LANGUAGE BIAS IN ACCIDENT INVESTIGATION

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ABSTRACT

This paper examined the language and content of the U.S. Forest Service's Serious Accident Investigation Guide (SAIG), which is used to investigate what the organization terms 'serious wildland fire accidents'. The purpose of research was to identify whether the language in the guide was objective, or if it biased the accident analysis process and conclusions of the accident report.

Qualitative research included philosophic, paradigmatic, and linguistic analyses of the 2001 and 2005 editions of the SAIG. Phone and/or questionnaire interviews were conducted with six current or former Forest Service personnel, who were familiar with the SAIG, versed in the use of the guide to complete accident reports, or familiar with the case study. This data was used to validate language biases and to determine what affects these might have on the report. The Thirtymile Fire Accident Report was used as a case study, to understand how the Forest Service and greater society may be affected by the language of accident reports.

Results affirmed that language bias exists in the SAIG and that it does affect accident analysis. The SAIG influences investigators to apply linear, hindsight biased, 'cause and effect' reasoning toward human actors in the event. The guide's use of agentive descriptions, binary opposition, and the active verb voice creates a seemingly exclusive causal attribution toward humans. Objective analysis was found to be impossible, using the SAIG's language and report structure. This stands in contrast to the agency's goal of accident prevention. It is recommended that more research be done on the language and structure of accident investigation guidance, to help determine what changes may be necessary to align espoused values of prevention and organizational response to accidents.

Keywords: accident investigation, accident report, Forest Service, Serious Accident Investigation Guide (SAIG), agentive language, human causal attribution

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INTRODUCTION

The United States Forest Service (USFS) has managed natural resources for the nation's forests and grasslands for over 100 years ("Fire & Aviation Management," p. 723). Though this agency encompasses a variety of systems, including ecological management, biological research, and the human-nature interface, this paper will focus on wildland fire. Fire is a complex and dynamic entity that presents an element of 'uncertainty' (S. E. Page, 2011), which can result in a seemingly controlled situation rapidly developing into wide spread disaster. Thus, serious accidents occur nearly every fire season, resulting in firefighter injuries and/or deaths (Pupulidy & Sutton, 2011). "More than 1000 people have lost their lives fighting wildfire since record-keeping began early in the 20th Century" (Harbour, 2011). The work environment of fire presents a particular challenge to wildland 'ground' firefighters, who predominantly work in a low technology environment, armed only with hand tools, personal protective equipment (helmets, fire shelters, etc.), a radio, their training and experience. Thus, the 'human factor'[1] plays a significant role in the perceived success of the mission.

The Forest Service has been investigating its own fire-related accidents[2] since the early 1900's ("Wildland Fire Lessons Learned Center," 2011). Initially, the reports seemed to 'tell the story' of the accident (I. Pupulidy, personal communication, August 7, 2011). Reports were explanatory, using the words of event participants who were 'inside the tunnel'[3] (Dekker, 2006). Over time, the general narratives that emerged from wildland fire accidents began to formalize into specialized reports, "To provide management with information for accident prevention" (Whitlock & Wolf, 2005, p. 2). Today, accident analysis and written reports are often guided by the Serious Accident Investigation Guide[4], a formal document published through the Forest Service Technology and Development Program (2005).[5]

In general, accident investigations are guided by models, which reflect the beliefs of the user and his/her culture. "As Kuhn proposed, our propositions about the world are embedded within *paradigms*, roughly a network of interrelated commitments to a particular theory, conception of a subject matter, and methodological practices" (Gergen, 2009, p. 24). An investigator will view an accident based on his belief paradigm about the world, the organization, the nature of error, and humans within the system. An example of such a belief is 'cause and effect reasoning', which is linked to the philosophy of Rene Descartes and Isaac Newton, who developed the idea that nature (the external, observable world) is like a machine. This expanded into the Scientific Theory, a linear method dependent on a set of 'natural laws' to create direct links between cause and effect. The

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[1] "Human factors" is a debated concept, with many definitions (Korolija & Lundberg, 2010). In general, it refers to the elements that a human brings to a system, such as biological and physiological factors, cognitive abilities, and social interaction with other systems (Author's definition).

[2] According to the USFS, an *accident* results in an injury or illness to a person, or damage to property (Whitlock & Wolf, 2005).

[3] "This is the point of view of people in the unfolding situation" (Dekker, 2006, p. 26).

[4] This guide is commonly referred to within the Forest Service as the Serious Accident Investigation Guide (SAIG), even though the actual title of the document is 'Accident Investigation Guide'. This paper will use the common term, SAIG.

[5] The 2001 and 2005 editions of the Serious Accident Investigation Guide will be addressed in this paper. A revision to this guide is underway, but has not yet been released.

Scientific Theory created a new language for describing objects, processes, events and outcomes. Initially, this framework was used to describe the 'objective world' of nature; however, the language also became attached to people. A follower of this paradigm may consider a human to fall under the same laws of cause and effect as a machine and might use the same language to describe both.

Human factors experts argue that the quantifiable world of scientific experimentation may not be applicable to predicting human behavior, due to the highly contextual and social nature of human interaction (Lutzhoft, Nyce, & Styhr Peterson, 2010). Social science questions whether it is accurate to use a 'mechanical classification' language to describe humans and their interactions. A machine can be a simple or a complicated system and can be reduced to a set of explainable outcomes, based on its limited processes. Machines lack the ability to 'adapt' to circumstances, which is a quality of complex systems. In contrast, humans have all the attributes of a complex system, "A system can be considered complex if its agents meet four qualifications: diversity, connection, interdependence, and adaptation" (S. Page, 2009, p. 4). Complex systems are often unpredictable, due to this adaptation. Thus, a complex system may need a different language of description, than a simple or complicated system.

Social construction theory suggests that humans negotiate what is 'true' or 'real' by interpreting and interacting with the social world through an ongoing, dynamic process. "What we take to be the world importantly depends on how we approach it, and how we approach it depends on the social relationships of which we are a part" (Gergen, 2009, p. 2). Language is a powerful medium for creating our reality. Accident investigators create their own reality, based on their paradigm. This allows them to qualify the significance of data, make observations and judgments, and communicate their findings through a written report. The language used in the report will have an impact on readers, who must fit the information into their own belief systems. Readers rely on the report to give them an accurate image of 'what happened', as this may be the only information they get about the event. Agency leaders may be dependent on the written report for developing changes to policies or procedures. The report may inspire lasting effects as it filters down through the organizational hierarchy and into the external community.

The USFS Serious Accident Investigation Guide (SAIG) has been used for a variety of accident analyses. Investigators are often encouraged to use the SAIG and sometimes it is required for *serious accidents*.[6] Other wildland fire agencies, like the Bureau of Land Management and the Bureau of Indian Affairs use their own versions of this guide. An accident investigation process is considered to have four basic components: the accident sequence, human factors analysis, equipment factors analysis, and environmental factors analysis (Whitlock & Wolf, 2005, p. 34). After accident team members and subject specialists complete these sections, an Accident Review Board and the Forest Service Chief evaluate the report and determine its readiness for public release.

Followers of the SAIG say that it offers a necessary formal structure for completing an accident analysis. Opponents have suggested that the guide encourages the production

[6] The 2005 SAIG defines a 'serious accident' as one that results in a death, three or more hospitalizations, fire shelter deployment, fire entrapment, property damage over $250,000, damage to an aircraft in excess of $1,000,000, or total destruction of an aircraft (Whitlock & Wolf, 2005, p. 2). In recent years, the Forest Service has adopted the use of other accident/incident analysis systems, in addition to the SAIG. Currently, the Accident Prevention Analysis (APA) may be used instead of a SAIG investigation, for some incidents.

of a meaningless checklist of non-contextual data (L. Sutton, personal communication, August 24, 2011). There have also been accusations that some reports focus on blaming individuals, which can result in moral judgments (Thackaberry, 2006). These divergent viewpoints suggest that this guide can have a powerful influence on investigators and the accident investigation process. "Texts serve as dynamic mediating mechanisms, creating those elusive linguistic products we call knowledge" (Bazerman, 1981, p. 379). An examination of the language within the SAIG may reveal some of its influence upon these entities.[7]

Thesis Question:

> How does the language used in the U.S. Forest Service's *Serious Accident Investigation Guide* bias accident investigation analysis?

[7] "We create our texts out of the sea of former texts that surround us, the sea of language we live in" (Bazerman, 2004, p. 83).

LITERATURE REVIEW

Language in accident investigation has received little attention, as suggested by the lack of academic articles and research on this topic. Thus, this paper engaged in a broader literature review of three subject areas: the influence of philosophy on accident investigation, the evolution of accident models, and language as communication and structure. The Serious Accident Investigation Guide (SAIG) was based on previous accident theories, which have their basis in philosophical paradigms. The resulting language will be based on these beliefs and will inspire both thought and action.

The Influence of Philosophy on Accident Investigation

In early Europe, the Roman Catholic Church set the framework for acceptable human thought. God was seen as the creator of the world and man was not allowed to question God's purposes, or the artifacts of creation. The Renaissance of the 14th and 15th century's awakened man from the stagnant Dark Ages and challenged common views. In 1507, Copernicus developed his heliocentric model of the universe, "This upset the received view of the universe as held captive by the chain of being -- God at the summit, earth at the base and men and angels in between" (Oliver, 1997, p. 57). The Reformation period exemplified this cultural change in man's relation to the universe and opened minds to the coming Age of Reason.

The early Enlightenment brought the genesis of the Scientific Method, which was led strongly by Italian mathematician and scientist, Galileo Galilei. Man's understanding and potential control of the universe was apparent in Galileo's belief that, "Laws of the natural world were firmly within the grasp of human rationality and not hidden in the hand of God" (Oliver, 1997, p. 73).[8]

A contemporary of Galileo, Francis Bacon believed that through reasoning, alone, we could understand the laws of nature. A key insight of Bacon's was that, "Knowledge is power, and when embodied in the form of new technical inventions and mechanical discoveries it is the force that drives history" (Simpson, 2010). Bacon developed the investigation method of Induction, which consisted of an exhaustive gathering of sensory 'facts' through observation, leading to an ultimate general statement. Induction was a strict form of knowledge attainment that Bacon deemed necessary to control the mind, which he believed was easily deceived by the senses. The inherent challenge of his method was knowing where to stop gathering these bits of information and come up with a conclusive hypothesis (2010).

17th Century philosopher and mathematician, Rene Descartes, also used reason to develop the natural sciences (Oliver, 1997). Descartes enforced a very mechanistic model to describe the structure of the world and even referred to the human body as a 'machine' (Wilson, 2010). Descartes insisted that the human mind (reasoning) was separate from the body (senses), a concept that became known as 'dualism'. "What the Scientific Revolution required, Descartes' disjunction provided. Nature became a perfect machine, governed by mathematical laws" (Dekker, 2005a, p. 8). From this dualistic perspective, it became important to rely on the rationality of the mind, instead of the potentially flawed senses.

[8] Ahead of the epistemology of his time, Galileo was condemned by the Inquisition for his heresy.

Descartes suggested, "Direct one's thoughts in an orderly manner, by beginning with the simplest and most easily known objects in order to ascend little by little, step by step, to knowledge of the most complex, and by supposing some order even among objects that have no natural order of precedence" (Wilson, 2010). This construction of order would become a critical element to the Scientific Theory.

Succeeding these earlier philosophers came Isaac Newton, who may have done more to "force the tide of reason" than anyone else (Oliver, 1997, p. 73). His influence is still felt strongly within the field of accident investigation. "His third law of motion, for example, lies at the basis of our presumptions about cause and effect, and causes of accidents: For every action there is an equal and opposite reaction" (Dekker, 2005a, p. 8). Newton's theory, that nature follows specific laws of action, was grounded in the concept of time, which was thought to be an absolute and mathematical 'container' for events (Dowden, 2010a, 2010b; Mannion, 2006). Newton's model of the world was seen to be 'mechanistic', much like Descartes. His discovery of gravity provided a new level of predictability and consequence of action, which comforted questioning minds for centuries to come.

The Age of Reason continued with the 17th Century German philosopher Gottfried Leibniz, who believed that "...there is no inexplicable phenomenon. In other words, there must be a sufficient reason for why the world is the way it is" (Oliver, 1997, p. 80). Leibniz agreed to some degree with dualism, saying that the soul followed its own laws, while the body followed a different set of laws (Carlin, 2010). He also believed that time consisted of a linear succession of events (Mannion, 2006). The work of this philosopher was critical to the era, "Leibniz put forth a theory of causation that would accommodate the Scientific Revolution's increasing mathematization of nature, one according to which efficient causes played a dominant role" (Carlin, 2010).

The exploration of causality continued with David Hume, who argued that thoughts and 'matters of fact' came from experience. According to Hume, to conceive of something implied its possibility. The challenge was to apply this reasoning to things or events that had not been experienced, a problem that pointed back to Bacon's method of Induction (Lorkowski, 2010). Hume suggested that it is 'human nature' to make inferences, even when we have no experience to support them. Hume also believed that the more we experience a particular 'truth', the more we tend to believe it will happen again. This is the basis of a 'cause and effect' belief system, as it is impossible to observe an action *every* time it occurs in the world (Lorkowski, 2010).

Hume had an important influence on his contemporary, Immanuel Kant. Kant stressed the importance of *a priori* knowledge (that which exists prior to experience) and suggested that the mind has an effect on structuring our reality. According to Kant, the human mind possesses an a priori 'template' for experience and judgment, which can give objects and action at least some of their characteristics. "The idea that the mind plays an active role in structuring reality is so familiar to us now that it is difficult for us to see what a pivotal insight this was for Kant" (McCormick, 2010). This reasoning would become critical for future accident investigation, as the presumption of cause is often outside our direct experience.

