

This is a paper I did for one of my classes. I look forward to any comments or input.
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UNITED STATES SPORTS ACADEMY

AN EXAMINATION OF THE PROCESSES THAT
OCCUR DURING COMPETITION

A Class Paper Submitted for
SAB 571
Coaching Methodology
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November, 2008

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Introduction

Purpose

I'd like to explain some of the changes that occur to an athlete during competition. I will include how different variables, for example: the temperature, the score, the expectations of the athletes, the skills difference in the opponents, equipment failure, previous preparation and other variables, affect what happens in the body mentally and physically. Specifically, I will reveal the thought processes of one racquetball player during a match while keeping the reader informed of the external influences that are provoking the changes.

Question

The changes described above involve multiple body systems: psychological, neurological, chemical and physical processes to name just a few. I would like to explore several of these processes that occur during competition, in hopes of creating new ideas on how to improve human performance in sports.

Significance

Persons with interest in human performance, athletes, coaches and spectators will see that the processes discussed here range from tangible chemical changes in the cellular level, to unseen decisions made by the subconscious mind. The breadth

of fields in sports studies wide. I predict that with the development of better technologies to measure and understand these processes, and the growth of sports in general, new highly-specialized fields of study of these processes will emerge, with the intention of improving human performance. These fields will begin in the training room and eventually branch out to the board room.

Review of Literature

Pre- Match

John is sitting on the bench in the locker room. His temperature is slightly raised, he's produced a light sweat and his pulse is elevated to 75 beats per minute, after the light exertion of the warm up and dynamic stretching routine he finished just seconds ago. He knows that for pre exercise, dynamic stretching has replaced ballistic and static stretching over the last decade. (Faigenbaum et al., 2007) His pre-match routine hasn't changed much in the past two years, except for giving his ankle a little more attention. He gradually pushes the tendons, ligaments and muscles around his ankle to their limit of flexibility after he increased circulation with a few minutes of light exercise, the imaginary jump rope. This process doesn't definitively prevent injury, but introducing the stressors to the body in a controlled fashion reduces the acute shock that can occur to the body that can lead to injury during exertion.

John is taking deep slow breaths to bring oxygen to his muscles, while doing some mental imagery exercises. In a few minutes, he will be playing the semifinal racquetball match on the Grand Slam Court at the US Open in Memphis, TN. His breathing also acts as a cue, or trigger to help him relax. He's been using the deep breathing technique for three years, and along with a progressive relaxation technique; he has noticed the calming effects it can produce. He imagines breathing in positive energy and confidence through his mouth and nose while tightening several parts of his body at once. Then, as he breathes out, he releases these muscles and imagines any negative energy and doubt leaving his body through his breath and skin. (Poirot, 2007) He will also use this technique during the game as well. He looks at the clock, five minutes until game time.

Match

He walks out to the court, the adrenal gland is secreting, epinephrine and adrenaline, two hormones that will help him perform. He notices how this feels, it is familiar him having. He does a quick 'systems check', a self awareness scan to make sure he is within his ranges for optimal performance. He uses the stoplight technique to measure his arousal state. Having competed at a high level for ten years, he knows how he feels during his best performances, and he will try to acquire that same mindset today. If his arousal state is close to but not within the desired range, he imagines a yellow caution stoplight. Maybe he reminds himself

how hard he has worked to get to the semis, how well he played his last match, how fun competing is. Or if he notices he is over-aroused, or too excited, he will imagine a red stoplight, and then use some relaxation exercises, or positive affirmations to get back to a green light state.(Biddle, 1988)

