguing that a combination of centralization and delegation from upper management is the only effective method in dealing with the complexities of this heavy interdependence. He refers to the disasters that occur because of this structure as 'normal accidents' (Perrow, 1984). In this sense, he refers to 'normal' as natural, rather than usual. He theorizes that normal accidents are a natural byproduct of the high-risk organizational structure, and that they are inevitable because the same effective bureaucratic structure is inherently ineffective in controlling damage as it spreads to contaminate the entire system (Perrow 1984). What Perrow is describing is the tightly coupled nature of high-reliability organizations (Weick, 1987).

The concept of 'coupling' has numerous different connotations across both subjects and disciplines. Loosely coupled systems were first recognized in organizational theory by Glassman (1973) as systems in which variables share weak or few similarities. This was further expanded upon by Weick (1976) as he conceptualized tightly coupled systems as those with variables that are responsive to one another, yet still retain their respective identities. It is apparent that other researchers may have found these definitions insufficient, because authors seemed to use the phrase incorrectly and by their own discretions (Orton & Weick, 1990). The struggle to grasp a common understanding in the literature led to a comprehensive review by Orton and Weick (1990) in which a more precise explanation and understanding of coupling was formed. They stressed that this concept is more dynamic than the descriptive usages found in various literature. Rather than viewing 'coupling' as a black-and-white scale with 'loose coupling' at one end and 'tight coupling' at the other end, it should be seen more dialectically to account for conditional situations.

| | **Responsive** | **Distinctive** |
|---|---|---|
| **Tightly Coupled** | Yes | No |
| **Loosely Coupled** | Yes | Yes |
| **Decoupled** | No | Yes |
| **Non-Coupled** | No | No |

Table 1. Team relationship to one another in each system

In the context of teams, systems are tightly coupled when teams are responsive to each other, yet lack distinctiveness; while loosely coupled teams are both responsive and distinctive. Decoupled systems are those with distinctive, yet unresponsive teams; and uncoupled systems are those with neither responsive nor distinctive teams. This interpretation of coupling is essential because it incorporates both connectedness and autonomy, while explaining systems as dynamic and not static (Orton & Weick, 1990). The information regarding the characteristics of the teams in these systems is summarized in Table 1. The use of 'coupling' as a dynamic description is recognized and adopted in the temporal consideration of Snook's (2000) Matrix and in the theory of practical drift in teams.

Weick (1987) further expounded the taxonomy of high-risk organizations into high-reliability organizations, those that prioritize reliability above all other goals and objectives within the organization. High-reliability organizations (HROs) require supreme efficiency and effectiveness in demanding circumstances in order to prevent catastrophic outcomes (Weick, Sutcliffe, & Obstfeld, 1999). Their operations are highly predictable and effective while balancing a wide range of hazards (Roberts, 1990). A healthy HRO would provide a centralized mental model that interplays with loosely coupled systems to result in this essential efficiency and effectiveness (Weick, 1987).

Technological advancement continuously introduces more complex systems into the workplace. Perrow (1984) advised organizations to discontinue the use of tightly coupled systems in order to accommodate for the limited support that the administration will be able to provide before an influx of normal accidents arises. In summary, the more interwoven the components in a system are, the more likely the system will experience failure; furthermore, the static use of these interdependent systems in non-static environments creates the potential for maladaptation. He stressed that accidents are a function of centralization and bureaucracy in tightly coupled systems (Perrow, 1984). This is contradicted as he argues for centralization because only upper-level decision-makers can see the inter-organizational consequences; but argues against centralization because bureaucrats become overwhelmed with decision-making workload (Perrow, 1984). This confounded explanation could indicate the need for a dynamic model that balances the various demands within an HRO. The main contribution of Perrow's (1984) theory is the acknowledgment that this particular organizational structure innately fosters systems that are bound to have occasional disasters because they do not function well in dynamic environments. Rather than submit to inevitability, the theory of practical drift stresses the importance of improving the design and management of systems to match the dynamic context and lessen the risk of failure (Snook, 2000).

In contrast to Perrow's bureaucratic approach to workplace error, Weick (1987) names the individual and his or her cultural influences as critical to accident avoidance in HROs. He focuses on the error of the individual in the accident process, as well as the influences that affect the individual, whereas Perrow focuses on the initial error and its progression into a disaster. Weick's argument centralizes on the fact that complex systems fail because the individuals operating within them are not complex enough to handle incongruence when it occurs. This can lead to poor decision-making and poor coordination (Weick, 1987). This focus of using personnel to diagnose problems is grasped in this approach toward a theory for practical drift in teams. It is not new practice to explore the people and their influences to explain error in the workplace. Lawton and Parker (1998) posit that unintentional errors are influenced by a lack of skill or information processing. Investigating the variables that influence these errors is a popular topic in realm of safety culture and climate.

