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Fire extremes and the triangle of climate, fuels and people

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Abstract

Over the past decade or so, statements by fire personnel claiming unusual fire behaviour beyond training or experience levels seem to be increasing. This is occurring globally. Concurrently, climate and weather extreme events have been increasing, fuel loads have notably increased due to both natural occurrence and management practices, and the people have been expanding into the wildland and rural interfaces. All of these factors appear to be intersecting causing an increase in "extreme" fire events based on another fire triangle of climate, fuels and people. Megafires (for those comfortable with the term and lack of official definition) could be considered the extreme of the extremes, but many large fires can be categorized as extreme events. But for these extreme events to occur, not all three factors on the triangle need necessarily be extreme simultaneously. For example, strong winds need not be out of the ordinary (e.g., Santa Ana in southern California), but combined with continuous and heavy fuel in a highly populated area can lead to "never seen before" occurrences. Sometimes fire personnel are surprised at how large a fire becomes. In some cases, the extreme event is truly a surprise; in other cases, while seemingly a surprise at the time, upon further reflection perhaps it should not have been. In either event, personnel safety can easily be at higher risk during extreme events, as these situations tax critical thinking given they are outside the common fire experience.

This presentation discusses a project that draws upon quantitative assessment of physical observations (e.g., climate, weather, fuels) along with qualitative assessment of firefighter claims to 1) determine if indeed there is a common trend and intersection of these factors; 2) determine if situational awareness factors can be identified to lessen the surprise of these events; and 3) provide recommendations that incorporate knowledge of extreme events into fire management training.

Keywords: *Fire extremes, large fires, human factors, climate, fuels, fire behaviour*

1. Introduction

This project is driven by the phrase "I've never seen fire do that before" and the concern that fire fighters in the US are being surprised by wildfire behaviour, which then raises concerns about fire fighter safety and if levels of training and situational awareness are sufficient to address current patterns of fire behaviour. Fire is inherently a complex environment, and by extension, almost all questions related to the intersection of fire and people will be equally complex. Added to this is a convergence of climate (hotter and drier), fuels loading (high in many areas), and expanded residential areas in fire-prone areas. In summary, by any measure, addressing the question of fire extremes, both in terms of a quantitative assessment of climate, weather, and fuels and a qualitative assessment of fire fighter perceptions of extreme wildfire behaviour, requires a method that can absorb the variability in this complex problem.

2. Methods & Timeline

Our methodological approach in this project uses a software developed by Cognitive Edge, SenseMaker®, which uses narrative story prompts to ask for "microstories" about an event or experience in someone's life (Figure 1). Once a person has either dictated or typed a brief narrative into the collection device (using either a app or website using a smartphone, tablet, or computer), they then answer a series of questions about the event or experience, applying context and meaning to their story. The questions employ a level of ambiguity to 1) deter "satisfying" or giving the "right answer"

to a question and 2) to provide the storyteller the ability to respond with complex answers—if you ask specific questions, you will get specific answers. While that may be advantageous for some questions, it does not provide the complexity needed in this situation. Survey’s, for example, tend to provide averages of responses to a question. In this problem, an average is exactly the wrong metric to use—what we need are a diversity of stories that provide an array events across geographies, timescales, and situations in response to surprising, unexpected, or extreme wildfire behaviour. This diversity and quantity of stories/context questions will provide us with an authentic reflection of reality that can then be analysed for weak signals and patterns to identify factors involved with fire fighters responses to these situations. The primary data in this methodology is not the stories themselves, but rather the responses to the questions that apply the context and meaning of the story to create a quantitative dataset that can then be analysed statistically.

