High-Stakes Ethics

Edward Barnard

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The HPC Tradecraft Master Practitioner, Volume 1

Edward W. Barnard

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Contents

Navigating Power Imbalance

This book takes the ACM Code of Ethics head on. We send our young computer scientists and software engineers out into the world thinking the Code of Ethics protects them. **It does not.**

Chapter 1's adventure shows why I am qualified to have an opinion. That training is referenced in my "DD-214" military discharge papers.

Chapter 2 shows precisely how, where, when, and why corporate responsibility shifted to amoral pursuit of shareholder value. The result is an unexpected power imbalance between corporations (particularly the Big Tech titans of our industry) and early-career employees.

The solution is not to fix the power imbalance, legal or illegal. The solution is to develop skills to survive that imbalance and remain intact. That is no small feat.

The book currently stops here without proposing solutions. This is a work in progress. The information is so urgently important that I am presenting the two chapters as useful background material.

The next book, *Unexpected Histories*, demonstrates that "corporate power imbalance" is the mild version. In our past, as corporate power was threatened, people died. Sometimes with aerial bombardment, sometimes with bullets, sometimes with clubs, and sometimes with official hangings (but only of women). Well-documented U.S. history (from primary sources) shows the stakes are not trivial.

Chapter 1. Chased By the Bad Guys

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Vietnam Experience

The first big test of the new (as of 1955) military Code of Conduct was during the Vietnam experience. The U.S. Prisoners of War (POWs) were mistreated in ways similar to what happened in Korea during the Korean War.

The U.S. Department of State explained "Ending the Vietnam War, 1969-1973" with the infamous "Christmas Bombing." We'll need that timeline.

> On October 11-12 [1972] Kissinger and [North Vietnamese Politburo member] Le Duc Tho reached agreement on a peace settlement, both sides working to reach that end before the U.S. presidential election on November 7. [South Vietnamese] President Thieu rejected the settlement, refusing to accept a peace that left North Vietnamese forces in South Vietnam, and legitimized the Hanoi-controlled Communist shadow government, the Provisional Revolutionary Government. His rejection forced Kissinger to resume negotiations with Le Duc Tho.
>
> Kissinger was unable to find any common ground acceptable to both Vietnamese parties in two renewed rounds of negotiations. Finally, in order to break the deadlock, on December 14 Nixon ordered massive B-52 attacks on the North Vietnamese heartland—the "Christmas bombing." Meanwhile he continued to exert intense pressure on Thieu, threatening to cut off U.S. economic, military, and political support of South Vietnam if Thieu refused to accept the agreement.

BBC Magazine on December 24, 2012, with "North Vietnam, 1972: The Christmas Bombing of Hanoi" summarized:

> The biggest ever bombing campaign by US B-52 aircraft took place over Christmas 40 years ago, when the US dropped at least 20,000 tonnes of explosives on North Vietnam, mostly Hanoi. More than 1,000 Vietnamese died, but some claim the assault may have helped bring about the deal signed a month later that led to an end to US involvement in the war.

The U.S. Department of State continues "Ending the Vietnam War":

