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Evaluation of Wildland Firefighter Leadership

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EVALUATION OF WILDLAND FIREFIGHTER LEADERSHIP

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by

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ABSTRACT

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There has been growing research evaluating hazardous occupations to gain a better understanding of how crisis leaders and followers, such as wildland firefighters make decisions in high-stress environments. In this study, wildland firefighters were examined to assess their decision-making skills using a wildland fire simulation computer game called the Networked Fire Chief (NFC). These results were compared against both the Multifactor Leadership Questionnaire and the Big Five personality traits using Saucier's abbreviated Mini-Markers. Only a small sample of wildland firefighters was available to participate due to the intense 2017 fire season. Additional participants were recruited through CWU Sona system. Results indicated that leadership experience, rather than personality traits, were a significant predictor of transformational leadership in the wildland firefighter sample. Additionally, agreeableness, conscientiousness, and extraversion were significant predictors of transformational leadership.

ACKNOWLEDGEMENTS

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Chapter I

Introduction

Panic and fear are present in crisis environments because the environment is chaotic and threatens the survival of all who are involved. Panic is defined as "a sudden overpowering fright, or a sudden unreasoning terror often accompanied by mass flight" (Merriam-Webster, 2017). Panic can be further defined as a state anxiety, where individuals are temporarily in a highly aroused emotional state due to a frightening situation (Popper, Amit, Gal, Mishkal-Sinai, & Lisak, 2004) and their immediate behavior is momentarily frozen as panic overcomes them (Schultz, 1965). Wang, Lo, Sun, Wang, and Mu (2012) reported that when people lack information about the level of threat in the crisis environment, panic and conflict increase. In the event of an attempted evacuation, group fear may continue to increase due to the lack of leadership that slows evacuation, demonstrating the need for competent leaders in crisis environments. The purpose of this study is to investigate the relationship between the levels of leadership experience and the performance scores on a wildland fire computer simulation for wildland firefighters. Additionally, the investigator examined participant's personality traits and leadership styles and compared them to scores to on the computer simulation and leadership experience.

In crisis environments, non-leaders are frequently unable to make decisive decisions and are dependent on others (Schultz, 1964). There are many types of crisis leaders and they are highly trained in specific fields that require them to function in such environments. Additionally, crisis leaders are trained to not only identify a crisis but to make quick and succinct decisions (Fener & Cevik, 2004). Leaders who work in crisis environments should be able to unite followers and provide time-sensitive solutions.

Their actions positively affect their followers and thus help determine the followers' quality of performance, for example, police, military, emergency medical services (EMS), and urban firefighters all work in crisis environments.

This thesis focuses on an additional occupation not mentioned in the above list of crisis occupations—wildland firefighters. This occupation is somewhat different from that of an urban firefighter in that the urban firefighter is responsible for suppressing fires in buildings and helping with rescue efforts. Urban firefighters are also referred to as civilian or structure firefighters. They are trained to suppress fires that are within the structure of a building before the fire spreads to other buildings. Wildland firefighters are trained to suppress fires that are in forest and desert landscapes. In the last decade, wildfires have been an increasing problem, especially in the hot summer months. Drought conditions continue to worsen in many geographical areas in the United States, resulting in wildland fires that are more intense and dangerous. In these conditions, the leaders' objective is to suppress the wildfire efficiently and safely. In this crisis environment, how do they maintain effective leadership? To gain a better understanding of the dynamic environment that a wildland firefighter faces, the next section provides a brief summary of the history of wildland fires and wildland firefighting organization in the United States.

History of Wildland Fire Fighting Organizations

In 1960 the United States Forest Service (USFS) and other agencies started actively recording fires, but it was not until 1983 that the size and complexity of the fires were consistently reported. In 1983, there were 18,229 wildland fires reported in the United States and over time the number of fires has increased. Between 2010 and 2015

there has been an average of 65,485 reported fires annually (Fire Statistics, 2015). With the increase of annual fires, many agencies have created fire departments to help suppress wildfires.

In addition to the USFS, the Bureau of Land Management (BLM), the National Parks Services (NPS), and the various organizations such as, including the Washington State Department of National Resources (DNR) have departments specifically related to fire suppression. Some individuals who work for these agencies have a wide range of job positions and responsibilities related to fire suppression. The firefighting organizational structure is complex. It includes aviation, ground support, planning, logistics, and incident command. Incident commanders are individuals who are in charge assigning tasks and delegating resources and overseeing fire suppression operations.

Ground support resources include hand crews and engine crews that operate on the fire line. This study will focus on incident commanders and the ground support crews. As shown in Figure 1, a hand crew consists of 20 people who are divided into a hierarchal structure that consists of a Crew Boss, Assistant Crew Boss, three Squad Bosses, and crewmembers. The hierarchal structure of an Engine Crew consists of an Engine Captain or Engine Boss, an Assistant, and crewmembers. Figure 2 shows a simple organizational structure of the operation section command system that specifically involves ground support resources. This structure would be used in large fires where the incident commander has a wide responsibility for resources.

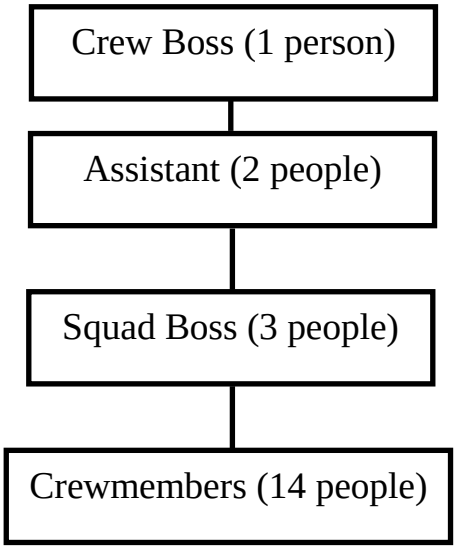

Figure 1. Simple example of hand crew hierarchal structure.

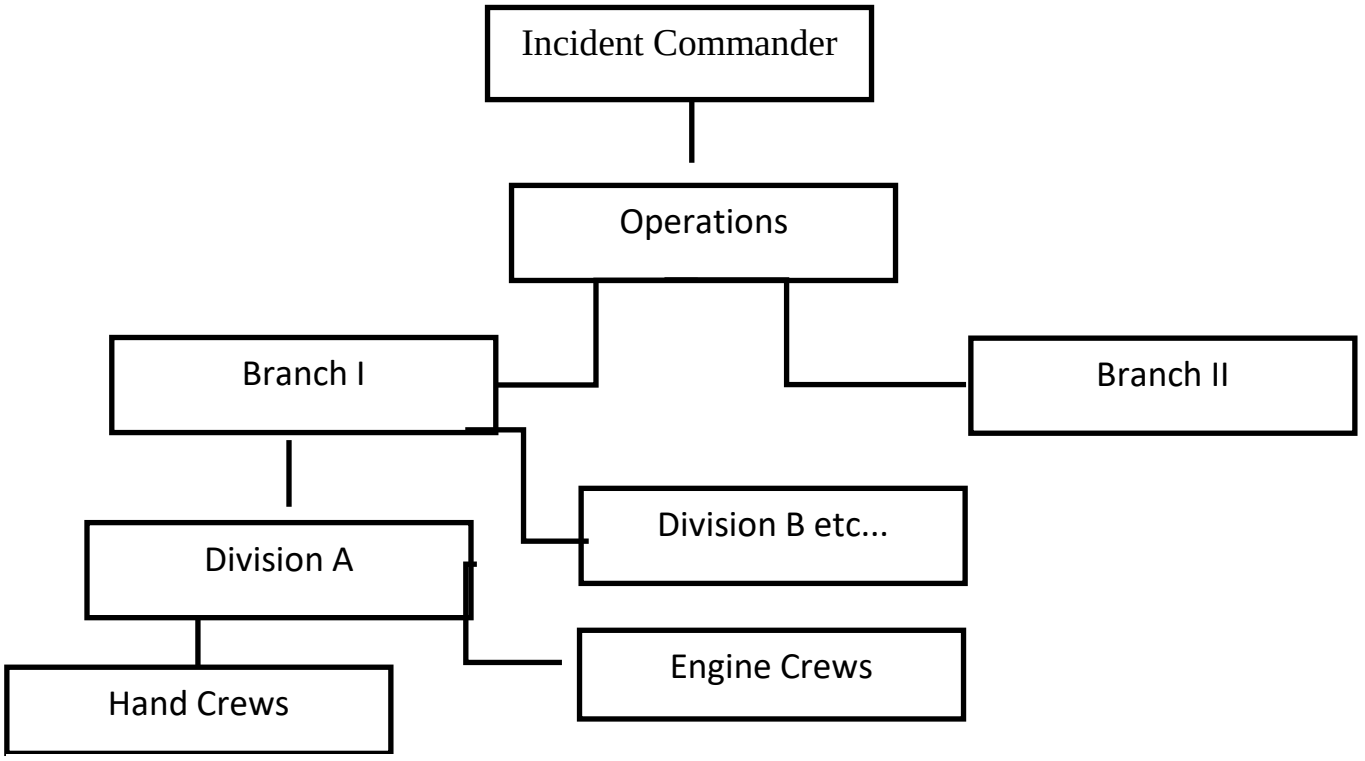

Figure 2. Complex hierarchal structure of incident command system.

Wildland firefighters begin their leadership training in their second or third year of firefighting. They take lecture-style courses that teach the basic principles of leadership and additional courses to understand fire behavior. The first leadership course is called Firefighter I, which is taken to become a Squad Boss. This position is the foundation and stepping stone that leads to future leadership positions. Experience as a squad boss teaches future leaders how to prioritize and delegate tasks and handle immediate problems within the crew. After mastery is reached, wildland firefighters have the ability to advance to more complex leadership positions such as Crew Boss, Engine Operator, Engine Boss, Incident Commander, and Burn Boss. In this study, the central focus will be wildland firefighters who are qualified as Squad Boss or above. Using the baseline leadership qualification of Squad Boss, the researcher can identify leadership styles among a range of leadership positions.

Wildland Fire Occurrences

Wildland fire may be conceptualized as a living dynamic system that has both input and output. The amount of vegetation (fuel), the dryness, and the current wind conditions determine how intense the fire burns. Once the fuel runs out, or if moisture is added, oxygen is restricted and the fire burns out. Over past decades, fire behavior has become more clearly understood, and specific tactics and strategies have been developed understanding and predicting, fire behavior is critical because fuel, wind, and terrain alignments can create catastrophic fires. In some cases, if a fire becomes large enough, the column of smoke will create its own weather, making the environment extremely dangerous. From 1910 to 2015, there have been 1,099 wildland firefighter deaths (Wildland Fire Accidents, 2015). In comparison to the military, police, and urban

firefighters, this number is small, but the wildland fire community is extremely small and each human fatality makes a large impact on the wildland fire community.