Philosophy played a strong role in structuring of the field of science, as well as in the development of accident investigation theories. Today's models are commonly based on cause-and-effect reasoning and follow the need to create a logical pattern of 'facts' and conclusions, even when the existence of a pattern is questionable or outside our

experience. Accident investigators ground themselves in assumptions of the measurability of nature and the linear flow of time. The concept of duality is present in the separation of social science from the mechanical workings of 'nature'. At the same time, however, investigators give humans machine-like attributes and expect them to operate within a predictable, ordered environment.

The Evolution of Accident Models

In order to examine the dominant USFS accident model(s), it is important to understand the genesis of Western accident theory over the last 100 years. This is the period during which accident models became formalized into three basic types: sequential, epidemiological, and systemic. Though these do not represent every model in existence, most other models were influenced by these main ideas.

"Accident analysis always implies an accident model, i.e., a set of assumptions of what the underlying "mechanisms" are" (Erik Hollnagel, 2002, pp. 1-1). During the First World War, British factories were experiencing a high volume of accidents, which led to a study of workers in a munitions factory. The study showed that some workers were more likely to have accidents than others, which led to the 'Accident Proneness Model' (Cooper, 2001).[9] This model provided a relatively easy way to deal with error - the organization had only to get rid of the 'accident prone' people. This idea was very 'sticky'[10] and helped form the basis for other models, even in our current times.

In 1931, H. Heinrich developed the first 'sequential accident model', which has often been called the 'Domino Theory'. This theory said that an accident occurs at the end of a linear sequence of events, created by either an unsafe condition or a worker's unsafe act. Like a line of dominos, if you push the first one, others will fall in succession (2002). Heinrich incorporated the Darwinian concepts of heredity and environment into his model and linked cause and effect in a deterministic manner. Through the findings from his industrial research, Heinrich proposed that humans were responsible for 80% of accidents, through their unsafe acts, whereas, 20% of accidents were caused by unsafe conditions (Cooper, 2001). This heavy weighting toward human error would influence many future theories, not just the sequential models.

Following Heinrich, a number of models developed in the sequential model line, some placing more emphasis on the human element, and some transferring the blame onto the organization and/or poor management (Cooper, 2001). The sequential model is compelling because it satisfies the human need for a causal explanation, especially a simple one that can be graphically represented and follows a linear timeline (Erik Hollnagel, 2002, 2009).[11] However, "While the sequential models were adequate for the

[9] The munitions factory study actually had three propositions for preventative safety measures, of which, one was the accident proneness theory. Though the data appeared to weakly suggest that some workers were more 'error prone', the researchers may have chosen this particular theory due to the ease of implementation as a safety strategy (Cooper, 2001).

[10] The concept of "stickiness" refers to the ability of an idea to become memorable and affect a culture (Gladwell, 2010).

[11] This need for explanation was eloquently stated by philosopher Friedrich Nietzsche, "With the unknown, one is confronted with danger, discomfort, and care; the first instinct is to abolish these painful states. First principle: any explanation is better than none. ... A causal explanation is thus contingent on (and aroused by) a feeling of fear" (Erik Hollnagel, 2009, p. 10).

socio-technical systems in the first half of the 20th Century, they turned out to be limited in their capability to explain accidents in the more complex system that became common in the last half of the century" (Erik Hollnagel, 2002, pp. 1-2).

In 1978, researcher Barry Turner discovered that some accidents did not seem to occur in a simple, ordered evolution. His early concept of organizational drift suggested that some accidents are not the direct result of recent events, or human acts. Rather, accidents may develop as a natural outgrowth of small decisions made over longer periods of time, which eventually can lead to a disaster or accident (Dekker, 2011; Woods, Dekker, Cook, Johannesen, & Sarter, 2010). This came be known as the 'Man-Made Disaster Theory'. "Turner's account was innovative because he did not define accidents in terms of their physical impact (e.g. uncontrolled energy release) or as a linear sequence of events. Rather, he saw accidents as organizational and sociological phenomena" (Woods et al., 2010, p. 47).

In 1987, James Reason broadened accident theory with his analysis of the Chernobyl nuclear disaster. "All man-made systems have within them the seeds of their own destruction, like 'resident pathogens' in the human body" (Erik Hollnagel, 2002, pp. 1-2). Reason's work helped establish a new category of accident model, called the 'Epidemiological Accident Model' or 'Latent Failure Model'. Likening safety systems in the organization to a disease process, Reason said that there are 'latent conditions' that lie dormant and combine with one another. These conditions are then triggered by 'active failures' (unsafe acts by humans, for example), which can overcome the system's defenses and lead to an accident. This was later termed the 'Swiss Cheese Model', a metaphor for holes in the defensive layers allowing the passage of the active failures (Cooper, 2001; Erik Hollnagel, 2002).

Epidemiologic models have some ability to analyze complicated systems by noticing the various interconnections between humans, the organization, and the environment. The 'health' of an organization may be monitored, to an extent, by its internal mechanisms. However, the dynamic and emergent nature of a *complex system* may not be summed up in such a linear, sequential manner (Erik Hollnagel, 2002; S. E. Page, 2011). These models may still shift blame around the organization and result in scapegoating individuals, without revealing the true nature of the problem (Dekker, 2006).

The necessity of explaining complex systems required the development of a third major type of accident model, the 'Systemic Accident Model'. In 1984, Charles Perrow introduced the idea that accidents may be a *normal* part of a complex system, "...accidents are the structural and virtually inevitable product of systems that are both interactively complex and tightly coupled" (Perrow, 1984; Woods et al., 2010, p. 61). Unlike the sequential and epidemiologic accident models, the systemic model does not view an accident as a sequence of causal events (or failures), nor does it try to use decomposition to break an event into smaller parts. This theory focuses on the entire system, its interconnections, and the attempted control of its components (including the human component). "Systemic accident models, in other words, are hardly "accident models". They are models of a system's or organization's normal functioning" (Dekker, 2006, p. 92).

Language as Communication and Structure

Language forms the basis of communication and experience, both between cultures and within a culture. The 'culture' of accident investigation is no exception. The choice of

words used in accident analysis communicates ideas and shapes interpretation. The words, themselves, may grow to form meanings or inspire outcomes that are different than those originally intended. Language is a complex living structure, which can be as difficult to predict or control as the fires that wildland firefighters try to extinguish.

An important debate has raged between language theorists, particularly over the last century. Does language come pre-programmed within the human, or is it something that is acquired through culture and experience? The 17th century philosopher, John Locke, suggested that ideas within the mind are innate and "...words stand for nothing but the ideas in the mind of him that uses them" (Proudfoot, 2009, p. 164). Noam Chomsky, a famous linguist and analytic philosopher, also explored this concept of an innate ability to create language, as did contemporary psychologist, Steven Pinker. For Locke, Chomsky, and Pinker, mental thought occurs *prior* to the formation of language, "...language does not shape thought in any important respect" (Proudfoot, 2009, p. 165).

Alternative views of this 'innateness of language' concept were posed by 20th century linguists Benjamin Lee Whorf and Edward Sapir, as well as Ludwig Wittgenstein. Whorf suggested that knowledge is created *through* language, "A person devoid of the means to express an idea is devoid of that idea" (Flygt, 2007).[12] Wittgenstein believed that our thoughts are shaped by our use of language and that our world is limited to what can be expressed through language (Proudfoot, 2009).[13] French philosopher, Michel Foucault, suggested that language is inextricably linked to our experience and the cultures we live in. According to Foucault, the nature of language is social and is tied to the 'historical moment' (Seargeant, 2010).

According to some theorists, words can emerge naturally, without a specific creator (i.e. It would be difficult to determine who first designated the word for 'tree'). Words can also become an artifact of creation from a specific author (Hilpinen, 2011). An accident guide might be an example of this, as there was a presumed intention to create meaning through words, for accident investigators to follow. "The study of artifacts (*qua* artifacts) is intrinsically evaluative, since viewing an object as an artifact means viewing it in the light of intentions and purposes" (Hilpinen, 2011). The question arises, whether the Forest Service's accident investigation guide contains language artifacts that truly express the original intent of the authors.

The language of children may seem like a simple form of expression, yet it is really a complex method of interacting with the environment. Wittgenstein suggested that language is manipulated into 'games', which can become simplified versions of the content (Proudfoot, 2009; Richter, 2010; Wittgenstein, 2009). Even dictionaries, which are said to hold the 'true' definition of a word, are influenced by cultural word use. 'Meaning' can become the combination of context and function (Seargeant, 2010). People generally use a less detailed method of language to communicate, called *cognitive economy*, where shared experience is relied upon to fill in details of their thoughts (Hanks, Knight, & Holloway, 2002). Thus, to describe a 'car', the speaker need not explain that it has wheels and is a mode of transportation, to get the idea across. Communicating through cognitive economy

[12] This became known as the theory of Linguistic Determinism.

[13] This 'expression' can be an actual creation of a thought. The creation of 'rules' is one example, where rules are only given meaning when they are embedded in action. For example, an organization might write a 'rule' that they expect to be followed -- but that 'rule' does not have meaning, until it is acted out by the worker (Richardson, 2009).

allows users to engage in day-to-day social transactions, without spending excessive time in explanation. However, this 'short cut' also leaves out details and is subject to misinterpretation, as the receivers must share the exact paradigm of the message sender. The use of cognitive economy may have a tremendous impact on accident investigation, where the details and context of the accident may not be fully shared.

In general, humans *desire* simple explanations to help them quickly explain and understand their world (Erik Hollnagel, 2009). This need for simplicity can lead to the use of *binary opposition*, "A relation between the members of a pair of linguistic items, as a pair of distinctive features, such that one is the absence of the other, as voicelessness and voice, or that one is at the opposite pole from the other, as stridency and mellowness" ("binary opposition," n.d.). This 'either-or' thinking can limit possibilities, so that problems can be solved in a timely manner (Chandler, 1994; E. Hollnagel & Amalberti, 2001).[14] However, according to some theorists binary language has resulted in a culture of judgment and blame, within the accident investigation world (Woods et al., 2010). An example of this occurred when two Brazilian jets collided in midair. The descriptive words chosen by the surviving pilots resulted in immediate blame and criminal prosecution from the Brazilian authorities (Langewiesche, 2009). This 'blame culture' was also apparent in the divisive Forest Service 'Storm King Mountain' fire, where firefighters were blamed, posthumously, for their own deaths (Thackaberry, 2006).

There is linguistic research that shows that the assignment of agency to an event is highly influenced by the language that is spoken. While traditional 'cause and effect' accident models tend to assign agency based on what they consider 'hard data', the construction of agency may be far more complex. "What it means to be an "agent" does not appear to be a stable, universal property of events in the world. What people see and believe to be an agent is constructed in context" (Fausey, Long, Inamon, & Boroditsky, 2010). Studies have shown that English speakers have a stronger tendency to assign agency to both intentional and unintentional events. "You see someone brush against a flower vase and the vase ends up in pieces on the floor. When asked about what happened, you might say, "*She broke the vase.*" In English, agentive descriptions like this are typical and appropriate even for clearly accidental events" (2010, p. 2). English speakers also seem to remember actors as agents of events, even in accidental circumstances. They also are more likely to remember causal agents if they are primed with unrelated agentive expressions. Thus, linguistic context has been shown to have a strong effect on how people encode and represent their experiences (Au, 1986; Boroditsky, Ham, & Ramscar, 2002).

Sentence structure may also play a role in the assignment causality and blame. Numerous studies have shown that the 'verb voice' in a sentence can have a dramatic impact. Studies have shown that using the active verb voice in a sentence is more likely to result in the assignment of causality and blame(Au, 1986; Rudolph & Forsterling, 1997).[15] "When active voice was used to describe actions relative to an event, that agent was more seen as the cause of that event than when passive voice was used" (Knobloch-Westerwick

[14] Examples of binary distinctions in accident investigations would include the labelling of a person's acts as 'right' or 'wrong', or 'good' or 'bad'. Qualifying descriptions may then attach directly to the person, instead of just the action.

[15] The *active verb voice* is denoted when the subject performs the verb's action (e.g. "we made mistakes"). In the *passive voice*, the subject receives the verb's action (e.g. "mistakes were made")("Active vs. Passive Voice," 2010).

& Taylor, 2008). Linguistic subtleties like this can result in the perception of an actor being the cause of an event and the assignment of intentionality to the action, even if this was not the case. "Active voice apparently conveys a sense of control and causation that is lacking in the passive voice" (2008, p. 732).

A challenge of communication is that words can have multiple meanings, particularly when they are applied to complex systems (such as accidents involving humans). Cognitive economy may fail to recognize these varied interpretations. Meanings can also change as a conversation progresses, or when other humans interpret and interact with the original content.[16] One qualitative study interviewed ten accident investigators to see what their interpretation of the term, 'human factors', would reveal. The results showed that there was no consensus on a definition of the term. The meaning of 'human factors' for each participant was emergent during the conversation and was also heavily dependent on context. In addition, the participants seemed to be drawn into a 'blame culture', when presented with the study topic. "Our study shows that professionals investigating accidents rather attempt to find conversational strategies for saying that single human beings actually are responsible for accidents" (Korolija & Lundberg, 2010, p. 164).

The desire for rationally bounded problem solving has led to the creation of taxonomies in accident analysis. These collections of limited categories (taxonomy bins) are supposed to provide a comprehensive, analytical framework into which all 'factual findings' are placed (O'Hare, 2010). This includes both mechanical systems and human actions (from a reductionist concept of 'human error'[17]). Accident investigators tend to see taxonomic bins as all-inclusive and will often try to 'force fit' human decisions and actions into the limited codes. Once again, this is a form of cognitive economy.

