SKILL
Principles that Surgeons, Athletes, and other Elite Performers use to Achieve Mastery

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Introduction

“Being good or even great at what you want to do – playing the violin, running a race, painting a picture, leading a group - is among the deepest sources of fulfillment we will ever know”

Goeff Colvin, *Talent is Overrated*
Introduction

Skill = the ability to do something that comes from training, experience, or practice

Mastery = knowledge and skill that allows you to do, use, or understand something very well
Don’t fall for the prodigy myth.
Sports

Earl Woods

• Teacher military tactics at CCNY
• Played HS and college baseball
• Second marriage
• Retired and dedicated training
Sports

Tiger Woods

- Age 7 months - putter
- Age 2 yrs - practicing on golf course
- Age 4 yrs - professional teachers
- Age 19 yrs - elite (17 yrs of practice)
Chess

Polger sisters

- László Polgára - Hungarian chess teacher /psychologist
- Advertises experiment
- Polgár sisters produced Zsuzsa, Zsofia, Judit
- #1 an #2 women chess players in the world
Music

Wolfgang Amadeus Mozart

- Father Leopold – composer
- Intense training at age of 3
- First master piece – Piano concerto #9 at 21
- 18 years of training
Sports Hotbeds

Spartak Tennis Facility

- 2 courts
- More female top 20 world ranked players than the US
Sports Hotbeds

Matthew Syed in *Bounce*

- 50% of England’s best table-tennis players from one street
How Do We Get There?

For orthopaedic surgeons, split-second decisions take years of experience.
10,000 hours
Time

10,000 hours =
20 hrs/wk x 50 wks/year x 10 yrs

- Anders Ericsson
- 20-year-old violinists
- Best group ave 10,000 hours
- Next-best averaged 7,500 hours
- and the next, 5,000
- ? same surgery, insurance sales, and sport
Take a Chess Lesson
Chess

New York Scholastic Chess Tournament
Chess
Chess

Chess Instruction Model

• Every move is analyzed
• Compared to master
  – Great move
  – Acceptable move
  – Poor
  – Blunder
Surgical Techniques Conference

- Workout – Beat-em don’t break-em
- Analogous to chess model
- Decide best move, then compare to master and analyze the differences

Chess
Chess

Question: Exposure is poor...what is your next move

Answer: Retractor.....
Chess/Technique Conference

• Not “Why did you do that?”

but rather

“What would you do if . . . . . . . . .?”

Josh Kaufman, in *The Personal MBA*

• Counterfactual simulation
• Powerful
• Mentally hard
Chess
May 2015
• Marshall Chess Club
• Washington Square Park
Chess

Natural Talent

- Elite chess have high IQs?
- Ability to project moves into the future

- Research has shown that chess masters have average IQs!
Chess

Experiment

- Chess masters vs novices
- View boards with 25 pieces
- Novices correctly place 5
- Masters correctly place all

1973 William Chase and Herbert Simon
Chess

Phase two

- Pieces placed randomly
- Experts = novices

Explanation

- Elite chess players have a mental library of themes and positions
Chess

- Inexperienced players use 95% calculation and 5% pattern recognition
- Converse for elite players

Magnus Carlsen

- Able to keep 10 games of chess going at once without even looking
Chess

• Train by studying prior games played by masters. Positions are analyzed in depth, predicting moves studying incorrect predictions

• Analyzing games is single most important predictor of chess players ability rather than amount of time playing chess
Check out the NEW 2015 AANA MASTERS EXPERIENCE Courses
Chess

Chunking

- Linking groups of information based on patterns
Avoid Excuses
Equipment, Environment
Equipment

Vietnam 1968
F-4 vs Russian MiG
Equipment

F-4

- Fastest jet of the time
- Six-barrel Gatling cannon
- Sparrow radar-guided missile
- Sidewinder heat seeking missile

- US prior wars kill ratio 5-10:1
- Against Vietnam 2.3:1
Equipment

• Military stop air combat
• Navy begins new training, Airforce stays the same

Navy Fighter Weapons School
• Navy records dog fight training exercises
• After-action review
• What were you thinking?
  What if you had tried this?
• Brutal honesty
• Then do it again
Equipment

- Air combat missions resumed after a year
- Air force’s kill ratio dropped to 2:0
- Navy’s ratio improved from 2.4:1 to 12.5:1
Equipment

Air force Colonel John Boyd

“Machines don’t fight wars, people do, and they use their minds.”

