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THE GENERATIVE PROPERTIES OF RICHNESS

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Richness may lie in the eye of the beholder, but there are ways to coax it into view. In other words, richness has power but we are not powerless to evoke it. I want to examine the topic of the power of richness through the lens of my experience learning how wildland firefighters try to make sense of confusing and complex interactions among flames, foliage, winds, humidity, terrain, temperature, bravado, rules, personal protective gear, their own physical condition, firefighter culture, and the uneven competence of their teammates and bosses. These complex interactions are consequential because they can generate fatalities. I came to appreciate the complexity of this wildland richness only gradually and in a secondhand manner (I have never actually fought a wildland fire). I want to convert that gradual process into a handful of lessons for other people who observe moments that matter.

Louis Agassiz as Model

Jean Louis Rodolphe Agassiz (1807–73) was a Swiss-born American zoologist and geologist who taught at Harvard. Imagine that you went to Louis Agassiz's laboratory at Harvard as a student. Agassiz would place a small tin pan in front of you with a small fish and utter the stern requirement that you "should study it, but should on no account talk to any one concerning it, nor read anything related to fishes" (Cooper, 1987: 79) nor use any artificial aids like a magnifying glass until he gave you permission to do so. As one student said, "To my inquiry 'What shall I do?' he said in effect "Find out what you can without damaging the specimen; when I think you have done the work, I will question you" (Cooper, 1987: 82). Students kept telling Agassiz what they had found and Agassiz kept saying "That is not right." This went on, typically, for 100 or more hours with the same now "loathsome" fish. Agassiz would keep asking "What is it like?," "Do you see it yet?" and saying "You have not looked carefully" and "You have 2 eyes, 2 hands, and 1 fish" (Cooper, 1987: 81). Gradually, things would begin to change. One student replied to the professor's query as to whether he had seen one of the most conspicuous features of the fish, the symmetrical sides with paired organs, "No I have not seen it yet, but I see how little I saw before." Agassiz replied, "That is next best . . . now put away your fish, go home; perhaps you will be ready with a better answer in the morning. I will examine you *before* you look at the fish" (Cooper, 1987: 81; emphasis added). Another student reported the following experience: "I pushed my finger down its throat *to feel* how sharp the teeth were. I began *to count* the scales in the different rows, until I was convinced that that was nonsense. At last a happy thought struck me—I would draw the fish; and now with surprise I began to discover new features in the creature. Just then the Professor returned. 'That is right,' said he; 'a pencil is one of the best eyes'" (Cooper, 1987: 81; emphasis added).

Agassiz and the Definition of Richness

With this example in mind, consider the definition of richness. Some of the clearer descriptions of "richness" are found in synonym dictionaries. In a representative text, "rich" is defined thus: "[Relating to] anything above the normal (a variable quantity or standard) in possessions . . . as in, the poem is rich in meaning; a career is rich in promise. . . . That is rich also which is above the line dividing the cheap from the costly or precious, or dividing the stinted in elements or ingredients from the bountifully supplied . . . a rich fabric, a rich tone" (Merriam-Webster, 1984: 712). The antonyms are words like "poor," "lacking," "insufficient." Descriptions and explanations that are rich are above some standard and unstinting.

Agassiz's work is consistent with that definition. And the direction of my work is toward a more bountiful supply of socially interpreted everyday life. But before I go further, some cautions are in order. My preoccupation with Mann Gulch, which will be evidenced below, is bad science in the sense that I fail to note where the dynamics of Mann Gulch do *not* occur; I'm weak on boundary conditions, strong on shameless generalizing. Much of my work is basically an existence proof: if an event can happen in one place, then it likely can happen again. My Mann Gulch preoccupation is also a good example of the maxim, "Believing is seeing." But that is true for most of us since perception (specific instances) without conception is blind; conception

(general simplifications, categories, interrelated variables) without perception is empty. "To perceive, we typify, there is no other alternative" (Gherardi & Turner, 1987: 14)

The Mann Gulch Incident

For the last 13 years, the Mann Gulch disaster has intermittently been at the front of my mind. To refresh your mind about this event, the Mann Gulch disaster, made famous in Norman Maclean's (1992) book, *Young Men and Fire*, unfolded as follows (this description is a composite of Maclean [1992], Weick [1993], and Rothermel [1993]).

On August 5, 1949, at about 4 p.m., 15 smoke jumpers—trained firefighters but new to one another as a group—parachuted into Mann Gulch. The crew's leaders originally believed that the blaze was a basic "10 o'clock fire," meaning that the crew would have it under control by 10 the next morning. Instead, the fire exploded and forced the men into a race for their lives.

