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System Safety Society



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Spinning the Hologram for System Safety

by Charles Hoes

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Once again, I'm facing the possibility of hiring new safety engineers. I always find this to be a daunting task because it's never clear what criteria to use. It's relatively easy if the people are experienced safety engineers with proven track records, but often that's not the case. In fact, because of the scarcity of safety engineers, I often end up hiring people from outside the field and training them in system safety.

It seems that something other than technical knowledge might be the most important attribute — something related to a point of view, or a way of looking at or understanding the world. I've been trying to figure out what that is, but I'm finding it exceedingly difficult to pin down.



I've been attempting to figure out how I work, in the hope of being clearer about what I'm looking for. At least it might yield some insight into how others work — and that might help in my search for people who could become highly talented safety engineers. When faced with a difficult safety problem, I might approach it "visually," by building a mental model that's both three-dimensional and dynamic. I can't actually "see" the problem (I don't have visual hallucinations of the system, for example), nor do I "see" it as in a dream, but it still feels like I'm working with a mental construct that represents the physical object. For example, if I'm worrying about the hazards associated with changing a car tire, I visualize a variety of cars, jacks, environments and people's actions. I get flooded with images and thoughts of pavement, mud, side hills, sand and wind. I see a variety of jacks, and I see people who are "handy," along with those with no mechanical experience, those who are fit or unfit, etc. This view also includes professionals in automobile shops. Then, out of this mess of thoughts, images and experiences, patterns start to form. The patterns get simpler and simpler until I'm presented with a summary of possible scenarios and solutions.

This all sounds pretty confusing, but it turns out not to be, because it all happens without my having to do much about it. It seems to happen in a part of my brain that is unconscious — I get questions and answers from that unconscious part, but I don't know much about the process used to generate them. It's a little like solving a mathematics problem. In solving math problems, I gather information to load into my mind's computer and then write out the answer. The writing of the answer isn't the solving of the problem; I'm just acting as a scribe, writing down what I already know. The process of actually solving the problem is invisible to me.

While I don't have much insight into how I solve problems, I do have some insight into what it feels

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like, and I have some idea of what form the answer takes. It comes as a three-dimensional model that lets me zoom in and out, and rotate the image, in my mind's eye. I can then describe that model from a wide variety of perspectives. Actually, it is more like a hologram in that it is a large number of simultaneous 3-D images. If I pick one view (for example, of using a scissor jack), then the rest temporarily recede into the background, and the selected images are those that involve scissor jacks. As I get more and more specific, it's like spinning the hologram, and I can see only those that line up with the details of interest.

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I doubt that I'll ever find anyone willing to admit to such a bizarre approach to problem solving, especially as regards selecting a new employee. However, I suspect that I'm not alone in this type of approach. The really good safety engineers that I've known all seem to have the ability to work from some kind of internal model in 3-D (actually 4-D, because time is definitely included). When describing their views, they often start moving their hands and arms and talking as if they are actually experiencing their model. They can, and do, place things in 3-D space physically by moving their hands and saying things like "this joint is over here," "the rod goes down this way" and "over here is a bolt."

There are others who don't seem to "get it" in the same way when working on a problem. It's as if they're trying to memorize the details using lots of words, but without making a mental model of the object or situation. When I try to help them by explaining the details of something, they may seem to get it because they can recite back what I said or give me back the specifications and numbers involved, but the next day or on the next similar project it's gone. One of my employees said that it's like keeping ice in a colander — it's there today, but by tomorrow the ice has melted, and the colander is empty again. It isn't that they forget the details; it's that they can't seem to reconstruct, and use, a mental model. Change a few of the details and they have to start all over again.

A contrary example is the time I attempted to set up and run the accounting system for my business. I found it to be an impossible task. There was no way I could set up a chart of accounts and books that followed the "best accounting practices." It isn't that I can't keep track of the assets and money flow; I'm very good at that. I just couldn't do it in the way that accountants have devised. I get images of piles of money, things, people working, and all of that. That works for me to understand and manage my business, but it sure doesn't get me to charts of accounts with credits and debits resulting in assets and liabilities, or profit and loss. I finally had to give up and hire a bookkeeper for this job. I check the answers periodically against my "gut" understanding to make sure that neither of us is straying too far from reality, but I just can't get it using their model of my finances. My guess is that these same very smart and capable people would have a difficult time getting it with my safety problems.

So now I have two descriptions of people who solve complex and important problems, but who do so with such diverse methods that there is almost no overlap in abilities. This is as I suspected when I started pondering the problem of finding people who will make good safety engineers. There are radically different ways of looking at and understanding the world — not better or worse, just different. I need to figure out which approaches are important for our profession so I can select them to work for me.

I wonder how artists view the world. The holographic view that I described sounds a little like what I think artists might see. However, there is a technical, science-oriented approach to safety engineering, and it requires knowledge of the properties of materials, human factors, psychology, mathematics, statistics, standards, regulations, etc. The safety engineer must create a mental model that matches the real world — one that behaves as things (and people) really behave, and that fails the way things (and people) really fail. The model must be based on sound engineering and good science. Some artists have this kind of background, and they may make splendid safety engineers as well as great artists. Personally, I'm not an artist because I seem to lack some of the attributes necessary for that profession. There's an emotional aspect to an artist's view that is not necessary for being a safety engineer.

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As I think about why this type of mental model is important, I wonder if it isn't because it allows a person to better address the unknown. It's very difficult to identify what's missing without some way of identifying completeness. Having a model like this helps to highlight the gaps in knowledge and descriptions because it won't all fit together properly without the missing information. Of course, even with such a model, it's extremely easy to fill in the gaps with assumptions — often ones that are not obvious or expressly stated. However, it does seem helpful for identifying areas that need more detail and information. If you look only at the information that you have, then it's all too easy to overlook important issues.

Assuming that I'm looking for people who are technically knowledgeable and view the world as some kind of hologram, my next task is to figure out how to identify these attributes. That might be a good topic for a future TBD article. Right now I have no good idea about how to accomplish this. The technical part will probably show up in their résumés, but the mental model part will be difficult to identify. 

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