Navy Fighter Weapons School became informally known as Top Gun
Improving Skills

Deep Training – Find the Sweet Spot, then Reach and Repeat
“There is a difference between people in music and sports talent hotbeds and ordinary people everywhere else—talented people have a vastly different relationship with practicing.”

Dan Coyle, 
*The Talent Code*
Brazilian Soccer Skill

• Futsal
• 6x the touches/min, 600 x the touches
• Higher pressure, tighter space
• Brought to England – developed youth national players
Practice

What is practice?

Strain = Change in Length of a Material / Original Length

Strain - analogous to reaching in skill development
Practice

Time

• Time = experience

• Experience in isolation does not equal better performance

“Never mistake activity for achievement”
John Wooden
Practice

GPS

- Attending navigates resident through 20 TSR
- Passive learning
Practice

• **TIME = EXPERIENCE**

• **STRAIN \times TIME = SKILL**

Trap

• Years pass and no development

• No strain in the equation
“Research shows that doctors who have been in practice for twenty or thirty years do worse on certain objective measures of performance than those who are just two or three years out of medical school…most of what doctors do in their day-to-day practice does nothing to improve or even maintain their abilities; little of it challenges them or pushes them out of their comfort zones”
Practice
Reach beyond your ability and repeating

Panic
Sweet spot
Comfort

Get comfortable with the uncomfortable
Practice

Reach

Plan/Correct

Feedback

Columbia U.
Center for
and Spol
Practice

Reach

Plan/Correct

Feedback
Reaches

- Component of the entire task
- Sweet spot
- Repeatable
Feedback

- Strong
- Immediate

Plan/Correct

Reach

Feedback
Feedback

Lack of feedback
• Bowling with a curtain in front of you
• Chef who never tastes his food
• Spine deformity specialist who never looks at postop x-rays
Feedback

Immediate feedback is best

• Musicians listen while they practice
• Dancers dance in front of a mirror
Feedback

How can surgeons enhance their feedback?
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Grade Your Surgery
Feedback

• Give yourself a grade after each surgery
• Develop self-critique

• Meta cognition - the ability to self-observe
• Top performers are always more critical and more specific in their criticism of themselves
Feedback

Josh Kaufman in *Personal MBA*

- Analytical honesty - dispassionately measuring and analyzing the data
Feedback

Honest feedback

“The best gift an educator can give is to get someone to become self reflective”

Randy Pausch
Self-awareness rarely in those lists of competencies that organizations use
Feedback

Sofies CPGS
yearbook

My favorite saying: If you give someone a fish, you can feed them for a day. If you teach them how to fish, you can feed them forever.
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Let go of Ego
Ego

Joseph T. Hallinan in Why We Make Mistakes

• In US 44,000 - 98,000 patients are believed to die each year from preventable medical errors.
Ego

- ORs vs cockpits
- ORs are hierarchical, cockpits are not
- Flight crews speak up irrespective of rank
- Everyone is equal when it comes to exposing potential errors
Ego

• Survey of tens of thousands of pilots and doctors

• Should junior staff question senior staff?  
  – 97% of airline pilots - yes  
  – 55% of surgeons – yes

• Even when fatigued, I perform effectively during critical times  
  – 26% of pilots agreed  
  – 70% of surgeons agreed
Ego

Radiologists who are incorrect with interpreting films are also the most confident of being right

Jerome Groopman, MD
Question

• “Advice on leading groups of physicians for better performance?”
“We have a team of all-stars much like the staff you have at your hospital. To get the players to work toward the goal of the team and win a championship, every player must leave his ego at the entrance to the stadium. Ego is the biggest obstacle to team performance when the team has all-stars.”
Cognitive Rehearsal
Close your Eyes and Visualize

Write the operative report before you perform every surgery
Visualize

“Practice with your fingers and you need all day..Practice with your mind and you will do as much in one and ½ hours”

Leopold Auer – Famous violin teacher
Visualize

- What makes a good resident?
- What are your goals for this rotation?
Visualize

• Visual-spatial relationship more important than dexterity
• Can be enhanced with practice

Geoffrey Norman,
McMaster Univ Ontario
Visualize

Stephen Kosslyn, Harvard Psychologist

Visualization consists of four separate abilities

1. Image generation
2. Image inspection - draw inferences from it
3. Image maintenance - ability to hold it
4. Image transformation - ability to manipulate the image
Visualization

Does a frog have a tail?