**Culture/Climate**

Research has shown that safety culture and climate can be very influential to high-performing HROs, and thus exactly what the high-reliability theory is based on (LaPorte, 1996; Matthews, 2005; Roberts, 1990; Rochlin, 1996; Rochlin, LaPorte, & Roberts, 1987). Weick (1987) further endorses that an unhealthy culture can be signified by tightly coupled rule design being mismatched with loosely coupled daily operations. Although safety culture is not an examined variable in this study, it is important to discuss the debate considering the difference between ‘safety culture’ and ‘safety climate’. While some researchers indicate the two synonymously (Flin, Mearns, O’Connor, & Bryden, 2000), climate is more recently referred to separately as the attitudes and perceptions of an organization’s safety culture (Wiegmann, Zhang, Von Thaden, Sharma, & Gibbons, 2004). The two terms should be recognized as different, though closely related in that they  are positively correlated (Singer, Falwall, Gaba, Meterko, Rosen, Hartmann, & Baker, 2009) and both can be used to indicate the value of safety (Guldenmund, 2007; Mearns, Whitaker, & Flin, 2003; Mohammed, 2003). Safety culture is reflected in safety climate (Chen & Jin, 2013; Melia, Mearns, Silvia, Silvia, & Luisa Lima, 2008); thus, climate is used to assess changes in safety culture (Choudhry, Fang, & Mohamed, 2007; Melia et al., 2008). Due to this relationship, the two terms are often used together by authors, but should not be used interchangeably.

It has been long understood that safety climate increases employee adherence to safety guidelines (Zohar, 1980). The study of safety climate and unsafe behaviors is related to the concept of practical drift, but this investigation shows that the process of practical drift involves much more than employee perceptions affecting maladaptive behaviors. The study of safety climate and unsafe behaviors is related to the concept of practical drift, but this investigation shows that practical drift is much more than employee perceptions leading to unsafe behaviors. Much climate research centralizes on the relationship between safety climate and leadership on safety performance. A relatively new stream of research is based on a multilevel model of safety climate, including a safety sub-climate in teams (Zohar, 2000, 2003; Zohar, Livne, Tenne-Gazit, Admi, & Donchin, 2007; Zohar & Luria, 2005). This research has found that organizational sub-climates are created because policies are variably enforced at supervisory discretion (Zohar & Luria, 2005); therefore suggesting that safety performance in a team's environment is a function of the leader's influence, which is influenced by the leader's supervisor and so on to the source of organizational safety guidelines and culture. This view concentrates on a team's safety sub-climate being positively related to employee adherence to written procedures. The theory of practical drift differs in its focus of safety performance by suggesting that adherence to written procedure is influenced by a misfit between the demands of procedure and the demands of the practical environment.

**Models of Fit**

Person-environment (P-E) fit models are based on the premise that outcomes are not due to characteristics of the person or features of the environment, but the gap between the two (Edwards & Cooper, 1988). When their relationship is unbalanced, it results in employees' needs not being met or occupational demands not being met (Cooper, Dewe, & O'Driscoll, 2001). This idea behind this theory of 'fit' has been used as a model in organizations such as information and communication technology (Ayyagari, Grover, & Purvis, 2011), virtual organizations (Shin, 2004), and globally dispersed organizations with traveling employees (Ivancevich, Konopaske, & DeFrank, 2003), to study many industrial factors such as satisfaction, commitment, motivation, and stress in their roles of causing strain (Ayyagari et al., 2011; Bretz & Judge, 1994; Hollenbeck, 1989; Ivancevich et al., 2003; Lauver & Kristof-Brown, 2001; Shin, 2004). As stated, the process of practical drift also involves incongruence between two factors to create strain and result in unideal performance; though not between an individual and context, but between protocol and situational context. Setting aside the individual component of P-E fit models, occupational demands are brought into focus.

The job demands—resources model suggests that an imbalance between the demands of a job and the resources available to employees creates job strain that results in poor performance (Bakker & Demoerouti, 2007; Bakker, Demerouti, & Shaufeli, 2003). The effect of this imbalance has also been found to hold true in predicting safety violations and severity of injury (Hansez & Chmiel, 2010; Snyder, Krauss, Chen, Finlinson, & Huang, 2008). Research has established that discrepant job demands and resources can greatly increase job strain, which leads to increased occurrence of accidents and near misses (Turner, Chmiel, & Walls, 2005); though this investigation further dissects job demands to explain practical drift by examining the fit of procedural demands and practical demands.

