

Learning to fly: Teaching mental strategies to future surgeons

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Abstract

In the medical education community, Dr Curt Tribble has played a major role in highlighting the importance of the mind in dealing with the performance demands of surgery and in incorporating systematic mental training into surgical training. The goal of surgical training at the University of Virginia Health Sciences Center is to help residents “learn to fly” - to reach a point where they are independent actors who take responsibility for their decisions. As surgery involves both mind and body, mental training has been made an integral part of the training process. This article describes the mental aspect of a training program for surgeons from laying foundations to practicing surgery as a flow experience.

Teaching the mental side of surgery

The following article is based on a keynote address Dr Tribble made to the delegates of the 1995 World Congress on Mental Training and Excellence in Ottawa, Canada.

Surgical training in the United States has many elements of a model adult educational system. It is a system that takes virtual beginners, and allows them to achieve a level of mastery over a fairly short period of time. The system has been extraordinarily successful, and is emulated around the world. Still, despite the success of the system, some of the lessons are not explicit. Thus, our interest in the mental strategies of surgery began with a search for improvements in surgical education. We have turned to the adult education literature,

to the self-help literature, to the business management literature, to performance education literature, and to our own observations and trials. Our mission has been and continues to be to categorize and articulate the performance tools that master surgeons need to have in their armamentarium as they achieve the status of master surgeons.

We have sometimes called our informal course in this type of training ‘cross-training your hands’. The idea behind this term is that there are really two parts to learning surgery. One is learning the physical or technical side. The other is learning the mental strategies that are associated with the technical side. The training would not be complete without attention to the ‘minute particulars’ of operative technique. However, I will not dwell on the physical training that we give our residents, but rather on the

mental training. One of the ideas that we tried to begin with in this area is the idea that training in the mental side of surgery is like learning to fly. Beginners learn speed control, then speed, and eventually achieve freedom. The various portions of our approach to ‘cross-training your hands’ include foundations, preparation, leadership, awareness, focus, anxiety, decision-making, reflection, vision, and flow. When all of these mental strategies are mastered, the resident has become free to act as an independent surgeon, responsible for his or her own actions without the need for supervision by his or her teachers.

Foundations

Training begins with foundations, which includes having an idea and taking it to the level of a dream. One must know the “whys” as well as the “whats”. An example of an idea about someone going into surgery that comes from my own experience is that when I was about twelve or thirteen I was with my dad at a football game and we were STAT paged to the emergency room. When we got there a person had been stabbed in the heart and had a cardiac arrest. My dad opened the patient’s chest and pulled a clot from around the heart, which allowed the heart to start beating again. There was a knife wound in the heart, and he had me put on a glove to hold my finger over the hole while he prepared the operating room. I did not think that it was a particularly unusual experience until many years later. Still, it formed the basis for the idea that I might someday be able to save someone’s life that way.

A way to take an idea like that to the level of a dream is idealism. Most people seem to have their most idealistic

thoughts around high school and college. I suppose I was no exception to the general principle. When I was in college, I read a book by Albert Camus called *The Plague*. *The Plague* is about a doctor who is taking care of patients in a walled city in Africa when the bubonic plague breaks out. The doctor has a choice of whether to escape from the city or to stay with his patients. He chooses to stay with his patients. I was very struck by this book and the principles portrayed in the doctor by Camus. This book, probably as much as anything, influenced me to consider going to medical school. I realized at that time that I was determined to make some specific difference with my life. I realized that life is a limited time offer, and that I needed to make the most of it. I hoped to make difference by taking care of people, and by teaching others to do so. This evolution from an idea to a dream led me eventually to decide that I would be both a surgeon and a teacher, and that I would orient my practice around cardiovascular surgery.

Preparation

When we have looked into the issues of preparation, we have turned to the principles of adult learning. These principles take full advantage of the concepts of repetition, variety, association, and, most of all, pertinence. Most adults will not really memorize things they cannot use.

We have realized that we are in a period of changing educational methods or paradigms. The older education model was one that was prominent in the Middle Ages and has been in use until modern times. This approach is called the monastic tradition, because it was formulated and promulgated in the mon-

asteries of the Middle Ages. In this model, the student is passive and is being taught. The teacher is the teacher and is omniscient. In the newer model, one that we would like to call the model of performance education, the student is active and is learning rather than being taught.