Though we are drawn to simplify our language, 'human language' is far from simple. A prime example of this is modern computer programming. Humans have been said to have minds that work like computers, yet artificial intelligence programmers have yet to create a computer that can 'think' like a two-year old child, let alone an adult (Klein, 2009, p. 202). The 'natural language' spoken by humans, "...is one of the hardest problems of artificial intelligence due to the complexity, irregularity and diversity of human language and the philosophical problems of meaning" (Howe, 2010).

Communication between humans is fraught with challenges. Assumptions of shared definition can often lead to unintended conclusions, especially within accident analysis. Human nature leads us to utilize simple explanations and investigation techniques, which can inadvertently direct accident investigators toward a single 'truth', which may not be valid.

Discussion

This review of literature began with the historical context of philosophy, viewed the evolution of accident models, and concluded with the effect of language on communication and beliefs. Each of these subjects is critical to understand how language can affect an accident analysis, particularly one centered on human action.

[16] A simple example is the children's game, where one child whispers a phrase to another. As the phrase gets passed to others in the group, the words - and meaning, can change radically.

[17] 'Reductionism' - the practice of simplifying a complex idea, issue, condition, or the like, especially to the point of minimizing, obscuring, or distorting it ("Reductionism," 2011).

The topic of philosophy was introduced to show that we each have an encompassing worldview leading us to interpret our environment and the actions within it. Our decisions and understanding of events are based on this foundation. Accident analysis has attempted to follow a scientific worldview, at least since the early 1930's with the introduction of the Domino Theory (Cooper, 2001). Numerous scientific paradigms have existed over the centuries and the origins of this process can be found in philosophical debate, as far back as Aristotle. The development of what we now call the 'Scientific Theory' emerged strongly in the Age of Enlightenment, through concepts like Descartes' dualism, the Laws of Nature (Galileo, Bacon, Newton) and the linear reduction of time (Leibniz). "Men whose research is based on shared paradigms are committed to the same rules and standards for scientific practice" (Kuhn, 1962, p. 11). Shared paradigms were necessary for the creation of a predictable world based on 'cause and effect' reasoning, which presumes the measurability of 'facts'.

The human need for explanation (to relieve so-called '*Nietzschian Anxiety*') (Erik Hollnagel, 2009) led early accident investigators to create 'models' that could simplify an event, usually by breaking it into pieces that could be evaluated, predicted and, hopefully, controlled. These methods tended to follow the scientific belief in 'Inductivism', where singular statements of experiential 'facts' are gathered and lead to a general hypothesis (Hoyningen-Huene, 2006 - 2007). The inductive method led to a mechanistic treatment of all the components of an event, including human actions. This mechanistic model reflects back to the 'man as a machine' concept, made popular by Descartes. The assumption that humans are accountable for 80% of accidents, encouraged investigators to blame this 'component' (humans) for failures. This model continues to influence accident analysis, though full knowledge of its origins and potential fallacies may escape many investigators.

Linguistic research has shown that humans are highly influenced by language. The language used in accident analysis can lead investigators, as well as report readers, to judge human action according to specific parameters. The concept of 'free will' arises across the entire spectrum of an accident analysis: Did the human participant have full choice of action in the event? This question may not even be asked, if the language surrounding the event implies causality and intentionality. The language of the accident report may also limit the ability of the reader to make his/her own judgment about the actions of the event.

Accident analysts often *presume* a shared paradigm, which allows them to use cognitive economy to describe their findings. By limiting linguistic terms to those found in specific taxonomies, the dynamic complexity of human action is limited by mechanical categorization. Much of the actual 'story' of the event may be missed as it becomes simplified into a shorthand version. The assignment of labels to actions (such as, "loss of situational awareness") can lead to judgments that have a comprehensive effect on the understanding of the event. This thesis will explore some of these 'labels' and attempt to discover if their meaning is truly part of a shared paradigm. It will also assess how these interpretations may affect the outcome of a human factors investigation.

RESEARCH METHODS

This research is designed to answer the question, "How does the language used in the U.S. Forest Service's *Serious Accident Investigation Guide* bias accident investigation analysis?" Several agencies in the U.S. Departments of Interior and Agriculture use a version of this guide to structure accident analyses. Wildland fire events occur in a complex system, with elements that are emergent, interdependent, diverse and adaptive (S. Page, 2009). A great part of this complexity lies within the human contribution, as people both *act* within the system and must also *interpret* actions and decisions. As suggested by Burns, "Social reality is regarded as a creation of individual consciousness, with meaning and the evaluation of events seen as a personal and subjective construction" (as cited in Blaxter, Hughes, & Tight, 2010, p. 64). The social nature of accident analysis makes it a rich topic for a qualitative research study.

Qualitative research built on the literature review, which explored the potential underlying paradigms of the authors of the Serious Accident Investigation Guide (SAIG). The review revealed previous linguistic, semantic, and psychological research, which can help us understand the power that language has on the SAIG, the process of accident investigation, and the interpretation of the accident report by readers. Two editions of the SAIG (Whitlock, 2001; Whitlock & Wolf, 2005) were reviewed in detail, with regard to the literature topics. However, the 2005 edition will form the basis of this paper, as it is the current guide in use with the Forest Service. The accident guide will provide the majority of research data, as the words of the text form the foundation of language bias.

The case study approach for this paper centered on a previously released accident investigation report from the Forest Service, which was evaluated and considered as an 'artifact' of the SAIG. "The study of artifacts (*qua* artifacts) is intrinsically evaluative, since viewing an object as an artifact means viewing it in the light of intentions and purposes" (Hilpinen, 2011). The Thirtymile Fire accident report addressed the rich and adaptive complexity of *human factors*[18], which figured prominently into its findings. This report covered an exceptional event - a dramatic wildfire that resulted in multiple human fatalities. Flyvbjerg supports the use of extreme examples in case studies, "...the typical or average case is often not the richest in information. Atypical or extreme cases often reveal more information because they activate more actors and more basic mechanisms in the situation studied" (Flyvbjerg, 2006, p. 229).

The Thirtymile Fire, which occurred in 2001, is still considered one of the worst in Forest Service events in history, due to the number of fatalities and the unprecedented criminal charges that were filed against firefighters. This paper reviewed the Thirtymile serious accident investigation report for its consistency with the SAIG guidelines and directives. Language in the report was compared with the SAIG, to assess carryover of terms and to identify how these are imbued with value.

To further support the document analysis, interviews were conducted with six Forest Service employees or former employees. Interviews were unsuccessfully attempted with the original authors of the SAIG, as well as current proponents/teachers of

[18] "Human factors" is a debated concept, with many definitions (Korolija & Lundberg, 2010). In general, it refers to the elements that a human brings to a system, such as biological and physiological factors, cognitive abilities, and social interaction with other systems (Author's definition).

the guide, as these people could not be reached. Of the successful interviews, four of the interviewees had served as accident investigators or subject matter specialists on accident investigations and all had a working knowledge of the SAIG. One of these four had also served on the Thirtymile Accident Investigation. The fifth interviewee was familiar with the SAIG as a receiver/consumer of the product. The last interviewee was present at Thirtymile and was familiar with the accident report, media attention, effects on the agency, and legal proceedings. These interviews were structured to help answer several main questions: Does the SAIG contain biased language? If so, what language is present and how does this affect an accident analysis? What accident model is suggested by the SAIG and how does this model affect human actors in the event?

Each interviewee signed a consent form consistent with the Swedish National Research Council guidelines, before participating in interviews. Four interviews were conducted over the phone, one was conducted by phone and email, and the last was provided by a confidential written survey. Interviews averaged 45 minutes in length and consisted mostly of open-ended questions, to encourage an emergent flow of information.

Research Ethics

The U.S. Department of Agriculture Office of Ethics was contacted, in regard to ethical considerations for the proposed thesis research with the Forest Service. The Ethics Specialist responded that an ethics review was not necessary (Sue Prada, personal communication, December 1, 2011). The Public Affairs Specialist supported this decision and stated that USFS employees may be interviewed, as long as proprietary information was not revealed. "You can certainly interview us... we are all public employees" (Robert Westover, personal communication, December 5, 2011). Research for this paper consisted of public information that is available to any person with Internet access.

As the researcher for this study, I view all information through my personal theoretical 'lens', which is based on my background, culture, and beliefs (Creswell, 2009). My experience includes previous academic study and/or work in the medical sciences, communication and philosophy. I have also provided services to government agencies, including recent work on an accident investigation. The current thesis and associated research is being conducted for a graduate program in Human Factors and Systems Safety, through Lund University, Sweden. My husband also completed this program and is currently employed by the Forest Service. In this research, rules and guidelines were provided by the Swedish National Research Council ("CODEX rules & guidelines for research," 2010) were followed.

RESEARCH RESULTS

Qualitative research for this paper was designed to answer the question, "How does the language used in the U.S. Forest Service *Serious Accident Investigation Guide* bias accident investigation analysis"? This included a detailed examination of the U.S. Forest Service 'Serious Accident Investigation Guide' (SAIG[19])(Whitlock, 2001; Whitlock & Wolf, 2005), an analysis of a prominent USFS serious accident investigation report, and interviews with individuals who were familiar with the SAIG and/or the report. Thus, the results section will be divided into these three categories.

The Serious Accident Investigation Guide

The Serious Accident Investigation Guide was created to give a consistent format to accident reports, which varied in structure and content since their initial appearance one hundred years ago (L. Sutton, personal communication, Aug. 24, 2011). The SAIG is mainly used to investigate *serious* accidents, which are described as those involving: A death; three or more persons hospitalized after treatment for reasons other than observation; wildland fire shelter deployments or entrapments; property damage, other than to aircraft, that exceeds $250,000; damage to aircraft that exceeds $1,000,000 or results in total destruction of the aircraft" (Whitlock & Wolf, 2005, p. 2). Aviation investigations will not be addressed in this paper, as they necessitate a National Transportation Safety Board (NTSB) report, which often replaces the internal agency SAIG report.

The SAIG provides a model for creating two accident reports: The factual report, which is shared within the agency and sometimes publicly released, and the Management Evaluation Report (given only to agency management), which contains elements of the factual report and also includes recommendations for corrective actions, with the purpose of future accident prevention. The SAIG includes a general format for conducting an accident investigation, including how to collect witness statements, how to gather evidence, templates for report documents, the accident review board process, aviation investigations, and a glossary. In addition, large sections of the guide are dedicated to establishing findings and identifying causal and contributing factors. These latter sections will be particularly important, as the language within them reveals the beliefs of the SAIG authors, which can influence subsequent accident reports. This language may also reflect the values and assumptions of the larger Forest Service culture (Schein, 2004).

Document research included an analysis of both the 2001 and 2005 editions of the SAIG. The earlier edition was used for the key case study of this paper, the Thirtymile Fire. The later edition is still in use by the Forest Service and impacts current accident investigations and reports. A comparison of these editions may reveal differences and/or similarities in language that may influence the final reports. The 2001 edition contains much of the same content and language as the later version, including a lot of 'word for word' carryover. Both editions state, "Information collected and developed during the

[19] This guide is commonly referred to within the Forest Service as the Serious Accident Investigation Guide (SAIG), even though the actual title of the document is Accident Investigation Guide. This paper will use the common term.

course of an accident investigation is to be used only for accident prevention" (Whitlock, 2001, p. 4; Whitlock & Wolf, 2005, p. 8). Other similarities include the definition of an accident as "an unplanned event" and the assertion that "the causes of most accidents or incidents are a result of failures to observe established policies, procedures, and controls" (p. 4; p. 2).

The SAIG states that there are four components to an accident investigation process: The accident sequence, human factors analysis (2001 edition), equipment factors analysis, and environmental analysis. In the 2005 edition, the wording of 'human factors' is changed to, "Human Factors Accident and Incident Analysis" (Whitlock & Wolf, 2005, p. 34), which refers to a separate formalized system of human factors analysis. "The Human Factors Analysis and Classification System (HFACS) was developed by behavioral scientists in the Unites States Navy" ("HFACS.Inc," 2010). The HFACS[20] system was originally used for human factors analysis within aviation, but has been adapted for other work environments. The 2005 SAIG includes a multiple page spread of the HFACS taxonomical checklist, which was modified and abbreviated for firefighting operations.[21] This checklist includes ten sections addressing human factor categories, such as 'sensory and perceptual factors', 'knowledge and skill factors', and 'personality and safety attitude' (2005, p. 37). The taxonomy may have the effect of limiting human-related causal factors to a predetermined list, which will be discussed in the analysis section of this paper.

The accident sequence is established in the SAIG as both a linear timeline and as a narrative describing the sequence of events. The 2005 edition states that an investigator should "start with the initiating event... and continue until the sequence reaches a logical endpoint" (2005, p. 34). Both the timeline and narrative are written to "establish the sequence of events leading to the accident to answer the questions who, what, when, where, and how" (2001, p. 15; 2005, p. 34). The accident sequence is supposed to reveal findings, which will lead to identification of causal and contributing factors. A causal factor is described as, "any behavior, omission, or deficiency that if corrected, eliminated, or avoided probably would have prevented the accident" (2001, p. 25; 2005, p. 58). The 2001 edition states, "Yes or no responses are required for each causal factor", in regard to questions that are asked about the human factors of the incident (p. 25). The 2005 edition tells investigators to use the 'active voice' to identify the actor in the causal action (p. 58).

A major difference between the SAIG editions occurs in the section that addresses the humans involved in the accident. The earlier edition gives a short guide for identifying causal factors and corrective actions, centering on the potential contributing factors of job procedures, personal protective equipment, and 'other' causal factors (Whitlock, 2001, pp. 26-27). The guide asks questions specific to human 'causal factors' and encourages investigators to include some context around these factors; e.g. "Is the job structured to encourage or require deviation from safe job procedures?" (2001, p. 26). Accident analysts are asked to "determine why" each factor occurred within the corrective action section (the

[20] Although the SAIG refers to the "Human Factors Accident and Incident Analysis", this analysis directly relates to the Human Factors Analysis and Classification System (HFACS). For the purpose of this paper, the acronym 'HFACS' will be used to describe this section of the guide interchangeably with the classification system.