This idea of 'fit' is similar to the process of practical drift, though a fit model for the coupling demands of procedure and practice has yet to be proposed in the literature. This research contributes the suggestion of a (mis)fit between the demands of written procedure and the demands of practical environment yielding poor safety performance; specifically, prompting the onset of practical drift and leading to dangerous maladaptive violations of procedure.

**Violations of Procedure**

There are two types of violations recognized by Reason, Parker, and Lawton (1998). "Routine" violations occur when employees take short-cuts, developing habitual or routine violations; and “situational” violations are a reflection of organizational failures in the form of compensatory behaviors. For example, choosing production over safety would be a routine violation; but compensating for a lack of resources available would be a situational violation. Recent research has revealed the effect of job strain in predicting routine violations and declines in safety performance (Hansez & Chmiel, 2010). This study theoretically infers that if an organizational system remains static, the situational violations caused by that system will also become routine violations as they solidify into a maladapted practice in the process of practical drift (Snook, 2000).

The key is to understand that organizational systems are dynamic and change over time; they should not be branded with static procedural demands. The passage of time entails changes in situational demands and shifts in cognition (Burke et al., 2006; Snook, 2000). Therefore, the misfit between the tightly coupled rules set in place by the organization and the loosely coupled demands of the practical environment emerges as the steering force behind practical drift.

## Adaptation

It is common practice in organizations, especially HROs, to structure goal achievement in interdependent teams, rather than in individuals, effectively creating tightly coupled systems. Working in teams inherently grooms adaptive behavior in organizations because the catalog that an individual pulls from when acting in unpredictable scenarios is multiplied by the amount of members in the team (Zaccaro & Bader, 2003). At the same time, the number of possible actions and outcomes is also increased. Recalling the definition of practical drift, the unintended systematic adaptation of practice from written procedure (Snook, 2000), it is a clearly described as an adaptive process. Burke and colleagues (2006) established a model of team adaptation and define the process as "a change in team performance … which leads to a functional outcome for the entire team". Because practical drift does not lead to functional outcomes, it is described as a maladaptation. This model (Figure 2) is one of the most established and highly cited models of team adaptation. As explained, practical drift is stimulated by the need for adaptation in practice; this makes it extremely more dangerous in HROs because their static, tightly coupled teams do not allow effective team adaptation without leading to dysfunctional operations across the organization (Snook, 2000; Weick, 1987). The Burke and colleagues (2006) input-