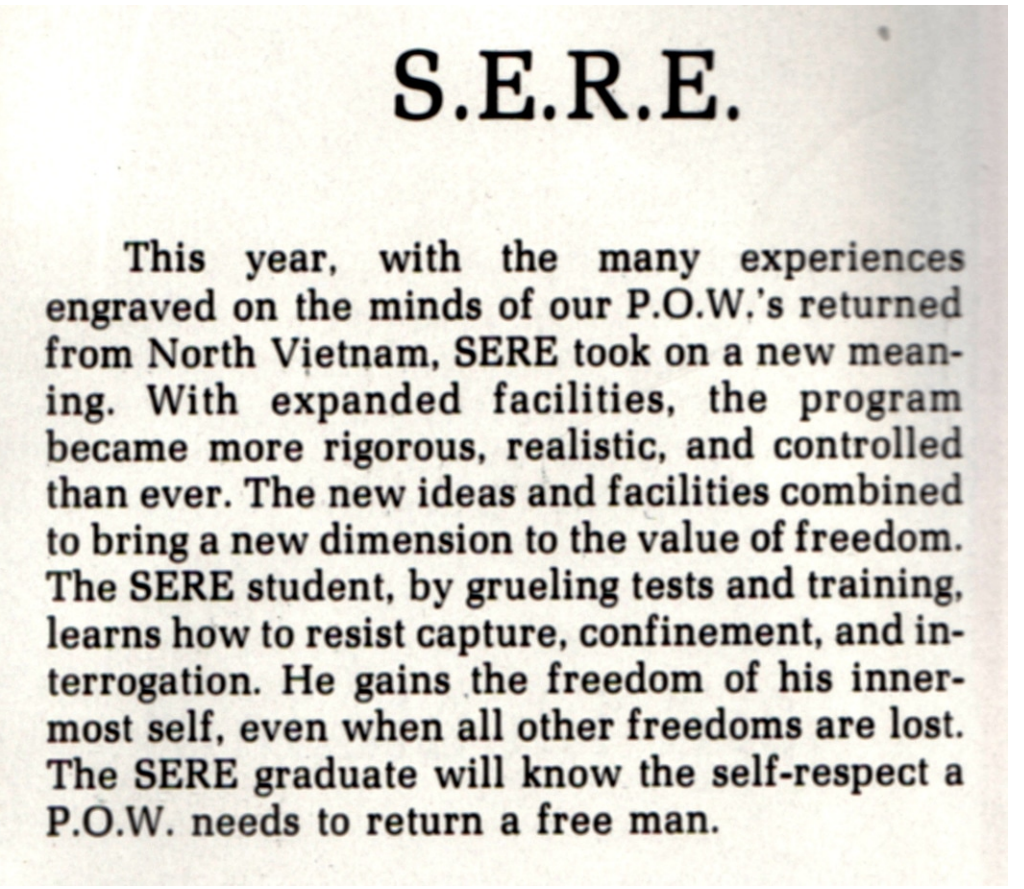
> Negotiations resumed on January 8, 1973, and the United States and the Democratic Republic of Vietnam initialed the agreement on January 23. Thieu reluctantly accepted the settlement despite his continued misgivings, and the peace agreement was signed on January 27.
>
> The peace settlement enabled the United States to withdraw from the war and welcome the American prisoners of war back home. Neither of the Vietnamese parties abided by the settlement, however, and the war continued.

That gets us to Operation Homecoming, the initial return of U.S. POWs from Vietnam, but we're not done yet:

> Nixon had gained Thieu's adherence to the agreement through a series of letters and envoys, all promising U.S. military support in the event of a North Vietnamese violation of the accords. On November 14, 1972, for example, Nixon wrote Thieu that "I repeat my personal assurances to you that the United States will react very strongly and rapidly to any violation of the agreement." Both sides understood this to mean the recommitment of B-52s to combat.
>
> In the end, these commitments were not upheld due to a combination of factors—domestic and Congressional reluctance to reengage in the war, economic constraints, and finally the Watergate scandal, which weakened and distracted Nixon. Having rebuilt their forces and upgraded their logistics system, North Vietnamese forces triggered a major offensive in the Central Highlands in March 1975. On April 30, 1975, NVA tanks rolled through the gate of the Presidential Palace in Saigon, effectively ending the war.

The very next summer (summer is SERE season at the Air Force Academy), in 1975, the USAFA responded (Figure 1.1, "New, improved SERE") with fresh training based on the now-closed Vietnam experience:

> S.E.R.E. This year, with the many experiences engraved on the minds of our P.O.W.'s returned from North Vietnam, SERE took on a new meaning. With expanded facilities, the program became more rigorous, realistic, and controlled than ever. The new ideas and facilities combined to bring a new dimension to the value of freedom. The SERE student, by grueling tests and training, learns how to resist capture, confinement, and interrogation. He gains the freedom of his innermost self, even when all other freedoms are lost. The SERE graduate will know the self-respect a P.O.W. needs to return a free man.


S.E.R.E.

This year, with the many experiences engraved on the minds of our P.O.W.'s returned from North Vietnam, SERE took on a new meaning. With expanded facilities, the program became more rigorous, realistic, and controlled than ever. The new ideas and facilities combined to bring a new dimension to the value of freedom. The SERE student, by grueling tests and training, learns how to resist capture, confinement, and interrogation. He gains the freedom of his innermost self, even when all other freedoms are lost. The SERE graduate will know the self-respect a P.O.W. needs to return a free man.