[21] The question of why HFACS was added to the 2005 edition of the SAIG is difficult to answer, as the authors of the SAIG could not be reached for comment. However, an informed research interviewee suggested that the main author was exposed to - and familiar with - HFACS and that this model was tied to Safety Management Systems, which was popular in the organization at that time.

term 'analyst' is used specifically in the 2001 edition)(2001, p. 26). In contrast, the 2005 edition only includes the word 'why' when referring to the narrative, "the narrative portion explains *why* the accident happened" (p. 62; italics added by author). The 2005 edition gives investigators the HFACS taxonomy to classify human actions; it also suggests that they, "do not include any more information in each finding than is necessary to explain the event occurrence" (Whitlock & Wolf, 2005, p. 58).

Case Study: The Thirtymile Fire

Research for this paper focused primarily on the Thirtymile Fire final accident investigation report[22], to illustrate the influence of the Serious Accident Investigation Guide. This report activates many of the language effects that are discussed in this thesis and also represents the living influence of language on society. In addition, other accident reports will be mentioned to balance the information provided by Thirtymile. However, these reports will not be described in full detail in this paper.

The Thirtymile Fire was the result of an escaped picnic fire in the Chewuch River Canyon, near Winthrop Washington, on July 9, 2001. The fire occurred during the height of the fire season, when environmental conditions were, "at or near historic extremes for temperature and relative humidity... and fuel conditions... created extraordinary circumstances for fire growth on July 10" (*Thirtymile Fire Investigation Report*, 2001, p. 23). The Forest Service dispatched several firefighting crews to the area, who worked the fire until the afternoon on July 10. As the fire grew and conditions worsened, fourteen crewmembers (from a mixture of different crews) were trapped in the "V" shaped canyon, when their escape route was blocked by fire. The Incident Commander (IC) assessed different areas for safety zones and finally located the group on a road, though some members located on a 'rock scree' above the road. Two civilians showed up, unexpectedly, and joined the firefighters. Shortly after the civilians arrived, the fire behavior increased dramatically, "crewmembers reported the fire was 'coming very fast, roaring' and was preceded by ash and a 'fire snowstorm'" (p. 16). Firefighters deployed their fire shelters in the two locations, with the civilians sheltering with one of the crewmembers on the road. Four of the six people who deployed their fire shelters on the rock scree died as a result of "asphyxia due to inhalation of superheated products of combustion" (p. iii).

The Accident Report. The Thirtymile Fire accident is considered one of the worst Forest Service accidents in history. The Thirtymile accident investigation team used the 2001 edition of the Serious Accident Investigation Guide for their analysis. Investigation findings were broken into the four categories, as suggested by this guide: Environment, equipment, people, and management (p. 21). The report states, "findings are defined as fact-based conclusions, or relevant facts themselves. The findings, taken together, should provide a complete understanding of what occurred. The goal of the Investigation was to speak to the needs of as wide an audience as possible" (p. 21). The "Significant Management Findings" section of the report contains five findings; two of these will be important for the language analysis:

[22] Readers can access the full Thirtymile Fire Investigation Report here: http://www.fs.fed.us/t-d/lessons/documents/Thirtymile_Reports/Thirtymile-Final-Report-2.pdf

> All 10 Standard Fire Orders[23] were violated or disregarded at some time during the course of the incident.
>
> Ten of the eighteen Watch Out Situations were present or disregarded at some time during the course of the incident (*Thirtymile Fire Investigation Report*, 2001, p. 22).

The "Significant Environment Findings" section contains a finding that relates more to decisions made by the people involved in this accident, than to the actual environment. "Potential fire behavior was consistently underestimated throughout the incident" (p. 23). The "Significant Equipment Findings" section states, "In spite of the ready availability of water, relatively little water was applied to the fire during the initial attack phase. This was largely due to operational problems with pumps and hoses, as well as delays in availability of a Type III helicopter" (p. 27). In the extended explanation under this section, there are statements that may be useful for a comprehensive language analysis, including: "several crewmembers recalled from their fire shelter training that rockslides are potentially effective deployment sites" (p. 28). This section also states, "the road was an effective deployment site. Shelters deployed in this area experienced either minor or no heat damage" (p. 28). Several times, the actions of the firefighters (particularly those on the rock scree) are considered to be "contrary to training", e.g. "Some of the firefighters deployed in ways contrary to current training" (p. 29). Crewmembers who located on the road deployment site are described in the following way, "as per training, people on the road were communicating with each other while they were in their shelters"; the communication of those on the rock scree is not addressed (p. 29).

As described earlier, the 2001 SAIG edition has a brief human factors section that does not include the Human Factors Accident and Incident Analysis (a later addition to the 2005 SAIG). However, the Thirtymile report *does* include an HFACS section, which figures strongly into the investigation findings. The addition of HFACS to this accident report was highly unusual, as no other report from the 2001 - 2005 period contained an HFACS analysis, until the new SAIG edition was released.[24] Thus, the Thirtymile Fire may be compared, to some degree, with reports that occurred later in accident history, from 2005 to present. The Thirtymile Report lists the following "Significant People Findings" on page 30:

> The fatalities and injuries all occurred during the fire shelter deployment. Failure to adequately anticipate the severity and timing of the burnover, and failure to utilize the best location and proper deployment techniques contributed to the fatalities and injuries.

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[23] The *Ten Standard Fire Orders* were developed by the USFS in 1957 after a review of major fires over several decades. These orders were based on the 'General Orders' of the U.S. Armed Forces and were designed to reduce the risk of firefighting. The *18 Situations That Shout 'Watch Out'* were created to expand the Fire Orders and were more "specific and cautionary" ("Standard Firefighting Orders and 18 Watchout Situations," n/d).

[24] Extensive research was done on accident reports released from 2001 to present. The author found no other instance of an HFACS analysis prior to 2005.

> Leadership, management, and command and control were all ineffective due to a variety of factors, such as the lack of communication and miscommunication, fatigue, lack of situational awareness, indecisiveness, and confusion about who was in control.
>
> Two civilians were involved in the entrapment due to a failure to properly close a potentially hazardous area.

The appendix of the Thirtymile report contains an extensive human factors analysis, which broadens the detail of the HFACS categories that were seen as 'causal'. Some of these will be addressed, for their language impact. Under "Sensory and Perceptual Factors", it states, "There were clear indicators throughout this incident of individuals with low situational awareness, possibly exacerbated by sensory or perceptual factors" (p. 79). The factors are listed to help explain why the firefighters were "taken by surprise... even though they had over 45 minutes to prepare for a possible deployment" (p. 79). Under the 'attention management' category, the fire management personnel are said to have been, ""surprised" by the explosive fire behavior in a riparian area. This occurred despite the known 1000 hour fuel levels, temperatures at historic highs and relative humidity at historic lows" (p. 79). The fire crew is described as having their attention "turned inward" or "channelized" and the crew leadership is said to have a "lowered vigilance level" (p. 79).

Under the HFACS category, "Medical and Physiological Factors", it states, "The single overwhelming physiological factor that impacted upon this mishap was fatigue caused by sleep deprivation" (p. 80). This factor "may help explain a series of uncharacteristic lapses in judgment and the multiple violations of the 10 Standard Fire Orders and the 18 situations that shout "Watch Out"" (p. 80). Under the HFACS "Knowledge and Skill" category the crew boss trainee is questioned in regard to his inexperience, and a media news release is used to supply information about the trainee; "he was quoted as saying he had "never lost a fire" and that "the hair on the back of his neck never stood up" (p. 81). Other crewmembers are said to have not followed procedure during fire shelter deployment, but "this may have been a result of the relatively sudden onset of the blowup." (p. 81)

Under the HFACS category "Mission Factors", the firefighters are said to have had a "lack of shared understanding of appropriate fire strategy and tactics", which the report concluded led them to the entrapment. The report qualifies this part of the event:

> Eventually, (due in part to significant curves in the road) this put the NWR #6 crew in front of the main body of a moving fire that was heading directly towards the one and only escape route. In effect, this was an entrapment by design, but one that might have been avoided if there was a shared understanding of what was being attempted with the roadside strategy (p. 82).

The HFACS category "Personalities and Safety Attitudes" is evaluated in both the Forest Service agency values, "safety is a stated core value", and in the firefighter crew values. A strong statement is made about the crew:

> However, in a mishap where the vast majority of the standing Fire Orders were violated and all but a few "Situations that Shout Watch Out" were present, one must question the field level understanding or commitment to the stated core value. One crewmember, when asked about the apparent apathy towards the guidelines, responded, "everyone knows that these things (Fire Orders) are just guidelines and

> can't always be followed." This appears to be a good distance away from the stated management philosophy that "we don't bend them and we don't break them." (p. 82)

This category also addresses the reconfiguration of the crew into familiar groups, which "likely accounts for the failure of some members who were fatally injured to respond to the direction of the Crew Boss to "come down out of the rocks"" (p. 82). The word 'failure' also appears under the "Communication and Crew Coordination" category, stating that there was a "failure to conduct briefings at key points" (p. 82). The category "Risk Management" is short but contains qualifying language, "This entire event was characterized by ineffective risk management... No one associated with this fire gave it the respect it was due" (p. 82).

The Impact of the Thirtymile Report. The Thirtymile Fire was considered "the worst wildfire disaster since 1994, when 14 firefighters perished on Colorado's Storm King Mountain" (Solomon & Welch, 2001). The accident report had a strong impact outside of its intended agency audience. Upon release of the report to the public two months after the fire occurrence, there was a storm of media attention. Reporters used the accident report as the basis for numerous written articles that appeared in newspapers around the country, with exact wording from the accident report found in nearly all of these. One article in The Missoulian stated, "A series of deadly mistakes, nearly all of them violations of basic safety rules, cost the lives of four firefighters..." (Ashton, 2001). The article goes on to say that the families of the victims, "were dissatisfied with the report" and that the Forest Service (through the report) seemed to be trying to "blame the victims" (Ashton, 2001). The words 'failed to', 'violated', 'disregarded', 'should have', and 'inadequate attention' appear in this article, representing a link to the accident investigation report.

Another newspaper report from The Seattle Times uses similar report language. 'Significant facts' are pulled out of the report, including several 'failed to' accusations. Once again, the article states that the families "found the conclusions drawn in the report infuriating" Ashton (2001). An example of escalated language occurs in this article, "investigators determined each of the 10 commandments designed to ensure safety was broken and most of the "warning signs" the fire was growing dangerous went unheeded". The term, "10 commandments" is not the term used in the report: "10 Standard Fire Orders" (Solomon & Welch, 2001).

The Forest Service report on Thirtymile has also been used by other agencies, as the basis of inquiry for their own reports. For example, the Occupational Safety and Health Administration (OSHA) released a report with findings - and language - very similar to the Forest Service internal report. "Specifically, OSHA noted that all of the 10 Standard Fire Orders and 10 of the 18 Watch Out Situations listed in the National Wildfire Coordinating Group's Fireline Handbook were violated" (Shimizu & Lupton, 2002; Solomon, 2002). This specific language is not from OSHA; rather, it is a carryover from the SAIG report. Though the Forest Service SAIG report is intended for "accident prevention" and not for "punitive or administrative action taken by agencies of the United States", the shared information of the report may, in the least, become a starting point for other investigations (Whitlock, 2001, pp. 4-5). The language of the report also had an impact on the Forest Service, itself: "The use of terms and phrases such as *work:rest,*

violate, disregard, underestimate, adequate briefing, timely road closure... led to follow up administrative actions the agency was compelled to take, notwithstanding the ambiguity they tended to promote" (P. Soderquist, personal communication, February 27, 2012).

The Thirtymile report also had an impact on the creation of new public law. Two Congressional bills were proposed by Washington Senator Maria Cantwell and Washington Representative Doc Hastings, related to independent investigations of wildland firefighter fatalities (these investigations would have used the Thirtymile report as a starting point). Bill H.R. 3971 became public law 107-203 on July 24, 2002, "to provide for an independent investigation of Forest Service firefighter deaths that are caused by wildfire entrapment or burnover" (*Bill Summary & Status: 107th Congress (2001-2002) S.2471 CRS Summary*, 2002). This bill specifically targets 'Forest Service' events, even though several agencies fight similar wildfires, including the Bureau of Indian Affairs and the Bureau of Land Management.

The influence of the Thirtymile report led to other consequences, including criminal prosecution of firefighters involved in the accident. Years after the fire, several Thirtymile firefighters and Forest Service employees had criminal charges filed against them, including the Incident Commander, who was charged with manslaughter and for making false statements (O'Hagan, Cornwall, & Bowermaster, 2006). These prosecutions were "unusual, if not unprecedented" (O'Hagan et al., 2006). The Seattle Times stated, "The consensus of experts is that all four deceased firefighters would have survived if they deployed (shelters) on the road near the other crew members" (2006). In addition, the two civilians that were accidently trapped with the firefighters at Thirtymile, also filed a lawsuit against the Forest Service and eventually won a settlement from the agency in 2007 (Morey, 2009; O'Hagan et al., 2006). Another lawsuit was filed by the family of deceased Thirtymile firefighter, Devin Weaver, over an alleged defective fire shelter (Morey, 2009).