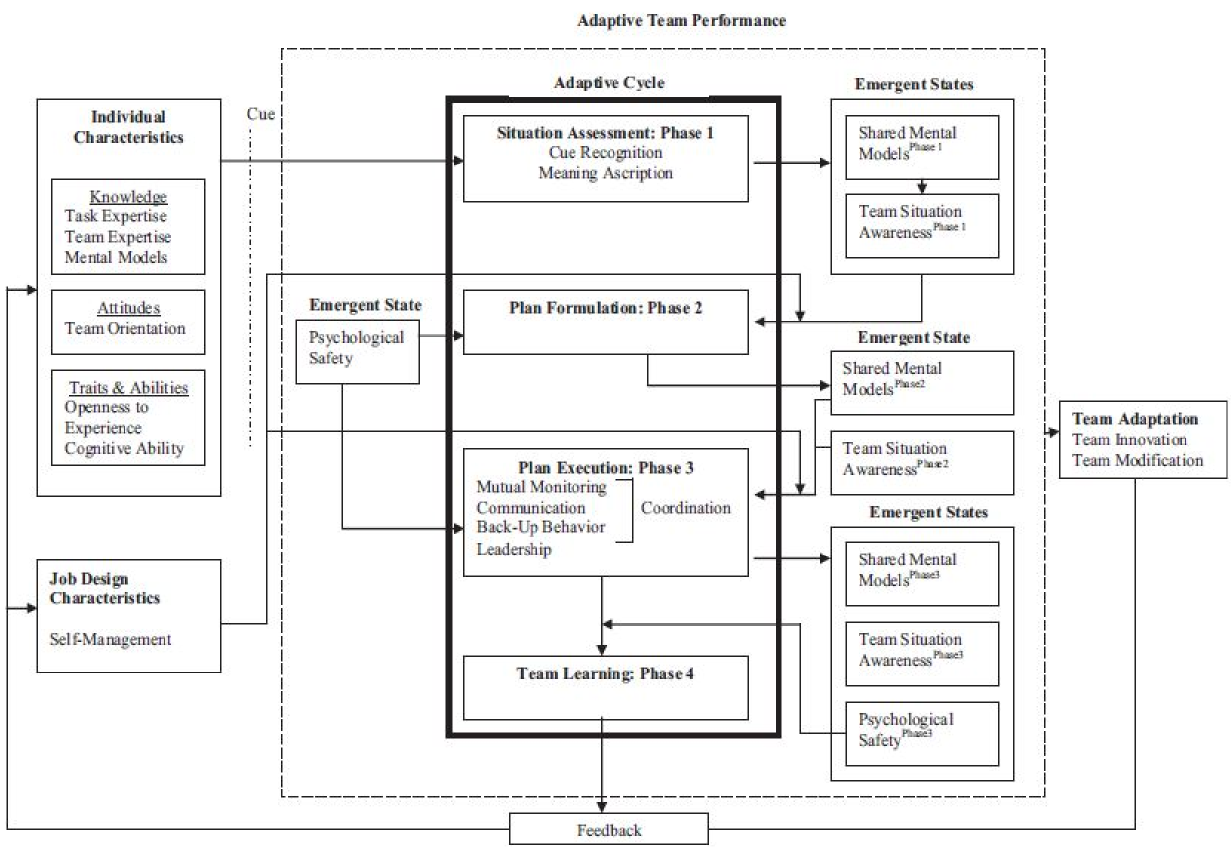

Figure 2. Input-Throughput-Output Model of Adaptive Team Performance (Burke et al., 2006).

throughput-output model of team adaptation serves as a framework to display where adaptation can go wrong in the form of practical drift and the effects that it has; demonstrating the dynamic, multiphasic process over time and the appropriate emergent states elicited. This study proposes that the process of practical drift lies within ineffective processes of the adaptive cycle. The investigation of this theory begins by examining shared mental models, team situation assessment, and the core process of coordination.

There are a few important factors that affect adaptive performance; and inversely, maladaptive performance in the form of practical drift. Marks and colleagues (2000) uncover the importance of shared mental models in testing the effectiveness of action teams in various performance conditions. As stated earlier, the effectiveness of action teams is a product of dynamic adaptation to performance conditions as they change (Coovert et al., 1996; Kozlowski et al., 1996; Marks et al., 2000). The findings of Marks and colleagues (2000) help support the idea that ineffective shared mental models lead to maladaptive behaviors in the process of practical drift in teams.

**Shared Mental Models and Team Situation Awareness**

The first phase of team adaptation is *situation assessment*. This process involves scanning the operative environment for potentially relevant happenings that could potentially affect team performance (Burke et al., 2006). Team members scan for and recognize signals that could negatively impact team performance, and then ascribe meaning to them based on their established memory and acumen (Burke et al., 2006; Salas, Rosen, Burke, Goodwin, & Fiore, 2006). In other words, whether or not events are considered potentially relevant depends on previous experience with analogous events. Communicating to the rest of the team the recognized cues and their meanings is what results in team shared mental models (Burke et al., 2006). Shared mental models give teams the ability to sense and manage unexpected situations collectively (Uitdewilligen, Waller, & Zijlstra, 2010). The cue sparking practical drift is conceptualized as the difference between procedural demands and the demands of everyday practice; specifically, tightly coupled teams operating with demands that do not require such tight coupling. The maladaptive process of practical drift is then set in motion and ultimately entails teams pragmatically adapting practice to the less-demanding situation at hand (Snook, 2000).

Cue recognition involves constantly scanning for and recognizing cue patterns that prompt a need for change in the current situation (Stagl, Burke, Salas, & Pierce, 2006). Meaning ascription to this cue involves deciding how to respond; it is the trigger that sets off adaptation (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995). Adaptation occurs because unstable situations breed the need for change. In practical drift, teams expel unnecessary procedures and replace them with more efficient methods of goal completion (Snook, 2000). The failure in this phase is that the adaptive response is not communicated to the other organizational members, a necessary action for efficient adaptation (Burke et al., 2006; Snook, 2000). Each individual in the team may go through this process in different ways and at different times, but each thinks, feels, and acts on the disposition that all members are thinking, feeling, and acting as a single unit. This ununiformed process in a maladaptive team leads to individual, unshared mental models; but dangerously, each member perceives them to be shared. Discordant teams that do not have a shared mental model will not properly develop synthesized problem models (Artman, 2000). Problem models refer to a team's shared cognitive model of awareness, understanding, solutions, and consequences of potential and current problems (Orasanu, 1990, 1994). This lack of shared understanding leads to a lack of team situation awareness, given that the roles, procedures, and available resources are actually being perceived differently per individual (Burke et al., 2006; Salas, Prince, Baker, & Shrestha, 1995).