Figure 1.1. New, improved SERE

Do you see how the game is played here? The Wikipedia page says that people erroneously think SERE training was based on abusive Chinese brainwashing. In fact the document said it was political indoctrination rather than brainwashing, explaining that "brainwashing" was a misused term at the time. For people unfamiliar with the exact background, but familiar with the term "brainwashing," the subtle deflection is easily missed.

The Wikipedia page, for the rest of the section, focused on reports of CIA interrogation stuff. That's a distraction. Look! Squirrel! Torture is bad!

Why do we care? Why in the world am I dragging you through this obscure piece of trivia?

Let's suppose, just for fun, that there was some discussion regarding Communist China. That is, the government and its intentions and practices. Is it the same country, established October 1949 with Chairman Mao? Yes. So, you might ask, how is their track record? Can history shed any light?

Well… there was this Korean War. There was this big scare about Americans being brainwashed and there seemed to be some sort of Chinese Communist connection. So perhaps Communist China is not to be trusted—or so you might be thinking.

But you'd need to be pushing age 75 to directly remember that. Or maybe it was discussed in your presence later… but you'd still have to be of Baby Boomer age.

More likely you'd choose to look online. You know what I mean. Check Wikipedia! Sure enough, Wikipedia says that No, it's the CIA that did us wrong. It seems that the U.S. Government has been lying to us—especially about torture.

Kristen Weir explains for the American Psychological Association in "Why we believe alternative facts" that:

> It takes more information to make you believe something you don't want to believe than something you do.

If you, the Wikipedia page reader, are inclined to believe the negative stuff about the CIA as presented, you'll be even more inclined to take the "origins of SERE techniques" information at face value. It's a well-crafted deflection. When we hear what we want to hear, we're more likely to believe—no matter that it's a different topic.

So, being suspicious that maybe Communist China is not a friend, and checking on the history, we find out that there is a history—but that it's been the CIA lying to us all along. All that stuff about military honor and Return With Honor? It's all based on a lie. But now we see the lie is a lie.

It's an obscure historical reference. Who would look? But the *topic* is propaganda and disinformation. It's about political indoctrination, to use the 1956 term.

So now it's time to ask. What if that's not an isolated example? What if there's more than one example out there on Wikipedia? Who would notice?

When you do a web search on a topic, what usually shows up first as an authoritative answer? The relevant Wikipedia article. What if tiny bits have been twisted here and there, to deflect away from the truth? Just the tiniest nudge—to deflect.

I didn't have articles or click bait sending me to that SERE section. I went there on purpose on my own. So it must be legit, unsullied, right? That's how sleeper cells (so to speak) work. Plant the land mine and let the forest overgrow it.

This one's subtle. How did I find it? Because parts of SERE are classified. Parts were classified as of when I took the course. Thus I can't question what's on Wikipedia. I can't disclose classified information in rebuttal. So the page editor is safe from me.

At various times I've searched online SERE information to find out what is public. I can safely reference whatever is online without specifically saying that I observed or experienced it. I can say "this is what's online over there." So I wanted to see what's public knowledge.

I saw that paragraph on the origins of SERE techniques and knew it contradicted a major premise of what I was taught. I was rather ticked off to find out I'd been lied to. But then I began to check my facts… and the years didn't match. I knew what to look for (Korea) because I had *not* been lied to.

This brings us to another lesson: It sometimes takes specialized knowledge to identify disinformation. Something might be a "red flag" for you and not to me because I don't have the background.

Therefore if someone you trust notes a red flag in an area where they do have the specialized knowledge or experience, consider that the warning may be legitimate. Proceed accordingly.

The next lesson is more subtle. It's what I call finding the pattern in the noise. I caught that something was "off" but it took a while to recognize the actual problem and to articulate it. That comes with practice.

For me it's the same skill as with debugging software—finding the pattern in the noise. I doubt many would call it the same skill, but for me it is! And practice counts.

Victory Garden

Now for a bit of whimsy: Victory gardens. Several people, while at home in April 2020, have discussed planting gardens to help with their personal food supply, calling them victory gardens (Figure 1.2, "Victory garden"). Do it! I have a story.

Figure 1.2. Victory garden

SERE, in my case, included a multi-day hike in the woods, which is pretty awesome (Figure 1.3, "Hike in the woods"). It was a gorgeous area just outside Rocky Mountain National Park. But we're talking about victory gardens.

Survival left little time for resting.