The largest wildland fire incident to date was in 2013 when 19 wildland firefighters were entrapped by a fire near Yarnell, Arizona. There is speculation about why this incident occurred. The firefighters were in a safe location, but their leader made the decision to move into a narrow canyon where the fire was heading. Why did the leader make this dangerous decision and why did crewmembers not speak up about the risk of changing locations? Sadly, this will never be known because all the onsite crewmembers were killed.

Considering the consequences, individuals in the wildland fire suppression organizations have high regard for safety. Black and McBride (2013) did a survey of the safety climate among USFS employees across the United States and participants reported that safety was a priority. Participants also emphasized that leadership development was a priority throughout the organization. Although this is encouraging, this survey was conducted at the beginning of a fire season when there was annual training and development of crew cohesiveness which may have made respondents more aware of these factors, thereby skewing the results.

Barton, Sutcliffe, Vogus, and DeWitt (2015) reported that there was a large disconnect between incident commanders and ground crews. Incident commanders perceived fire suppression progress more positively than ground crews did. In addition, researchers found that proactive leadership in a dynamic environment was critical than when clarity of tasks was low. There is also the concern about the ability of crew members to voice concerns. In a qualitative study, Lewis, Hall, and Black, (2001)

reported three levels of a firefighter: (a) novice firefighters, (b) experienced firefighters, and (c) veteran firefighters. Novice firefighters with less than three years of experience relied on other crewmembers for safety and information. Novice firefighters chose to not speak up about concerns because they lacked understanding of the dynamic environment. They also chose not to speak up because they were afraid to be embarrassed or punished.

Additionally, more experienced firefighters felt social pressures about not speaking up about safety concerns. Experienced firefighters had concerns about the risks in the field, they were not able to formulate an alternative plan to avoid these risks. They also chose not to speak up because they were more afraid of repercussions and that they would not be promoted. Some veteran firefighters were comfortable speaking up without fear of repercussions because they were able to create alternative plans (Lewis et al. 2001). Overall these results are concerning because leaders stated they relied on their crewmembers to identify risks and speak up about the things that made them uncomfortable during the fire assignment. The leaders explained that this input was critical especially when they were busy with other tasks, such as coordinating with other crews and developing plans. As a result, leaders could have accidentally overlook critical elements.

As stated above, wildland firefighters have high regard for safety while suppressing wildland fires. However, upon close a closer inspection it appears that crew dynamics may prevent safety risks from being brought to a leader's attention, resulting in not being addressed. In order to reduce the risk to firefighters, further investigation needs to be done to understand leader decision-making. There is little research on wildland fire

leaders the following sections examine leadership styles, personality traits, and decision making tools in other occupations.

Leadership

In a crisis environment, well-trained leaders are needed to maintain control of their subordinates. As described earlier, without leadership, chaos and disorder develop resulting in panic. With good leadership, order and structure ease subordinate fear. The subordinates are able to work effectively and complete assignments because they have trust in and respect for their leaders. Leaders have a range of responsibilities, experiences, training, and styles. Different leadership styles, such as the laissez-faire, transactional, and transformational styles are often compared in research studies as shown below. There are other leadership styles, but for this thesis, only these three will be discussed. Each style has its own strengths and weaknesses and is best utilized in specific environments. It has been argued, that no single leadership style is best suited for any one occupation (Alkharabsheh, Ahmad, & Kharabsheh, 2013). The question is: which style is better suited for wildland firefighters?

In the following section, the studies cited have used the Multifactor Leadership Questionnaire (MLQ; Bass & Avolio, 1995). The MLQ has been widely used in research that investigates the relationship between perceived leadership styles and follower behavior. The scales pertain to three main leadership styles: laissez-faire, transactional, and transformational leadership. In recent research, there has been a variety of studies that have examined leadership styles in a dynamic environment. In the following section, the three leadership styles are explored to fully understand each style.

Laissez-Faire Leadership. Leaders with this leadership style are described as passive and they refrain from making decisions. Laissez-faire leaders are passive because they refrain from using their authority and detach themselves from the crew. This allows followers to have the freedom to make their own decisions (Deluga, 1990). However, due to the lack of leader interaction, Laissez-faire leaders are less effective and their followers are stressed (Skogstad, Hetkand, Glaso, & Einarsen, 2014). The perceived stress is due to the lack of role clarity. Crews that work in high-risk occupations need role clarity and it is often created through a hierarchal organizational structure with a clear chain of command. Role ambiguity, emotional exhaustion, and stress lead to destructive workplace environments (Arnold, Walsh, Connelly, & Martin-Ginis, 2015; Skogstad, et al., 2014). Deluga (1990) reported that when subordinates attempted to influence their leader's behavior, subordinates would be more assertive and hostile. Crew members were also likely to fight with each other for leadership. In a crisis, leaders are under pressure to make decisions that could affect the safety of the crew. Effective crisis leaders need to be able to make time-sensitive decisions by actively engaging with their crew and the environment.

Laissez-faire leaders cause subordinate stress, conflict, and low trust due to the lack of interaction. In crisis environments, effective leadership is critical to maintain safety and make decisions. Leaders must take a proactive approach to leadership and task delegation. Laissez-Faire leaders are considered to be destructive leaders to organizations and to subordinates' wellbeing. Leaders who reported higher levels of stress and burnout reported more Laissez-faire traits (Courtright, Colbert, Choi, 2014). As stated above, the passive approach to leadership and role clarity would be detrimental to a crew in a crisis

environment. However, effective leadership can rise from within the subordinate structure if the current leadership is ineffective. These crewmembers are able to lead from their follower position by motivating their leader and their peers (Russell, 2014). Perhaps these crewmembers have either a transactional leadership style or a transformational leadership style.

Transactional Leadership. Transactional leaders maintain leadership through a system of exchanges based on task performance (Deluga, 1990; Hamstra, Van Yperen, Wisse & Sassenberg, 2013). It can also be defined as a style that stresses the importance of goal accomplishment, clarifies rules and procedures, and emphasizes fairness (De Hoogh, Den Hartog, & Koopman, 2005). Subordinates have a clear idea that their performance is being evaluated and when contingent rewards are present (Hamstra et al., 2013; Aga, 2016). Contingent rewards (psychological or material) are provided by the transactional leader when a contractual obligation has been met. Research by Ismail, Mohamad, Rafiuddin, and Zhen (2010) demonstrated that subordinates of transactional leaders had trust in their leaders and they understood that distributive justice influenced the performance-based awards.

It has been argued that since this style in based in performance, transactional leadership is effective in dynamic environments because it allows for complex procedures. Transactional leaders closely supervise their subordinates and this allows them to make time-sensitive decisions and initiate more complex procedures (Alkharabsheh et al., 2013; Zohar & Luria, 2004). However, some researchers have determined that this leadership style was less effective in dynamic environments and more effective in routine and structured environments. Crisis environment leaders need to

be able to make less restrictive decisions based on the current environment (De Hoogh et al., 2005). It was also reported that this style is the most effective in an environment when employees competed to outperform each other (Hamstra et al. 2013).

In summary, while some researchers argued transactional leadership to be viewed to perform effectively in crisis environments, others have found this leadership style is the most effective where tasks and rewards are based on performance in a structured environment. They can perform in crisis environments, but these leaders prefer restrictive decision making rather than dynamic decision making. In the wildland fire organization, this style seems to be best suited for Incident Commanders who are overseeing all operations on the wildfire.

Transformational Leadership. Transformational leaders are defined as leaders who influence and inspire their followers, recognizes their followers' needs and abilities, and treat them as individuals (Deluga, 1990; Hamstra et al., 2013). This leadership style does not replace transactional leadership. Instead, it enhances transactional leadership by getting followers to put aside their own self-interests and to increase awareness while providing structure (Bass, 1990). According to Bass (1990), transformational leadership is derived for four factors, (a) charismatic leadership, (b) inspirational leadership, (c) intellectual stimulation, and (d) individual consideration. Charismatic leaders inspire followers to follow and to have complete trust in their leaders. Charismatic leaders are also very expressive and promote high performance from followers during a time of crisis or during mass organizational change. Inspirational leaders build up the followers' expectations by creating goals that are clear and attainable. Leaders who provide

intellectual stimulation and individual empathetic consideration can engage followers, get them to think differently and to set aside their own self-interests.

Transformational leaders prefer a wide range of decision making styles rather than restricted decision making (Alkharabsheh et al., 2013). This leadership style is able to moderate follower stress and burnout in crisis environments (Russell, 2014). They are able to maintain composure, stay calm, and have a sense of humor (Bass, 1990). They turn crises into challenges by creating opportunities and increasing courage and enthusiasm. This is done by ensuring there is a positive outcome with clear expectations and goals. As a result, follower confidence increases, and they have a higher tolerance for ambiguity, uncertainty, and working in new conditions (Bass, 1990). This style allows crewmembers to maintain their identity, have trust in their leader, and is effective in influencing safety and reducing risk (Clark & Ward, 2006).

In the context of wildland firefighting, transformational leadership helps to engage crewmembers and therefore to maintain safety, however, as the literature review indicates, transactional leadership could also be used. Either style may be beneficial to leaders because they are able to make decisions that directly affect their crew and maintain motivation. While the MLQ has been widely used to assess leadership styles in occupations that operate in crisis environments there has been no known research that uses the MLQ with wildland fire leaders. This thesis uses the MLQ to assess leadership styles. In addition, personality traits will be evaluated and compared to leadership styles to further understand wildland fire leaders.

Personality Traits

The Big Five personality traits consist of five basic personality traits that summarize dimensions of personality: (a) conscientiousness, (b) extraversion, (c) agreeableness, (d) openness, and (e) neuroticism (Costa & McCrae, 1985). In this study, the Mini Markers (MM; Saucier, 1994) will be used to assess the Big Five personality traits. The MM was designed with 40 specific adjectives extracted from the full Goldberg (1990) 100 adjective Big Five assessment tool. Dwight, Cummings, and Glenar (1998) conducted a comparison between the Mini Markers and Goldberg's Personality Inventory and the results showed that the MM was only slightly less reliable when compared to Goldberg's Big Five markers. For example, the internal consistency for Goldberg's scale of emotional stability (Neuroticism) was .84 and agreeableness was .88. The MM internal consistency for emotional stability was .75 and agreeableness was .79. In another study comparing the Mini Markers and the Neuroticism Extraversion Openness-Five Factor Inventory (NEO-FFI), the results indicated the measures were similar in reliability. The Mini Markers had the advantage over the NEO-FFI because the measure only consisted of 40 items compared to 60 items (Mooradian & Nezlek, 1996). The purpose of comparing the Mini Markers to other personality inventories is to show that the measure is reliable and comparable to widely used measures as seen in the literature review below.