There are two aspects of preparation: general and specific. General preparation for surgical training includes the kind of education and experience you get in both college and medical school. This general training includes background information, principles, and various other issues that form the fundamental foundation for the later areas of expertise to be gained. Specific preparation includes preparing to deal with certain types of cases as well as preparing for a particular patient's operation.

Sometimes one is unable to prepare specifically ahead of time for a particular activity or event, but rather must be prepared in case such an event occurs. When I was a junior house officer, one of my patients was losing his airway after an operation had been done to remove a tumour in his neck. When I got to the patient, it was obvious to me that the patient was in dire straits. I knew the situation was complicated by the fact that the patient had recently undergone radical pharyngeal surgery. I put in a call for the faculty anaesthesiologist who had intubated the patient the day before. I looked into the swollen tissues of this man's mouth and pharynx and knew that I had little chance of getting an airway through the narrowing area. The attending anaesthesiologist and his resident arrived and were similarly discouraged but set about getting together their instruments over the next few minutes to try to

intubate the man since it was obvious that he would not be able to breathe much longer through the very narrowed opening. I put in a call to my senior resident hoping that he could come and help us in case we needed to do something heroic. By the time the senior resident arrived, the anaesthesiologist was still unable to obtain access to the airway. The patient was turning blue, and we all knew his next breath might be his last. My senior resident walked in the room, picked up a large needle, inserted it into the man's airway, picked up a flexible guide wire of the type often used in vascular procedures, threaded it through the needle into the windpipe and pushed on it until it was visible in the back of the man's pharynx. I grabbed the end of the wire with a clamp, and the resident asked me to thread an endotracheal tube onto it while he and I both held each end taut. The tube threaded right along this guide wire into the airway and immediately the man could breathe again. His colour turned from deep purple back to a healthy, normal pink. This move had saved this man's life. I, even in retrospect, have little doubt this man would have been dead within a minute or two. The resident looked at his hands, looked at the patient, looked at me and did not say a word. The attending anaesthesiologist said, "Wow, have you ever done that before?" The resident with absolute honesty, and not even a hint of sarcasm, looked at him and said, "No, but I've thought about it a lot." Many times since then I have thought about that situation and the concept of "thinking about it a lot" - ahead of time. I made a pact with myself that I would have in my armamentarium the knowledge to do, as best I could, whatever needed to be done to save a person's life, even if I had not seen it or done it before. I knew at the

time that it was my responsibility to be prepared for those kinds of contingencies. I knew that I had to be active in this process and to not just wait until the opportunity to learn about such things presented itself. This type of specific preparation for contingency has subsequently saved a number of my patients' lives.

Another aspect of specific preparation is to prepare for each procedure that you know you **are** going to do. I believe that the surgeon should review the patient's history, exam, and the results of all studies, personally viewing all pertinent X-ray studies and other types of data. The resident should talk at length with the patient and the patient's family as well to make sure that they understand what is going to happen and also that they understand what is expected of them.

Surgery is a psychomotor skill as is the performance of a master piano player or an Olympic gymnast. Generally, to acquire some sort of psychomotor skill requires an introductory period, a period of deliberate practice, a further period of full time commitment, and when all of this has been accomplished, the performer may have the opportunity to achieve a level of elite or eminent performance. Anders Ericsson, studying this type of expert performance, looked at many elite performers, including various world champions and others who were considered to be eminent performers. As described in Ericsson, Krampe and Tesch-Römer (1993), it was found that almost invariably, expert performance required ten years to achieve, which is about the period of time that people invest in the initial portion of surgical training, starting from the time they

make their decision in medical school to become a surgeon, until they have achieved mastery of their particular aspect of surgery. Ericsson et al. also found that this investment usually consisted of about 10,000 hours of time. This is about the same amount of time invested by the surgical residents in their training.

Leadership

One of the most important summarizing principles of leadership is that the team leader must make sure that everyone in the room knows that everything matters. Nothing is neutral. Everything that happens in that room, every thought, every sound, every action will have an impact on the patient's outcome. Each thing will either help or hurt, but nothing will be neutral. The importance of this concept must be made clear to the team.

Leadership is very important in the world of surgery as it is in many other areas of performance. Every surgical patient will require care from a team and the surgeon must be skilled at leading such a team. The typical number of people in one of our heart surgery rooms during a cardiac operation ranges from 15 to 25. When we are harvesting two lungs and a heart for three separate recipients, we have over 100 participating in the process. Thus, a surgeon must learn to become a leader. The surgeon must also help create a team environment.