Figure 1.3. Hike in the woods

In my group of six, both Paul and I had prior knowledge of growing things. That hike through the woods was without any food—or water, which becomes something of a problem.

But my childhood knowledge of what growing things are edible becomes a useful life skill. In my case it became useful at a weird point in time—but if you have children immerse them in all phases of your victory garden!

Figure 1.4. Evasion

So much for gardens. That hike through the woods (which was awesome) included "bad guys" searching for us. That's the first "E" in SERE, "Evasion" (Figure 1.4, "Evasion").

Figure 1.5. Escape

We noticed a "pattern in the noise" which allowed us to have a bit of fun with the bad guys. We had already escaped (Figure 1.5, "Escape") from the resistance training (Figure 1.6, "Resistance"). So by this point a hike through the woods was great.

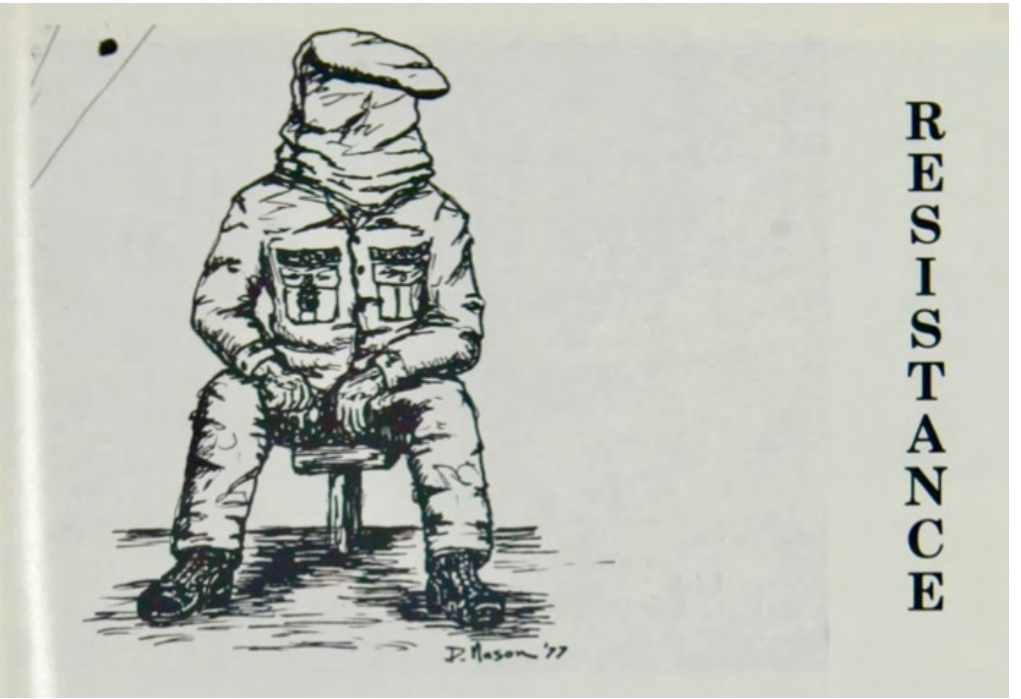


Figure 1.6. Resistance

The "evasion" treks, with our teams of six (Figure 1.7, "Survival"), involved getting from point "A" to point "B" and checking in with the "good guys" at point B. Two of us could navigate and travel quite well. The six of us tended to reach the check-in point long before schedule. We observed "good guy" arrival, setup, and so on. We began to realize the bad guys' patterns and strategy. We hadn't eaten in days and were dehydrated but the views were amazing.

Figure 1.7. Survival

We noticed that the bad guys tended to search for us on the direct line between point A and point B, just before point B. A lot of guys (all participants were male) got caught that way, blundering into the opposition (Figure 1.8, "Simulate getting caught").

A group of prisoners is lead to their new "home" in the SERE compound.