There has been extensive research on the relationship between leadership styles and personality traits. Personality traits that have been associated with leadership are (a) openness, (b) conscientiousness, (c) extraversion, and (d) agreeableness (Bono & Judge, 2003). Buch, Martinsen, and Kuvaas (2015), examined the extent to which laissez-faire leadership had a negative impact on subordinates and assessed personality traits

associated with this leadership style. They suggested that laissez-faire leadership was associated with personality traits that were not associated with effective leadership but no specific traits were reported. De Hoogh et al. (2005) examined the relationship between transactional and charismatic leadership-which is associated with transformational leadership. Their results indicated there was no significant relationship between the Big Five personality traits and the two leadership styles, a pattern was identified. The Big Five relevance to the two leadership styles depended on environment variation. In dynamic environments, good leaders ranked higher in agreeableness and conscientiousness. In dynamic environments subordinates rated their leader more charismatic when the leader displayed an openness to experience.

Researchers have also attempted to distinguish specific personality traits that are associated with rescue roles, such as in police officers and urban firefighters. Salter-Pedneault, Reuf, and Orr (2010), reported that there was no specific set of traits that determined the personality of someone in the rescue role. Although, they did find that police officers scored higher in extraversion and conscientiousness. Bono and Judge (2004) conducted a meta-analysis between transformational, transactional leadership, and personality traits, and reported weak associations between leadership styles and personality traits. This suggests that the relationship between leadership styles and personality traits varies depending on the environment, as seen in De Hoogh et al. (2005).

Despite these weak relationships, efforts continue to further understand the relationship between leadership styles and personality. This research indicates that effective leadership styles are dependent on the complexity of the environmental, therefore variation and this will affect the personality traits associated with leadership.

There has been no research on the personality traits of wildland fire leaders. Additionally, there has been no research with the Mini Markers and the MLQ together. To gain a further understanding of the relationship between dynamic environments and leadership, researchers have taken the approach to computer simulations to understand decision making in these environments.

Computer Simulations

There have been studies that have addressed decision making and the level of risk among wildland firefighters without the use of computer simulations. In those studies, researchers have found that leaders tend to over predict low probability of risk and under-predict high probability of risk when an injury to others is possible (Hand, Wibbenmeyer, Calkin, & Thompson, 2015). In other words, leaders in wildland fire overestimated the chances of lower risk accidents and underestimated the chances of higher risk accidents. This shows the importance of furthering our understanding of decision making using computer simulations.

Field studies are done to evaluate individuals in their typical roles and environments in order to observe decision making. However, in crisis environments this proves to be difficult and puts the researchers and participants in unnecessary risk. To mitigate this computer simulation of dynamic crisis environments were created. The participant is able to engage in a simulated environment in the safety of a laboratory. Decision making in simulated crisis environments can be stressful and requires quick attention to strategies and tactics to be executed (Brehmer, 2005).

Computer simulations allow researchers to address problem-solving and decision making on the content of more elaborate studies (Brehmer, 2005; Kretzschmar & Sub, 2015). One limitation of computer simulations is their construct validity. Although simulations allow researchers to examine decision making in the safety of their labs, participants who have little knowledge about the specific environment of the occupation can perform well, which negatively affects the construct validity of simulations. Expertise in the field does not necessarily mean that experienced participants will perform better than participants who have no experience (Chapman, Nettelbeck, Welsh & Mills, 2006; Elliott, Welsh, Nettelbeck & Mills, 2007). Despite this limitation, computer simulations allow researchers to examine decision-making if they control for relevant previous experience with the presented simulation and if they increase the difficulty of the simulated scenario.

For this study, the NFC (Omodei & Wearing, 1995) was used to examine decision making in wildland fire leaders. This program was designed as a training and research tool for wildland firefighters in Australia, but the research on this population was not found. There has been research conducted with the NFC using convenience sampling. Omodei and Wearing (1995) conducted a study using the NFC on a convenience sample.

Elliott et al. (2007) assessed decision making using the NFC and reported that the NFC required participants cognitive skills, accuracy, speed, placement, planning, and efficiency, which is similar to naturalistic decision making. Chapman et al. (2006) also compared the NFC to decision making and assessed construct validity. Their sample consisted of civilians and Army officers who used the simulation for firefighting. Results indicated there was no difference between the Army officers and the civilian participants,

suggesting the simulation had low construct validity. They also stated the NFC did not contain all of the decision making processes as reported in Elliott et al. (2007).

While this is important to consider, Alison, van den Huvel, Waring, Power, Long, O'Hara, and Crego (2013) and Lipshitz (2010) argued the construct validity can be overcome by to four operational factors: (a) generalizability, (b) reproducibility, (c) objectivity, and (d) plausibility. Although this simulation was created for studying decision making in wildland firefighters and it seems generalizability should not apply, the scenarios are designed to be comparable to other events that happen in crisis environments. If computer simulations are going to be continuously used they need to reproduce consistent results. Computer simulations maintain objectivity because there is no researcher or participant bias to skew the results and is performance based. Plausibility is supported by establishing specific methods and hypotheses for the analysis of the decision making logs recorded in computer simulations.

In an attempt to bridge the gap between computer simulations and leadership, Siewiorek, Gegenfurtner, Lainema, Saarinen, and Lehtinen (2013) examined leadership styles and business profit using a computer simulation. Participants were split into virtual a transformational, transactional, and laissez-faire group to manage a company. The results indicated the group who had transformational and transactional leaders reported better profits than the laissez-faire leadership group. Although the NFC has been used in previous research, there has been no research that compared the NFC outcomes and leadership performance.

In summary, leadership style plays a critical role in successful outcomes in crisis environments. In the wildland fire organization experience also plays a critical role in the

effectiveness of leadership. Wildland firefighters begin their leadership training at the beginning of their second season and this training continues throughout their entire career. In order for a wildland firefighter to move up to the next leadership level, they must gain experience in their current leadership position and be able to make decisions, delegate tasks, and maintain safety in a crisis environment. More experienced leaders are expected to be better at decision making than less experienced leaders because they acquired the skills through training and experience. As a result, they are able to make effective decisions and understand the dynamic environment around them and their crewmembers. The NFC simulation is a reliable means of evaluating decision making. Thus, the first hypothesis that this thesis test is: Experienced wildland fire leaders will perform better on the NFC compared to the leaders with less leadership experience.

The literature is mixed on which leadership style, transactional or transformational, performs the best in crisis environments. However, there has been no research to date that has examined leadership styles using the MLQ in wildland firefighters. As an occupation that operates in a crisis environment, it important to understand leadership styles, leading to the question: What leadership style is the most prominent in wildland firefighters? Thus, the second hypothesis that this thesis test is: Transformational and transactional leadership styles are more prominent in wildland firefighters than laissez-faire leadership style.

There has been no research examining which leadership styles among wildland firefighter leaders is best at decision making as measured in a computer simulation. The research question is: Which leadership styles are better at decision making? Thus, the

third hypothesis that this thesis test is: Transformational leaders and Transactional leaders will both perform better than laissez-faire leaders on the NFC.

Lastly, certain personality traits have been associated with effective and ineffective leadership; however, those personality traits can change based on environmental changes. This could be due to the fact that environmental changes require the leader to change his or her style, thus, the personality traits associated with the leadership style change. To date, there has been no research that has examined wildland firefighters and the personality traits associated with effective firefighting decisions. Nor has there been any research on leadership styles and personality traits in this occupation. This research the question is: What personality traits are the most prominent in wildland fire leaders? Thus, the fourth hypothesis that this thesis test is: Transformational and transactional leaders in wildland fire will report higher responses in agreeableness, openness, conscientiousness, and extraversion, but lower in neuroticism than laissez-faire leaders.

Chapter II

Methodology

Setting

The research took place at the agencies where the participants were employed. The investigator accommodated the participants by creating a secure and mobile data gathering environment. The study specifically took place at the United States Forest Service (USFS) office in Wenatchee, WA, the Bureau of Land Management (BLM) office in Idaho Falls, ID, and the Washington State Department of National Resources (DNR) office in Ellensburg, WA. The researcher had five laptop computers ready for the participants to use. At each location, data collection took place in a standard conference room that allows up to 20 people to sit at one time. This allowed the researcher to administer the study to multiple participants at in a single session.

Participants

Wildland firefighters with supervisory experience were chosen to participate in the study because they are exposed to high-risk environments where effective leadership is imperative to the success of suppressing wildland fire in a safe and effective manner. The participants of interest are individuals who have at least one year of leadership experience as a Squad Boss. This position is considered a stepping stone to all leadership positions within the various wildland fire suppression organizations (Figure 1). Positions above Squad Boss (beginning supervisor) include Assistant Crew/Engine Boss, Crew/Engine Boss, or Superintendent. More advanced positions include Incident Commander, Division Supervisor, or Branch Supervisor (Figure 2). Individuals may be

qualified in more than one leadership position. For example, a wildland firefighter may be qualified as a Squad Boss, Incident Commander, and Division Supervisor. Participant recruitment included all of these positions.

Prior to contact with participants, a letter of cooperation was completed by the Fire Program Managers in the USFS, BLM, and Washington DNR agencies. Agencies that have officially agreed are the (a) Okanogan-Wenatchee USFS, (b) BLM- Idaho Falls District, and (c) DNR office in Ellensburg, Washington. As part of the agreement, the managers from each agency have requested a summary of anonymous leadership survey scores from their employees. This did not include scores from the Networked Fire Chief. After agreement letters were signed, participants were recruited via email with a flyer and face-to-face request (Appendix A).

Measurements

Networked Fire Chief. The NFC simulation was used to assess decision making in a complex dynamic, high-risk environment. The NFC was created to assess complex crisis decision making while participants were in a controlled research facility (Appendix B; Omodei & Wearing, 1995a; Omodei & Wearing, 1995b). The program is designed to have participants attempt to control a large forest fire that is difficult to contain (Barber & Smit, 2014). The researcher has the ability to create a specific scenario that requires the participant to take control and make commands by using a keyboard and mouse while the fire is progressing (Figure 3). To help extinguish the wildland fire, the participants will have an allotted amount of resources available to them. Two main resources used in the simulation will be a fire engine apparatus and a helicopter; however, only the fire engine will be able to actually extinguish the fire.