He has won the coin toss to determine who serves. He visually scans the court, the crowd, the referee and his opponent, then he starts his pre-serve routine. The benefits of the pre-action routine have been the subject of research studies. (Gentner, 2008) Using a routine encourages sub-conscious process that occur in the pre-motor cortex. Multiple studies have shown that in elite athletes, the best performances are initiated in the sub conscious part of the brain. Neuro- imaging has been beneficial to determine what brain functions are most active during what activities. Athletes were asked to recall their best performances, while they were hooked up to MRI and/or FMRI machines. (The machine measures the amount of oxygen being consumed by each part of the brain. Researchers can then see which parts are more involved in the actions. (Remy, 2008) So John, wanting to win, will try to recreate these processes by focusing on external cues, without consciously trying to do so. (Shea, Wulf, 1999)

As he executes his first explosive move, a hard drive serve into the left corner, the two anaerobic energy systems will provide the primary source of energy for his muscles. The ATP-PCr combines ATP and phospho-creatine for fuel, then the anaerobic glycol sis system use the carbohydrates (glucose) that are stored in the

muscles and liver. After a few minutes, the aerobic fuel systems will take over, and oxygen will become the primary muscle fuel.(Marten, 2004)

John continues drive serving with immediate success. He has won the first 4 rallies of the first game with his powerful drive serve. The combination of the two types of fast twitch muscle fibers, FOG and FG, (Martens, 2004) along with his long arms and methodical training method have helped him to hit the ball harder than most other players in the pro draw. His coach saw his abilities in the vertical jump portion of his F.A.S.T form results, and encouraged him to become an explosive style player.

After quickly getting down by four points, John's opponent takes a time-out. John leaves the court and drinks some water to rehydrate; knowing that when loses 2% of his bodyweight through perspiration, his performance could suffer. He should drink 4-8 ounces for every 20 minutes of exercise. He takes a brief moment to scan the crowd, acknowledging his broad external focus. He suddenly remembers how he felt (a narrow internal focus) when his mom signed him up for his first league at the local racquet club.. Being an ectomorph, he wasn't suited for football, but had early successes in racquetball with his long reach due to his long arms. The referee calls "Time in" and he resumes his narrow external focus on serving the ball. (Emanuel, 2008)

John makes a tactical decision and decides to keep serving a hard drive serve, only now he changes it's angle, making it a jam serve. A jam serve works best when it is hit very hard, and it has less risk than a standard drive serve, because it

is more likely to bounce ‘in bounds’ than bounce short or long serve. John wants to keep the momentum. The most comprehensive of these models is the Multidimensional Model of Momentum in Sport, (Taylor and Demick,1994) In their proposal, momentum is defined as an “arbitrary shift, a positive or negative change in cognition, affect, physiology, and behavior caused by an event or series of events that will result in a commensurate shift in performance and competitive outcome. This definition provides the foundation for a model that postulates momentum is developed through a series of changes consisting of: “(a) a precipitating event; (b) changes in cognition, affect, and physiology; (c) change in behavior; (d) change in performance; (e) opponent reactions; and (f) a change in the immediate outcome. It is predicted that positive momentum will lead to positive changes in behavior and outcome while negative momentum will have a negative effect.” (p.54)

John attributes his recent successes on the court to reducing his cognitive dissonance, identified by (Festinger, 1957). For example, before training with plyometrics, John thought of himself as a slow mover. With his trainers insistence on tracking his progress on a white board through an eight 8 week long plyometric course, John had a visual representation of his increase in speed. He could see his improvements. He used daily positive affirmations to change his perception of himself from being slow to being quick and agile.

John's next drive serve was called short, so his opponent came in to serve at 0-5. His opponents' style was unorthodox. He was a former squash player, and didn't