Figure 1.8. Simulate getting caught

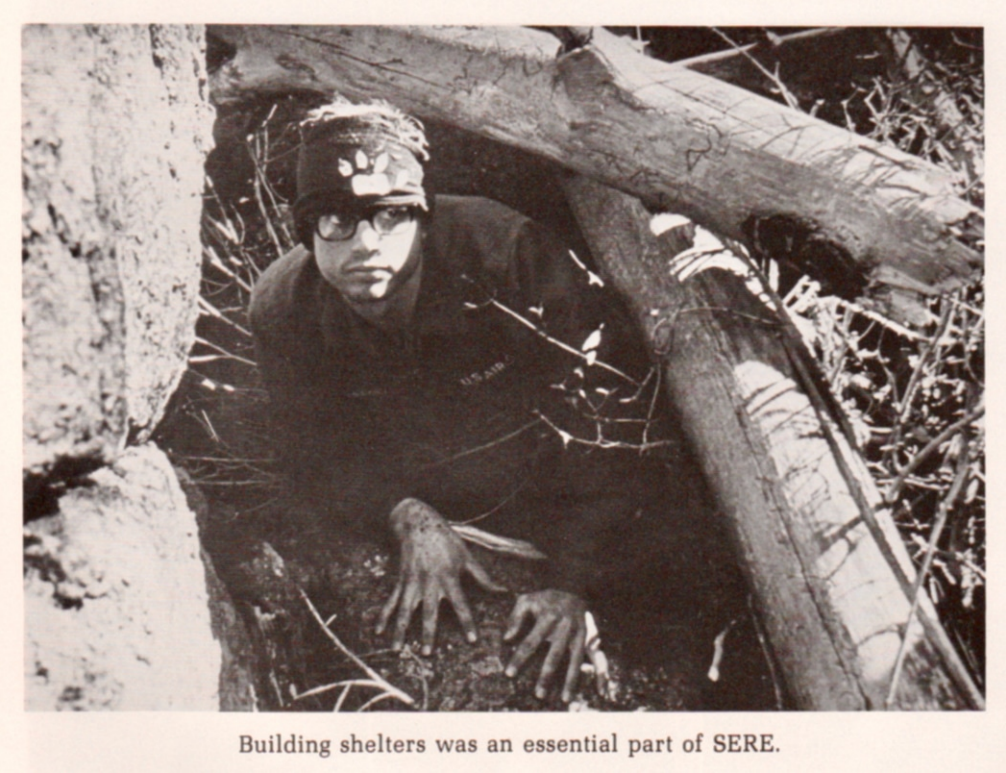
Final Checkpoint

The final checkpoint was to be early the next morning. We had a full day to get there. We quickly traveled to the area the day before and discovered the checkpoint was near a dirt road. The dirt road was slightly past the checkpoint. We were confident we knew the bad guys' pattern.

We had arrived in the afternoon, and check-in was not until the following morning. Did we really want to spend the night near the check-in location with the U.S. Army (who acted as the "bad guys") searching for us all night?

How far away would we need to travel to be safe? We'd not eaten in days, were very low on water, tired and sore (poor me). If we took an easy route into hiding, we'd likely get caught coming back along that easy route in the morning.

Should we climb up the hill? High in the Colorado Rockies, a hill is a *hill*. Have you ever tried sleeping in the open on a steep hill? No, that would not be a good answer for us. Meanwhile the all-night searches didn't bode well for us. Trekking somewhere safely distant and back might not end well (Figure 1.9, "Evasion").



Building shelters was an essential part of SERE.

Figure 1.9. Evasion

But we knew the situation would get worse. We were the vanguard of several groups heading to the same checkpoint. We certainly did not want to get swept up with the stragglers. The teams with the worst scores (due to getting caught or missing check-in) would be staying behind to wash the mud off the jeeps and ton-and-a-half trucks while the rest of us were on leave. Losing a day or two from the three weeks' summer leave was a big deal.

We had decisions to make. We did not want to get caught, not on the last day (Figure 1.10, "The opposition").

Figure 1.10. The opposition

So what did we do? We looked both ways (so as to not get caught) and crossed the road.

We found a fairly flat meadow on the other side just out of sight. It was only a few yards off the dirt road.

We really should have moved farther off the road. There were jeeps and big trucks up and down that road all night catching other teams. The noise kept waking us up. That was our mistake; it was annoying.

But, sure enough, the bad guys only searched for people near the check-

point, and before the checkpoint, not after the checkpoint. We were sleeping in the open, just barely out of sight of the road.

Then, in the morning, small groups of good guys walked through the middle of our camp. There were far too many to be manning a single checkpoint. We realized that *all* SERE students must be checking-in somewhere in the area. No wonder there was so much noise in the night!