The Thirtymile accident report also served as the inspiration for two novels. The first book, "The Thirtymile Fire: A Chronicle of Bravery and Betrayal" (Maclean, 2007), details the events of the fatal fire and uses specific information and quotes from the accident report to help tell the story. The accident report was used in addition to the author's interviews and document research. The appendix of the book states, "The Thirtymile Fire Investigation Report contains the following commentary, which has withstood the test of time, on how safety orders and guidelines were violated or stretched" (Maclean, 2007). The following pages quote the accident report sections, "Standard Fire Orders" and "Watch Out Situations" (*Thirtymile Fire Investigation Report*, 2001, pp. 40-43). A second book was written as a memorial by the mother of firefighter Karen Fitzpatrick, who lost her life on the fire (FitzPatrick, 2007).

Interviews

Interviews were conducted by phone or through the Internet, with six Forest Service employees or former employees. Four of these interviewees had served as accident investigators and/or subject matter experts on serious accident investigations and had a working knowledge of the Serious Accident Investigation Guide. One interviewee had not worked on an accident investigation, but had a strong knowledge of the SAIG due to his position. The last interviewee was familiar with accident reports, particularly the Thirtymile report, and had firsthand experience with the Thirtymile Fire. The others were all familiar with the Thirtymile report; one interviewee had been part of the Thirtymile investigation team.

Interviews consisted of questions that focused on the general accident model of the SAIG, the use of HFACS in determining human factors, and the general language and specific wording used throughout the guide. When possible, qualitative questions were asked to encourage open answers, such as, "The SAIG gives the following definition for 'fact': reality, actuality, truth. How do you feel about this definition?" Another question ended with, "How do you feel about the word 'failure' being used in accident investigation?" Each interview took its own direction, even when based on the pre-written question framework. Questions were personalized to each interviewee, to take advantage of their knowledge and history with the organization.

An analysis of the six interviews revealed several common themes. The first was that 'facts' do not necessarily tell the entire story of the accident and may be subjective and biased. Interviewee #1 stated, "Facts are whatever story is believed by the accident team; they tell 'what happened', but not 'why'". Interviewee #3 stated, "No context is given for facts; even the most ardent supporters of the SAIG would say that it is heavily subjective and biased". Another suggested the following, "most folks just take what they see and assume it is factual and my guess is that it is not even examined" (Interviewee #2). Interviewee #6 suggested that the 'facts' of the report might not have adequately represented the story of the firefighters on the Thirtymile Fire, "I found the opinion nature of it (the report) to be unprofessional".

The next theme developed from the definition of 'causal factors' in the SAIG. Four respondents suggested that the focus on causal factors could exclude other significant elements, like the context of the decisions or actions. This could lead investigators to depend on counterfactuals[25] to support their causal theories.

> That definition of causal factors is laughable and I think that paragraph about causal factors has done more damage to accident prevention in the agency than almost any other single thing... it basically shows predisposition bias against the human operator at the sharp end.[26] For causal factors, it locks us into this counterfactual world - if that happened, then something else *probably* would have happened. If that is what we are going to say, then we are on incredibly shaky ground. (Interviewee #1)

[25] "Counterfactual: expressing what has not happened but could, would, or might under differing conditions" ("counterfactual," 2009).

[26] Sharp end operators are directly in contact with the safety critical process (Dekker, 2006).

Another respondent added the following, "...the SAIG is worthless because it is already setting you up to frame your mental model... the causal stuff is basically counterfactuals" (Interviewee #2). The respondent goes on to say that investigators can only categorize failures *after* an event has occurred. Two other interviewees suggested similar opinions about 'causal factors'. "The presumption that accidents are caused by a deviation from rules is the number one flaw... it doesn't pursue the 'why'. You have to ask, "how did that make sense?" if it involves human judgment" (Interviewee #3). Another respondent stated, "When we investigate, we look with 20/20 hindsight to build the facts. Seldom will we say 'why' it occurred, because we can't get inside the heads of the people" (Interviewee #4).

The next theme built on the 'causal factor model' and suggested that causal links within SAIG accident investigations are weak, at best, and may not be a sufficient basis for making broad agency changes. This causal attribution is usually directed toward humans involved in the accident.

> The whole process fits together nice and neat, which is part of its problem, in that you determine a cause (a failure)... We have a cause we can now fix - traditionally fix with more rules, procedures... The organization puts sweeping system changes into effect based on one single accident - and changes the whole system based on that. For them, a sample size of 'one' is sufficient. (Interviewee #1)

Another interviewee suggested that accident investigations have, on occasion, been used for blame or punishment by the agency, not necessarily due to intent, but because the language of the process points causal attribution to the human. "Just look at HFACS, which labels some things as causal, which are merely temporal associations (associated events in time)" (Interviewee #2). This respondent also stated that it takes more than one event to tell you "what the system is doing". A different respondent suggested that the causal attribution of 'root cause' is based tenuously on the 'proximal cause' - the cause that is closest to the event by time and space (Interviewee #3). Another interviewee said that the Thirtymile report did not do a good job of linking causes to the effects, but did make conclusions that seriously impacted the firefighters in the investigation:

> Words like violate with regard to the 10 Standard Orders, disregard in reference to the 18 Situations, underestimate with regard to fire behavior were used without specific examples as to the who, what, where, when, and how... In the report the reader is left to surmise these conclusions on their own, rather than have a clear connection to the findings. (Interviewee #6)

Another theme suggested that the practical outcome of a SAIG investigation may be different from the guide's stated goal of 'accident prevention' (Whitlock & Wolf, 2005, p. 8). One interviewee said that even though the SAIG offers "the most current guidance" for conducting a serious accident investigation, "HFACS and the SAIG do not meet the goal of accident prevention through learning, if followed as prescriptively designed" (Interviewee #5). Another respondent agreed, "The 2005 guide has almost nothing to do with learning - it is meant to identify cause. And then, once you identify cause it gives management something to 'fix'. The holy grail in all of this become 'the fix' - what can we fix?" (Interviewee #1). This person also gave an example that occurred during a recent accident report review board, "The need is also to have a 'smoking gun' ...this phrase was

actually used for the accident review board[27], as the report did not report a single cause or single person as having caused that fatality." Interviewee #4 stated, "An accident investigation is not necessarily a safety tool and does not, by definition, provide safety... If we wanted to actually keep firefighters safer as a result of investigations, the reports would not look anything like they do".

The next interview section focused on the addition of HFACS to the 2005 guide, to assist with the human factors analysis. Several respondents agreed that HFACS might be a starting point for new accident investigators, but is insufficient for a full human factors analysis, as the categories do no fully explain the context of what happened - and *why*. HFACS was also seen as subjective to the investigators, in both its model and language. The HFACS 'checklist' was also said to lack consistent use in accident investigations.

> As written, that whole thing is absolutely worthless. The Esperanza Fire is a good example - the team dutifully went through the checklist, they checked or did not check boxes. However, there is no explanation to go along with that. The reader has no idea whether all the factors were equal, or one was more important than another, or why one box is checked and another isn't. (Interviewee #1)

Another respondent referred to the same fire, "A prime example is Esperanza, where all they did was go through the checklist and cut and pasted what they thought applied to that accident, with no explanation" (Interviewee #2). This person goes onto explain, "The taxonomy can result in an easy fix. For those looking for a simple checklist, they can mark something down and feel they have addressed the human factor and wash their hands of things." Another respondent suggested the following about the HFACS checklist, "I don't think it is of any value - I think it is a distraction. For physical human factors it might be good to use. I have never been involved in an accident where I found it of value" (Interviewee #3). Interviewee #5 seemed to agree, "It is an abysmal failure. It does not work at all."

Specific words were given to interviewees, to assess their reaction. The word 'failure' was given, as it appears frequently in the SAIG, particularly in the HFACS section. Some interviewees saw this word as value-laden, a term that can lead to blame of individuals.

> It is as if they (the firefighters) did not do their duty. Failure means you did not succeed - there is a failure on your part. With the advantage of hindsight, it is clear what *should have* been done. Part of the problem in the way this accident guide is written is that we tend to look at black or white - you have 'failed' or 'succeeded'. It does not leave room for shades of gray - and when you look at the world, it is full of shades of gray. (Interviewee #1)

When asked, "What do you think of when I mention the term, 'failure'?" the next respondent answered, "To use the word 'failure' would be value laden" (Interviewee #2). Another interviewee agreed,

> The term failure is problematic also and is why this review is oftentimes seen as a 'hanging document' (a document used to 'hang' the guilty parties). You are setting

[27] The Accident Review Board reviews the draft accident investigation report and accepts, modifies, or rejects the report (Whitlock & Wolf, 2005).

> up those involved for a ride on the Blame train by using the term failure as often as HFACS does. (Interviewee #5)

Another respondent had a slightly different interpretation, "I think it depends on the context of how it is used... in terms of an accident, I don't see it as a negative term." This person explained that this term's use would be like looking at a mechanical failure, but with humans (Interviewee #3). The last interviewee had a different opinion from the others on this topic, "I think the word is perfectly appropriate" (Interviewee #4). This respondent did not necessarily agree that the term 'failure' implied a conscious decision and suggested that it referred to either negligence (which might imply a conscious act, according to the interviewee), or incompetence (which "certainly does not imply a conscious act"). This person also stated that an investigator should not "sugar coat" the term 'failure' for the accident investigation audience. This person was asked if language is important to an accident investigation, "I believe that words are hugely important. ... At the end of the day, what is left for people is the report and the headstones."

Hypotheses

Overall, the research supported the main thesis question, that the Serious Accident Investigation Guide contains language that can bias investigation analysis and the resulting accident report. Language plays a role in the accident model, which is silently proposed[28] by this guide, and leads to certain interpretations and courses of action. The guide's language displays a direct influence through its choice of words and its suggestions for investigators to use specific language elements. The following hypotheses are suggested, based on the qualitative research data:

1. The SAIG uses an accident model that is based on simple systems with mechanical components, which relies on linear 'cause and effect reasoning' and hindsight-based judgments. The framework of this model, and its resulting language, treat humans and mechanical components similarly.

2. The language used in the SAIG attributes cause and places blame almost entirely on the human actors in the event.

3. The language of the SAIG may not be effective in reaching the stated goal of this guide, to prevent accidents.

[28] The SAIG never states the basis of its information. Other than the HFACS section, no other investigation model is referenced.

ANALYSIS

Language is highly influential in human society and can influence our actions and beliefs. The research for this paper revealed a number of language bias issues in the Forest Service's Serious Accident Investigation Guide (SAIG). The 2005 edition of the SAIG will be used for reference, unless a comparison is necessary with the 2001 edition.

Accident Models in the SAIG

Accident analysis is based on accident model(s), which inspire how people think about accidents (Erik Hollnagel, 2002). "It is a truism that we cannot think about something without having words and concepts that describe it, or without having some frame of reference" (2002, pp. 1-1). The Serious Accident Investigation Guide (SAIG), used by the Forest Service, does not state which accident model(s) may have influenced the writing of this guide. Indeed, it is possible that the authors were not aware of accident theories that contributed to their creation. However, the language used in this document can help us understand what the belief system of the authors is, or may have been.[29] A belief paradigm (Kuhn, 1962) can influence investigators as they attempt to utilize the framework of this guide, for the language contained within it may predispose them to specific action. This effect of language will be explored through a paradigmatic analysis of the SAIG, "A *paradigmatic analysis* seeks to identify the various paradigms (or pre-existing sets of signifiers) which underlie the manifest content of texts" (Chandler, 1994).

Heinrich's Domino Theory. A review of the SAIG and the Thirtymile Accident Report have revealed two main accident models that could have influenced the guide: Heinrich's Domino Theory and Reason's Swiss Cheese Model. The Domino Theory suggests that accidents are caused by a sequence of events that trigger one-another over time, much like a row of falling dominos (Cooper, 2001). The SAIG instructs accident investigators to look for causal factors, defined as "Any behavior, omission, or deficiency that if corrected, eliminated, or avoided probably would have prevented the accident" (Whitlock & Wolf, 2005, p. 58). Each causal factor is linked to the next event in the chain, both through time and space. Causal factors are supported by findings, which are based on 'facts'. The SAIG language exemplifies the falling dominos analogy, "Findings (events or conditions) that started or sustained the accident sequence are the basis of causal factors" (p. 58). The Domino Model also links causes to consequences - each cause must have an effect; each effect must have a cause. The Thirtymile Report has many examples of connected and causal 'dominos', particularly in the 'Findings' section; many of these are preceded by the word *failure*. For example, "Two civilians were involved in the entrapment due to a failure to properly close a potentially hazardous area" (*Thirtymile Fire Investigation Report*, 2001, p. 22). This implies that if the road had been closed 'properly', the civilians would not have been involved in the entrapment - the causal chain would have been broken.

[29] The 'authors' include the people who are listed in the SAIG as the principle writers, as well as the Forest Service and Interagency supporters who had an influence on the creation of this guide.

The guide also parallels Heinrich's Domino Theory in its attention toward human actors involved in the accident. Heinrich developed what came to be known as the 80:20 rule, which states that 80% of accidents are triggered by human decisions and actions, and 20% are caused by unsafe conditions (Cooper, 2001). Heinrich believed that human error was related to poor attitudes, a lack of knowledge or skill, and/or physical unsuitability (2001, p. 7). The SAIG strongly relates to this belief, by stating in the very first paragraph of both editions, "The causes of most accidents or incidents are the result of failures to observe established policies, procedures, and controls" (Whitlock, 2001; Whitlock & Wolf, 2005). Humans are frequently seen as propagators in the chain of events that lead to an accident, in models that use this theory (Woods et al., 2010). The Thirtymile Fire accident report is a good example of the application of this logic, as human actors figure prominently into the causal findings.

Reason's Swiss Cheese Model. The second accident framework that appears to be tied to the SAIG is Reason's 'Swiss Cheese Model'[30]. This model metaphorically uses the concept of 'holes' that emerge during work production, through active failures or latent conditions, in a complex system. When the defenses of the system are breached, the 'holes' line up and an accident can occur (Reason, 1990). Similar to the Domino Theory, the Swiss Cheese Model (SCM) focuses on human error and 'violations' of rules, practices and procedures (Reason et al., 2006). "As an accident model, the SCM reinforced the already existing view that the proximate causes of accidents were to be found in failures at the sharp end, specifically in “human errors” " (2006, p. 16).

