Achieving flow in surgery

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Discussing a topic like this feels somewhat risky because it strays from the constraints of academic convention. However, my experience with challenges I have faced over the last 3 ½ years and research I have done have convinced me that this is an important topic. Allow me to begin with a question to each of you: **“Does how you feel influence how you perform?”** If you answered “yes,” then I suspect you will find something of value in my remarks.

I will frame my talk by asking 3 additional questions. The first is **“How do you need to feel to perform well?”** I am at my best when I am in “flow.”

Flow has been described by some as being “in the zone” or having the “hot hand.” Olympic backstroke gold medalist Jeff Rouse described the phenomenon as “easy speed.” A state of focused, relaxed high efficiency wherein an 85% effort yields 100% of maximum speed. In surgery, we experience this when our hands seem to move deftly with no wasted movement. Needles travel exactly where we want them to go, and it feels almost as if we’re watching ourselves operate with a tremendous sense of satisfaction. Mihaly Csikszentmihalyi describes flow in his landmark book as “the state in which people are so involved in an activity that nothing else seems to matter—the experience itself is so enjoyable that people will often do it at great cost and for the sheer sake of doing it.”¹ There is often a sense of being outside of everyday reality. Great inner clarity is achieved knowing what needs to be done and fully confident that our skills are up to the task. Often we are unaware of time passing, and hours feel like minutes. And most important, the experience provides intrinsic motivation. Whatever we are doing in flow becomes its own reward. The quality of our lives fundamentally depends on the quality of our experiences. The best moments in our lives are not the passive, receptive, relaxing times. Rather, our best moments come when we are stretched to our limits to accomplish something difficult, something of value.

Surgery is a field that encourages the experience of flow. Parameters that promote flow include defined goals (particularly those associated with a significant challenge), participation in activities that require a higher level of skill, availability of clear feedback, and a keen self-awareness. These conditions are present in abundance in our

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Central Message

The address represents the culmination of extensive research, multiple expert opinions from a range of relevant fields, and insights gained from a career of experience.

profession. Challenges are numerous, and great skill is required to meet them. Figure 1 illustrates Csikszentmihalyi's concept, in which flow is represented by the blue pie. Skill is depicted on one axis, and challenge along the other. When we are a bit more confident that our skills are more than adequate to handle the task at hand, we experience *control*. Control is good because we feel comfortable. However, to achieve flow one needs challenges that require you to find a higher level of functioning or discrete improvement. In *arousal*, we are perhaps less confident that our skills will quite match the demands of the task we are facing. High performers prefer to spend the majority of their time in 1 of these 3 states, and ideally *flow*.

Individuals who seek flow experiences also demonstrate a deliberate openness to novelty. Such individuals are not necessarily happier but are definitely more involved in complex activities, which in turn make them feel better about themselves and increase their self-esteem. Surgeons with this predisposition remain self-critical throughout their careers and seek paths to acquire new skills and innovate and enhance performance. Consider looking at pulmonary hilar anatomy from as many different perspectives as possible. Practicing a variety of dissection sequences will allow one to encounter an unanticipated challenge and “flow” to an efficient, safe, and optimal completion. In athletics, this could be described as expanding the size of one's proprioceptive envelope. Skier Bode Miller has a conditioning regimen that includes loading a wheel barrel unevenly

FIGURE 1. In this graph, the intensity of task-related challenges is plotted on one axis and the degree of operator skill or ability is plotted on the other. When they are perfectly matched, the flow state is more likely to occur.

with rocks and charging up rough terrain. This forces him to not only build strength and agility but also react to ever-changing conditions. Such a willingness to throw yourself out of balance inevitably trains you to efficiently recover it in times of intense and unpredictable demand.

My second question is: **If you know how you need or want to feel, what gets in the way of that feel?** Injuries and physical breakdown certainly can. For years I experienced flow in the operating room nearly every day without conscious behavior to encourage its appearance. Change occurred suddenly with injuries and required an immediate and comprehensive response. I was thrust into new territory and forced to examine this topic in an effort to try to rediscover *my* flow. However, we are all aging, and the threats to flow are inevitable. At the age of 35 years, facing death, Mozart said, “I am finished before I enjoyed my talent.” As we gain knowledge and experience, we unfortunately are growing older at the same time. Therefore, our most seasoned and insightful surgeons are forced to face physical limitations that are often the result of wear and tear from a life spent standing in the operating room. Therefore, we need to be more thoughtful about behaviors that more specifically preserve the appearance of flow as we move through our careers.