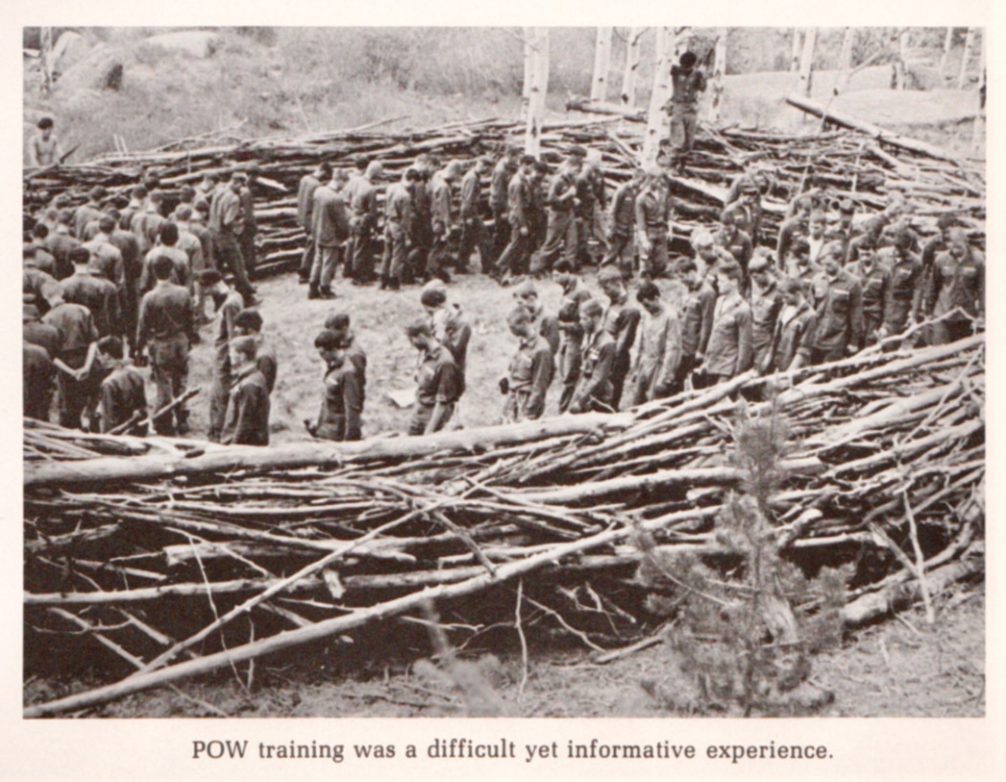
It so happened that we were camping on their trail to their check-in points. They walked through our camp headed towards and across that dirt road. They ignored us as they passed, so we ignored them and went back to sleep each time. It had been a long noisy night of other people getting caught.

Finally one traveler announced, "It's about time to get up, guys" as he continued on his way toward the road. So we did. We had scoped out a safe route to our check-in the afternoon before, so we knew our travel route.

As we checked in, the "good guy" wore a bit of a smirk on his face. He'd been through our camp that morning. But we had checked in and we were now safe. Our survival and evasion phases were complete. The views were awesome.

The *Denver Post* interviewed 1986 SERE graduate Troy Calhoun in 2008 as the USAFA head football coach (see Figure 1.11, "POW training"):

> When Troy Calhoun was an Air Force Academy student, all cadets had to spend part of one summer going through a three-week program labeled "SERE"—or Survival Evasion Resistance Escape. They were downed pilots, attempting to avoid capture, and regardless of their skills in the program, they eventually were "interned" behind barbed wire.
>
> "It was one of the most miserable 20-day periods of my life," Calhoun, the AFA's second-year head coach, said Wednesday at the Falcons' media day. "The 48 hours in the simulated POW camp… when you're going through it, you're thinking, 'there is nothing worse than this.' And yet I'd also tell you that it was one of the greatest sources of pride in my life, too."



POW training was a difficult yet informative experience.

Figure 1.11. POW training

Personalize the Concept

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Summary

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Road Map

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Appendix A. HPC Tradecraft Road Map

What is "HPC tradecraft" as I know it? This is high-performance computing (HPC) arising from signals intelligence (code breaking) needs. My particular lineage begins with the "Tunny" code breaking project at Bletchley Park during World War II. That produced such an odd-looking contraption that the "Wrens" operating it named it the Heath Robinson. W. Heath Robinson was a cartoonist known for portraying fantastically complex machines designed to accomplish simple tasks.