The focus on human failure can be noted throughout the SAIG, especially in the Human Factors Analysis and Classification System (HFACS), which was built on the Swiss Cheese Model (Wiegmann & Shappel, 2003). HFACS was developed to 'find the holes in the Swiss Cheese' and classify human error into specific categories. Unsafe actions by human agents are classified into two main categories: *errors* (due to faulty skills, decisions, or perceptions) and *violations* (which are either habitual or exceptional) (2003). The authors of HFACS developed this bifurcation, and multiple subcategories, through an empirical analysis of military and civil aviation accident reports (2003, p. 70). The developed categories were dependent on the limited language and content of these reports, a subject that affects the veracity of HFACS as an analysis tool, but is outside the scope of this paper.

The 'Facts' of a Factual Analysis

The SAIG states that the accident sequence must be, "established based only on the facts" (Whitlock & Wolf, 2005, p. 34). The glossary defines a 'fact' as, "Reality, actuality, truth" (2005, p. 104). This concrete belief that 'facts' exist externally in the world - waiting to be discovered, is a remnant of the philosophy of *positivism*, which reflects an outdated version of the Scientific Theory[31]. Positivism suggests, "The goal of knowledge is simply

[30] Professor James Reason did not call his model, 'Swiss Cheese'; however, this label was at some point attached to this model. Today, the term 'Swiss Cheese Model' is most commonly linked to Reason (Reason, Hollnagel, & Paries, 2006). This model has also been referred to as the Pathogen Model or the Epidemiologic Model.

[31] Though many elements of positivism still exist in scientific reasoning, few scientists today would claim to conduct research from a purely positivistic viewpoint (Trochim, 2006).

to describe the phenomena that we experience. The purpose of science is simply to stick to what we can observe and measure. Knowledge of anything beyond that, a positivist would hold, is impossible" (Trochim, 2006). The positivist view regards everything in the world (including human nature) as measurable and determinable, with natural laws that guide observation and causation. "A positivistic quality paradigm is not always appropriate in qualitative HF (human factors) research, where there are no objective facts that can be studied in isolation" (Lutzhoft et al., 2010, p. 534). Both editions of the SAIG are adamant that the investigation should rely only on 'facts', which are to be determined through physical and photographic evidence, and witness interviews. This is reflective of a positivistic position.

It is particularly important to analyze the SAIG's concept of *facts*, because this data may be used as evidence of civil or criminal misconduct, and may be used to take punitive actions (Whitlock & Wolf, 2005, p. 8). The SAIG states that only *factual data* may be used for these purposes (and that the entire report is supposed to be based on factual evidence). What the accident team purports to be factual can have far reaching effects.[32] The question arises whether 'facts' are entities in existence by themselves, or whether they are just subjective creations of the investigators. This distinction will be developed throughout this analysis section. The term 'facts' appears many times in the SAIG, including the few listed here:

- "Evidence is gathered... to provide documentation to support the investigation facts, findings, and recommendations" (2005, p. 52)
- "Findings are based on facts or conditions that are material to the accident" (p. 7).
- When conducting interviews, "Explain that the interview is for accident prevention and that you are only seeking the facts related to the accident" (p. 45).
- Physical evidence is gathered, "To provide documentation to support the investigation facts, findings, and recommendations" (p. 52).
- "When possible, findings should be supported by two or more facts discovered during the investigation" (p. 58).

If a fact is "reality, actuality, truth", then how does an investigator determine what is real, what is actual, or what is true? The investigator will gather evidence based on physical findings, or the recollections of people in the event. The interpretation of this information will rely, however, on the personal judgment of the investigator. The language of the SAIG attempts to convince investigators that their report will be factual, if the guide's process is followed; yet there is no proof that the 'facts' are more than suppositions, as the following sections will show.

The myth of an objective analysis. According to the SAIG, a 'fact' is *reality* or *actuality*, which suggests that there is an objective - and knowable - state of the world around us. Philosophers and scientists, like Newton and Descartes, have called this state ‘nature’ for hundreds of years (Oliver, 1997). The SAIG reinforces this supposition through its language, which treats material and human 'factual information' in the same

[32] The Thirtymile Report is an example of this effect, as the report's findings led to the blame and prosecution of several firefighters. This resulted in, among other things, a reduced willingness of firefighters to take leadership roles on fire assignments, as evidenced by a survey of 3,362 firefighters by the International Association of Wildland Fire.

manner. For example, on page 58 it defines *causal factor*, "A causal factor is any behavior, omission, or deficiency that if corrected, eliminated, or avoided probably would have prevented the accident" (Whitlock & Wolf, 2005). The glossary adds to this definition, "A causal factor may be related to persons or machines" (p. 104). Thus, according to the SAIG, there are only two causes available to investigators - a human cause or a mechanistic cause. The SAIG uses mechanistic language to describe the both of these, as a later section will show.

Denotative and connotative causal factors. The omission of other causal elements in the SAIG may have been by mistake, as the category, 'environmental' is present in the chapter that describes causal factors, even though it is not present in the definition (Whitlock & Wolf, 2005, p. 58). However, even if we accept that this *denotative*[33] meaning simply left out other potential factors, the definition is still imbued with a strong *connotative* meaning. The SAIG's connotation of 'causal factor' may suggest that humans and machines should be treated equally, are subject to the same rules of analysis, and can have the same language used to describe them.

Additionally, the language used to describe human thought and action becomes even less tied to human experience in the 2005 edition. For example, the 2001 SAIG gives four categories for causal factors: people, management, equipment, and environment. The 2005 edition reduces the categories to three: human, material, and environmental. The dropped usage of the term 'people' has a strong connotation that dehumanizes the individual, making it easier for the investigator to regard actors like unfeeling, preprogrammed machines. The earlier edition attempts to create some context around the 'people' factors, as evidenced by questions asked about the individual (such as mental stress and physical factors) and job factors (such as funding pressures, incentives, overtime, and culture). The 2005 edition immediately takes investigators to an HFACS based taxonomical checklist, which limits choices of human error.[34] The loss of the word 'people' may be seen, connotatively, as a placement of the accused individual into a category that no longer includes 'us'. This makes the work of the investigator simpler, as context around the event may not need to be taken into account. By removing the human from the general population (of which the investigator is a member), the 'bad apple' has now been identified and the agency can return to the illusion of a safe system (Dekker, 2006).[35] It can be easier for an agency to find a 'quick fix' (removing the 'bad person'), as opposed to looking deeper into the systemic issues reaching through hierarchical boundaries and faulty paradigms.

Reality - a social construct. The SAIG's equation of fact to 'reality, actuality and truth' results in a singular reflection of the accident, which is frequently the only story told about the event. We must ask ourselves, "Whose reality, actuality, or truth are these?"

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[33] A *denotation* is the literal meaning of a word - the definition you would find in the dictionary. *Connotation* refers to the socio-cultural and 'personal' associations of the word (Chandler, 1994).

[34] Machines can be *simple* or *complicated systems* and have a limited number of components and actions; thus, they can be reduced to taxonomical categories of error. Living systems adapt to condition and are, therefore, *complex*. Adding a human component to a system creates complexity, which cannot be fully categorized or predicted.

[35] Dekker argues that complex systems, such as those that involve human interaction, are never truly safe - that safety is a 'story we tell ourselves' (Dekker, 2006).

Accident investigators are encouraged by the SAIG's repetitive, adamant language to believe that everyone shares the same beliefs and assumptions. However, the accident report may become less of an objective reality of the event, than a *social construction* provided by the accident investigators. "Let us not mistake the word for the "world"", suggests Gergen, who argues that 'reality' is always a negotiation of meaning between people and that there is no world 'out there' other than the one *we agree* exists through social construction (Gergen, 2009, p. 172). Wittgenstein said that language is attached to action through 'language games', a metaphor he used to describe how meaning is assigned in human culture (Gergen, 2009; Gozzi, 1998). Gergen follows this 'game theory' and questions the traditional idea that language is an exact 'picture of the world', which can be communicated to others like a mirror image:

> If we view language as gaining its meaning from its utility in our various forms of life, we have an answer to this question. When we say that a certain description is "accurate" (as opposed to "inaccurate") or "true" (as opposed to "false") we are not judging it according to how well it pictures the world. Rather, we are saying that the words have come to function as "truth telling" within the rules of a particular game - or more generally, according to certain conventions of certain groups. (Gergen, 2009, p. 10)

The ontology of the SAIG suggests a crystal clear reality, which is similar to the idea supported by the hard sciences ("hard science," n/d)[36] However, there is no scientific evidence provided to backup these ascertains. The SAIG does not follow (or cannot follow) the basic elements of a scientific theory, to justify its causal attributions in accident reports. According to Dreyfus, who invokes Socrates, a scientific theory must be (1) explicit - laid out in clear detail; (2) universal - apply to all places at all times; (3) abstract - must not require concrete examples; (4) discrete - not be context dependent; (5) systematic - context independent factors must be related to each other by natural laws; and lastly, the ideal theory must be (6) complete and predictive (Flyvbjerg, 2006, pp. 38-39). Any account of a wildland firefighting accident would be challenged to fit any one of these categories, let alone all. Wildland fire is a complex system of human actors, who engage in a rapidly changing and unpredictable environment. "When we describe something as complex, we mean that it consists of interdependent, diverse entities, and we assume that those entities adapt - that they respond to their local and global environments" (S. Page, 2009, p. 3).

The presumed measurability of nature. The SAIG appears to reflect the belief that there is only a single reality existing in the world, a view that was shared by some Enlightenment philosophers. This is exemplified by the preponderance of the term 'facts' in the guide and its corresponding connotation that these 'facts' exist by themselves in the world, without a need for human interpretation to make them so. The implied accident models that support this view (Domino and Swiss Cheese) do not offer a complete picture of the world, as they seem to suggest. Every theoretical model is a simplification of perceived reality. However, words in the accident report can become the "core currency" for the communication of meaning, and limited, repetitive words can have an effect that

[36] 'Hard science' - Any of the natural or physical sciences, as chemistry, biology, physics, or astronomy, in which aspects of the universe are investigated by means of hypotheses and experiments.

directs interpretation by readers (Seargeant, 2010). The use of labels, hindsight judgments, and counterfactual statements can be taken at face value by readers, even though these language and communication tools offer only incomplete elements of the full account.

Labels. In order to simplify communication in the SAIG, labels are applied to complex concepts, such as 'fact', 'failures', or 'human factors'. The SAIG's explanation of these terms is superficial, circular, or even absent, leading to what Woods describes as, "Labels that masquerade as explanations" (D. Woods, personal communication, August 7, 2011). A label is not an explanation, in itself. Complex concepts, like those listed above, are not independent entities in the world; rather they are the result of a social and psychological process that assigns this status (Woods et al., 2010). However, once these labels are in place, investigators using the SAIG may not question their validity, as they assume that prior tests of veracity have been completed. The investigators will then use these concepts (labels) as the framework on which to base their assumptions. The labels may also not be questioned by sources outside the team, as accident investigators are often seen as the 'experts' and their findings are seen as definitive. Once the report findings are released, a cascade of events tends to occur in one direction - toward human causal attribution and blame, as in the Thirtymile report. The *label became the explanation* for those that read this accident report, as evidenced by the multiple sources (e.g. media, internal agency, external agencies) that directly quoted the 'causal findings' of Thirtymile, without questioning the process that created them.[37]

Hindsight. The SAIG's presumption that facts equal a singular reality is also questionable because 'facts' can only be gathered retrospectively after the event has occurred, usually by people who were not present at the time. Though firefighters are interviewed and may have firsthand knowledge of the event, the information received by investigators is subject to personal selection and will be categorized as 'factual' or 'not factual'. Of the 'factual' data gathered, the investigators will choose to include or omit each piece of information.[38] The effect of hindsight can be detrimental to a report, as it can cause investigators to oversimplify the historical event. "Hindsight changes how we look at past decision making. It turns real, convoluted complexity into a simple, linear story; a binary decision to err or not to err" (Dekker, 2006, p. 25). This simplistic story can also weight the conclusions of the investigation, even during the process of analysis. "Research has shown that once people have knowledge of an outcome, they tend to view the outcome as having been more probable than other possible outcomes" (Woods & Cook, 1999).

Counterfactuals. Studies have shown that people tend to overestimate what others 'should have' known in foresight (Woods & Cook, 1999). Statements that are contrary to what actually occurred are called 'counterfactuals' (e.g. "could have", "should have", "would have"); these are found in accident investigations that use the SAIG. For example, in the Thirtymile appendix 'Human Factors' section, the fire crew is admonished for having placed themselves in front of the fire, "Due in part to significant curves in the road, which *should have* been obvious to local officials or anyone consulting a map" (italics added) (*Thirtymile Fire Investigation Report*, 2001, p. 81).

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[37] The SAIG is filled with labels, including examples of what the author terms 'prosecutory language' - the language that generally surrounds criminal proceedings. The SAIG uses terms like *investigation*, *evidence*, *custody*, and *witness*, which are most frequently used in criminal law proceedings. The use of these terms might bias the process, by suggesting that a crime was committed, even before the analysis begins.

[38] This may be for personal reasons, or to make the information fit into the investigation report framework (author's personal experience on accident investigation).