*Proposition 1*: The coupling misfit of procedure and practice is negatively related to shared mental models in the cycle of practical drift in teams of high-reliability organizations.

*Proposition 2*: Shared mental models are positively related to team situation awareness in the cycle of practical drift in teams of high reliability organizations.

*Proposition 3*: Shared mental models and team situation awareness are negatively related to maladaptive violations in the cycle of practical drift in teams of high-reliability organizations.

The second phase of team adaptation is *plan formulation*. After assessing the situation in the adaptive cycle, teams go into a process of setting goals, structuring action plans, and identifying potentially influential factors (Burke et al., 2006). The quality of plan formulation is largely affected by the emergent states resulting from Phase I. A lack of shared mental models and team situation awareness obstructs structuring and planning because all team members are working from different vantage points (Burke et al., 2006). As stated, it is characteristic of HROs to have statically, tight-coupled teams (Perrow, 1984; Weick, 1987). The action of just one team has the potential to result in catastrophic failure for the entire organization, as the actions of teams are so interwoven. Each individual's perception creates a shared mental model that directs plan formulation towards the achievement of shared goals (Endsley, 1995). A shared mental model that has been tainted with the negative effects of Phase I will carry over to decrease the quality of plan formulation, and further decrease shared mental models and team situation awareness.

In order to successfully complete the following step of strategy development, the team's purpose must be clearly defined and agreed upon (Marks, Mathieu, & Zaccaro, 2001***;*** Rosen, Bedwell, Wildman, Fritzsche, Salas, & Burke, 2011). Mission analysis involves the formulation, planning, and evaluation of the team's mission. This includes identifying goals that fall in line with the mission and the resources available to achieve these goals and the mission, as well as being aware of influential environmental circumstances (Fleishman & Zaccaro, 1992; Marks et al., 2001; Prince & Salas, 1993). This is an attitude-based teamwork competency that requires member synchronization to complete tasks by integrating resources, responses, and actions (Guzzo, Yost, Campbell, & Shea, 1994). Failures in these integrations decrease shared mental models and ultimately end in disasters for team effectiveness, rooted in the maladaptation of practice known as practical drift (Marks et al., 2001; Snook, 2000).

Effective strategy development includes developing multiple plans of action using problem solving and analytical reasoning to properly prepare for any course of events in the achievement of each goal (Gladstein, 1984; Hackman, 1983; Hackman & Oldham, 1980; Marks et al., 2001; Prince & Salas, 1993). Effectively developing strategies that integrate task completion among teams entails assigning specific roles to each member to achieve a common goal, and that failure to do so results in poor team performance (Cannon-Bowers et al., 1995; Marks, et al., 2001; Stout, Cannon-Bowers, Salas, & Milanovich, 1999; Weldon, Jehn, & Pradham, 1991). A team that is not developing effective strategies may not share a common plan of action or guidelines enforcing obedience to the strategy, as well as a common awareness of situational risks. In the event of an emergency, effective strategy development is crucial to successful team performance (Stout et al., 1999). The level of effectiveness in this stage affects the team's shared mental models of goal achievement strategy and shared awareness of the situation. It is apparent that the failure to establish shared mental models and team situation awareness can carry over throughout the phases of adaptation, but also has the potential to go awry at any stage.

**Coordination**

The *plan execution* phase of team adaptation involves a concurrent mix of individual-level and team-level processes that interplay to achieve shared goals. The successful coordination of these processes is essential to create effective team adaptation (Burke et al., 2006). In the same light, the disorder of these processes has the potential to result in maladaptive violations of procedure. Referring back to Snook's (2000) Matrix, the advancement from quadrant 3 to quadrant 4 marks the slim potential of an accident to occur actually doing so. This means a team is faced with the task of assuming how others will behave in this unfamiliar situation; and if the wrong assumption is made, disaster will result (Snook, 2000; Stolte et al., 2010).