There is no doubt that everyone on the team counts. The surgeon must be aware of even subtle psychological differences that might be present in some of the team members and help each of these people contribute while avoiding letting these differences interfere with the

team's overall function. If any of these very important people do not do their job, the operation will not turn out well. The leader must also recognize that everyone must understand what is happening, especially on a complicated or unusual operation, and take the responsibility to teach other team members what they need to know to help effectively.

Another important aspect of leadership is to be a role model. The surgeon must set the standard for care, attention to detail, and the level of commitment to the patient that others must emulate.

One of the most important aspects of leadership for the surgeon is optimism. The surgeon must exude optimism. He or she must believe that the operation is accomplishable and must convey that feeling to all other team members. If everyone does not think this way, they will not do their best and all may be lost. I often use the example of an elite pro quarterback like John Elway in the two-minute drill at the end of a game with his team behind. Can you imagine that his line will block to the utmost of their ability and that his receivers will dive for barely catchable balls if they do not believe they can win? There is no way that a quarterback of his ilk would enter the huddle and say anything other than, "We can win this game". There is no reason for a surgeon to enter the operating room without conveying the same attitude.

Awareness and focus

A person performing in a tumultuous situation, as an operating room often is, must have a general awareness of what is going on around them. In basketball this is called court sense and

some of the best basketball players of all time were known for this ability. This was one of the greatest strengths of players like Larry Byrd and Magic Johnson.

In the world of martial arts, the fighters are taught to maintain a general awareness of everything going on around them. They are taught to keep a "glaze" in their eyes, which means that they do not necessarily focus on any one particular thing, such as an opponent's hand or foot. Rather they maintain a more general awareness not only of all movements of their opponent, but also movements of other potential opponents in an area. In the martial arts this general awareness is known as "mushin".

When we tell our surgical residents that they will need to focus on what they are doing, one must be aware of the fact that people are fairly much like computers, and that it is difficult to think of more than two things at a time. Thus, it is possible for someone who is doing something to focus on two things at once, but they are usually unable to focus on more than that. To be able to maintain a general awareness and simultaneously to be able to focus in on a specific task, one must be more like an air traffic controller with an array of radar screens with alarms which will draw greater attention to one screen or another if necessary.

There is a particular type of IV fluid that we do not like given to our patients because it thins the blood too much. It comes in an unusual cellophane wrapper. If you hear the sound of this cellophane crinkling above the ether screen, you know that the anaesthesiologist is preparing to give this "forbidden fluid", and

without even looking up, you can tell them that you do not want it given. This is an example of being trained to allow a specific sound to interrupt your stream of thought so that a particular problem can be dealt with. Other analogous situations in the operating room are the necessity of listening for abnormal flurries of activity in one part of the room or the other, such as in the area of the anaesthesiologists. Such activity may signal trouble that you would need to know about.

It is best if you are able to maintain several layers of unconscious thought about what is being done. One layer is a type of surgical “conscience” that follows along behind what you are doing, “double checking” what has been done. The picture I have in my mind is of people swimming along at different levels in the ocean, perhaps while scuba diving. The person who is higher off the ocean floor has a greater perspective and can see more things around them. Sometimes the primary surgeon will have to shift back and forth between these various levels in order to pay proper attention to all issues.

Another aspect of focus is distraction control. It is often true that there are many things that do not need one’s attention and must be blocked out of conscious thought. An example of this occurred to me when I first joined the faculty and a patient was being brought from the cardiac lab with his heart failing. A large, important artery had closed down, and the patient’s blood pressure was falling. As I was bringing the patient to the operating room and trying desperately to find a surgical resident to help me with the case, the attending cardiologist wished me well and mentioned to

me that the patient was the former mayor of Charlottesville. I knew then and there that my future in the city would probably be determined by editorial comments in the newspaper if the mayor did not do well.

I was already fairly distracted by this as well as by the emergent nature of the operation, when one of the other faculty members in our department came into the room and really hit into the surgical resident who had come to help me. This other faculty member did not realize that I was in the room and he thought that the resident had wilfully not taken care of some other chore he had been assigned to do. I was pretty annoyed by this intrusion into our already precarious situation, and told this colleague so. My colleague was apologetic, of course, once he realized that what the situation really was, but by then I was stirred up in about every way that a person could be, when what I really needed was to be calm. I knew then and there that if I did not get settled down, I would not be able to do a reasonable operation for this patient.