The use of common counterfactual phrases ("could have", "should have", "would have") is not necessary, as counterfactual reasoning can be implied without them. In Thirtymile, this is evident in the 'People Findings' section. "Failure to adequately anticipate the severity and timing of the burnover, and failure to utilize the best location and proper deployment techniques contributed to the fatalities and injuries" (*Thirtymile Fire Investigation Report*, 2001, p. 30). This statement is full of counterfactual reasoning, implying that firefighters *should have* anticipated the severity and timing of the burnover. The next part of the 'finding' implies that firefighters *should have* chosen the best location. Report interviews with firefighters did not indicate that they knew the fire was going to burn them over, until the actual event was upon them. The judgment that the 'best location' was an easily interpreted fact, implies that the firefighters had full rationality of the event - that they knew every piece of data that existed at the time and could separate the relevant data from the irrelevant (and essentially, predict the future).

Another example of counterfactual reasoning occurs in the 'findings' that the 10 Standard Fire Orders and 18 Watchout Situations were violated or disregarded. This implies that the firefighters could have simply *chosen* not to violate these precepts. One interviewee questioned these judgments from investigators, "It must be understood and stated that fire fighting (*sic*) occurs in a dynamic environment. What is in place and working at one moment can be different than the next. In other words the 10 and 18 might be applicable and covered during one phase, place, and time, and not the next". The use of counterfactual reasoning by investigators is a strong indicator of hindsight bias and brings their findings into question. "Counterfactuals prove what could have happened if certain minute and often utopian conditions had been met" (Dekker, 2006, p. 40).

The linear flow of time. Traditional western European thought tends to view time as a measurable, linear entity that progresses in a singular direction. People are obsessed with time, as evidenced by Oxford University Press research, which showed that 'time' was the most frequently used noun in the English language ("The popularity of 'time' unveiled," 2006). Concepts of time may differ across cultures, which affects how people think about their world. Research on English speakers showed that the abstract domain of time was categorized by using spatial metaphors for 'horizontal'. English speakers were found to commonly use horizontal metaphors like, "the good times are ahead of us", "we can move the meeting forward", or "falling behind schedule" (Boroditsky, 2001).[39] The choice of spatiotemporal metaphors may have an effect that is applicable to accident investigation. "Using spatial metaphors to describe time encourages structural alignment between the two domains and may cause relational structure to be imported from space to time" (2001, p. 7). When sensory information of an event is not available, as in accident analyses (which are based on hindsight), language can play a critical role in shaping how the investigators think about the causal relation of actions and events.

The theory that time is linear was shared by philosophers like Bacon, Newton, and Leibniz, who influenced the Scientific Theory. It also forms the basis for much of the measurement and reasoning done in accident investigation. By accepting that time is linear and proceeds sequentially from the past toward the future, an investigator can start with an event and look backwards in time, eventually arriving at the start of the causal chain, the 'root cause'. "The attraction of a root cause is that *if* it is possible to find a single

[39] In contrast, Mandarin speakers referred to time as 'up' or 'down'.

cause for any outcome, *then* the elimination or neutralisation of that single cause will prevent the outcome itself" (Erik Hollnagel, 2009, p. 105). This theory simplifies the idea of causation by limiting the search for cause to singular 'chains of events', which does not take into account the complexity of nature (e.g. fire), where multiple action chains may exist concurrently. One property of a complex system is *emergence*, which refers to phenomena that are new and not explicable by the properties of their components (2009; S. E. Page, 2011). This is different than *resultant* phenomena, which can be linked directly to other entities or events. The Domino Theory of accident investigation (and its offshoot Root Cause Theory) relies on resultant phenomena. "The logic of causal analysis makes failures and malfunctions the pivotal elements, but also makes them artefacts of the causal reasoning" (2009, p. 107). An accident investigation timeline may appear to be clear and well ordered, linking moments of time to events or causal agents; "This orderliness is, however, an artefact of retrospection" (Reason et al., 2006, p. 16).

The SAIG follows a linear time theory in its reliance on a 'factual' analysis to point to specific causes. The SAIG states that the narrative, "...explains why the accident happened. It should provide a detailed chronology of the facts, before, during, and after the accident" (p. 62). This suggests that investigators, with hindsight, can know all the 'facts' on the timeline. Which causal chain they choose to pursue is based on their personal judgments of what they consider relevant and what information is accessible to them. The addition of HFACS to the SAIG may provide a false sense of direction, when applied to the humans in the event. By listing a set of categories to label human error, investigators are tempted to use the 'what-you-look-for-is-what-you-find' principle, "Which means that the causes found during an investigation are seen as specific, individual problems to be fixed during implementation" (Lundberg, Rollenhagen, & Hollnagel, 2009). An investigator may be tempted to use an HFACS category, simply because it is provided in the guide and makes their work easier. The actual causal link between the human action and category may be weak, or even absent; however, the investigator's desire to reach a conclusion may be so strong that the connection is 'force fit' onto the linear timeline and into the causal chain.

If accident investigators 'begin with the end in mind' and try to match their data to a limited taxonomy, they may stop their search for information once they have linked the event (e.g. a fire tragedy) to the root cause contained in an HFACS category, such as 'Anger or frustration on the job'. The investigator would be tempted, at this point, to stop the search for 'why' the person was angry or frustrated on the job, which might lead to information that helps prevent future accidents. The external motivator of simply 'checking off' this category for the analysis may create a superficial 'stop rule' that prevents further analysis (Rasmussen, 1990)(Interviews). This concept was supported by research interviewees, who mentioned accident reports that used HFACS to categorize human error, but provided no explanation of how or why it occurred. Rasmussen suggests that stop rules are necessary for analysis, particularly for identifying accident causes. Stop rules are pragmatic and subjective and help direct the aim of the analysis, "...to allocate responsibility and blame, or to identify possible system improvements to avoid future accidents" (1990, p. 452). The SAIG, through its language and written directives, seems to fall into the 'allocation of responsibility' and 'blame' categories.

Language and Human Causal Attribution

Another example of language bias in the SAIG occurs in the causal attribution directed toward human agents. This idea was supported by research interviews, which also suggested that humans are often selected as the 'cause' of an accident due to their proximity to the event, either in time or space. It was also mentioned that a 'find and fix' mentality is encouraged, which centers on the human agent. This can lead to blame of individuals within the SAIG report, which was metaphorically called a 'hanging document', by one interviewee. The search for cause can become an independent goal, with the question of *why* the accident occurred artificially halted when a 'sufficient person, thing, event, state, or action' is found.[40] In fact, the word 'why' only appears four times in the SAIG, with only one instance related to *why the cause occurred*. The SAIG states, "The narrative portion explains why the event happened" (Whitlock & Wolf, 2005, p. 62). There is no instance where the SAIG asks the investigator to consider the context surrounding the cause.

The language contained in the SAIG does lead investigators to attribute cause to human actors, which can then lead to blame. To demonstrate an awareness of context, this paper must ask *why* this human causal attribution occurs, a question that takes us beyond the simple answer, "because the SAIG authors tell us so..." Research into the English language has revealed some important elements that may have influenced the SAIG authors in their quest to create a document that guides accident investigation. An analysis of language elements will show how the causal attribution becomes inextricably linked to the human due to characteristics of the English language, human nature, and the specific wording of the SAIG.

The active voice and causal attribution. Small differences in language can have a large impact on the attribution of causality (Rudolph & Forsterling, 1997). The structure of a sentence may influence how readers perceive causality in the situation, even if the actual causal link is tenuous. The 'active voice' of a verb[41] has particular impact, as research has shown, "Active voice apparently conveys a sense of control and causation that is lacking in the passive voice" (Knobloch-Westerwick & Taylor, 2008). Research has also shown that the attributions of control, causation, and dominance are all affected by the verb voice, even when an agent's actions are presented as non-intentional (Au, 1986; 2008).

The 2005 SAIG tells investigators to specifically use the active voice, when identifying causal factors, "Write causal factors in the active voice, clearly identifying the actor(s) and causal action, along with any necessary explanation" (Whitlock & Wolf, 2005, p. 58). This may direct investigators to apply human causal attribution, which can lead readers of the accident report to believe that the human agents were in full control of their actions, applied full rationality to the decisions, and had free will to choose their responses - even when other complex system factors were involved.

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[40] A dictionary definition of 'cause' ("Cause," n.d.).

[41] The 'active voice' is "One of the two "voices" of verbs (*see also* passive voice). When the verb of a sentence is in the active voice, the subject is doing the acting, as in the sentence "Kevin hit the ball." Kevin (the subject of the sentence) acts in relation to the ball" ("Active voice," 2005).

The Devil's Den Incident Report, which used the 2005 SAIG, is one example where 'active voice' is used to describe human causal factors. One causal factor states, "The AFMO[42] lost situational awareness while focused on direct action (coordinating bucket drops and securing spots)" (*Accident Investigation Report: Firefighter entrapment, burnover, and fatality; Devils Den Incident*, 2006). The active verb 'lost' is linked from the agent (the AFMO) to the subject (situational awareness). The structure of this sentence implies that 'situational awareness' is a self-contained entity that can be acquired, maintained, or lost. Further, the actor is judged (in hindsight) to have lost this important state, which then has a negative impact on the accident. However, in the complex system of wildland fire, where environmental factors combine with human social interaction (a complex system, in itself) and agency directives, the AFMO's awareness of situational elements would have been constantly changing. There is no static state of 'situational awareness' to maintain - it is a dynamic and emergent concept that cannot fit into a single definition. Situational awareness exemplifies a state of 'bounded rationality', that what people do makes sense to them based on their goals, limited knowledge, and focus of attention *at the time* (Woods et al., 2010). Woods and Cook call this concept 'local rationality', a state which can place actors (like the AFMO) in real-world double binds. "Unlike simple laboratory worlds with a best choice, real complex systems intrinsically contain conflicts that must be resolved by the practitioners at the sharp end. Retrospective critiques of the choices made in system operation will always be informed by hindsight" (Woods et al., 2010, p. 138). In the Devil's Den report, the causal attribution placed on the agent is not provable, leaves out important contextual elements, and can be based only on subjective hindsight. However, the use of the active voice in the construct may influence the reader to take the causal connection at face value, instead of questioning the validity of the data.

Agentive descriptions lead to blame. The SAIG states that investigators should identify actors and the causal actions that resulted in the accident (Whitlock & Wolf, 2005, p. 58). As detailed in the last section, this directive can lead to inappropriate causal attributions. Language in accident reports may play a subtle and powerful role in identifying agents, implying causality, and placing blame. These effects will potentially bias investigators as they write the report, as well as readers of the finished product. This includes Forest Service leadership, which has the ability to reward or punish behavior and may be influenced to make ineffective policy changes.

Research has shown that the concept of agency is subjective, "What it means to be an "agent" does not appear to be a stable, universal property of events in the world. What people see and believe to be an agent is constructed in context" (Fausey et al., 2010, p. 1). Though agency may be dependent on individual interpretation, certain elements - such as the language you speak, may have a strong influence on the way agency is constructed. The English language exhibits a strong tendency to ascribe agency to events, as compared to other languages like Spanish. For example, research has shown that English speakers will assign causality to human actors more frequently than Spanish speakers, regardless of whether the event was accidental or intentional (Fausey & Boroditsky, 2008). An English speaker would likely explain an event as, "Jon broke the vase" (an agentive description); whereas, a Spanish speaker might describe the same event as, "The vase broke" (a non-

[42] Assistant Fire Management Officer.

agentive description). In addition, English speakers were more sensitive to changes in linguistic context and remembered agents better after hearing agentive language (2008; Fausey et al., 2010).

Linguistic framing can also have an affect on the assignment of guilt, blame, and punishment. After studying 197,745 trials from London's central criminal court, researchers found that cases that included an agentive phrase, such as "broke it", resulted in more guilty verdicts (Fausey & Boroditsky, 2010). Further research showed that agentive language descriptions inspired greater financial liability, leading to a 30% - 50% increase in requested financial damages (2010). This language influenced subjects in a third study, even when they were presented with a familiar example, about which they had already formed previous opinions.[43] These combined findings showed that linguistic framing can influence how agency is assigned, as well as how much we blame and punish others.

> Placing attention on individuals involved in accidents may improve memory for those individuals, but it may also undermine memory for other details of the situation or context and may invite undue punishment (or undue reward in the case of positive accidental outcomes) on those who were not acting intentionally. (Fausey et al., 2010, p. 8)

Several research interviewees for this paper indicated that the SAIG has done a lot of harm to the Forest Service through its bias against people involved in accidents, which often results in blame (and punishment, as in the Thirtymile report). The above research on language may explain, in part, why the SAIG has such an influence. The tendencies of English speakers to attribute agency to human actors, assign cause to these agents, and apply blame and punishment - even in accidental events, may be partially inherent in our linguistic culture. The SAIG supports these tendencies by framing its accident model with language throughout the guide.

A tension between terms: 'Accident' verses 'failure'. The dictionary defines an *accident* as, "Any event that happens unexpectedly, without a deliberate plan or cause" ("Accident," 2012). The SAIG's definition is, "An unplanned event that results in an injury, illness..." (Whitlock & Wolf, 2005, p. 104). To examine accidents is to look at outcomes that were in some way undesirable, as our cultural connotation for accident implies (you would not term a favorable outcome an 'accident') (Erik Hollnagel, 2009). However, in its quest to reveal the essence of the event, the SAIG creates a bias toward the human actor. This bias leads to judgments about the person's physical, mental, personal, professional, and even moral capabilities. This judgment begins in the first paragraph of the SAIG, where it states, "The causes of most accidents and incidents are a result of failures to observe established policies, procedures, and controls" (2005, p. 2). Most certainly, it is the human that is noted in this section, not the environmental or mechanical factors. The inference that the human 'failed' is a central construct in the SAIG's language bias.

[43] The study used video footage from the memorable Superbowl half-time show, where singer Janet Jackson's costume either 'malfunctioned', or potentially 'ripped' with the assistance of co-singer Justin Timberlake. When research subjects read the agentive description, "tore the bodice", they blamed Timberlake more and assigned 53% more in fines (Fausey & Boroditsky, 2010).

