Safety in Numbers: Safer Hiking through Science

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You're planning a three-day backpacking trip. How far can you hike in? How long will it take to get there? How much food should you take? What stove? How much fuel for the stove? What sleeping gear? What jacket? What tent? What pack to carry it all? Some people answer such questions by shooting from the hip; I try to defend my answers with hard data.

The theme of this collection of essays is their title: "Safety in Numbers". A quantitative approach can help to answer all of these questions, and many more. That approach can even teach you additional questions to ask: Should I continue forward with my plan, cut it short and stay here, or turn around and go back out? The approach is to mix and match tiny pieces of the fields that are commonly abbreviated as STEM: Science, Technology, Engineering and Mathematics.

Other essays show the approach in action; this essay gives the philosophy that underlies it.

Mathematics

It is a little helpful to know that "I've been walking in this direction pretty quickly for a while." It is much more helpful to know that "I've been heading southeast at about three miles per hour for two hours." Whenever possible, reduce key facts to numbers.

Sometimes we have to perform calculations on those numbers. In this walking example, we know that we are about six miles southeast of where we started. If we have kept detailed records and we know that we walked at 137 degrees at 3.15 miles per hour for 1 hour and 55 minutes, then we should be able to quickly compute in our head that we are about six miles southeast of where we started. Ballpark calculations are usually good enough; I can imagine few circumstances in which it would be necessary to calculate that we have progressed exactly 6.0375 miles.

I keep a few relevant numbers in my head, such as my starting time and sunset. Many of the numbers are on my map: it came with a lot of details (trail lengths, elevations), and I scribbled more onto my photocopied version. The majority of the numbers are in the digital photographs that I take during the trip. Looking back at the pictures I can tell where I was, the times I was there (from the time stamps), the temperatures (easy to shoot my thermometer), the amount of water I purified (photograph the containers you fill), the amount of fuel I used (photograph my plastic fuel bottle before and after cooking), and so on. Afterwards, if I want to, I can collect almost all the numbers of my trip.

Science

You don't need a course in thermodynamics to keep warm in the woods. But it can be helpful to know that all objects can lose heat by conduction, convection and radiation. A few insights from meteorology will help you to use your barometer more effectively.

A typical walk in the woods can be viewed as a series of experiments. Every outing tests a number of hypotheses, along the lines of

This sleeping bag will keep me warm at 28 degrees.
This jacket will keep me dry in rain with wind gusting at 20mph.
This food will keep me going over this three-day backpacking trip.

Such "natural experiments" also estimate parameters: How long will this headlamp burn before the batteries die? Sometimes I've run simple "horse races" on trips: I'll use different durable water repellent (DWR) finish on each boot, and see which one does better on a rainy day.

We can do "backyard experiments" on car camping trips or behind our homes. How long does it take this stove to boil a pint of water on a 38-degree day? Will this cover stay on my pack in a 28-mph wind?

Other times we conduct our experiments in an indoor laboratory. If I'm worried about the water repellency of my parka, I'll sprinkle a few drops of water on it. If they bead up, it is fine. If they start to soak into the material, though, then it is time to restore the finish. A great way to measure the performance of your new headlamp in cold weather is to leave it on in your freezer (most stay at around zero degrees Fahrenheit), and open the door every half hour to evaluate and record its brightness.

Engineering

The dictionary says that an engineer is someone who applies science, math and ingenuity to solve problems. We need more of those people in the woods.

Several key attributes of an engineer are particularly appropriate outdoors. We have to define what the problem is, and then work to solve it efficiently. Along the way, we employ pithy rules of thumb that convey deep truth: "if your feet are cold, put on a hat". We delight in diagnosis and debugging: first figuring out what is wrong, and then fixing it.

Technology

I once watched a brilliant young mathematician stare intently at the pressure gauge on the filling-station air pump as he inflated his bicycle tire. He would pump in air, stop and read the pressure only to find that it was zero, then pump in more air and repeat. The process continued until the bicycle tire exploded. Even though the pressure gauge was broken, the air pump was working just fine.

You have to understand a technology to use it properly. My compass points to north all the time, as long as I recall magnetic declination and I haven't rubbed it across a big magnet recently and I'm not near an iron mine. I try to buy only accurate thermometers (I compare them to the others on the shelf), and then check them now and then to ensure they haven't wandered. And when I look at the thermometer, I try to recall exactly what temperature it measures. We could assign fancy names to these tasks, such as "domain of applicability", "calibration", and "precise interpretation". But in the woods, we just call it common sense. Let's work to make it more common.

I try to enforce a discipline whenever I employ a technology. Before I read a number, I guess what it will be. In my car, I always guess my speed before I glance down at the speedometer. And similarly for the fuel level, the outside temperature, the average MPG, and all other numbers that the vehicle gives me. It has made me a pretty good guesser, but also aware of the fact that I'm sometimes way off. And when I am, I trace the discrepancy to its root.

The Big Picture

I go to the hills to be in the hills. Other people go to the hills to park their RVs and watch their 55-inch HDTV, and I hope that they enjoy that. But I go to the hills to be there, and to let nature wash over my soul. Won't the Science, Technology, Engineering and Mathematics, the Tiny STEM, destroy that feeling?

At first, it might interfere just a little. In the long run, though, I rarely even notice it.

Think about driving an automobile. When I first started, I was completely absorbed by all the details: What exactly are the rules of the road? Can I make a right turn on this light? Who has right of way here? How fast am I going? What is the speed limit? And I had to focus on every detail of control: how can I turn to stay within the lane, accelerate fast enough, shift gears, and – oops! – signal that I'm making the turn back there, too. Toss in the art of navigating from where I was to where I wanted to be, and I was completely absorbed by the task of driving. It took me a long time to achieve competence.

But now I'm there. I'm adept at all of the individual tasks: the rules of the road, the details of driving, and the techniques of navigation are all second nature. Sure, when I get in a rental car I have to focus on some little issues – how exactly do I turn on these windshield wipers? But usually I can have a pretty reasonable conversation, or enjoy the scenery, all while driving safely and efficiently.

I've had the same experience with the Tiny STEM in the woods. I had to think about my new barometric altimeter when I first got it, but now I use it with little effort. When I come to a key decision point, I have lots of information at my fingertips, and an approach to asking and answering the right questions. But for the most part I don't worry about the numbers, and my mind and my soul are in the woods.