- Bring up in your mind a frog (image generation)
- Hold it in your mind (image maintenance)
- Rotate to see backside (image transformation)
- Look for a tail (image inspection)

Abilities are highly variable
Visualize

- The greatest displays of surgery are created twice. First in the mind; then in the OR
- Write the operative report prior to the surgery
Visualization

- Jack Nicklaus - never taken a swing that he didn’t first mentally rehearse

- Yo-Yo Ma age of 7 - solves a difficult musical problem by visualizing himself playing the piece on the cello
Charlie Wilson, MD

- Runs in AM and reviews surgery
- Visualizes entire procedure and each possible outcome
- “It was a virtual rehearsal so when I was actually doing the operation, it was as if I were doing it for the second time.”
Visualization

• Our brains activate same way when were visualizing as when real 60-90%
  Kossyln, Cognitive Neuropsychology, 2005

• The more we mentally rehearse, the stronger the neural pathways become
Visualize

• Competitive diver practicing a new dive

• First forms a clear mental picture of the dive and also what it will feel like in terms of body position
Visualization

• 2 groups of beginners taught to play piano sequence 2hrs practice per day
• Group 1 – practice only in their minds
• Group 2 – physically practice
• Day 3 – both groups equal
• Day 5 – physical group edged ahead
• Visualizers with one practice session allowed them to catch up

Visualization

- Mentally rehearse a golf stroke and the axons and dendrites that orchestrate those moves wire together a bit more strongly.

  *Daniel Goleman, FOCUS*

- Practice triggers oligodendrocytes to produce myelin which optimizes the neural connection.

  *Daniel Coyle, The Talent Code*
Does mental practice improve performance?


- Meta-analysis in fields from violin to dart-throwing
- Mental practice produces 2/3 benefits of physical practice

- “For tasks that are dangerous to perform physically, for tasks in which there are seldom opportunities for physical practice, or as a means of supplementing normal training, mental practice should be considered an effective training alternative.”
Visualize
U.S. Army Special Forces soldiers
• Weeks of training for single mission
• 2 part routine day of mission
• Every mistake/problem possible
• Appropriate response created

• Counterfactual simulation, premortem

• Team takes a break, lunch together, relax
Visualize

Phase two

• Talk and visualize each step going perfectly

• Many top performers take this approach
  Peyton Manning, Football teams
MENTAL REHEARSAL FOR WARRIORS
by LOREN W. CHRISTENSEN

- 90 percent of athletes at the US Olympic Training Center use mental rehearsal
- Of those, 97 percent of the athletes believed it improved their performance
- "Keep in mind these are our top athletes. They don't waste time on anything that doesn't work."
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Chunking can unleash magical improvisation
Magic

*Blink* by Malcolm Gladwell
Hard skill mastery leads to unleashing improvisational skills
Google “Greatest plays in Yankee History”
http://www.complex.com
1 – Mr. October
2 – Don Larsen Perfect Game
3 – Lou Gehrig’s speech
4 – Bucky "F*ckin" Dent
5 – DiMaggio's Hit Streak
6 – Maris Breaks Ruth's HR record
7 – Babe Ruth Hits 3 Homers in the WS x 2
8 – The Flip
9 – Aaron "F*ckin" Boone
2001 Game 3 ALDS

Magic
Magic

How do fighter pilots, athletes, fire fighters see things before they happen?

• Game Sense
• Playing Unconscious
Magic

Josh Waitskin, The Art of Learning

• Intuition
  – Portal between the unconscious and the conscious mind
Magic

- Practice (cognitive rehearsal)
- Automaticity
- Deeper thinking, and perception
- Improved execution
- Creativity
“What distinguishes a great bridge player or a great surgeon or a great pilot from the rest of us mortals is how much they have on automatic. When the bulk of what an expert does is on automatic, people say she has “great intuitions.”