For some reason I had an epiphany at that moment, and realized that what I needed to do was to shut out all of the things that were going on around me and to focus on what I was doing. Somehow I imagined myself in a former life as a water safety instructor, teaching and swimming the breaststroke. When one swims using this stroke, the water line hits you on your forehead. Thus, your face and your ears are underwater and you can see nothing nor can you hear anything of what’s going on above the surface of the water. While your face is in the water, you have only the water around you and your environment is

peaceful. I imagined myself in that mode and shut out all that was around me. I did not realize it right at the time, but that picture has helped me enormously since then. One cannot maintain total focus at all times. The “neuro-circuits” just get too hot, and there must be a rhythm to one’s focus. There must be an ebb and flow of its intensity. The breaststroke became a good analogy for this rhythm, because as you stroke with your face in the water, all around you is quiet. And then you come up for air, transiently becoming aware of more of your surroundings, and then you regain your focus during the next stroke with your face in the water. I have found this to be a very useful way of working through the ebb and flow of the focus required to do operations and even specific steps of operations.

The hardy personality

To be a master surgeon, or an elite performer of any kind, one has to develop a resilient, hardy personality. One must face challenges positively and trust in one’s abilities and one’s preparation. We tell our residents that they need to be determined to do more than just survive. They must be ready to prevail over the circumstances that they find in their sometimes chaotic lives. One of these challenges is dealing with anxiety. We teach the residents that there is little physiological difference between anxiety and arousal. The paradox is that people spend a great portion of their lives trying to avoid anxiety and a great deal of the rest of their lives trying to seek out arousal. If one realizes that the physiological reaction of the body to both anxiety and arousal is similar, then one can approach situations that might seem anxiety provoking with a positive outlook instead of apprehension. One should

channel these feelings of arousal into an energetic state of being that will allow one to do one’s best.

We have enjoyed utilizing the line from one of Phil Collins’ songs in which he says, “*You’ve been waiting for this moment all of your life*”. We tell the residents that everything they have done up until this time has prepared them for what they are getting ready to do. They are able to reflect on that reality and often attain a state of calm that allows them to get on with their work. A discussion of this need for calm is seen in the famous baccalaureate address, *Aequinimitas*, by Sir William Osler. Osler discussed the need for physicians to maintain a state of equanimity and calm when dealing with stressful situations. Ernest Hemingway often wrote about the “grace under pressure” required of bull fighters as they watch a bull charging at them, stepping gracefully out of the way at the last minute, never seeming to be flustered. An important concept in dealing with anxiety and arousal is that you, the performer, get to choose how you are going to react. We suggest you choose arousal.

Decision-making

We teach that great surgery is often much more about decisions than incisions. It is true that a surgeon has to have good hands, but also good judgement. Precisely placed stitches are of no value to the patient if they are precisely placed in the wrong position. A perfectly executed operation is of no value to the patient if the wrong operation was done. A study was conducted of cardiac surgeons during a five to six hour cardiac operation to determine how often they made life-threatening decisions. It was determined that they made a life or death

decision approximately every five to ten seconds during the operation.

We teach the residents that great decision making is more about asking yourself the right questions than it is about knowing the right answers. We were all taught in medical school that about half of what we learn in the first two years will be out of date in five to six years. Another way of saying the same thing is that the answers will change, it's the questions that will remain stable. When our students come on our service, even after the first two years of medical school, they think they know almost nothing about clinical medicine, but I tell them that they do. If I ask questions of them in the right order and in the right degree of increasing difficulty, they will virtually always be able to work their way through the decisions to an appropriate answer. I do this to illustrate to them that once they know these questions, they will be able to ask themselves the questions and that they already know the answers.

Another aspect of decision making that is very important to realize is that optimal decision-making is not often accurately compressed into algorithms. An algorithm is a diagram in which each decision point usually has only two choices. Decision making in medicine very rarely involves choosing between two courses of action. There are almost always more than two choices and attempts to put medical decision making into "if this, then that" types of decision trees ultimately will not provide the best outcomes for our patients. I believe alternatively, decision making is more like a polynomial equation of the type that we learn about in advanced algebra.