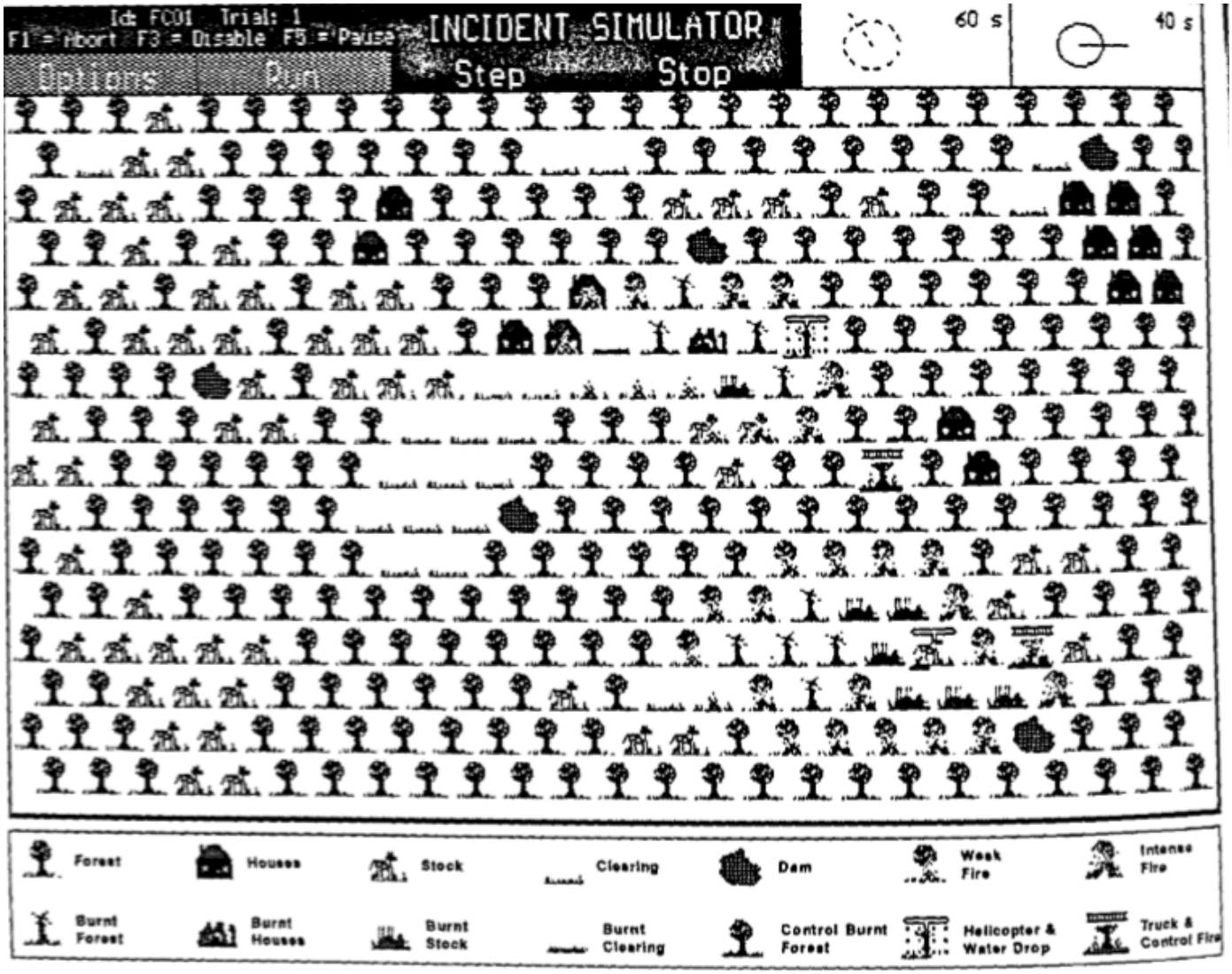

Figure 3. Example of Networked Fire Chief computer simulation. Adapted from Omodei & Wearing, 1995a.

The specific simulation is a pre-developed scenario the researcher created to simulate a real fire. At different points during the game, the fire intensity would either increase or decrease and wind directions changed. The fire's location and size determined the participant's change in strategies and tactics. For example, changes could be due to the fire heading towards houses and livestock or towards a rock outcropping.

The participants' strategy and tactics used to contain the simulated fire was determined by their performance score (Figure 4). After completion of the simulation, the program created two reports: a statistics report and a history report. The statistics report provided a summary of the status of the fire and commands. The history report provides a detailed (by time and sequence of events) review of all commands given and all the events that occurred within the simulation (Omodei & Wearing, 1995b). The overall performance score is a combined score of the statistics and history report and this was used as a measure of the participants' decision making. The score relates to the remaining unburned area and objects (trucks, houses, and livestock). The performance score can ranged from one hundred percent (able to extinguish the fire immediately) to zero percent (the fire consumed the entire forest and all the objects).

Mini-Markers Big Five Personality Inventory (MM). To further assess leadership decision-making, the MM Big Five Personality Inventory (Saucier, 1994) was used. The Mini-Markers are open source allowing permission to use for research purposes only. The measure assesses the Big Five personality traits; Extraversion (α=.83), Agreeableness (α=.75), Conscientiousness (α=.81), Emotional Stability (α=.74, and Openness (α=.69). The measure consists of 40 adjectives with each factor represented by eight specific adjectives. The adjectives are presented on a 9-point Likert scale, ranging from 1 (Extremely Inaccurate) to 9 (Extremely Accurate). For example, the participant would provide a number to rate themselves or others for the adjectives "Bold," "Complex," "Efficient," "Kind," and "Relaxed (Appendix C). To score the MM, the adjectives are categorized into the appropriate Big Five factors (Appendix D). Then

all adjectives were added together for its trait (Table 1). Then dividing by the total number in the trait will provide the mean response for each trait.

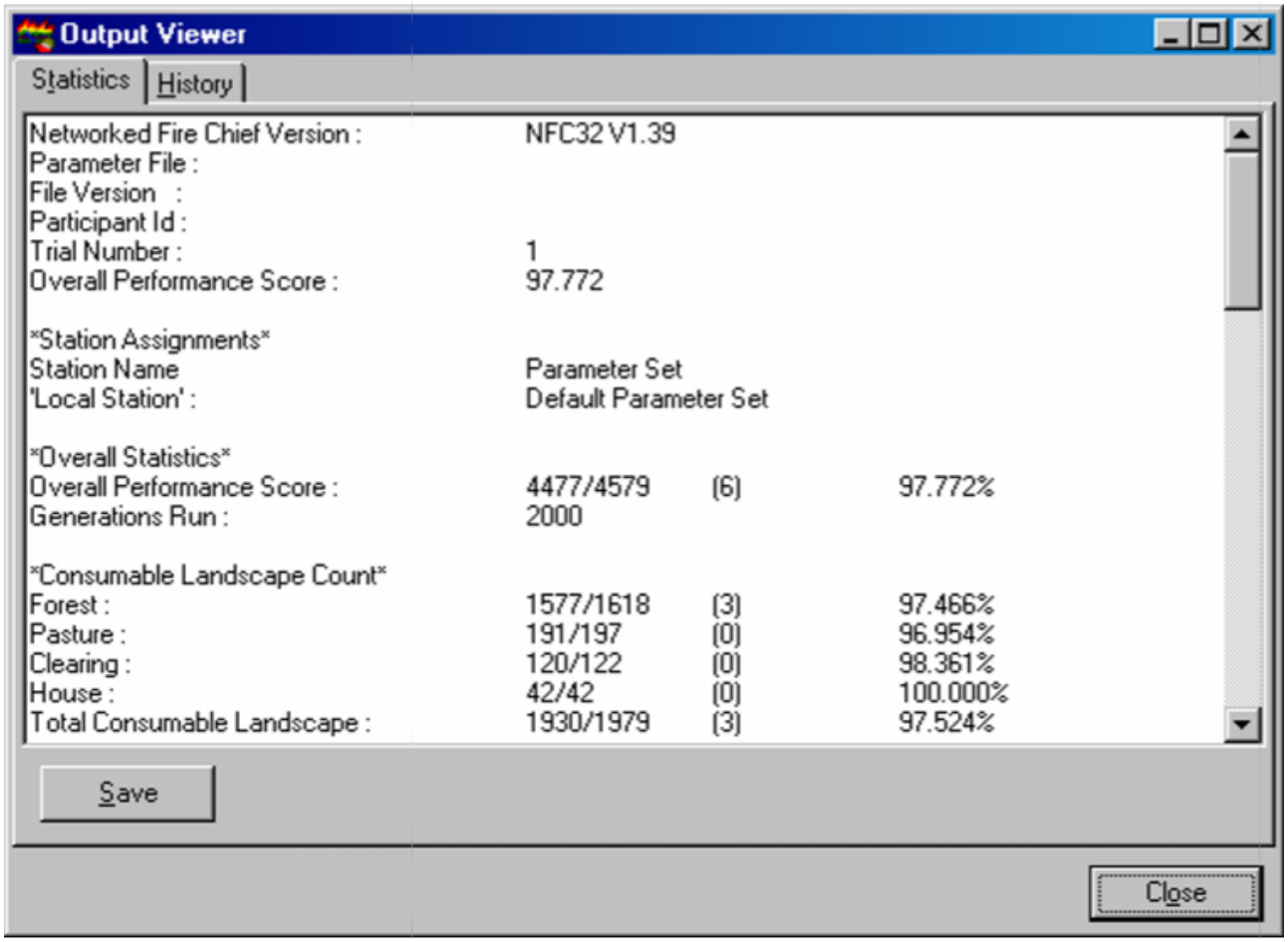

Figure 4. Example of performance score after completion of simulation. Adapted from the Networked Fire Chief Manual.

Table 1

Mini Marker personality traits and corresponding adjectives

Trait	Adjective
Extraversion	Bold, Energetic, extroverted, talkative
Introversion	Bashful, quiet, shy, withdrawn
Agreeable	Cooperative, kind, sympathetic, warm
Disagreeable	Cold, harsh, rude, unsympathetic
Conscientious	Efficient, organized, practical, systematic
Unconscientious	Careless, disorganized, inefficient, sloppy
Emotionally Stable	Relaxed, unenvious
Emotionally Unstable	Envious, fretful, jealous, moody, temperamental, touchy
Open	Complex, creative, deep, imaginative, intellectual, philosophical
Closed	Uncreative, unintellectual

(Saucier, 1994)

Multifactor Leadership Questionnaire (MLQ). The next measure was used was the MLQ (Bass & Avolio, 2004). The measure assesses the transformational (α=.83), transactional (α=.79), and laissez-faire (Passive, α=.63 and Active, α=.85) leadership style. The measure consists of 45 items. Each leadership style has individual subgroups and was examined. In the literature that has used the MLQ in research, has combined each subgroup for the specific leadership style to create a compiled score for each leadership style. Each item is presented on a five-point Likert scale, ranging from zero (not at all) to four (frequently, if not always). For example, participants would rate themselves for the following two statements, “I avoid getting involved when important

issues arise" and "I spend time teaching and coaching." To score the leadership form, each leadership style is characterized by their respective subgroups. The number of responses in each category ranging from 0-4 is added, then divided by the total number of responses. This is repeated for all groups (Bass & Avolio, 1995; 2004).

Demographics. In addition to the NFC, MM, and the MLQ, demographic questions were asked (Appendix E). In addition to questions regarding age, gender, and ethnicity, participants were asked about their current position, how many years fighting wildland fires, how many years they have been at their current organization, and their current qualifications. Qualifications are separate from positions because qualifications pertain to experience on a wildland fire incident. Current positions determine their place within their crew or organization at the agency. Seasonal employees were asked if they are career seeking in the agencies where they were employed.