Wind conditions that day were turbulent, so the smoke jumpers and their cargo were dropped from 2,000 feet rather than the usual 1,500. The parachute connected to their radio failed to open, and the radio was pulverized as it hit the ground. But by 4:10 the remaining crew and supplies had landed safely in Mann Gulch. The smoke jumpers then collected their supplies, which had scattered widely, and grabbed a quick bite to eat.

While the crew ate, foreman Wagner Dodge hiked to the fire, where he met up with ranger Jim Harrison, who was already on the scene trying to extinguish the fire. They scouted the fire and came back concerned that the thick forest near which they had landed could become a "death trap." Dodge told the second-in-command, William Hellman, to take the crew across to the north side of the gulch away from the fire and march along its flank toward the river at the bottom of the gulch. While Hellman did this, Dodge and Harrison ate a quick meal. Dodge rejoined the crew at 5:40 and took his position at the head of the line moving toward the river. He could see flames flapping back and forth on the south slope as he looked to his left. Then Dodge saw that the fire had suddenly crossed the gulch about 200 yards ahead and was moving toward them. He yelled at the crew to turn around and angle up the steep hill toward the bare ridge of rock at the top of gulley.

The crew was soon moving through slippery grasses two and a half feet high but was quickly losing ground to the flames—eventually towering at a height of 30 feet—rushing toward them at a rate that probably reached a speed of 660 feet per minute. Sensing that the crew was in serious danger, Dodge yelled at them to drop their tools. Two minutes later, to everyone's astonishment, he lit a fire in front of the men and motioned to them to lie down in the area it had burned. No one did. Instead, they ran for the ridge and what they hoped would be safety.

Two firefighters, Robert Sallee and Walter Rumsey, made it through a crevice in the ridge, unburned. Dodge survived by lying down in the ashes of his escape fire. The other 13 perished. The fire caught up with them at 5:56—the time at which the hands on Harrison's watch melted in place.

We see the collapse of sensemaking in this account at the point when firefighters persisted in calling the exploding fire a 10 o'clock fire, even through their senses told them it was something more than this. And we see the collapse of the relating that is so crucial for sensemaking in individuals torn between leaders, forgetting about their buddies, disobeying orders, failing to share information, and ignoring the solution that would have saved them. Access to resources for sensemaking was made difficult by the way the firefighters were organized.

The Growing Richness of Mann Gulch

My interest in Mann Gulch started with a book club discussion of Maclean's book. I was getting close to the date where I would have to deliver a named lecture. The normally smooth trajectory of developing a lecture was interrupted by the basic fact that I had nothing to talk about. The book club discussion gave me something to think about, and I framed the lecture in a very preliminary fashion as an account of a collapse of sensemaking that might have been remedied by greater resilience. The lecture was attended by an *ASQ* editor, who requested the lecture for the journal, and the journal was read by a forest ranger, who passed the article to firefighting friends, who asked me how I had come up with my analysis, which they thought was better than their own investigations. All of this happened just before a similar fire occurred in 1994 at South Canyon, killing 14 firefighters. The circumstances at South Canyon were eerily similar to Mann Gulch. A post–South Canyon workshop, "Human Factors in Wildland Fire Fighting," organized by firefighter Ted Putnam, gave me the chance to dig deeper into the question of how people make sense of unexpected events when they are under pressure.

The richness of my South Canyon analysis (Weick, 1995) came from the earlier probing of the Mann Gulch incident. For example, I thought resil-

ience was important at Mann Gulch, but the firefighters didn't seem to think it was important. Why not? Part of the problem was that their retreat was slowed because they were carrying heavy tools. This raised the question, why don't people drop their tools when they are in danger of being entrapped? In fact, they seemed not to realize that they were becoming entrapped by their expectations, their briefings, and the way they had structured the team. They expected that suppression of the fire would be a "piece of cake," summarized in their belief that that the fire would be under control by 10:00 the following morning. Their briefings were minimal, due in part to a taciturn crew chief who put more stock in doing than talking. They did not create a structure in advance consisting of lookouts, communication, escape routes, and safety zones; the wisdom of doing so was not codified until 1991, when Paul Gleason introduced his LCES formula for survival (Gleason, 1991). And above all, in the Mann Gulch incident, there is the intriguing question, how did the crew chief, Dodge, invent a possible life-saving solution at the last possible second in the form of an escape fire? These questions, and others involving sensemaking and high-reliability systems, all flowed from a single book I consumed while acting as an armchair ethnographer.

What lessons about richness might one derive from this experience?