Within the past thirty years, there has been an increasing amount of theoretical models centralizing on team processes as the foundation of team effectiveness (Gist, Locke, & Taylor, 1987; Guzzo & Shea, 1992; Hackman, 1983; LePine, Piccolo, Jackson, Mathieu, & Saul, 2008; Marks et al., 2001). The processes that are both noted in the literature to enable effective coordination and affect practical drift in teams are mutual performance monitoring with backup behavior, systems monitoring, and communication (Brannick, Prince, Prince, & Salas, 1992; Brannick, Roach, & Salas, 1993; Burke et al., 2006; Cannon-Bowers et al., 1995; Dickinson & McIntyre, 1997; Fleishman & Zaccaro, 1992; Gladstein, 1984; Hackman, 1983; Hackman & Oldham, 1980; Kozlowski, Gully, Nason, & Smith, 1999; Marks et al., 2001; Prince & Salas, 1993; Rosen et al., 2011; Snook, 2000; Stout et al., 1999; Tesluk, Mathieu, Zaccaro, & Marks, 1997; Weldon et al., 1991; Zalesny, Salas, & Prince, 1995). Each of these processes plays a unique role in team coordination and practical drift in teams.

***Mutual monitoring and backup behavior***

Mutual performance monitoring is an individual-level cognitive process that involves actively monitoring oneself, as well as other team members, in effort to prevent and discontinue performance errors (Burke et al., 2006, McIntyre & Salas, 1995). Mutual performance monitoring aids the effort of team coordination by allowing team members to recognize potential obstacles impeding each other's performance and therefore, of the team as a whole (Rosen et al., 2011). A team member who is participating in mutual performance monitoring can recognize when fellow team members need assistance and how to best assist them in fulfilling task requirements (Marks & Panzer, 2004). When a team member aids or assumes the responsibility of another team member, it is referred to as backup behavior.

Team members participating in backup behaviors are actively monitoring the status of their team and are able to identify situations in which other team members need assistance to complete taskwork. Backup behaviors can include giving feedback to team actions, and assisting in or completing the task work of a fellow team member (Dickinson & McIntyre, 1997; Marks et al., 2001). Effective team monitoring and backup behavior requires all team members to be familiar with each other's roles and responsibilities in order to identify how to provide assistance when necessary, made possible by a healthy team situation awareness (Marks et al., 2001). This means that team members should provide checks and balances, stepping in when necessary.

The critical danger of practical drift is its latency, as it often remains unnoticed until disaster strikes (Snook, 2000; Stolte et al., 2010). Team monitoring may be the most efficient way to notice a drift from designed procedure and eliminate it, because these members know exactly what each team member should be doing and how to fix it when they are not; this indicates that the level of team monitoring and backup behavior can be used to reduce the maladaptive behaviors of practical drift.

***Systems monitoring***

This variable was added in the expansion of the model of adaptive team performance by Rosen and colleagues (2011). Fleishman and Zaccaro (1992) have done extensive research on the crucial process of systems monitoring in team performance. Systems monitoring is a team processes that involves actively monitoring the internal and external systems of a team. Monitoring the internal systems involves keeping track of the resources available to the team, such as equipment, personnel, and relevant information related to team function. Lautman and Gallimore (1987) found that 70% of airplane crashes are rooted in the poor management of team resources. Monitoring external systems is actively scanning for and tracking potentially influential environmental conditions that are relevant to team functioning (Marks et al., 2001; Fleishman & Zaccaro, 1992).

The active scanning involved in systems monitoring enforces members' awareness of each other's actions, resources, and environmental influences, adding to team situation awareness. Systems monitoring ensures the team is adequately prepared for any situation, as well as the status of the team at all times; both of these issues are at the core of practical drift (Fleishman & Zaccaro, 1992; Snook, 2000). Teams efficient in systems monitoring are more likely to recognize when a system is not functioning properly and are collectively aware of the situation and how to fix it. Recognizing failing components in a system and assuring preparation for emergency events are key actions that could reduce the potential for maladaptation in teams, as well as the accidents that can result from practical drift.

### ***Communication***

Communication is another essential role in the adaptive process. It is the medium of knowledge sharing between team members and is absolutely necessary for the effectiveness of monitoring behaviors (Burke et al., 2006). It is used to share potential issues and other voluntary information with each other and between teams, as well as the understanding of these messages (Fleishman & Zaccaro, 1992; Smith-Jentsch, Johnson, & Payne, 1998; Stagl et al., 2006). Poor communication is often the factor that gets the most attention when searching for a reason for the tragedies incurred from practical drift. Without discounting its role in the processes, communication should be recognized as a single component in coordination of a team. All three of these processes are vital to successful team coordination and show the potential to decrease maladaptive behaviors in the process of practical drift.

*Proposition 4*: The coupling misfit of procedure—practice demands is negatively related to coordination in the cycle of practical drift in teams of high-reliability organizations

*Proposition 5*: Coordination is negatively related to maladaptive violations in the cycle of practical drift in teams of high-reliability organizations.

