

Further Thoughts on  
**Being Forehanded**<sup>1</sup>

*Christopher Nemeth PhD, CHFP*

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COGNITIVE TECHNOLOGIES LABORATORY, DEPARTMENT OF ANESTHESIA AND CRITICAL CARE,  
THE UNIVERSITY OF CHICAGO, 5841 S. MARYLAND AVENUE, MC4028, CHICAGO, IL 60637

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*Being forehanded is anticipation and preparation for the uncertain future so that we are ready for it by the time it becomes the present. Forehandedness in health care enables us to achieve a robust performance that can make success possible in spite of circumstances.*

Taking error seriously means to first understand the domain in which it is said to occur. Like the Navy, health care is teeming with hazards, risks, ambiguities, paradoxes, dilemmas and conflicts. Like the Navy, it is populated with a wide range of people who are capable of failure as well as success. Unlike the Navy, though, health care is not well understood as a system. By that I mean understood at the level of groups and organizations instead of the more atomic level of the single patient case. Health care resists study at this level in part because of the amount and density of information that converges at the sharp end.

Understanding health care at this level calls for an approach that incorporates resources and methods from many fields: psychology [1,5], anthropology [2], sociology [3], human factors [4] and engineering [1,5]. To borrow a phrase from my Navy background, this sort of study will lead us to understand robust performance, which is *the ability to succeed despite circumstances*. I think that is what we are striving for in our discussions.

High stakes environments inherently involve hazard, risk and danger. Robust individual, group and institutional performance accounts for hazard, risk and danger and it succeeds in spite of what occurs. Much of that success may be due to formal mechanisms in the system, such as procedures. However, a large part of it is derived from the ability of workers to look ahead, to anticipate and to prepare for the uncertain future in order to be ready for it by the time arrives as the present. The Navy calls that being forehanded.

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My research activity is in health care environments, procedures and products: the operating room, the intensive care unit and infusion devices. I came to my current research after a 30-year Navy active duty and reserve career and design of products used in medical settings. My Navy career included Viet Nam combat experience in the Combat Information Center (CIC) of a guided missile destroyer in the Gulf of Tonkin and later service as a Navy diver, parachutist and eventually as a senior staff member in Europe. While I was Research and Development Manager for Herman Miller's health care products subsidiary, our projects included a hospital and clinic carts system, headwalls for neonatal intensive care units and clinical laboratory and nursing workstations. Consulting work included a catheterization lab contrast dye injector, a specimen collection kit for sexually transmitted diseases (STD) and a lactation aid for mothers breastfeeding children in need of supplementation. In each instance, I learned about the nature of dealing with environments that are complex, constrained, conflicted, uncertain and risky. These two threads inform my work today.

*If error is human-system mismatch, then the Anesthesia Coordinator's work has a direct bearing on minimizing it.*

Despite much marketing promotion to the contrary, human factors research does not inform medical device design very well. I have encouraged members of the design [6], human factors [7] and legal [8] professions to improve how connections are made between research and design and the practice of health care. Having been an operator and a designer, I am now looking for ways to improve the connection through better research. My recent research focuses on cognitive artifacts. Most artifact study is done to make them better, presumably to improve their usefulness. That's not what I refer to here, though. Artifacts are good research tools, offering a "way in" to study health care practice *between* and *among* cases, to sort out what does and does not matter, and to learn how things are done in one place versus another. Artifacts that users make or change, particularly users who coordinate work, are very well suited to learning about the features of technical work. These are the features that are so troublesome in daily practice and so thoroughly ignored in the literature on safety and error in health care.

The operating room schedule provides a way to understand the interplay between the demands and resources that shape practice. The development and use of schedules reveals the daily pressures, gaps, confrontations, oversights and trade-offs in the context of uncertainty, danger and life-or-death decisions; much like combat.

Here is an example of schedule use that demonstrates forehandedness. In it, the Anesthesia Coordinator (AC) in the operating room (OR) takes a call from a surgeon who is declaring a case as an emergency.