*Flourish*, Martin Seligman
“Champions don’t do extraordinary things. They do ordinary things, but they do them without thinking, too fast for the other team to react. They follow the habits they’ve learned.”
Obsess Over the Fundamentals like Coach Wooden
JOHN WOODEN: HOW TO PUT ON YOUR SOCKS
NEWSWEEK ON 10/24/99

• I think it's the little things that really count.
• The most important part of your equipment is your shoes and socks.
• Positioning and Draping
Automaticity

Chunking gone right

• Physical genius
Automaticity / Chunking

Tennis Serve

Novice
• Watch the ball

Expert
• Watch the racket

Elite
• Watch body
Chunking

Chunking gone wrong

• Jennie Finch vs Albert Pujols
• Strike out on 3 pitches
Reflection 5
Coaching
Coaching

A teacher affects eternity; he can never tell where his influence stops

Henry Brooks Adams. CIRCA 1900
Education

• Teacher

• Coach

• Difference ?
WOULD YOU WANT YOUR SURGEON TO HAVE A COACH?
HOW ELITE PERFORMERS ACHIEVE MASTERY

by Christopher S. Ahmad
Coaching

- Sees performer in a way that they can’t see themselves then give them feedback
- Pitchers, Golfers, Singers, CEOs have coaches
- Surgeons do not
Coaching

Atul Gawande, New Yorker October 3, 2011

• Invited a coach to his OR
• Pointed out what he could not see himself – feedback
• “Most surgery is done in your head. Your performance is not determined by where you stand or where your elbow goes. It’s determined by where you decide to stand, where you decide to put your elbow.”
Coaching Residents / Fellows

• Would u tell me please which way I ought to go from here, said Alice
• That depends a great deal on where u want to get to, said the Cat
• I don't care much where, said Alice
• Then it does not matter which way you go, said the cat

Lewis Carroll, *Alice in Wonderland*
Coaching Residents / Fellows

Method vs Concept

Plate application vs rigid fixation and early motion
PERFORMANCE

Ninety percent of the game is half mental
—YOGI BERRA
Choking

“Look, if you had one shot, or one opportunity to seize everything you ever wanted. One moment. Would you capture it, or just let it slip?”

“His palms are sweaty, knees weak, arms are heavy. There's vomit on his sweater already, mom's spaghetti. He's nervous, but on the surface he looks calm and ready to drop bombs, But he keeps on forgetting what he wrote down, The whole crowd goes so loud. He opens his mouth, but the words won't come out. He's choking how, everybody's joking now.”

Eminem “Lose Yourself”
Choking

• Panic – fight or flight or freeze

In a close game I check my pulse. I know if it gets over one hundred it's going to affect my thinking.

— PHIL JACKSON
Choking

• Choking - about thinking too much, different than panic

    Greg Norman 1996 Masters
Choking

Dan Coyle

• Top performers make a habit of pre-creating pressure situations in vivid detail, so that when the time comes, they’re ready and have less performance anxiety, fear, and choke potential

• Simulate actual conditions
• How Preshot Routines Can Improve Your Performance

By Patrick Cohn

• Avoid distraction and negative thoughts
• If preshot routine disrupted, stop and begin again
Managing Intraop Complications

Sign above a bus driver’s head

The First Rule of Holes

When you find yourself in a hole, the first rule is to stop digging
Managing Complications

• The greatest and toughest art in golf is “playing badly well.” All the greats have been masters at it.

JACK NICKLAUS
Final Message 1

Principles of surgery - Principles of mastery?

Core competency - Core excellence?
“I got tenure a year early… Junior faculty members used to say to me, 
wow, you got tenure early. What's your secret? I said, it's pretty simple.

Call me any Friday night in my office at ten o'clock and I'll tell you”

Randy Pausch Last Lecture
The difference between expert performers and the rest of the world reflects a life-long passion and deliberate effort to improve performance in a specific domain. The path is clear, long and demanding—few will follow it. Everyone who has achieved skill has encountered terrible difficulties along the way; there are no exceptions.
THANK YOU