## **Shared Mental Models, Team Situation Awareness, and Coordination**

The three previous processes enable effective coordination in teams, permitting successful plan execution (Burke et al., 2006; Rosen et al., 2011). Teams in HROs critically depend on each other for task completion and goal achievement, often to the crux of survival. As members' tasks become increasingly contingent on each other, the need for coordination increases correspondingly (Tesluk et al., 1997). Concise coordination and cooperation within a team is extremely influential to team performance, as well as to team training (Klein, Feltovich, Bradshaw, & Woods, 2005). In conducting a task analysis, the basis of all team training, Salas and Cannon-Bowers (2000) recognized the particular importance of "coordination-intensive" tasks in effective teams. It is no question the role that coordination plays in team functioning.

Failures in coordination have played a role in past instances of practical drift, including the 1980 failed Iranian hostage rescue (Allard, 1990) and the 1983 bombing of Marine barracks in Beirut (Ryan, 1985). Both instances were the result of friendly fire, and were discussed in Snook's (2000) publication of the matching title. Allard (1980) and Ryan (1985) both indicate that these avoidable events were preceded by a lack of coordination. In 1999, the Mars Climate Orbiter disintegrated upon entering Earth's atmosphere due to failed coordination between teams using incompatible measurement tools in software design, causing the Orbiter to enter at a miscalculated angle (Sauser, Reilley, & Shenhar, 2009). These interdependent teams were not well coordinated, so they did not have a shared understanding of their roles, and thus were unaware of the dangerous situation they created. This evidence shows the implication of poor coordination on decreased shared mental models and poor team situation awareness.

Shared mental models have also been theorized to facilitate coordination efforts in counter-terrorism operations and crisis response teams (Fiore, Jentsch, Bowers, & Salas, 2003). Shared mental models have been suggested to play a role in a cockpit crew's ability to fly safely under situational pressures and unideal conditions (Cannon-Bowers, Salas, & Converse, 1990). The Burke and colleagues (2006) model of adaptation also supports this relationship, positing that shared mental models leads to  team situation awareness, which collectively enhance coordination; and efficient coordination results in strengthened shared mental models and team situation awareness.

> *Proposition 6*: Shared mental models and team situation awareness are positively correlated with coordination in the cycle of practical drift in teams of high-reliability organizations.

# DISCUSSION

Results from this literature review fill a gap in organizational research by identifying variables in the cycle of practical drift in teams of HROs, providing explanations of how each variable affects the process. These findings were used to construct an introductory model representing measurable variables in the process of practical drift in teams (Figure 3).