The following is an example of a polynomial equation in which the letters are constants and the other factors are raised to different powers:

$$ax + bx^3 + cx^2 + dx + k = \text{decision.}$$

To me, this illustrates better the way decisions are made. Different factors have different levels of importance, and they also have different degrees of likelihood. All of these factors must be taken into account before a decision is made. Also, some of these varying levels of likelihood of importance and consequence will change depending on some patient related factors such as their religious or ethical beliefs as well as on hard and fast medical issues. Like other elite performers, a surgeon must learn to make decisions with incomplete information. One must take into account the need for more information and balance it against the urgency of the situation and be ready to move ahead even when all the information is not known.

I often say that surgeons are gamblers and must know the odds of almost everything that might happen in an equation. Even when one does not know the exact odds, it is sometimes useful to calculate a rough estimate of the odds of certain events occurring. Overall, perfection under these conditions is virtually unattainable, and in fact, one of our sayings is that "perfection is the enemy of good". If one waits until all information is available or perfection in decision making could be achieved, one may end up with a perfect decision, but a dead patient.

Reflection and analysis

One of the most important aspects of learning to be a master surgeon is to learn how to reflect upon what you have done, analyse your results and learn from everything that goes on around you. One of the first steps of dealing with something that has not gone the way you want is to realize that, in essence, there is a sense of loss, or even grief as outlined by Dr. Elizabeth Kübler-Ross. Denial, anger, bargaining, depression, acceptance, and hope are the stages that she observed terminally ill patients went through in dealing with their illnesses. These stages are also applicable to anyone dealing with any other type of loss or grief. People will often vacillate back and forth between these various stages, but eventually as they work through the psychology of their loss, they will come to a point of acceptance and look forward instead of backward. These are the same feelings that any performer will have when he or she deals with a suboptimal outcome.

The process of dealing with bad outcomes has been formalized more in surgery than in any other realm of medicine. Virtually every department of surgery in the United States has a weekly conference known as Death and Complications Conference or Morbidity and Mortality Conference. These conferences are formal reviews of complications, deaths, and any other suboptimal outcome that occurred. While this process is formalized, it is one in which our residents need guidance in order to participate optimally and to take the approach taught in these conferences back to their everyday lives.

Some of the things that we teach our residents are that the goal of the con-

ference is to search for the lessons and not the guilty. We ask them to outline what may have been done differently or better. We ask that they teach others some lesson from the case under discussion. We even encourage them to create a “wish list”. When using this approach, one can merely write down what they wish had been different. For instance, they might wish that a patient would have been younger or healthier or that the patient might have gotten to the emergency room sooner. This type of wishful thinking is helpful on occasion when it just seems that the bad outcome was inevitable.

The reason this approach is useful is because the goal of every discussion of this sort is to learn to be able to approach similar situations better in the future. There is also an emphasis on catharsis. Often, people will carry around the bad feelings of some untoward result for a long time without really dealing with them. With the emphasis on shared learning and support from the group, it is possible to unload some of the feelings one might have had and to go on better armed for the future. In a sense, given that nobody is perfect and that nature is at times flippant, bad outcomes are bound to occur and the surgeon or physician really only has two choices when these things happen. One is to forgive themselves and the others involved, learn all the lessons that he or she can and go forward. The other alternative is to get out of medicine altogether. Some do choose the latter, but if all physicians and surgeons did, we would not have any doctors!

As we have tried to further define this process of analysis and reflection, we found ourselves talking about the

concept of quality. Robert Pirsig (1991), in *Lila*, says that the “metaphysics of quality” could be called the “high country of the mind”. He says that he makes this analogy to the high country of mountain climbing because it takes a lot of effort to get there and more effort once you’ve arrived. But unless you can make the journey, Pirsig believes you are confined to one valley of thought all your life. Pirsig emphasizes that one must think about quality, not only in an abstract sense, but also in a practical sense. For us, the message of *Lila* is that one must strive to maintain a life of quality.

The business world has provided some insight into quality management in industry. One of the most well known writers in this field is W. Edwards Deming, who was very influential in the restoration of the Japanese economy after WWII with an emphasis on quality of industrial production. When one reads about Deming’s thoughts, the primary theme is “total quality management”. He emphasizes that one must base decisions about the production of quality on accurate, timely data.