Procedure

Letter of cooperation was received and HRSC approval was obtained. As stated above, the researcher administered the study at the convenience of the participants by coordinating with the Fire Program Managers from the Okanogan-Wenatchee USFS, the BLM- Idaho Falls District, and the DNR in Ellensburg. Prior to participation, a flyer was attached to an email, asking for individuals to participate. Through the fire program managers, a specific time was established for the researcher to arrive and administer the study.

Upon arrival to each agency, the investigator arranged three MacBook, macOS Sierra laptop computers, and two Asus laptop computers that contained the fire

simulation. These computers were obtained by rental agreement from the Multimodal Education Center at Central Washington University. Once participants arrived, the investigator provided the consent form (Appendix F) and went through the itemized list on the form. The consent form asked if the participants' anonymous scores could be used for future leadership training purposes, per request of the Fire Program Managers. They were informed that their scores will be compiled into a summary with no identifiers leading back to them. When the forms had been signed, participants began the fire simulation. They had five minutes to become familiar with the program. This involved reading instructions (Appendix G), using the computer mouse, and becoming familiar with the map legend. After five minutes of familiarization, participants were given a written scenario with objectives for them to complete. Once they had read the scenario (Appendix H) they began the simulation. The task took approximately five to ten minutes depending on how quickly the participants extinguish the wildland fire or until the fire consumes the landscape.

When the simulation was complete, participants completed the following surveys using the paper and pencil method: MM, MLQ, and demographics. Excluding the demographics, the MM and MLQ form questionnaires were randomized. Completion of all three surveys took approximately 15 minutes (five minutes each). After completion of the study, participants were given a debrief form (five minutes; Appendix I). Total time to complete the study was roughly 30 to 35 minutes.

Planned Data Analysis

The first hypothesis was, the more wildland fire leadership experience, the performance on the NFC will be higher. A correlational analysis was planned to be done

between years of experience and NFC performance. The second hypothesis was, transformational and transactional leadership styles are more prominent in wildland firefighters than laissez-faire leadership styles. A Chi-Square test of independence was planned for this test. The third hypothesis was when presented with the NFC, transformational and transactional leaders will perform better than laissez-faire leaders. A one-way, three-level ANOVA was planned to be used to compare NFC scores and leadership styles. The fourth hypothesis was, transformational and transactional leaders in wildland fire will report higher responses in agreeableness, openness, conscientiousness, and extraversion, emotional stability than laissez-faire leaders. This analysis was to utilize a one-way, three-level MANOVA of the Big Five personality traits and leadership styles.

Chapter III

Results

Demographics and the Study Transformation

Data were collected from wildland firefighters from May 2017 to August 2017. Due to the intensity of the fire season, only twenty-two wildland firefighters participated in the study. The limited number of participants was attributed to the amount of time away from home units and the responsibilities required of the firefighters. All of the twenty-two participants were Caucasian males, ranging in age from 21-53, with varying levels of education, from high school diplomas to a Master's degree. Unfortunately, the results from the NFC simulation were unusable because there was a ceiling effect with scores ranging from 98%-99%. Therefore, only leadership experience, the MM and the MLQ values were used for analysis. Since this was a small sample with little diversity, demographic analyses were not used with either the MM or the MLQ and, therefore hypothesis one and three could not be tested. Furthermore, hypotheses two and four could not be tested because the collected data failed the assumptions for the MANOVA and ANOVA. The assumptions that failed were: independence of observations and adequate sample size. The study shifted to an exploratory assessment of the relationship between leadership experience, the MM and the MLQ, which led to the collection of an additional sample of data from Central Washington University (CWU) students that were recruited through the SONA system. The two samples were analyzed separately with multiple regression analyses.

There are numerous types of regressions that could be used to evaluate the gathered data such as simple, multiple, stepwise, and hierarchical regression. Simple regression evaluates one predictor and one criterion variable, thus, only examining the relationship between two variables and the p-value is the same is the same as the p-value in a correlational table. A multiple regression analysis treats the two or more predictors equally. This is used when there is no statistical or theoretical basis for considering one variable over another in terms of the research goals. Stepwise regression selects the best predictor that has the largest *t* value, and that predictor is used to create a model. The model sequentially continues to build until the last predictor has no significant value. Hierarchical regression is used when the predictor variables are entered based on a specific focus of the research. In other words, a specified hierarchy of predictors is based on previous research and the purpose of the research. Considering the shift in the study to an exploratory assessment with no specific hypothesis, multiple regression was used. As reported in the literature review, there are mixed results when comparing the Big Five personality traits and transformational leadership.

The firefighter sample and the CWU sample were analyzed separately because of the difference in the participant demographics in each sample. However, the analysis for both datasets followed the same pattern. The analysis uses a correlation matrix to determine the correlation coefficients (r) and associated p-value for each of the Big Five personality traits, transformational leadership and its subcategories, and, for the firefighter sample, leadership experience. A series of multiple regression analyses measured the significance of the relationships between personality traits and leadership and subcategories. In each regression, the criterion variable was a specific

transformational leadership category or subcategory. The Big Five personality traits and, for the firefighter analysis, the leadership experience variables, are predictors.

The categorization of variables into either a criterion or predictor variables is based on two assumptions. First, the Big Five personality traits represent a broad-based view of personality, which has cross-cultural validation (McCrae & Allik, 2012). The MLQ represents a much narrower domain, focusing strictly on leadership. It is assumed that the broader traits are more predictive of the narrower traits, rather than vice versa. Second, with the firefighter sample, the experience factors represent behavioral opportunities to improve skill. Therefore it is assumed that experience could also be predictive of leadership.

Wildland Firefighter Sample Results

Only transformational leadership was evaluated because it had the highest reported mean scores out of three leadership categories (n=20 out of 22). Multiple regression analyses were conducted with transformational leadership and its subcategories as criterion variables and with the Big Five personality traits and leadership experience as predictor variables.

Correlation Results. Table 2 shows the correlations between transformational leadership, its subcategories, leadership experience, and the Big Five personality traits. Leadership experience was defined as years of leadership experience in wildland firefighting. Agreeableness was significantly and positively correlated to leadership experience. There were significant positive correlations between the subcategory

inspirational motivation and three of the Big Five personality traits: extraversion, conscientiousness, and emotional stability. All other correlations were non-significant.

Multiple Regression Results. Multiple regression results for overall transformational leadership as the criterion variable are shown in Table 3. Leadership experience significantly predicted transformational leadership, and none of the personality traits significantly predicted overall transformational leadership. Multiple regression was conducted on the idealized attributes subcategory, as shown in Table 4. Leadership experience significantly predicted idealized attributes, but there were no significant personality predictors. The next transformational leadership subcategory that was examined was idealized behaviors as shown in Table 5, with no significant predictors.

Inspirational motivation was the next transformational subleadership category to be examined. Table 6 results indicated that both leadership experience and extraversion significantly predicted inspirational motivation. The next subcategory examined was intellectual stimulation. Table 7 shows there is no significant prediction with either the Big Five variables or leadership experience. Similarly, with individual consideration (Table 8), there was no predictive significance with any other Big Five variables or leadership experience.

Table 2

Correlations between transformational leadership, its subcategories, experience, and the Big Five personality traits in the wildland firefighter sample.

		All Variables											
		E	A	C	ES	O	LE	TF	IA	IB	IM	IS	IC
All Variables	E	1											
	A	.051	1										
		.822											
	C	**.639**	.244	1									
		.001	.274										
	ES	**.553**	.022	**.675**	1								
		.008	.923	**.001**									
	O	-.121	-.06	-.024	-.140	1							
		.591	.793	.916	.537								
	LE	-.150	**.440**	-.132	-.290	-.290	1						
		.516	**.047**	.568	.203	.203							
	TFL	.366	.136	.404	.219	.402	.160	1					
		.094	.548	.062	.328	.064	.488						
	IA	.275	.082	.326	.135	.355	.249	**.861**	1				
		.215	.716	.139	.550	.105	.275	**.000**					
	IB	.404	-.110	.308	.060	.346	.124	**.746**	**.611**	1			
		.062	.642	.163	.792	.115	.594.	**.000**	**.003**				
	IM	**.630**	.150	.610	.424	.247	.080	**.861**	**.74**	**.766**	1		
		.002	.507	**.003**	**.049**	.268	.731	**.000**	**.000**	**.000**			
	IS	.036	-.020	.094	.110	.383	-.15	**.706**	**.536**	.225	.399	1	
		.875	.917	.679	.627	.078	.511	**.000**	**.010**	.314	.065		
	IC	.084	.224	.224	.099	.243	.300	**.719**	**.437**	.366	**.450**	**.553**	1
		.710	.317	.317	.661	.276	.187	**.000**	**.042**	.094	**.035**	**.008**	

Note. Wildland Firefighter sample N=22. The top row contains the correlations; the bottom row indicates the p-values. Abbreviations: Extraversion (E), Agreeableness (A), Conscientiousness (C), Emotional Stability (ES), Openness (O), Leadership Experience (LE), Transformational leadership (TFL), Idealized Influence (Attributes; IA), Idealized Influence (Behaviors; IB), Inspirational Motivation (IM), Intellectual Stimulation (IS), and Individual Consideration (IC).

Table 3

Big Five personality traits and the experience variables as predictors of transformational leadership in the wildland firefighter sample.

Predictors	B	SE	β	t	*p*
Leadership Experience	.335	.150	1.609	2.228	**.044**
Extraversion	.104	.076	.343	1.357	.198
Agreeableness	.021	.104	.043	.199	.845
Conscientiousness	.080	.106	.232	.747	.468
Emotional Stability	-.019	.073	-.071	-.262	.797
Openness	.122	.065	.360	1.895	.080

Table 4

Big Five personality traits and experience variables as predictors of the transformational leadership subcategory idealized attributes in the wildland firefighter sample.

Predictors	B	SE	β	t	*p*
Leadership Experience	.610	.225	2.021	2.707	**.018**
Extraversion	.128	.115	.292	1.117	.401
Agreeableness	-.075	.156	-.107	-.477	.284
Conscientiousness	.099	.160	.198	.618	.641
Emotional Stability	-.025	.110	-.063	-.225	.547
Openness	.140	.097	.285	1.449	.826

Table 5

Big Five personality traits and experience variables as predictors of the transformational leadership subcategory idealized behaviors in the wildland firefighter sample.

Predictors	**B**	**SE**	**β**	**t**	***p***
Leadership Experience	.256	.186	1.085	1.371	.193
Extraversion	.166	.095	.485	1.752	.103
Agreeableness	-.146	.129	-.269	-1.127	.280
Conscientiousness	.123	.132	.315	.928	.370
Emotional Stability	-.105	.091	-.343	-1.157	.268
Openness	.108	.080	.281	1.349	.200

Table 6

Big Five personality traits and experience variables as predictors of the transformational leadership subcategory inspirational motivation in the wildland firefighter sample.