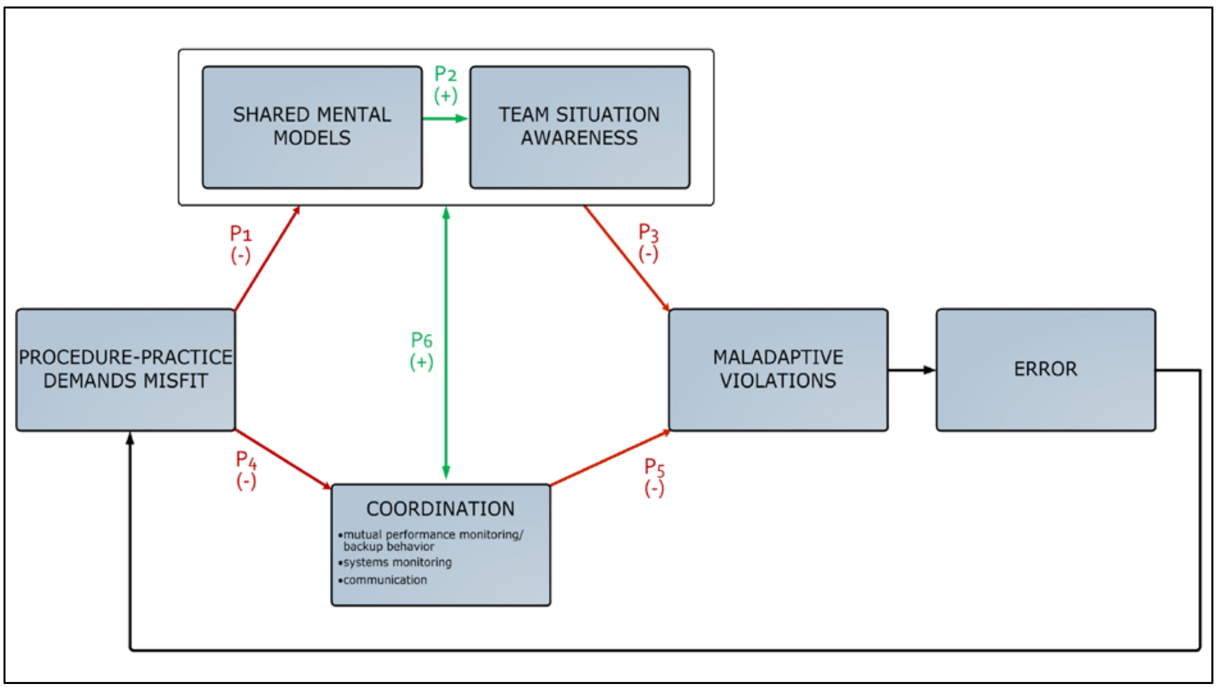


Figure 3. The proposed Model of Practical Drift in Teams of high-reliability organizations

The model embodies the continuous, sequential cycle that characterizes practical drift in a model of fit that utilizes the input-mediator-output-input style (Ilgen, Hollenbeck, Johnson, & Jundt, 2005; Snook, 2000). The cycle begins with a misfit of coupling demands of written procedure and coupling demands of the team's practical environment, leading to maladaptive violations of procedure, and subsequent error.  This relationship is mediated by shared mental models, team situation awareness, and coordination; which show a mutual positive effect on one another.  It also shows shared mental models leading to team situation awareness.  The cycle then restarts with the overcorrection of policies in reaction to the error, recreating tightly coupled rules that are not in concert with the loosely coupled reality.

# CONCLUSION

Accidents caused by practical drift often leave people void of a compelling explanation; wondering, “how did this happen?” when hindsight shows that the signs were there all along. The goal of this research was to theorize where to look for these signs in teams. This investigation drew upon relevant literature to compose a theoretically based rationale in hopes of generating a better understanding of the variables involved in the process of practical drift in teams, and to set the groundwork for future research seeking to predict its occurrence. The resulting model should serve as groundwork for future research to expand upon and modify as more discoveries are made.

The model of practical drift in teams is not intended to be a comprehensive compilation of all variables involved in the process, but to portray a portion of what currently exists in the literature and to provide an introductory investigation to help stimulate research in a much needed area. To compile a more comprehensive literature base, the concept of practical drift was investigated and inferred upon using plausible processes involved such as the phases in routine formation, procedural memory, tight and loose coupling, and the influences of these components. This model is focused on the specific context of high-reliability organizations, and it should not be generalized to any other organizational context without further examination. While the process of practical drift in teams may be similar in other types of organizations, the outcomes have the potential to differ drastically as operations become less risky.

## Future Implications

There is plenty of room for research in the area of practical drift. As previously stated, there is a significant gap in the empirical examination of this phenomenon. This introductory model can be used to develop a better understanding of practical drift in teams and to guide future research in the development of tools that serve to prevent this process in high-reliability organizations. The development of a measurement tool that can predict the likelihood of practical drift in teams would be a suitable continuance to this research.

### Secondary Variables

The model of adaptive team performance includes several secondary variables that were not analyzed in this introductory review that may play a role in the process of practical drift in teams; including job design and various individual characteristics (Burke et al., 2006). Though many studies show inconclusive results in correlating individual differences with safety performance (Bell, 2007; Reason, 2008), some researchers may be interested in investigating individual-level variables to contribute to this team-level model. Recent developments have found significant results in relating personality and safety performance (Christian, Wallace, Bradley, & Burke, 2009; Hogan & Foster, 2013). Grote, Kolbe, Zala-Mezö, Bienefeld-Seall, and Künzle (2010) found that, in part with effective adaptive coordination, heedfulness in pilots makes better cockpit crews, regardless of task load. Self-efficacy has also been shown to result in increased adherence to safety procedures (Chan, Woon, & Kankanhalli, 2005). Other studies have shown that a healthy attention span correlates with better safety and productivity (Pater, 2001). In exploring this realm, it is important for researchers to be mindful of distinguishing accident preventative behaviors from the maladaptive behaviors in the process of practical drift by keeping in mind that practical drift must begin with a misfit between procedural demands and practical demands.

Catastrophic happenings, like all performance outcomes, cannot be attributed to a single source. Technical causes are the most apparent, but latent causes could be the driving attribution (Reason, 2008). This research set out to investigate one of those latent causes, practical drift, to provide a better understanding of the process and to investigate ways to recognize it in a high-reliability organization. A conceptual framework is provided along with testable propositions for future research to build upon, giving practical avenues to develop diagnostic tools that can predict and prevent accidents resulting from drift in high-reliability organizations. By examining the relationships reflected in this model, steps can be taken to prevent the tragic accidents of practical drift, consequentially saving many innocent lives.

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