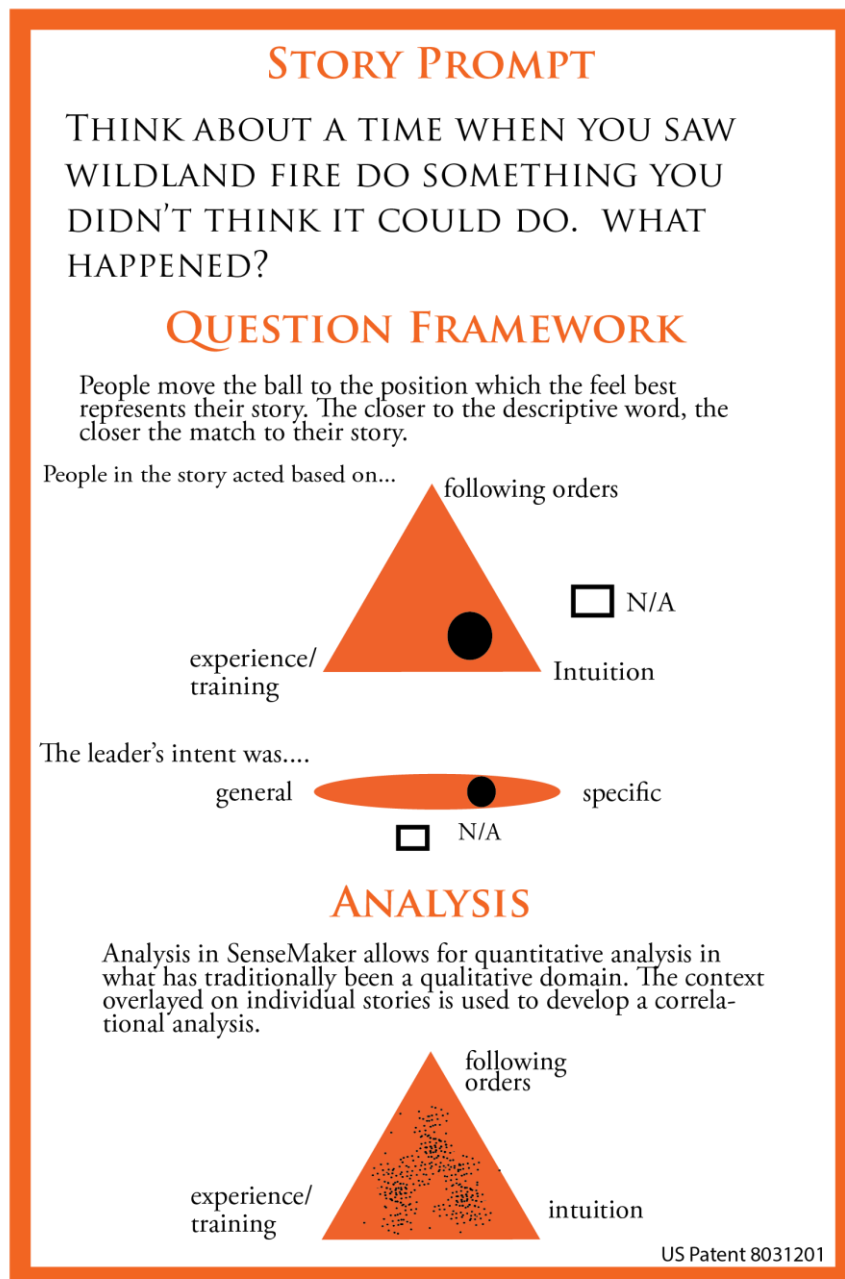


Figure 1. SenseMaker framework.

For this project, we worked iteratively with several groups of expert fire fighters and supervisors, as well a consultant experienced in SenseMaker® to develop the initial question framework. SenseMaker® uses a series of questions that are framed as triads and dyads (Figure 1). Once a preliminary framework was developed, we tested pen/paper versions with several different fire crews to finalize the framework. At this point the framework was coded, and uploaded to a demo server where it was tested again on the website, as well as both iOS and Android operating systems, and the mobile apps.

Quantitative analysis of the physical side of fire - fuels, weather and climate - will be done in association with the stories and other analyzed case studies. This quantitative analysis will assess the extent that fuels, weather and climate are associated with firefighters view of extreme fire. The data for this project component includes weather observations, climate background (e.g., extent of drought), fuels conditions (e.g., moisture, fire danger), and atmospheric synoptic characteristics that might be associated with the fire.

3. Summary

At the time of this writing, we are about to launch the data collection system and are developing and deploying an extensive outreach strategy to reach both current and past wildland fire fighters in the United States. We hope to gather approximately 1000 stories through December of this year. Analysis of the data will occur simultaneously with the data collection. We will also develop a workshop and/or series of webinars to explore the data themes and results with the fire community early in 2015. Following the U.S. analysis, we would to begin collecting stories in Australia, Canada and Europe.