When U.S. Navy veterans built something similar for a similar purpose, they named it GOLDBERG in honor of cartoonist Rube Goldberg's fantastically complex machines, explicitly acknowledging the Heath Robinson tradecraft origins. One of the founders of Engineering Research Associates (ERA) was Bill Norris. ERA built GOLDBERG, and also hired Seymour Cray. Norris later founded Control Data Corporation (CDC) and Cray soon followed as their youngest employee. Cray later founded Cray Research, which I joined early 1980.

Thus the high-performance tradecraft I learned within Cray Research already had a 40-year history. Perhaps because so much was classified Top Secret, we never wrote down *how* we did things. Institutional knowledge was passed from person to person as mentorship, collaboration, and informal apprenticeship.

The 1995 Barrier

Circa 1995, something shifted. We hid the messy details behind abstractions, allowing for far more complex software development. We no longer needed to think of systems as a whole, and how things performed on bare metal.

For high-performance computing, this presents a problem. HPC tradecraft remains constraint-based design, but we can no longer see the constraints informing the design. This became a niche topic rarely covered in school (or the workplace).

Meanwhile, the pre-1995 tacit knowledge is retiring out of the workforce. My role as Custodian (the Russian term is more specific, хранитель) is to share this knowledge with you as a living practice.

Two Series

I created two book series to teach HPC tradecraft.

- "HPC Tradecraft Apprenticeship", three books, is the institutional tradecraft as I learned and practiced, and still practice. Tradecraft is useless unless replicable. The first book teaches my replication method; the second teaches *how* we accomplished what we did; the third teaches systems thinking, with close observation and characterization of HPC systems under load, using modern AI as the example. The three books are transmission protocol; HPC design; HPC operations.
- "The HPC Tradecraft Master Practitioner", three books, is the author letting loose and having fun, expressing his mastery of HPC tradecraft. High-Stakes Ethics prepares for the insurmountable power imbalance of a new graduate in the amoral corporate environment. Unexpected Histories demonstrates debugging skills applied outside computer science, showing their value and timeless nature. Constraint-Based Design demonstrates 1986 tradecraft directly applies to modern AI transformer design and usage.

Book 1. HPC Tradecraft for Computer Scientists: What We Stopped Teaching

I iteratively created book 1 as I circled what I actually have to share, why it is important, and how to make it accessible to the right persons.

- Show my teaching method of formation text that performs what it teaches, which I frame as the manner of replication.
- Act as filter and qualification, so that readers have the necessary information before buying/committing to the two large flagship books.
- State *Nobody but Us* as prerequisite to *Wizard's Lens*, which readers might perceive as problematic if they came for AI.

The sequence itself is formation. This was the teaching order within Cray Research.

Book 2. Nobody but Us: A History of Cray Research and the Building of the World's Fastest Supercomputer

This book is by far the largest and highest writing quality. However, persona walk-throughs consistently report the quality as uneven. This is because the book attempts to overcome the Edwin Abbott Flatland paradox. "Look here" in the midst of formation text appears to be uneven quality requiring an editor, and a human might see it the same way, but "look here" is pointing to something most readers do not have the vocabulary to see on their own.

The book serves a crucial purpose of credentialing the author (via demonstration not assertion). Why? Because the next book makes apparently-outrageous claims which are not proven until reading through to the final chapter. The claims are based in "Nobody but Us" tradecraft.

What Cray Research accomplished is well documented. This book teaches *how* we did it. But there is another aspect, which is the next book.

Book 3. The Wizard's Lens: Learn to Think Like AI

Think Jay Forrester and Donella Meadows and Eli Goldratt and Robert Gagné and Anders Ericsson, all of whom are referenced in the book. This is the craft of closely observing and characterizing HPC systems, using AI as the working example. This is the Cray Research attitude of treating barriers as opportunities. Barriers point to the point of maximum leverage. Meadows lists points of leverage. For my purposes, I collapse her list to Liebig's Law of the Minimum (plant growth is bounded by the relatively scarcest nutrient). This principle matches Goldratt's *The Goal*.

Rather than the skills in the prior book, this teaches shifting perspective, systems as a whole, interactions between systems at the boundary, and the attitude of not being distracted by the fact that it has never been done before.