Fatigue also impairs performance and threatens flow experiences. Sleep loss negatively affects learning capacity, memory consolidation, mood, cognition, coordination, reaction times, and tolerance for stress. This has been specifically examined in healthcare worker performance. After one 24-hour period of wakefulness (imagine if you have been operating all night and have elective cases facing you), your cognitive and physical performance are at best 85% of your baseline. Stated differently, your functionality is equivalent to that associated with a blood alcohol level of 0.1%.² Remember, the legal limit is 0.08%. Successive

nights of 4 hours of sleep or less have been shown to have a demonstrable functional impact. After just 4 such nights (perhaps you had a tough week of emergencies and transplants), your functional efficiency decreases to approximately 50%. Such a phenomenon associated with successive nights of sleep restriction is referred to as “sleep debt” and usually requires 2 full nights of sleep to recover.³ Such surgical marathons are ill advised. Your performance will definitely suffer, flow is unlikely to appear, stress management will be impaired, and patient outcomes will be threatened.

Operating late at night also impedes flow and impairs performance. Performance and alertness vary greatly with circadian rhythm. Function begins to deteriorate after 10 PM and is not fully recovered until 10 AM the next day. Our performance is at its worst between 3 AM and 6 AM. This is referred to as the *circadian trough*. As people age, their circadian rhythms shift to earlier in the day. In view of this, the effects of off-hours operating are felt to a greater degree by our more senior surgeons. I acknowledge that there are times when late-night operating is unavoidable. However, if the timing of operation can be managed, we might do a better job of enhancing surgical performance. Adjusting donor operating room times to optimize timing of complex recipient operations would be an excellent example. A study is planned at the Medical University of South Carolina wherein human factors engineers will measure human error and performance during heart transplant operations performed during the day or at night. The difference in performance and threats to patient safety are measurable and real.

Work flow breaks also are detrimental. That same group of human factors engineers recently observed 10 cardiac operations. They looked at flow breaks or disruptions to process from the time the patient was wheeled into the room to the time the patient was wheeled out. During those 10 cases, 1080 flow breaks were observed. The largest category of disruptions related to poor communication or extraneous information coming in to the environment that did not relate directly to the case being performed.⁴ Imagine that while you are trying to operate, an intern comes in to give report to your fellow, a coordinator is trying to text the cell phone in your pocket to tell you about a donor organ offer, a call comes in to remind you that your 1:30 appointment is waiting in your office, and in the meantime, your anesthesiologist just left the room and you are left trying to explain to the junior resident how and when to administer certain medications before you remove the crossclamp. The human brain can process approximately 110 bits of information per second. Conversation with a single individual occupies 60 bits per second. This is why we cannot carry on 2 conversations at once. Clearly, we need to simplify our focus and sharpen it to unlock our optimal performance.

Finally, although self-awareness is required, self-consciousness is distractive. While we need to know whether our skills and insights are adequate to the task at hand, preoccupation with the external perception of our skills or abilities is counterproductive. The surgeon's confidence is centrally important to the dynamic of his team and their cooperative flow. Stated simply, optimal performance requires an uncluttered feel **"for"** what we are doing in the moment; however, preoccupation with how we feel **"about"** what we are doing is detrimental.

The third question I have for you is **"How do we get that feel back?"** You can't stop aging, but you can slow its effects. Step out of your demanding schedule to invest in the preservation of your overall health and well-being. Surgery is a very physical profession. "Toughing it out" and ignoring your ailments will invariably lead to progressive degradation of your surgical performance. The impact will manifest for your patients, your team, and your family. It may also require that you create ways to work around your changing physical state.

As Beethoven lost his hearing, he began placing his head near the soundboard so he could *feel* the music. He stopped performing and conducting but continued to compose. Later, he had the legs removed from his piano and laid on the floor to better feel the vibrations. Some of his most memorable work (including the 9th Symphony) was completed when he was profoundly deaf. Rather than mourn the changes we encounter with age, celebrate innovative ways to persevere.