Predictors	**B**	**SE**	**β**	**t**	***p***
Leadership Experience	.419	.176	1.418	2.380	**.033**
Extraversion	.232	.089	.541	2.596	**.022**
Agreeableness	.001	.122	.002	.009	.993
Conscientiousness	.119	.125	.245	.958	.355
Emotional Stability	.009	.086	.024	.109	.915
Openness	.121	.076	.251	1.600	.134

Table 7

Big Five personality traits and experience variables as predictors of the transformational leadership subcategory intellectual stimulation in the wildland firefighter sample.

Predictors	**B**	**SE**	**β**	**t**	***p***
Leadership Experience	.214	.260	.781	.825	.424
Extraversion	.005	.132	.013	.038	.970
Agreeableness	.083	.180	.131	.459	.654
Conscientiousness	-.018	.184	-.041	.100	.922
Emotional Stability	.023	.127	.064	.181	.859
Openness	.161	.112	.359	1.441	.173

Table 8

Big Five personality traits and experience variables as predictors of the transformational leadership subcategory individual consideration in the wildland firefighter sample.

Predictors	**B**	**SE**	**β**	**t**	***p***
Leadership Experience	.174	.238	648	.730	.478
Extraversion	-.013	.121	-.034	-.110	.914
Agreeableness	.240	.165	.390	1.454	.170
Conscientiousness	.075	.169	.170	.445	.664
Emotional Stability	.002	.116	.005	.014	.989
Openness	.081	.102	.186	.795	.441

Central Washington Sample Results

The ninety-three participants varied in age from 18-36 and sixty-nine participants were female. Correlations between transformational leadership, its respective subcategories, and each of the Big Five personality traits was conducted. Transformational leadership was the only leadership style to be examined for this sample because it is the highest frequency leadership style for the wildland firefighter sample. Multiple regression analyses were conducted for transformational leadership and its subcategories as criteria with the Big Five personality traits as predictors.

Correlation Results. Correlations between transformational leadership categories and the Big Five traits were conducted. Table 9 results indicate that there were some significant correlations between transformational leadership, its subcategories, and all of the Big Five personality traits. Transformational leadership was significantly correlated with agreeableness, conscientiousness, emotional stability, and openness. Idealized attributes was significantly correlated with extraversion, agreeableness, conscientiousness, and emotional stability. Idealized behaviors were significantly correlated with agreeableness, conscientiousness, and emotional stability. Inspirational motivation was significantly correlated with agreeableness, conscientiousness, and emotional stability. Intellectual stimulation was significantly correlated with agreeableness and openness. Lastly, individual consideration was significantly correlated with agreeableness, conscientiousness, emotional stability and openness.

Table 9 Correlations between transformational leadership, its subcategories, and the Big Five personality traits in the Central Washington University student sample.

		Big Five Personality Traits										
		E	A	C	ES	O	TFL	IA	IB	IM	IS	IC
All Variables	E	1										
	A	.104	1									
		.322										
	C	-.013	**.522**	1								
		.903	**.000**									
	ES	.116	**.423**	**.274**	1							
		.269	**.000**	**.008**								
	O	**.318**	**.379**	.132	.143	1						
		.002	**.000**	.206	.173							
	TFL	.147	**.498**	**.379**	**.366**	**.242**	1					
		.159	**.000**	**.000**	**.000**	**.020**						
	IA	**.261**	**.372**	**.280**	**.325**	.121	**.789**	1				
		.011	**.000**	**.007**	**.002**	.250	**.000**					
	IB	0.03	**.480**	**.408**	**.254**	.191	**.875**	**.610**	1			
		.777	**.000**	**.000**	**.014**	.067	**.000**	**.000**				
	IM	.189	**.434**	**.408**	**.329**	.181	**.809**	**.556**	**.684**	1		
		.070	**.000**	**.000**	**.001**	.082	**.000**	**.000**	**.000**			
	IS	.122	**.333**	.141	.178	**.240**	**.769**	**.449**	**.648**	**.492**	1	
		.245	**.001**	.179	.089	**.020**	**.000**	**.000**	**.000**	**.000**		
	IC	-.015	**.415**	**.279**	**.372**	**.251**	**.799**	**.577**	**.604**	**.506**	**.547**	1
		.887	**.000**	**.007**	**.000**	**.016**	**.000**	**.000**	**.000**	**.000**	**.000**	

Note. CWU sample, N=93. The top row contains the correlations; the bottom row indicates the p-value. Abbreviations: Extraversion (E), Agreeableness (A), Conscientiousness (C), Emotional Stability (ES), Openness (O), Transformational leadership (TFL), Idealized Influence (Attributes; IA), Idealized Influence (Behaviors; IB), Inspirational Motivation (IM), Intellectual Stimulation (IS), and Individual Consideration (IC).

Multiple Regression Results. Multiple regression analysis was conducted on overall transformational leadership as shown in Table 10. There was a significant predictive relationship between agreeableness and transformational leadership. Multiple regression was then conducted on the idealized attributes subcategory, as shown in Table 11. Results showed that extraversion, agreeableness and emotional stability were significantly predictive of idealized attributes.

The next transformational leadership subcategory that was examined was idealized behaviors as shown in Table 12. Agreeableness and conscientiousness were significant predictors of idealized behaviors. Inspirational motivation was the next transformational leadership subcategory to be examined. Table 13 results indicate there was a significant predictive relationship of agreeableness and conscientiousness on inspirational motivation.

The next category examined was intellectual stimulation. Table 14 showed that agreeableness was a significant predictor of intellectual stimulation. Similarly, Table 15, showed that there was a significant predictive relationship of agreeableness on individual consideration.

Table 10

Big Five personality traits as variables of the transformational leadership in the Central Washington University sample.

Predictors	B	SE	β	t	*p*
Agreeableness	.158	.059	.321	2.689	**.009**
Extraversion	.055	.041	.125	1.329	.188
Conscientiousness	.087	.053	.173	1.626	.108
Emotional Stability	.080	.054	.147	1.469	.146
Openness	.016	.053	.031	.304	.762

Table 11

The Big Five personality traits as variables of the transformational leadership subcategory idealized attributes in the Central Washington University sample.

Predictors	B	SE	β	t	*p*
Extraversion	.146	.051	.277	2.882	**.005**
Agreeableness	.139	.073	.234	1.917	.059
Emotional Stability	.136	.067	.209	2.027	.046
Conscientiousness	.077	.066	.127	1.168	.246
Openness	-.055	.065	-.089	-.853	.396

Table 12

The Big Five personality traits as variables of the transformational leadership subcategory idealized behaviors in the Central Washington University sample.

Predictors	**B**	**SE**	**β**	**t**	***p***
Agreeableness	.178	.072	.304	2.466	**.016**
Conscientiousness	.147	.066	.245	2.230	**.028**
Extraversion	.030	.051	.057	.587	.559
Emotional Stability	.012	.067	.019	.179	.858
Openness	.007	.064	.012	.114	.909

Table 13

The Big Five personality traits as variables of the transformational leadership subcategory inspirational motivation in the Central Washington University sample.

Predictors	**B**	**SE**	**β**	**t**	***p***
Agreeableness	.162	.081	.241	1.996	**.049**
Conscientiousness	.178	.074	.259	2.410	**.018**
Extraversion	.104	.057	175	1.843	.069
Emotional Stability	.090	.075	.123	1.207	.231
Openness	-.008	.072	-.012	-.116	.908

Table 14

The Big Five personality traits as variables of the transformational leadership subcategory intellectual stimulation in the Central Washington University sample

Predictors	**B**	**SE**	**β**	**t**	***p***
Agreeableness	.168	.077	.289	2.187	**.031**
Conscientiousness	.049	.054	.094	.906	.367
Extraversion	-.018	.070	-.030	-.258	.797
Emotional Stability	.030	.071	.048	.429	.669
Openness	.054	.069	.088	.786	.434

Table 15

The Big Five personality traits as variables of the transformational leadership subcategory individual consideration in the Central Washington University sample

Predictors	**B**	**SE**	**β**	**t**	***p***
Agreeableness	.155	.078	.250	1.992	**.050**
Emotional Stability	.141	.072	.206	1.954	.054
Extraversion	-.052	.054	-.095	-.957	.341
Conscientiousness	.049	.071	.078	.696	.488
Openness	.070	.070	.109	1.012	.314

Chapter IV

Discussion

The original goal of the present study was to evaluate leadership styles, personality, and decision making in wildland firefighters. The decision to not analyze the NFC data was based on the high ceiling effect. This effect was due to the lack of complexity of the developed scenarios. The scenarios were too easy to complete and most participants finished under five minutes. The intention of the program was to have participants apply the strategies and tactics they developed over the course of their careers as wildland firefighters. Since these data were not used, and because of the small firefighter sample, a sample of college students recruited through SONA which served as a separate sample population to the wildland firefighter sample which allowed for comparing actual leadership to theoretical leadership.

The decision to solely focus on transformational leadership was based on the responses of the wildland firefighter sample. Since an overwhelming majority had the characteristics of a transformational leader, there was little reason to further examine passive-avoidant and transactional leadership. Zero participants responded with passive-avoidant leadership characteristics and only two participants (out of twenty-two) responded as transactional leaders. Upon closer examination, the two participants had just slightly higher mean scores in the transactional category than the transformational category. To facilitate the comparison with wildland firefighters, I focused on transformational leadership in the student sample as well.

Wildland Firefighter Sample Conclusions

The results indicate that leadership experience accounts for most of the variance when predicting transformational leadership. This suggests that experience is more important than personality when actually operating in a crisis environment. Wildland fires are crises that threaten the survival of the firefighters. All firefighters know this, and they depend on their leaders to keep them alive while they suppress the fire, and the leaders are highly aware of this responsibility. In this study, experience controls for most of the variance than personality traits. Personality traits are important, but they are not the most important when working in unstable environments: experience is.

The regression analyses imply that increasing wildland firefighter leadership experience causes leaders to become more transformational. This makes sense given how Bass (1985) defined transformational leadership. Transformational leadership, unlike transactional leadership, is not defined by the exchange of rewards for compliance. Instead, transformational leadership is defined in terms of the leader's effect on followers: They feel trust, admiration, and respect toward the leaders, and they are motivated to do more than they originally expected to do. That is, they are transformed to perform extraordinarily, which is what they have to do get the job done and survive in a crisis environment. Crisis leaders need their followers to be transformed, therefore, the leaders must become transformational leaders.

The wildland results of this study indicate that actual crisis leadership experience is what, one, motivates leaders to become transformational leaders, and two, teaches them how to actually become transformational leaders. The results also indicate that personality traits are not predictors of the total score for transformational leadership in a

crisis environment. Again, this makes sense given the life and death nature of the crisis. Any wildland firefighter leader, regardless of his or her personality profile, comes to realize through experience that the transformational leadership style is the best style to ensure both task completion and survival. Additionally, leadership experience was a significant predictor of idealized attributes and inspirational motivation. Leaders who are considered to have idealized attributes are "admired, respected, and trusted" because they put their followers' needs before their own (Bass & Avolio, 2004). Transformational crisis leaders prioritize safety as their number one goal, thus putting their followers' needs first. Everything a leader does in the crisis environment is to further that goal. As shown in the CWU sample, an individual who is extraverted, consciousness, and agreeable ultimately can become a transformational leader, but in a crisis environment, the most important factor is experience.