Lesson 1: Reading Builds Richness

I had a huge advantage because I started with Norman Maclean's rich initial description of Mann Gulch in *Young Men and Fire*. But great books don't guarantee rich follow-ups. The reading itself matters. This is evident in E. B. White's (1954) wonderful essay, "The Last Reader," written 52 years ago. White worries over the future of reading "in these audio-visual days" where AV devices "ask no discipline of mind and . . . . are already giving the room the languor of an opium parlor." True reading "is the work of the alert mind, is demanding, and under ideal conditions produces a sort of ecstasy." These are outcomes capable of restoring projects. These outcomes were hard to come by in 1954. And they still are hard to come by. "Indeed, there is very little true reading, and not nearly as much writing as one would suppose from the towering piles of pulpwood in the dooryards of paper mills. Readers and writers are scarce, as are publishers and reporters. The reports we get nowadays are those of men who have not gone to the scene of the accident, which is always farther inside one's own head than it is convenient to penetrate without galoshes" (White, 1954: 551).

To go "to the scene of the accident" in search of meaning, and to locate the scene of that accident deep inside one's own head, is to catch the significance of the accident scene, and to use that significance to reanimate analysis.

Lesson 2: Read with Theories in Hand Because Theories Increase Requisite Variety

I approached the world of wildland fire fighting with a head full of theories. I had what Paul Schulman calls "conceptual slack." Schulman (1993) summarizes a rich analysis of reliability at the Diablo Canyon nuclear power station by means of his own version of the law of requisite variety, which he calls "conceptual slack." Schulman argues that the many procedures, meetings, and negotiations at Diablo Canyon initially seemed confusing but turned out to be expressions of divergent analytical perspectives, all of which were focused on maintaining operational reliability. These are expressions of conceptual slack defined as a diverse set of theories, models, and causal assumptions about technology and production processes that serve as a hedge against surprise and analytic error. What is crucial about conceptual variety is that it protects against hubris. "At Diablo Canyon, there is a widespread recognition that all of the potential failure modes into which highly complex technological systems could resolve themselves have yet to be experienced. Nor have they been exhaustively deduced. In this respect the technology is still capable of surprises" (Schulman, 1993: 364).

The importance of a head full of theories is that this increases requisite variety. By that I mean that it takes a complicated sensing device to register a complicated set of events. And a large number of theories can be a complex sensing device if believing is seeing. Haberstroh describes the law of requisite variety this way: "If the environment can disturb a system in a wide variety of ways, then effective control requires a regulator that can sense these disturbances and intervene with a commensurately large repertory of responses" (1965: 1176). Thus, it takes richness to grasp richness.

Lesson 3: Rich Comparisons Breed Further Richness

A simple way to demonstrate the point that richness begets richness is to perform a small experiment suggested by Parmenter (1968). The next time you visit an art museum, before you actually view the exhibit itself, go to the gift shop. Purchase post-

card reproductions of several items that are hung in the gallery. When you get to the original work of art, hold the postcard reproduction alongside the original. What you will discover is that portions of the painting are not well reproduced on the postcard (e.g., the background isn't that color, the sparkle in the original is missing from the reproduction, changes in perspective are more dramatic, etc.). The postcard essentially alerts you to features of the painting you might otherwise have overlooked. The imperfect reproduction serves as a clue to sites where the artist's genius is more evident. In similar fashion, what any event means, what is significant in its unfolding, may become clearer when it is compared with another event, and the observer looks for similarities and differences.

Something is rich relative to something else. Is that painting rich? Compare it to a postcard reproduction. Fire fighting is rich relative to desk work, relative to prevailing ideas about teams, relative to sensemaking puzzles, relative to a simple set of expectations. Go into inquiry clear about what you expect, what you believe. That is your postcard.

Lesson 4: Simple Accounts Mean You're Not Paying Attention

If things seem simple, if your actors seem single-minded, you're not paying attention. Instead, you are settling for the misleading focus induced by hindsight. You need to restore the past to its own present with all its incoherence, complications, and "might-have-beens."

Capturing more of the present moment is important to offset our tendency to rely too heavily on the specious clarity of rolling 20/20 hindsight. As Clifford Geertz has said, "Social scientists are professional second guessers" (1995: 40). One of my favorite bits of fire-fighting lore comes from the much-quoted chief of the Phoenix Fire Department, Alan Brunacini. He said, "The number of faults in a fire operation is in direct proportion to the number of viewers; [furthermore] the intelligence of the viewers is in direct proportion to how late they arrive" (1985, cited in Flin [1996: 22]).

The point I want to make is that richness gives to elapsed events their own present in all its possibilities, incoherence, and might-have-beens (Dening, 1996: 204). The problem we all have, in the eyes of historian Greg Dening, is that the texts "we study are mostly past-participled, hindsighted, stilled, closed" (Dening, 1996: 17). Here's what he means. "We are comfortable in our view of the past. The past happened in a totally particular way in space and time. That is its realism. All the possibilities of what might have happened are reduced to one. The energies of historical enquirers are focused on discovering what that one possibility was. But by that we have not re-presented the past. To do that we have to enter into the experience of those actors in the past who, like us, experience a present as if all the possibilities are still there. If a historian's ambition is to describe how people actually experienced their lives, then that historian has to slough off many certainties. To give back to the past its present, one has to be a little humble about what one can know" (Dening, 1996: xv-xvi).