You may have to adapt the way flow is experienced. In the context of the more senior surgeon, consider experiencing flow by intensifying your teaching. If you want to make your mark in *the specialty*, you have to do more than just operate well. You must take all the unique knowledge and insight you have developed and teach it back into the pool so that you can effectively raise the tide of understanding to a level higher than when you entered the field. Make it an absolute imperative to impart all the knowledge that you have accumulated over your career, especially the little moves you have learned from years of experience that are not captured in a book or article. It takes focus to recognize what you know and then to reach back and teach those who have come to you to learn. I assure you that it is worth it. Immediately after the reattachment of my bicep, I was unable to use my right hand. I had to talk surgeons and fellows through lung transplant operations stitch by stitch. I conveyed all the things I had learned through experience and all the reasoning behind every move that led to greater accuracy and efficiency. It was exhausting, but my team said these were the best educational experiences any of them had ever had. These were also profound *flow* experiences for all of us.

Most extraneous communication that causes a work flow break can be redirected or managed easily by someone else on the team. Minimizing work flow breaks requires that

you organize your team thoughtfully and consistently. Encourage ownership and pride in your team so they can manage other parts of the process *themselves*. When you have established this culture, you will no longer have to manage everything that is happening in your operating room, you can simplify your focus to how *you* feel and only attend to what *you* need to do in the moment.

Simplification also relates to the *way* we teach. Rather than overload residents and fellows with rapid-fire corrections, try to identify singular corrective interventions that unlock a favorable chain of performance gains. In *Harvey Penick's Little Red Book* on golf, the chapter on putting is 3 words long: "Take dead aim." Thinking about too many things at once will ultimately result in performance breakdown. Simplification and insightful targeting are critical. We must pursue approaches to instruction that are consolidative to unlock flow.

Let me also address the notion of why we teach residents to work with 2 hands. Obviously, an idle hand is not productive in the conduct of an operation, but there is a relevant psychomotor concept that may help to unlock better performance. Excessive focus on single-handed tasks strangles flow. I learned this lesson from a musicologist and piano teacher. I began taking lessons in an effort to elevate my performance in both hands. Keyboard players know that when 2 hands are executing tasks that are different but complementary, both hands manifest enhanced relaxation and greater efficiency of movement. This is true in surgery as well.

This is likely due in part to the fact that more complex tasks require more of your bandwidth to complete, leaving less available to be preoccupied by thoughts about "how we are doing." This phenomenon can be generalized by seeking greater challenges. It is human nature to divert attention to "feelings about" what we are doing if we are not sufficiently challenged. When challenges are sufficient to require all of our skill and fully occupy our attention, *flow* is more likely to occur.

To feel the way we need to for optimal performance, it is critical to set our focus before we begin. It also may require resetting later in the case. There is a certain tenor to the dissection portions of our operations. Consider the intensity and even aggression that are required for a complex reoperative dissection. Contrast that with the calm deliberate focus necessary for sewing an anastomosis with fine Prolene suture. To facilitate such transitions, consider taking a brief pause between the dissection and reconstructive elements of your surgeries.

In 2013, lightning interrupted a Seattle Seahawks game in the first quarter at CenturyLink Field. The teams were sent to their locker rooms. Quarterback Russell Wilson decided to shower and dress in a fresh uniform. He *reprogrammed* himself as if he was starting the game anew. The Seahawks went on to soundly defeat the San Francisco 49ers, and now Russell Wilson makes this a regular habit at halftime.

Change your gown and gloves (put on a fresh uniform if you will), get a drink of water, or just pause for a few breaths before moving on to the next phase of an operation.

I believe in the value of music in the operating room. It has been shown to mask unpleasant sounds and feelings and can slow down and synchronize brain waves. Appropriately selected music can enhance the appearance of alpha waves and theta waves that are known to correlate with periods of peak creativity, relaxation, contentment, and a sense of peace. It can create a dynamic balance between the more logical left and more intuitive right hemispheres. This is the basis of creativity. Carefully selected music also has been shown to reduce muscle tension and improve body movement and coordination.⁵ Of course, the type of music selected is critically important. Music that is unpleasant to the listener adds a sense of dissonance and stress. The music you select for a certain portion of an operation should have associated emotional content that is desirable and appropriate. For example, the music of Elvis Presley has been shown to stimulate active movement, release tension, and reduce the effects of other loud and unpleasant sounds in the environment. It also can create tension if you are not in the mood to be energetically entertained. As I said, we need different types of music for different portions of operations. It all gets back to controlling your environment to optimize how you *feel*.