Transformational leaders inspire and motivate their followers by increasing enthusiasm and optimism within the group (Bass & Avolio, 2004). This is important for leaders in a crisis environment because it helps the team stay motivated when there is uncertainty. Extraversion was also significant in this subcategory, suggesting that extraversion and leadership experience together are important to motivate followers when the environment is uncertain.

There were no significant predictors for the subcategories of idealized behaviors, intellectual stimulation, and individual consideration. Leaders with idealized behaviors are considered to be consistent in their values, ethics, and principles (Bass & Avolio, 2004). Intellectual stimulation allows followers to be creative and innovative and leaders who portray individual consideration serve as mentors or coaches to their followers by

creating learning opportunities. All of these subcategories are important for effective leadership in general; however, they are not the most important when operating in a crisis environment. The main priority for crisis leaders is safety, thus ensuring that their subordinates are willing to work in the crisis environment. In a non-crisis environment, leaders can focus on mentoring and creative endeavors.

CWU Student Sample Conclusions

As with the wildland firefighter sample, only transformational leadership was examined in the student sample. There were no participants that had wildland firefighter experience. This sample served as a hypothetical group, meaning it is unlikely they had any leadership experience in crisis environments, and presumably most had limited leadership experience of any kind. Therefore, participants responded hypothetically to the MLQ. Without experience to inform answers, the MLQ essentially becomes another personality measurement. In other words, the MLQ became an applied extension of the Big Five. In this hypothetical assessment, with no leadership training, agreeableness, conscientiousness, and extraversion were the most important predictors of a transformational leader. All three of these traits are logical predictors of transformational leadership, given the goal of transforming followers into extraordinary performers. Extraversion is important because transformational leaders need to interact with followers extensively. Agreeableness convinces followers that the leader has their interest as a priority, and conscientiousness demonstrates consistency and practicality.

Agreeableness was a significant predictor of idealized behaviors, inspirational motivation, intellectual stimulation, and individual consideration subcategories. Agreeableness (i.e., cooperative, kind, sympathetic, and warm) may predict

transformational leadership subcategories because the students intuitively understand that agreeableness characteristics can translate into transformational intentions and behaviors. Additionally, conscientiousness was a significant predictor for idealized behaviors and inspirational motivation. Conscientious leaders are practical and sympathetic because these characteristics help maintain motivation within the group to continue production. Extraversion (i.e., bold, energetic, and talkative) was a significant predictor of idealized attributes. Leaders who interact with their subordinates on a regular basis show extraversion and are likely to be reported as outgoing and talkative. Outgoing leaders are more likely to foster team building among members than leaders who are quiet and withdrawn.

It is also important to examine what is not significant in this sample because it provides some insight into personality traits and leadership. Openness to experience was never a significant predictor for transformational leadership and its subcategories. The adjectives used to describe openness to experience are: complex, creative, deep, imaginative, intellectual, and philosophical (Saucier, 1994). While these characteristics are important for enhancing long-term growth among followers, they are not the most important components for transformational leader.

In line with Judge and Bono (2000), the CWU result indicated that agreeableness and extraversion were significant predictors of transformational leadership. They also reported that openness to experience, neuroticism, and conscientiousness were not associated with transformational leadership (Judge & Bono, 2000). The results of this study support previous research that has examined personality traits and transformational leadership characteristics.

Limitations and Conclusions

The original intention of the study was to examine the strategy and tactics that wildland firefighters used in the NFC and then compare their overall performance score to their responses on the MLQ and the Big Five Mini Markers. However, participants completed the NFC portion of the study in under five minutes and all twenty-two participants received a score between 98-99%. This data was not useful because it did not provide any insight into the leaders' decision-making process.

The data collection time frame of the study occurred during the 2017 fire season in the Pacific Northwest. Many of the potential participants were unable to participate in the study due to the intense fire season, thus, only twenty-two individuals participated. In addition to the time frame, the study gathered data through self-reporting for both the wildland firefighter and the student samples. The transformational leadership scores are the result of self-perception. There was no measure for subordinates or peers to complete to gain a different perceptive of the participant's leadership style. Additionally, the student sample served as a strictly hypothetical framework for transformational leadership.

The results of this study indicate that crisis environments reduce the influence of personality traits on leadership style. This may be because one of two reasons, one, crisis leaders instinctively recognize that they must become transformational leaders in order to achieve two somewhat contradictory goals: survival and fire suppression. If the leaders want to complete these two goals consistently, and thereby perform successfully, they have to find internal pathways to the transformational style. Obviously, having a certain

personality profile, such as being extraverted, agreeable, and conscientious, will help leaders become transformational. However, the results seem to indicate that crisis leaders without these favorable personality traits will also find ways to enact the transformational style. These results support a fundamental finding in social psychology: powerful situations can dramatically influence behavior, overwhelming personality differences (Milgram, 1963). Two, there was a type I error and personality does contribute to transformational leadership, and experience does not contribute to as much variance as this study showed. Despite whether it is personality or experience that determines how a person becomes a transformational leader, one thing is known, safety is placed above all else in wildland fire.

Safety is the number one priority for wildland firefighting organizations as demonstrated by training and reporting systems such as SAFECOM and SAFENET. The wildland fire organizations have been working diligently to increase their leadership and safety training for their personnel. This study contributes to this effort by showing that (a) transformational leadership is the most effective style in a crisis environment, (b) transformational leadership contributes to most of the variance, and (c) the more experience a crisis leader has the more skills they develop toward transformational leadership. There is more work to be done to understand the decision making and leadership characteristics associated with this population. With the increased fire activity every year, it is imperative that wildland firefighters have leaders that are engaged in training that develop their transformational leadership skills.

Future research should investigate the decision making process and leadership characteristics based on agency and type of crisis environment. The overall wildland fire

organization is a large umbrella that encompasses federal agencies (Forest Service and Bureau of Land Management), state agencies such as the Washington State Department of Natural Resources), contractors, and rural and county volunteer agencies. It would be interesting to evaluate the differences from agency to agency. Additionally, also examining different environments, such as a desert landscape versus a forest landscape, researchers can evaluate the effectiveness of training across environments.

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Appendix A: Recruitment Flyer

PARTICIPANTS NEEDED FOR RESEARCH IN WILDLAND FIRE

We are looking for volunteers to participate in a study about leadership in wildland firefighting.

WHO: You may participate if you have at least two seasons as Squad Boss or above.

WHERE/WHEN: The researcher will establish a specific date and time during May or June with the agency where you work.

WHAT DO YOU HAVE TO DO?

As a participant, you will be asked to complete a computer game that simulates a wildland fire and complete anonymous questionnaires.

This will take approximately 35-40 minutes.

WHAT DO YOU GET OUT OF IT?

There are no direct benefits to you for participating. However, research on leadership styles may improve future training for wildland firefighters.

Participants will be entered in a raffle for a chance to win a $25 gift certificate to Sportsman's Warehouse.

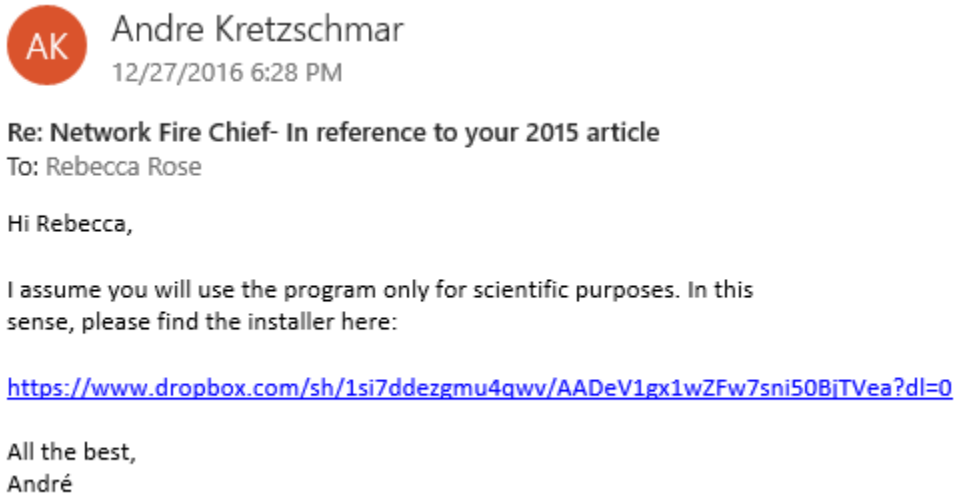
Your decision to participate or not has no consequences with your employer.

For more information, or to volunteer for this study please contact:

Rebecca Rose
rebecca.rose@cwu.edu
Graduate Student
Central Washington University
Ellensburg, WA

Appendix B: Instrument Approval Letter

Letter from previous research user: stating the Networked Fire Chief can be used for research purposes only.



AK

Andre Kretzschmar
12/27/2016 6:28 PM

Re: Network Fire Chief- In reference to your 2015 article
To: Rebecca Rose

Hi Rebecca,

I assume you will use the program only for scientific purposes. In this sense, please find the installer here:

https://www.dropbox.com/sh/1si7ddezgmu4qwv/AADeV1gx1wZFw7sni50BjTVea?dl=0

All the best,
André

To whom it may concern,

This letter is to grant permission for the above named person to use the following copyright material for his/her research:

Instrument: ***Multifactor Leadership Questionnaire***

Authors***:*** ***Bruce Avolio and Bernard Bass***

Copyright: ***1995 by Bruce Avolio and Bernard Bass***

Five sample items from this instrument may be reproduced for inclusion in a proposal, thesis, or dissertation.

The entire instrument may not be included or reproduced at any time in any published material.

Sincerely,

Robert Most

Mind Garden, Inc.

www.mindgarden.com

Appendix C: Mini-Markers Big Five Inventory

How accurately can you describe yourself?

Please use this list of common human traits to describe yourself as accurately as possible.

Describe yourself as you see yourself at the present time, not as you wish to be in the future.

Describe yourself as you are generally or typically, as compared with other persons you know of the same sex and or roughly your same age.

Before each trait, please write a number indicating how accurately that trait describes you, using the following rating scale:

1	2	3	4	5	6	7	8	9
Extremely Inaccurate	Very Inaccurate	Moderately Inaccurate	Slightly Inaccurate	Neither Inaccurate nor Accurate	Slightly Accurate	Moderately Accurate	Very Accurate	Extremely Accurate

Please provide a number for every trait.