Trying to apply Deming’s statistical methods to the quality of performance, however, has been difficult since performances do not lend themselves as well to statistical analysis as do the thicknesses of sheet metal or the number of bad computer chips coming from a production line. Thus, we have turned to look at some of the concepts of qualitative analysis. These concepts are discussed in the sport psychology and performance education literature, as well as in some of the other types of educational writings.

Dr. Steve Rosenzweig, writing in *Academic Medicine* in 1994, discussed this issue by pointing out that the division between science and non-science can be “false and dangerous” and that sometimes people “confuse theory with fact, resulting in dogma”. He makes the point that medicine and medical education may have tried to be too quantitative, forgetting that not all things can be easily quantified. In fact, some of these important lessons and ideas in the area of managing the quality of performance can only be passed along as stories. Though we have been required to learn the language of mathematics in order to be accurate in telling these stories, and in making our measurements and performing statistical analyses when appropriate, still not all descriptions of human interaction can be passed along by numbers.

This background has led us to propose a term that should be considered as a concept that is complementary to Deming’s “total quality management”. This term is “performance quality management”. We believe that this concept, in which one can analyse, reflect on, and manage the quality of one’s own performance, requires that one understand the difference between quantitative analysis and qualitative analysis. This concept revolves around a personal approach to quality management which requires that each person be independently responsible for his or her own output and performances. This requires constant feedback, but it also requires analysis at a later time.

The immediate review of one’s performance requires that one analyse it, learn from it, remember the lesson, forgive one’s self and others for whatever parts of it are sub-optimal, suppress the emotional side of the event, refocus on

what needs to be done next, and go on. There is an implication here of establishing a rhythm of doing, analyzing, and doing again. One of the best lessons in the need for this immediate review and a need for a rhythmical approach to performance was taught to me as I learned how to do coronary anastomoses. When doing a coronary anastomosis one has to stitch a graft to an open coronary artery beyond the blocked area. This is the primary event in doing coronary artery bypass surgery. Often, these coronary anastomoses will be ones in which a person's life will hang in the balance. Some of these lesions that need to be bypassed are so critical that we call them "widow makers" since if they are done wrong the patient will die. This situation certainly will raise the angst that one feels when doing this kind of work. As I was learning how to do this I would be in the mode of putting in stitch after stitch and feeling pretty good about the way things were going. My professor would then say that the stitch was too deep and that my stitch, if left alone, would be a "widow maker" stitch. One can certainly get rattled by that sort of an assertion. On the one hand, you would feel the need to argue, and on the other hand you would feel hurt that this criticism had been levelled at you. However, your only choice was to look at the stitch, see what it was that the faculty member thought was not right, do it over, see if you could make it better, and go on. However, if you were not learning from each of these stitches and each of these comments you would never improve and, of course, within the personal quality management concept one has the need to constantly improve and get better. So I learned to get into a rhythm where I would place the stitch, analyze it, listen to any comments that were

made, learn from it, remember it, get rid of the emotional side of any feelings I had about the stitch itself, suppress that thought, and refocus for the next stitch which was often even more important than the one I had just done. I have subsequently learned to apply this same approach to many other things of that sort, whether it be giving a speech, learning people's names, shooting baskets in a basketball game, learning how to snowboard, or any one of many, many other tasks.

The second stage of optimal performance quality management requires some form of later review. I have often thought that this is analogous to minimizing and maximizing windows in the currently popular computer programs. These programs have small arrows which can close a window and leave it as a small icon in the corner of the computer screen while one works on something else. However, one is able to go back to that small icon and "maximize it" to examine the window more fully. This concept of "minimizing a window", which can later be reopened is very valuable when one is performing. This is all the more valuable in situations where one must learn from what one is doing and in which the time constraints are enormous, such as a coronary artery bypass.

One of the ways I try to incorporate the concept of maximizing the window later is to dictate my thoughts at the end of an operation or after some subsequent conversations. Frequently a partner or a resident and I will discuss a case the next day or even later after it has been done, and I will have some new ideas or understanding of what we have done. When this occurs, I make a note in

my daily planner to dictate my thoughts about the subject. My secretary will type up the notes and I keep them collected in my techniques books or surgical journals. In this way, I am able to later reflect more fully on things that I have done. This type of contemplative review is very valuable, both for improving in surgery, and in many other realms also.