Let me illustrate Dening's point with a contemporary example of the difficulty people have dropping their tools. Recently I asked the fire chief of a major California county if he had ever heard of such incidents. He said, "I did one."

He and a partner were protecting a house with water from a new water tender truck. A wall of fire was coming up a canyon behind them and pinyon trees were exploding and throwing flaming pitch balls that stuck to the firefighters' clothes. The pitch balls also started a spot fire in front of them, which meant that fire was coming at them from both directions. Normally, the way to handle such a crisis is what is called "sheltering-in-place." You go inside the house as the fire burns over the area. The house catches fire slowly, and when the house has caught fire, you go back outside because supposedly the worst of the fire wall has passed. That's not what happened here. Rather than drop the tool of the truck and "shelter up," the two firefighters attempted to drive it out through the wall of fire on an unfamiliar road. The hoses on the truck caught fire, the engine kept stalling because the fire had sucked all of the oxygen out of the air, they were in the fire wall for a full 35 seconds, and they came out of the fire wall with their front wheels near the edge of sheer cliff. Their failure to drop their tools almost cost them their lives.

To understand the chief's present, we need to register his ambivalence, the contradictory pressures created by such things as a new truck, an available house, fiery pitch balls that were sticking to his clothing, responsibility for the life of another firefighter, unfamiliarity with the locale, and the effects of increasing anxiety on his sensemaking. We need to give up clear single-focus hindsight that says simply, he reverted to overlearned behavior and was unable to drop his tools. Instead, we need to accept that the signature of a rich account is often the preservation of disorder and confusion. In the case of the chief, a rich rendering of his plight provides important data. The fact that he kept his tools and lived fills a crucial cell in a two by two matrix composed of these variables: whether the people involved dropped or kept their tools, and

whether they lived or died. Most entries in this matrix are in the cell "kept tools and died" or in the cell "dropped tools and lived."

Lesson 5: Adopt an E-Prime Mind-set

In my own theorizing I often try to say things without using the verb to be. This tactic, known as "e-prime" (Kellogg, 1987), means that I'm not allowed to say "Wagner Dodge *is* a taciturn crew chief." Instead, I'm forced to be explicit about the actions that went into the prohibited summary judgment. Now I say things like, "Wagner Dodge surveys fires alone, issues orders without explanations, assumes people see what he sees, mistrusts words, overestimates the skills of his crews." When I'm forced to forego the verb to be, I pay more attention to particulars, context, and the situation. I also tend to see more clearly what I am *not* in a position to say. If I say that Dodge overestimates the skills of his crews, that may or may not mean that he is taciturn. It all depends on other concrete descriptions of how he behaves.

The larger point about e-prime is that it helps the theorist move closer to the territory that is being mapped. Part of my fascination with "saying" is summarized in one of Robert Irwin's favorite maxims: "To see is to forget the name of the thing one sees" (Weschler, 1982: 203). When people perceive flowing experience, those undifferentiated sensations gradually take on explicit meaning when they are named, systematized, and formalized. When people name and formalize, they move farther away from their initial impressions. This transformation is necessary in order to coordinate with others. But people pay a price for it. As social complexity increases, as people pay more attention to coordination, they shift from perceptually based knowing to categorically based knowing (Baron & Misovich, 1999). Coordination is facilitated, but at the potential cost of greater intellectual and emotional distance from the initial phenomenon.

Conclusion

Recall Louis Agassiz's admonitions: "You have not looked carefully, that is not right, it is right there in front of your eyes." Richness restrains hubris. That may be its single most important power. Mann Gulch, with all its disorder and lack of tidiness, nevertheless points up fear, thrusts death in our face, reminds us that we often don't listen and often act with empty bravado, attests to the limits of our powers in the face of danger, stirs excitement, shows the power of credibility and the consequences when it is never established, is social through and through, suggests that better organization might have prevented all this, and counsels wariness as well as the necessity of confidence. If a Mann Gulch can keep all of these realities in play and insert them into people's conversations, then richness will have added something to the store of wisdom with which everyday life is lived. This is not an argument for the value of research on firefighters. Instead, it is an argument for a larger point. It is an argument for detail, for thoroughness, for prototypical narratives, and an argument against formulations that strip out most of what matters. It is an argument that the power of richness lies in the fact that it feeds on itself in ways that enlarge our understanding of the human condition.

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