The concept of 'failure' is rooted in theories surrounding simple or complicated systems, like machines, which have a limited number of parts that can break (Dekker, 2005b). Morin calls these 'trivial machines', "A trivial machine is one about which if you know all the inputs you know all the outputs. You can predict the behavior as soon as you know all that has gone into the machine" (Morin, 2008, p. 56). Technological systems function in a bimodal manner - either they function, or they do not function (Erik Hollnagel, 2009, p. 95). Humans may have a limited number of physical parts, but the essence of humanity goes beyond this element into the realms of social interaction and cognition, which affects how they think and function (Gergen, 2009; Sweeney, 2011). Humans behave in non-trivial ways during moments of decision or crisis and, thus, cannot be predicted (2008).

Binary opposition. Binary opposition[44] refers to polar opposites, such as 'up/down', 'happy/unhappy', 'right/wrong', 'good/bad', and 'success/failure'. "Whilst there are no opposites in 'nature', the binary oppositions which we employ in our cultural practices help to generate order out of the dynamic complexity of experience" (Chandler, 1994). Binary opposition occurs in terms that are related, by adding a prefix to the term to create an opposite (e.g. formal/informal); it also occurs in terms that do not seem to have direct relation (Maurais, 1978). Unrelated terms may present powerful connotations that go beyond descriptive characteristics, "'Male' and 'female' are not 'opposites', and yet cultural myths routinely encourage us to treat them as such" (1994). In addition, the structuring of texts by binary opposition may, "position the reader to privilege one set of values and meanings over the other" (1994).

The SAIG uses binary opposition, particularly in the human factors (HFACS) section of the 2005 edition. For example, "Noncompliance with personal limits" (Whitlock & Wolf, 2005, p. 39) suggests the binary opposites 'compliance/noncompliance'.[45] Other binary examples include: adequate/inadequate - "inadequate assignment plan or brief" (p. 39); appropriate/inappropriate - "inappropriate type or level of automation" (p. 40); intentional/unintentional - "intentional violation of a standard or regulation" (p. 40). Perhaps the strongest example of binary opposition on the SAIG would be 'success/failure', e.g. "Failure in problem solving" (p. 38), or "Failure to work as a team" (p. 39). The binary term 'failure' appears 91 times in the SAIG, with 39 of these instances found in the HFACS section. The word 'failure' is used almost exclusively to refer to humans, even though the guide covers mechanical and environmental systems (and the origin of the 'failure' concept is rooted in mechanical systems). The strong polarity of this term also suggests that there is no middle ground and that human agents could have failed *or* succeeded, but due to some reason(s), they did not succeed. Hollnagel and Woods suggest that human actions should not be - and cannot be - described in binary terms. "The correctness of actions can only be judged in hindsight, i.e., with knowledge of the outcome (Woods et al., 1994). It must be assumed that people always try to do what they think is right at the time they do it" (Erik Hollnagel, 2002, pp. 1-4). The use of binary terms to

[44] Binary opposition: "A relation between the members of a pair of linguistic items, as a pair of distinctive features, such that one is the absence of the other, as voicelessness and voice, or that one is at the opposite pole from the other, as stridency and mellowness" ("binary opposition," n.d.).

[45] It may be questioned how an investigator could judge another person's 'personal limits' from an outside perspective.

describe human action can make the event look simple to readers, who may only see the polar opposites instead of the limitless 'grey space' in between.

According to the SAIG, the reasons behind the causal factor (failure) should be stated in the 'findings' of the accident report, "Each causal factor must be supported by a finding" (p. 58). However, once the causal factor is found, the context behind the finding (if it is pursued at all) is no longer evident. The structure of the accident report focuses attention on the 'Significant Findings' sections (human, environmental, material) and insists on an economy of words to describe these factors.[46] This directive may encourage investigators to leave out context. Indeed, multiple SAIG reports exhibit findings and/or causal factors that are so simplistic they leave the reader with only one possible interpretation of the event (*Accident Investigation Report: Firefighter entrapment, burnover, and fatality; Devils Den Incident*, 2006; *Esperanza Fire Accident Investigation Factual Report*, 2006; *Thirtymile Fire Investigation Report*, 2001). This is another example of binary opposition, with one polar extreme being offered as the likely choice. Most readers of accident reports do not read the entire lengthy report; rather they skip to these specific sections. Thus, if context is presented in other areas of the report, such as the narrative, the reader will never see it.

'Failure' and moral accountability. Language contained in the SAIG, particularly in the HFACS section, may also imply breaches of morality by suggesting that there is a 'right', 'correct', or 'good' way of doing things (all binary opposites). In a way, the SAIG has helped to create a particular culture of accountability, which contains a belief system that can impact greater bureaucracies.[47] Once a paradigmatic framework is set, the system is now expected to succeed or fail according to these values. "The establishment of "the good" creates the context for its violation" (Gergen, 2009, p. 32). One prime example occurs under the HFACS taxonomical heading, "Personality and Safety Attitude"(Whitlock & Wolf, 2005, p. 39). This heading contains subcategories such as, "overconfidence", "excessive motivation to achieve assignment", "overly assertive or nonassertive", and "acquiescence to social pressure (from organization or peers) to operate in hazardous situation or condition". These descriptions are only useful to accident investigators if they compare the subject to other human actors, or to themselves. The investigator must decide if the individual displayed confidence - or *overconfidence*; or choose whether motivation was *excessive*. These are hard to support with external evidence and are dependent on the investigators application of personal value measurements. Another example appears under the heading, "Judgment and Risk Decision", with the subcategory "intentional deviation from safe procedure (imprudence)". While the assessment of deviation as 'intentional' may be found during an interview, if a human actor admits to this action, the addition of the definer 'imprudence' suggests that this may be a moral judgment. One definition of imprudence is, "The quality or condition of being unwise or indiscrete" ("Imprudence," 2009). The question of a person's wisdom certainly goes beyond a normative 'factual analysis'.

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[46] "Do not include any more information in each finding than is necessary to explain the event occurrence" (Whitlock & Wolf, 2005, p. 58).

[47] Multiple agencies in the Departments of Interior and Agriculture use versions of the SAIG and, thus, may be affected by the language within it.

Judgments of morality go beyond the 'factual analysis' that the SAIG espouses. Thackaberry questions the use of morality and virtue judgments in accident analysis, in regard to the South Canyon Accident Report.[48] This reports findings are very similar to the Thirtymile report and state that firefighters had 'broken the rules' of the 10 Standard Firefighting Orders and 18 Watch Out Situations. Though the report may seem to have a clear case of broken rules, "The findings also conveyed a sense of *moral indignation* that might not be expected in an otherwise straightforward analysis of the facts. Specifically, the report chided firefighters for an overly aggressive "can-do attitude" that had caused them to break those rules" (Thackaberry, 2006, p. 266). Thackaberry asserts that the wording of the accident report went beyond an objective analysis, resulting in moral judgments against the firefighters, who exhibited a 'failure of virtue' and a 'failure of duty' (2006, p. 277).

The Thirtymile report contains similar judgment language in its Findings section, stating, "All 10 Fire Orders were violated or disregarded at some time during the course of the incident", and "Ten of the eighteen Watch Out Situations were present or disregarded at some time during the course of the incident" (*Thirtymile Fire Investigation Report*, 2001, p. 22). These findings are not stated in the 'active verb voice' (the voice of causation and blame). However, the words have the same effect on those who read the report. One Associated Press article inferred the following from the Thirtymile accident report, "At critical times, fire managers and forest personnel failed to accurately assess fire behavior" (Ashton, 2001). This article also mentioned reaction to the report, from the wife of one of the deceased firefighters, "...she said it seemed as if the Forest Service were trying to blame the victims". Another news article stated, "...leaders failed to gauge the fire's behavior or its potential danger" (Solomon & Welch, 2001).

The strong emphasis on human causes in Thirtymile may be linked to the repetitive language that focuses on human failures, including moral failures. This occurs even in sections that are supposed to be treated separately from humans. For example, in the 'Significant Environment Findings' section, there are two findings listed; the first focuses on weather, fuels, and fire potential. The second states, "Potential fire behavior was consistently underestimated throughout the incident" (*Thirtymile Fire Investigation Report*, 2001, p. 21). This finding is centered on the human actors, not the environment. Under 'Management Findings', once again the focus is on human actors in the event - not management (the 10 Standard Fire Orders were violated or disregarded; Ten of the eighteen Watch Out Situations were present or disregarded). The verbs 'violated' and 'disregarded' are also frequently repeated through the accident report, binding themselves to the humans in the event. The linguistic framing of human causation becomes the focus of the report, as revealed during this paper's earlier language analysis. "Placing attention on individuals involved in accidents may improve memory for those individuals, but it may also undermine memory for other details" (Fausey et al., 2010, p. 8). Thirtymile constantly reminds readers that the cause of the fatalities was due to the human actors, including their failures of moral duty. The context of this event, including *why* the proposed causal factors occurred, becomes lost in the other repetitive language, which leads readers to accept the findings as 'facts' and follow the same trail of blame.

[48] The South Canyon fire occurred in 1994, before the use of the SAIG or HFACS. However, the similarities in moral judgment make this report comparable to Thirtymile.

CONCLUSION

This paper was designed to answer the question, "How does the language used in the U.S. Forest Service *Serious Accident Investigation Guide* bias accident investigation analysis?" This guide influences investigators in their beliefs, analysis process, and final product - the accident report. This report impacts Forest Service firefighters, personnel, and leadership; it also affects readers outside the organization, such as the public, media, other organizations, and law enforcement. The power of the Serious Accident Investigation Guide (SAIG) makes the question of bias unsettling. Various forms of language bias were indicated through interviews with knowledgeable Forest Service personnel and from an academic analysis of the guide. In addition, language artifacts from the SAIG were found in the Thirtymile Accident Report, which resulted in unprecedented prosecutions of firefighters, making it one of the most damaging reports in Forest Service history.

The three hypotheses generated during research were explored in the analysis section and will now be finalized. The first stated, "The SAIG uses an accident model that is based on simple systems with mechanical components, which relies on linear 'cause and effect reasoning' and hindsight-based judgments. The framework of this model, and its resulting language, treat humans and mechanical components similarly." This hypothesis was shown to be valid, as the SAIG has many indicators linking it to Heinrich's Domino Theory and Reason's Swiss Cheese Model. The Domino Theory mirrors the cascade of steps that a SAIG accident investigator would take - first starting with the event (accident) and then working backwards in time and space to find the 'cause'. This theory suggests that humans cause 80% of accidents, a premise that is a driving force in the SAIG. When this search for human error is combined with the 'What-you-look-for-is-what-you-find' principle, the result may be an incorrect, incomplete, or unbalanced analysis (Lundberg et al., 2009). Such an analysis may tie human actors causally to events, often through judgment in hindsight or the use of counterfactual qualifiers. Once a human action or attribute is labeled as the 'cause', the label *becomes the explanation* and the process of inquiry and explanation can be arbitrarily halted (Woods et al., 2010). In addition, labeling a complex human action a 'failure' inappropriately likens the person to a machine.

The next hypothesis stated, "The language used in the SAIG attributes cause and places blame almost entirely on the human actors in the event." A paradigmatic analysis of the SAIG's language and the Thirtymile Fire accident report did show this to be true. Both editions of the guide contain causal directives that implicate humans directly into error processes. The 2005 edition also includes the Human Factors Analysis and Classification System (HFACS), which focuses even more attention on the human 'component' and uses language that seems to judge involved persons from the start. This language uses binary opposition to categorize human decisions, which can result in moral criticism or censure (as in the Thirtymile report). A SAIG accident report may likely remove the possibility of a non-intentional 'accident' and, instead, focus on human 'failures'. This type of accident analysis may lead investigators (and readers) to presume that willful, fully rational violations occurred, instead of opening them to inquire about *why* these actions or decisions were made.

A review of linguistic research showed that the genesis of human causal attribution is found in human nature; it is also particularly expressed in the English language, which is

the language of the SAIG. These tendencies are reflected in the SAIG's use of agentive descriptions, linguistic framing, and the active verb voice (the 'voice of blame' (Knobloch-Westerwick & Taylor, 2008)). Though the cognitive and social basis for agentive bias may lie outside the SAIG, this guide uses language and unbalanced accident theory to position investigators to follow a certain path of analysis, and arrive at specific conclusions.

The last hypothesis suggested, "The language of the SAIG may not be effective in reaching the stated goal of this guide, to prevent accidents". The central theme of this accident guide is to find causal factors for the undesired event, which are then used as the basis for developing recommendations to prevent, or reduce the risk of reoccurrence (Whitlock & Wolf, 2005). This assumes that a direct link exists between cause and effect, and that cause can be objectively found through retrospective inquiry. Though this works for mechanical systems, which exhibit a limited number of components and can be analyzed in a reductive manner, the same may not hold true for an analysis of human action. Humans add complexity to every event they encounter - including social, linguistic, cognitive, and physical elements. This complexity makes it unlikely that an event will repeat itself in exactly the same way again. Thus, removing a 'bad component' (the human, action, or decision) may not result in future accident prevention. In addition, the SAIG encourages investigators to apply an early 'stop rule' of analysis when they find a 'causal factor'. This may halt further inquiry, making it impossible to find out *why* the accident truly happened.

The Serious Accident Investigation Guide is but one example of a current accident analysis tool. The language of this guide biases analysis and supports questionable accident theories, especially regarding human agency. This can potentially lead to conclusions that do not support accident prevention. However, the SAIG may not be the worst offender of its kind. It is recommended that more research be done on the language and structure of accident investigation guidance, to determine what changes may be necessary to align espoused goals of prevention with organizational response to accidents.

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