This ends the primary series, the HPC Tradecraft Apprenticeship.

Book 4. High-Stakes Ethics

The book is a work in progress. My premise is that we do not give computer scientists, particularly recent college graduates, the skills to survive the corporate power imbalance. I wrote two essays regarding that power imbalance. They are the raw material from which I plan to write the book, but the essays themselves have urgent importance, thus publishing as a work in progress.

Book 5. Unexpected Histories: Spotting Patterns and Making Connections That Others Miss

This book consists of 15 essays/chapters, 49,000 words, demonstrating tradecraft in primary source analysis and constructing interesting narratives by "connecting the dots" that others miss. While nothing in here is technically difficult, some seem to have this aptitude and some do not. Book 2 has a chapter on what William Friedman has to say about developing intuition. This book is practice in developing that premise.

Tradecraft demonstrated across the centuries and outside computing demonstrates invariants, skills non-specific to a given technology, while demonstrating Piotr Galperin's final stage of formation.

Book 6. Constraint-Based Design: A Gateway to AI

In 1986, I wrote a bare metal device driver inside the Cray I/O Subsystem as a joke and to demonstrate the author's capability. It is a text adventure game, Swiss Adventure, inspired by Colossal Cave Adventure. What is useful is its characteristics.

The game itself forces the user (adventurer) into an operational apprenticeship, working with incomplete information in an unfamiliar context. I created a PHP/Laravel/React.js version that is live on my website, stateless, requiring no login or registration or data collection. The live version is the game itself presented as typing at the operator console, with side displays (essentially event traces) showing flow through the assembly language overlays, and flow through the LLM attention mechanism patterns.

Thus it is an executable companion to the book. The 1986 source code and the PHP engine are in a public GitHub repository, with the most recent timestamp in the repository as May 2019, which is well before GPT and Claude became well known publicly.

- The live website is here: Swiss Adventure
- The assembler and PHP source code are here: SwissAdventure

There are several aspects of interest.

UPDATE

The source code is in UPDATE format. Secondary sources (wikipedia) indicate CDC UPDATE is one of the earliest known source code management systems, from late 1950s or early 1960s, punch card based. I know from personal (as primary source) knowledge that the first Cray Research software person was hired directly from CDC. I know from internal statements that CDC's UPDATE was ported to Cray Research. While onsite at Boeing Computer Services 1980-1982, the front end systems were CDC Kronos. I used CDC UPDATE and Cray Research Update side by side. Thus I am clear on the provenance.

Relatively few extant examples of live code in UPDATE format exist. This one is publicly available on GitHub.

APML

When the CRAY-1/S was announced with a new I/O Subsystem (IOS) in addition to the mainframe CPU, the IOS had been developed as the "A" Processor. Extant documentation as of 1980 called it that. The cpu assembler was CAL, Cray Assembly Language. The IOS assembler was called APML, "A" Processor Macro Language.

The 1986 source code is a live, complete, package, and likely the only substantial example of IOS programming written by an actual Cray Research IOS programmer. It was written (as a student) during a class *teaching* IOS programming, but I was later part of the IOS group for 10 years, so can act as primary source asserting it is authentic and representative.

"Live" might be misleading in that no system still exists to run it. But the precise port to PHP *is* live and online.

Adventurer Experience

The adventurer experience has characteristics similar to many realms of operational training. I intentionally wrote it inspired by Colossal Cave Adventure and Zork. It might be worth noting that the authors of those two programs worked in operational environments. Thus I was not inventing the formation aspect. That was already a characteristic of text adventure games.

Constraint-Based Design

The source code has many levels and aspects of constraint-based design, and it is possible to teach the design without dwelling on assembler syntax. I implemented the training data (all navigation and text content) as a domain-specific language using the assembler macro and micro facility. I had a deep enough understanding (including making mods to the CAL assembler source) to do this. Adding game features did not require executable code changes.

Here is the odd part: The source code architecture is isomorphic to 2017 "attention is all you need" architecture function. Similar constraints shape similar solutions (Genrich Altshuller's TRIZ principle). My operating environment was quite similar to a hot LLM token context under load. Attention heads, weighting, pulling from external source then deallocating… quite a few features are present.

A working bare-metal example of constraint-based design can be useful. But a 1980s demonstration that HPC methods are relevant to modern AI has interesting implications, which is why I decided to include this as a book.