Vision

I believe that one of the main characteristics of a master surgeon is vision. One of my performance education colleagues asked me once what I thought separated the great or master surgeons from the others. He had observed that there was wide agreement around our hospital as to who are the best surgeons, but it was not obvious to the untrained eye what made certain surgeons the best. In fact, he had even watched some of these people operate and some seemed a little bit sloppy, others seemed slow, others seemed hasty, but somehow they were all thought to be very good at what they did. My reflection on this question was that first and foremost these surgeons always get good results, but the way they did so, I thought, more than any one thing, was that they had a vision of what they wanted to accomplish. This vision, in its fully developed form, is analogous to a sculptor who can carve a statue out of a block of stone. The sculptor has a vision of what he wants to create or accomplish and everything he does with his tools leads to that ultimate goal.

I think that there are many surgeons who approach their operations thinking they will just figure it out as they go along and do not really have a vision of what they want to accomplish. I think that that approach holds them back quite a lot, making them slower and

less efficient, but also interfering with their end result. I think they simply must have a vision of what it is they are trying to do to perform at their best. Obviously, the surgeon at the beginning of residency has a more unfocused image and may not realize quite as well how to gain this vision. One obviously can look at books, do dissections in the lab, and watch videos. An even better technique is to observe others operating, however, the real incorporation of vision into one's practice will come only with experience. The development of vision requires constant reflection and analysis. It requires one be a lifelong learner.

Independence

Obviously, the goal of our surgical training program is to make independent surgeons of our trainees. They come into the system being unable to be very independent and must leave ready to be on their own. I sometimes think of that evolution as being analogous to young birds learning how to fly because both require emulation, experimentation, and constant learning. We believe that there are three categories or stages of freedom going from "freedom from" to "freedom to" to "freedom of". Rollo May (1981) in *Freedom and Destiny* discussed the responsibilities that come along with attaining each stage of one's newly acquired freedoms. He stated, "*Each step...carries a new sense of the responsibility equivalent to the new freedom.... One can only be as responsible as one is free*".

The concept of "freedom from" involves freedom from externally imposed rules or guidelines. When one is in the mode of obtaining "freedom from", one is moving from the position of being evaluated and criticized to beginning to

evaluate and critique one's own performance.

In discussing the concept of "freedom to", one dwells on the freedoms that one would like to have to do things. This begins to get into the area of creativity. Albert Einstein (1954) stated that, "*The development of ...the creative activities of the spirit in general requires ...inward freedom*". He was aware that one cannot be creative unless one has an element of independence and freedom in one's life. Jacob Neusner, a college professor giving a commencement address at Elizabethtown College, pointed out that the real purpose of education is to teach people to teach themselves. The goal for our trainees in achieving the independence of "freedom to" is that they need to learn independently, perform independently, and begin to manage their own performance quality.

The next category of freedom is the "freedom of". We think that people, in order to perform at their best, must be happy in their role and receive positive feedback from what they do. One of the greatest disservices to medical education was a book by Samuel Shem entitled *House of God*. Shem was a trainee who did not want to be in medicine and who was miserable during his training. His experience was very different from most who relish the opportunity to work and learn in a medical education environment and who enjoy taking care of people and learning how to do it better.

There is an ad for a currently popular running shoe that states, "*It's the difference between **having** to run and*

wanting to run". When one enjoys what one is doing one has achieved "freedom of". Csikszentmihalyi in *Optimal Experience* (1988) discusses the concept of achieving a "state of flow" in which one has a seamless, subconscious, visceral feeling of turning an idea into an action. I think that this type of flow is seen in kids who play computer games. I have experienced it in other activities such as scuba diving, sailboat racing, bike riding, performing heart transplants, rollerblading, and snowboarding. In all of these areas, one has a sense of freedom and gets a visceral satisfaction from what one is doing. I do think that when people ask me how I do what I do in the operating room, my response is oriented around this concept of flow. Performance is a total body event. It is not one that involves just the mind, or just the body, but involves both. It requires intuition and emotion, and it should be fun. We often say in talking about surgery and about learning surgery, that it is the ultimate full contact sport. Thus, we have concluded that the freedom and independence that we are talking about is not a personal attribute or state of mind, but it is an activity, something that must be worked on at all times.

When our trainees have reached this point of independence, we believe they have earned the freedom to be independent operators. They have learned, after thirty years of formal education and tens of thousands of hours of training, to balance their freedom with the responsibility for managing the quality of their performance. They are ready to fly.

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