hit the ball as hard as the other players on the pro tour, but was very precise in his placement and his control of speed. He had excellent drop shots and controlled center court very well. He served an off speed drive serve with sidespin that forced the ball into John's body. John was surprised by the unusual speed and spin and consequently skipped the ball. The score now is 1 -5. His opponent next serve was exactly the same with the same results. John feeling a little puzzled, takes his allotted 10 seconds to receive the serve by raising his racquet over his head. During this time, he is thinking of a strategy to best deal with these 'funky serves'. He commits to watching the ball right off his opponent racquet and being conservative with his return just to get into the rally. This skill is part of the tactical triangle. It's the process of reading a situation, applying experience to it, then making a decision of how to proceed. Knowing that he can cover lots of court, John decides to be slightly less aggressive on his return and get himself into the rally. His opponents' next serve hits the crack between the floor and the sidewall, and squirts into the corner for an ace serve 3-5. John realizes that his momentum is gone. He feels confident he has the skills to out hit his opponent, but he is still confused on how to return the serve. He knows hit has hit serves that were delivered much harder than these, so it must be the reading of the ball and not his reaction time, that's causing him trouble. He patiently takes his allotted 10 seconds, using another important competition skills called time management. He tells himself to focus on the ball, watch carefully to see the spin and read the path of the ball accordingly. One deep breath later, his opponent serves that same weird spinning ball. John can't see the actual spin on the ball, but his 'instincts'

react to the subtle action of his opponents' racquet on the ball upon contact. Time seemed to slow down for John, as the ball came toward him, he noticed a gradual drop (actually microseconds) of the ball a lot sooner than other drive serves, he slid his racquet under the ball and returned a ceiling ball. But before he could hit another shot, John's opponent hit an overhead smash down the left line, also an usual choice for conventional racquetball. John again receives serve at 4-5. Having noticed the success in reading the ball last time, he again focuses on reading the spin and racquet face of his opponent. Again, he commits to paying attention to his opponents racquet face a little longer than usual, to get more information about the spin. He realized that he will have to learn 'on the run', as the expression goes. John is learning a new skill *during* competition. John scores a few more points, but his opponent wins the first game 11-7. At 4-5 in the second game, John receives serve and notices his comfort level of returning the serve has increased. What actually happened is John has created new neuro-pathways, for the skill of reading the spin of his opponents serve through a series of trial and error. (New patterns of neurons have created a small groove, or pathways of behavior.) This topic has been studied using brain mapping, and neuro-imagery ... There are three stages of learning: mental, practice, automatic. Because of John's athletic ability, he has quickly progressed to the practice stage of this skill. He will still be using his conscious process to return these serves until it becomes automatic.

Feeling a little more confident in reading the position of the ball, he becomes more aggressive with his serve returns by blasting passes down the line and cross

court. He wins the next 3 games and the match, by disarming the former squash players' only weapon offense, the spinning serve.

After the match, he makes sure to re-hydrate right away, and take in some protein within 45 minutes, because of he is adding strength training to his workout program, so he requires more protein to build the muscle.

Post match

Later, John discusses the match with his coach and writes about it in his journal. He records three things he did well, three things he can improve in each of these categories, tactical, technical and mental. This process is called evaluation. It's done at the end of a match, practice, and season, to determine what aspects of his game worked well and what skills need work.

Summary and Conclusions

A Multi-disciplinary Field

The fields of sport coaching requires a basic knowledge of many broad fields, the actual technique of the sport, the strategies, the tactics, human psychology and physiology of the body, not to mention all the business aspects involved. In examining the variables that affect processes of one athlete during a single racquetball match, and we can see how other fields like biology, neurology, sociology, pharmacology, nutrition and many more can be applied to sports

performance studies. I predict that these fields of study will keep dividing into sub-fields of ever- more specialized applications to improve human performance.

Future Developments

In the future, I believe we may see real time measurements like blood analysis, (perhaps with automated fluid feeder system for perfect nutrient balance during competition) or perhaps real time neural imagery sideline device, that gives a visual representation of the athletes' actual state, versus their predetermined PPS state. Coaches may soon be able to create training programs with the aid of new devices that can determine the exact point of muscular fatigue. The point is that the knowledge about human performance and how external and internal variables is endless. Our fascination at the rookies' game saving diving fingertip catch, to the season-ending drop of a routine fly ball by a 12 year veteran will keep us watching and participating in sports competition. Coaches, athletes and spectators will continue to be amazed what it's like to be human, when studied through sports.

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