AC (on phone) *I don't think we can do it today.  
We can book it and see if we can fit it in.*

...

AC (on phone, separate conversation) *You're in the bump room, Number 1.*

AC (on phone) *He wants to do it*

AC: (on phone) *I don't make those decisions. You'll have to talk to him.*

...

AC: (to Nursing Coordinator (NC)) *Clean it up and let's set it up.*

AC *Ask the person bumping to talk to the surgeon who is being bumped.*

NC *Six is coming out.*

AC: (to NC) *We can put [Surgeon 1] in there. (Calls, no answer.)*

(to NC) *We can put [Surgeon 1] in 4 and [Surgeon 2] in 6.*

*Let me page [Surgeon 2].*

(to NC) *You're planning to put something in 6.*

(points to a case on the add-on list)(pages Surgeon 1)(calls Surgeon 1)

...

Nurse (while walking past station) *Are we being bumped? Is this for sure now?*

AC (to nurse) *Do the scheduled case*

...

AC (calls Surgeon 2) *[Surgeon 2], Room 6 is coming out.*

(calls Surgeon 1) *[Surgeon 1], [AC]. I just talked to [Surgeon 2] and he  
doesn't mind waiting 45 minutes.*

What has happened over ten minutes is that the emergency threatened to invoke a predetermined arrangement to “bump” an elective procedure out of the way in order to clear an operating room for a higher priority procedure. While the arrangement works, the staff prefers not to use it if possible. That is because bumping causes significant changes to the way staff, rooms and patients are assigned that the unit would prefer to avoid. The Anesthesia Coordinator resolved this conflict by operating at three levels. At one level, he worked with the two surgeons to develop a consensus solution. At another level, he had the Nurse Coordinator report on operating room status. In the meantime, he also directed subordinates to set up another room, opening an option for the surgeons to consider. When he got the news from the Nursing Coordinator that Operating Room 6 was coming open, he proposed that room as a feasible solution for the bumping surgeon (Surgeon 2). It would require Surgeon 2 to wait 45 minutes for the room and staff to be prepared. Yet the AC was able to get the surgeons to agree based on a deep knowledge of potential and implications as well as deft diplomacy. Within ten minutes, he had fielded a potential problem, put others on a course to create solutions, found a feasible alternative, presented it to both surgeons, elicited their support and avoided bumping a procedure. To do this, the AC had to know a

great deal about how this environment works. Without this knowledge, the system will continue to work, but not anywhere near as gracefully.

What does this have to do with error? This particular AC has many years of experience with this environment and he uses that knowledge to balance resources with demands. This happens in two ways. He develops the master schedule for anesthesia service assignments including sixteen rooms of the OR a day in advance. He efficiently accounts for many considerations including who is qualified for certain procedures, who needs certain experience, and who works well with whom. After the schedule is distributed at about 1500, he fields questions and adjusts the schedule through the afternoon and evening. From 0630 until 1500 the next day, he oversees how the scheduled activity plays out. As the AC, he has the ability and the authority to push for compliance, to change the schedule to respond to new demands or to seize the opportunity to optimize the use of resources.

If error is human-system mismatch, then the Anesthesia Coordinator's work has a direct bearing on minimizing it. Adverse events flow from causes that are inherent in daily circumstances. "Error" is part of the broad spectrum of activity in a system, not a discrete entity that can be isolated, counted, and removed. To return to a military analogy: counting the number of marks on a range target enables us to understand *that* the rifleman is on or off-target, not necessarily *why*. Knowing what is causing poor performance comes not from counting the number of shots off-target (counting error) but rather from knowledge that is related to firing the weapon (the system). Knowing what to do about the rifleman's error also flows from knowledge about the system. This could include hardware (site adjustment), technique (position adjustment, trigger actuation, breath control), or weapon knowledge (training), among others. So, too, in healthcare, deep knowledge of technical work makes it possible to anticipate, to prepare for and to even mold the future. This is what it means to be forehanded. Understanding and supporting forehandedness is a strong step toward achieving robust performance.

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