____ Bashful	_____Fretful	_____Rude
_____Bold	_____Harsh	_____Shy
_____Careless	_____Imaginative	_____Sloppy
_____Cold	_____Inefficient	_____Sympathetic
_____Complex	_____Intellectual	_____Systematic
_____Cooperative	_____Jealous	_____Talkative
_____Creative	_____Kind	_____Temperamental
_____Deep	_____Moody	_____Touchy
_____Disorganized	_____Organized	_____Uncreative
_____Efficient	_____Philosophical	_____Unenvious
_____Energetic	_____Practical	_____Unintellectual
_____Envious	_____Quiet	_____Unsympathetic
_____Extraverted	_____Relaxed	_____Warm

Appendix D: Mini-Markers Big Five Inventory- Researcher Scoring Key

Each scale has 8 items as shown below. To reflect the appropriate values, first add each item for its scale, then divide (for each scale) by 8 to arrive at the mean response for items on the given scale.

I- Extraversion
II- Agreeableness
III- Conscientiousness
IV- Neuroticism (Emotional Stability)
V- Openness

1	2	3	4	5	6	7	8	9
Extremely Inaccurate	Very Inaccurate	Moderately Inaccurate	Slightly Inaccurate	Neither Inaccurate nor Accurate	Slightly Accurate	Moderately Accurate	Very Accurate	Extremely Accurate

Please provide a number for every trait.

_____ Bashful	_____Harsh	_____Sloppy
_____Bold	_____Imaginative	_____Sympathetic
_____Careless	_____Inefficient	_____Systematic
_____Cold	_____Intellectual	_____Talkative
_____Complex	_____Jealous	_____Temperamental
_____Cooperative	_____Kind	_____Touchy
_____Creative	_____Moody	_____Uncreative
_____Deep	_____Organized	_____Unenvious
_____Disorganized	_____Philosophical	_____Unintellectual
_____Efficient	_____Practical	_____Unsympathetic
_____Energetic	_____Quiet	_____Warm
_____Envious	_____Relaxed	_____Withdrawn
_____Extraverted	_____Rude	
_____Fretful	_____Shy	

Appendix E: Demographic Questionnaire

Please answer the following:

1. What is your current age? _____

Please circle your answer:

2. Gender: ___Male
   ___Female
   ___Other

3. What is your ethnicity?
   ___American Indian or Alaska Native
   ___Asian or Asian American
   ___Black or African American
   ___Native Hawaiian or Other Pacific Islander
   ___White
   ___Multiracial
   ___Other (please specify) _____

4. Highest level of education:
   ___Less than high school
   ___High School Diploma
   ___Some College, No diploma
   ___Associate's Degree
   ___Bachelor's Degree
   ___Master's Degree
   ___Doctorate Degree
   ___ Trade/Technical/Vocational training

5. Have you had any previous experience with a computer simulation of wildland fire?
   ___Yes ___No
6. Are you a permanent employee or seasonal employee? ____Permanent ____Seasonal
   If you answered seasonal, are you career seeking? ___Yes, ___No, ___Undecided
7. How many fire seasons/years have you worked in wildland fire? _____
8. How many of those seasons/years have been in leadership positions (not including fire assignments)? _____
9. How many fire seasons have you been employed at this organization?
   _____

Continued

10. What is your current position (not on fire assignments)? Examples: Crewmember, Senior, Lead, Assistant Engine Boss, Engine Operator

_____

11. What is your highest qualified leadership position on a fire assignment? Examples: Squad Boss, Crew Boss, Burn Boss, Division, IC Type 1

_____

12. What current leadership related taskbook(s) do you have open?

_____

_____

Appendix F: Informed Consent

CENTRAL WASHINGTON UNIVERSITY

RESEARCH PARTICIPANT INFORMED CONSENT

Study Title: Evaluation of Wildland Fire Fighter Leadership

Principal Investigator: Rebecca Rose, Graduate Student of Experimental Psychology Program, Psychology Department, (208)589-6617, rosere@cwu.edu

Faculty Sponsor: Dr. Anthony Stahelski, Professor of Psychology, Psychology Department, (509)963-2368, stahelsa@cwu.edu

CWU Human Subjects Review Council: (509) 963-3115

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1. What you should know about this study:

- You are being asked to join a research study.
- This consent form explains the research study and your part in the study.
- Please read it carefully and take as much time as you need.
- Ask questions about anything you do not understand now, or when you think of them later.
- You are a volunteer. If you do join the study and change your mind later, you may quit at any time during or right after testing without fear of employment penalty.
- While you are in this study, the study team will keep you informed of any new information that could affect whether you want to stay in the study.

2. Why is this research being done?

This research is being done to further understand leadership in dynamic environments. In addition, skill assessments will be explored through a computer program.

This study will also attempt to discover the leadership styles of wildland fire employees to better understand decision making in a dynamic environment.

3. Who can take part in this study?

Individuals who works in a wildland fire organization, specifically the Department of Natural Resources, Bureau of Land Management, and the United States Forest Service.

You must have at least one year of minimal leadership training as Squad Boss.

The goal is to collect a minimum of 30 participants from the following agencies: Department of Natural Resources, Bureau of Land Management, and United States Forest Service.

4. What will happen if you join this study?

If you agree to be in this study, we will ask you to do the following things:

The study is expected to run about 35-40 minutes. During that time you will be asked to complete

- Network Fire Chief computer game simulating a wildland fire
- Multifactor Leadership Questionnaire
- Mini-Markers Personality Assessment
- Demographics Questionnaire

Familiarization with the computer program will take approximately 5 minutes. The computer game will take approximately 10-15 minutes. To complete each questionnaire with take approximately 5 minutes.

By participating in this study, your **anonymous** scores will be given to the Fire Program Manager at the agency where you are employed. There will be no identifiers that will be connected to you.

You may still participate if do not want your scores to be available to the agency where you are employed.

5. What are the risks or discomforts of the study?

You will be asked to sit in front of a computer for part of the study, this may cause eye fatigue. You will also be asked to sit for the entire duration of the study, which can cause fatigue and leg cramping. Additional side effects and discomforts are not yet known.

6. Are there benefits to being in the study?

There is no direct benefit to you from being in this study. However, the agencies tasked with wildland fire suppression will benefit from the summary of results of this study. Therefore, if you take part in this study, you may help others in the future

7. What are your options if you do not want to be in the study?

You do not have to join this study. If you do not join, it will not affect any benefits to which you are entitled.

8. Will it cost you anything to be in this study?

The study procedures will be provided at no cost to you

9. Can you leave the study early?

You can agree to be in the study now and change your mind later. If you wish to stop at any time, please tell us right away.

If you leave the study early, the investigator may use information already collected from you.

10. **What information about you will be kept private and what information may be given out?**

To assure confidentiality, all information you provide will be anonymous. All information will be stored in a secure site at Central Washington University. Only trained researchers will have access to material. Data will be destroyed at the end of the study.

Summary of the findings will be given to the Fire Program Manager as part of prior agreement with your agency at which you are employed. There will be no information given that will be connected to you.

You may still participate if do not want your scores to be available to the agency where you are employed.

11. What other things should you know about this research study?

a. What is the Institutional Review Board (IRB) and how does it protect you?

This study has been reviewed by the CWU Human Subject Review Council. HSRC is made up of faculty from many different departments, ethicists, nurses, scientists, non-scientists and people from the local community. The HSRC's purpose is to review human research studies and to protect the rights and welfare of the people participating in those studies. You may contact the HSRC if you have questions about your rights as a participant or if you think you have not been treated fairly. The HSRC office number is (509) 963-3115.

b. What do you do if you have questions about the study?

Call the principal investigator, Rebecca Rose, at (208) 589-6617, or her Faculty advisor, Dr. Anthony Stahelski at (509)963-2368

c. What should you do if you are injured, ill or emotionally upset as a result of being in this study?

If you think you are injured or ill as a result of being in this study, call the principal investigator, Rebecca Rose at (208)589-6617.

This study is not able to offer financial compensation nor to absorb the costs of medical treatment should you be injured as a result of participating in this research

12. What does your signature on this consent form mean?

By signing this consent form, you are not giving up any legal rights. Your signature means that you understand the study plan, have been able to ask questions about the information given to you in this form, and you are willing to participate under the conditions we have described.

A copy of the form will be given to you.

Participant's Name (print): _____

Participant's Signature: _____ Date: _____

Signature of Investigator: _____ Date: _____

_____ Please initial here if you wish to have your anonymous scores in the summary of findings. The summary of findings will be given to the agency where you are employed.

Appendix G: Networked Fire Chief Instruction Sheet

In the computer simulation you will see a screen of Trees, Pastures (image of a cow), Houses, Clearings, and Dams.

Below shows their respective image in order.

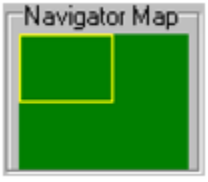
Next, you see the engine resource available for you to use.

To activate the resource, hover mouse over icon and click. Then drag icon to desired location. To start the fire suppression, double click on the icon when it's on the fire (resources do not burn in the scenario). You will know the icon is engaging in fire suppression when it flashes and shows a different icon.

Standard Fire Engine Fire Engine Engaged in Suppression

The fire will be in one of the 9 forms during the scenario. The larger the flame, the more intense the fire is and the quicker it will consume the landscape.

To move around the screen, you will need to look at this box in the lower left hand corner of the computer screen. The small yellow outline within the green box indicates your current view. To navigate the screen, click outside the yellow outline to see the entire landscape.



Appendix H: Networked Fire Chief Scenario

In the scenario, you are the IC with 2 engines and 2 helicopters under your command. Dispatch reported two small fires. The weather has been sunny and dry, with no storms in the last week. Winds have been consistently out of the West, Southwest with strong gusts.

The surrounding area is ranch/farming landscape. There are multiple homes with livestock around.

There are multiple locations for your engines to get water, but they will have to travel a ways to get it.

Your objective is to suppress the fires as quickly as possible.

Please note:

In this scenario, your resources cannot burn over. The resources must be on the flame in order to suppress it. Once the resource is on the flame, you must click the icon to activate the water suppression.

To refill the engines and helicopters have the icons must be over the pond and then click the icons. The icon will start flashing and will be full with water.

The water in the ponds decrease with each use.

Appendix I: Debrief Form

Debriefing Form

Thank you for participating in the study, "Evaluation of Wildland Firefighter Leadership." The purpose of this study is important because there is limited research on leadership, personality traits and decision making in wildland fire leaders.

In this study I asked participants to complete a computer game in order to assess decision making. I also asked participants to complete surveys about their personality traits, their own leadership style, and demographic questions. I expect to find that wildland fire leaders report more responses towards a more effective leadership style. I also expect the more effective the leadership style, the higher the responses in the personality traits of extraversion, openness, agreeableness, conscientiousness, and emotional stability. It is also expected that leaders will perform better on the computer game.

As explained in the informed consent, all of your results will be anonymous and your leadership style responses will compiled into an anonymous summary report with other participants from the agency where you are currently employed.

If you wish not to give permission for this use of your results, there will be no penalty against you from your agency or from the researcher.

If you have any questions or concerns about this study, you may ask me now or contact me at a later date rebecca.rose@cwu.edu

If you wish to contact another person about questions or concerns about this study, please contact one of the two contacts below.

Thank you for your participation.

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