As I stated earlier, to feel our best and encourage optimal performance, we must be keenly self-aware but eliminate self-consciousness. We need to focus on our *feel for* what is happening in the operating room but disregard our feelings *about* how we are performing. Such notions do not add value in the moment. One way to move away from self-consciousness is to operate under the rubric of *detachment*. These children at the Cove Alliance Catholic orphanage in Uganda (video displayed during talk) are utterly content, even joyful at play. They have no thoughts of being judged while they play and care not for wealth, power, or honor. Many of us are preoccupied with how others perceive us and how much power and influence we can amass. Perhaps that is why J. R. R. Tolkien proposed as the most tempting talisman, a ring of power. But such thoughts are counterproductive to optimal performance. To experience flow, we need to evolve to a state more detached, more akin to *play*. Friedrich Nietzsche described 3 steps in the development of the human spirit: In the first we take on the burden of cultural duties, in the second the human psyche rebels against slavish obedience to authority, and finally the highest level of humanity is unburdened and creative—symbolized as the child at play.

Picasso was quoted as saying “It took me 4 years to paint like Raphael but a lifetime to paint like a child.”

There is another form of *detachment* that also may be of value to you when facing great challenges in the operating room. In his book *Do No Harm*, British neurosurgeon Henry

Marsh describes why he avoids seeing patients on the morning of their operations: “I prefer not to be reminded of their humanity and their fear, and I do not want them to suspect that I, too, am anxious.” Once he is in the operating room and the patient—largely hidden behind monitors, drapes, and equipment—has transformed “from person to object,” his own state of mind undergoes a similar sort of change: “The dread has gone, and has been replaced by fierce and happy concentration.”

Finally, let us consider how the experience of flow may vary throughout the *phases* of one’s surgical career. As residents and fellows, we learn the mechanics of proper operating and decision making. The process is broken down and repeated over and over again until its elements begin to gel. It requires 10,000 repetitions of skilled tasks to become an expert. Much like the swimmer in a laned pool, we practice for years until efficiency and performance are optimized. It is difficult to experience flow during this training phase, but it does happen. When we become seasoned attendings, we hit our stride. We can deal with complex cases and rapidly evolving challenges with confidence and exhilaration. The lane markers are removed, and the walls of the pool come down; now you are swimming, even surfing in the ocean. Despite the waves and currents, we are confident. However, as we become more senior, we accept a greater number of responsibilities and commitments, some of them dissipative. At this point, when we should experience our best performance and maximal benefit to others, we can become overburdened with multitasking and begin to run into “debris in the water.” It is critical at this junction to simplify and clarify, to clean the water, if you will. We do not have infinite capacity. Although the ego drives us to excel and accept a seemingly endless list of responsibilities, we would do better if we were more selective. The Chinese classic *I Ching* states, “unlimited possibilities are not suited to man. If they existed his life would only dissolve into the boundless. To become *strong*, a man’s life *needs* limitations ordained by duty and voluntarily accepted.” Simplify and focus, because we cannot be all things to all people but must be fully committed to those who have entrusted us.

Perhaps this is my cautionary note about flow. Initially conceived as a path to optimal personal experience, we cannot accept such a selfish or narcissistic definition. Our time in flow must have meaning to others as well, meaning that resonates deeply inside everyone involved. We must be inclusive of team members, our patients, and the families who support us. By all means, enjoy the privilege we have of doing extraordinary things in the operating room and do them to the very best of your ability. Optimize your experience, but do so with reverence and respect. Thank you.

You can watch a video of the Presidential Address by going to: <https://m.youtube.com/watch?v=3NJI13MkpWE>.

Four individuals helped me with my research and preparation for this address. Scott Shappell is a world-renowned human factors engineer and performance analyst at Embry-Riddle. Juris Vagners is a professor of aeronautical engineering at UW and a hall of fame ski instructor. Connie Wible is a celebrated pianist and musicologist. Finally, Doug Newburg is a performance coach who served on the medical school faculty at the University of Virginia for 15 years. His insights and feedback were critically important.

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