This is a paper I did for one of my classes. I look forward to any comments or input. Thanks Jo Shattuck. Joshattuck@racquetballacademy.com

UNITED STATES SPORTS ACADEMY

"DISCUSSION OF TIME CONSTRAINTS, ATTENTIONAL FOCUS AND STATES OF CONSCIOUSNESS DURNG A TASK AND IMPLICATIONS FOR FUTURE EXPERIMENTS."

A Class Paper Submitted for

SAB 568

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Table Of Contents

Title Page 1

Section I. Introduction 1

Purpose 1

Thesis 2

Definition of Terms 3

Audience or Significance 3

Section II. Review of Literature 4

Methods *4*

Participants *4*

Procedure *4*

Results *6*

Discussion 7

Section III. Summary and Conclusions 9

Further Research *10*

Additional Comments 10

References 11

Introduction

I would like to study certain aspects of Beilocks' and Gonso's experiment titled "Putting in the Mind versus putting on the green: Expertise, performance time, and the linking of imagery and action. " (Quarterly Journal of Experimental Psychology, first, 1-13, 2008) (1) and Beilock, Carr, MacMahon and Starkes, (2002), and Jackson, Ashford and Norsworthy's " Attentional Focus, Dispositional Reinvestment, and Skilled Motor Performance Under Pressure" Journal of Exercise and Sport Psychology, (2006) (2).

Purpose

This paper will document results found when repeating portions of the experiment with racquetball drive serving (a closed complex sensorimotor skill), with time constraints by experts. I called the experiment, "Time limit constraints and its effects on a closed sensorimotor task performed by experts"

Thesis

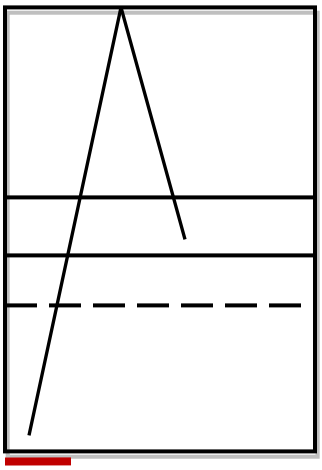
This expectation is consistent with the theory of automaticity, and conscious mind interference of processes that are best performed automatically. In the timed portion, the 'pressure' to complete the task doesn't allow for the conscious mind to override the automatic processes of serving, allowing the automatic process to take over. In the untimed portion, servers now have the 'luxury' of too much time. The tendency is for servers to consciously over-think the task and therefore be less precise.

Definitions of Terms

Expert will be defined as a player who has played at the Open level for two or more years.

Drive serve will be defined as a hard low serve that bounces past the short line.

Racquetball courts measure 20x40x20. The court used in the trials at both the at Goodson Recreation Center and the Denver Athletic Club were confirmed to have these dimensions. See below of a diagram of the parameters of successful serves.



Audience

This paper will be useful for coaches, trainers and athletes anyone who has interest in human performance. Perhaps this discussion will lead to better training techniques and a better understanding of the brain processes that occur while performing in competition.

Method

Participants

For the purposes of this paper, an expert is defined as an Open level player with two or more years of experience at the open level. There were 5 subjects, 4 right-handed and 1 left-handed Because of the task was the same for every player, no special considerations were taken for dominant handedness.

Procedure

The sport will be racquetball; the task will be a drive serve. (Generally defined as a hard low serve that bounces past the short line, and hits the back wall near the corner of the court. "Near" the corner will be defined as the span of space on the back wall that up to 31 inches away from the side wall/back wall seam. If the ball does not bounce on the floor past the short line, and hit the back wall within the 31 inches, the serve is not considered successful. If the serve is a fault serve (long or short), the serve will not be considered successful.

This parameters for a successful serve was chosen because it is a very common target for drive servers during singles competition. To provide data for the choice of the parameters, I recorded every drive serve in three open level matches observed, approximately 70 % of the drive serves' first or second bounce landed within a 4 foot by 4 foot square in the back left corner. Our parameter for the test, reduced the target to 31 inches along the back wall, in the back left corner, so we could test for small inconsistencies in precision under the two variables.

Un-timed Portion (Control)

In the control (untimed) portion of the experiment, there will be one experimenter in the court. This experimenter will act as a ball handler and retriever, to return the ball back to the server and record successful serves. Subjects will have as much time as they need to complete 30 serves, each successful serve, as defined in the parameters below, will be recorded. See below for the exact script of instructions.

"You are to hit 30 drive serves. You can take all the time you need for each attempt. Try to hit as many 'successful' serves out of the 30. A successful serve has two criteria. It must first bounce on the floor past the short line, and hit the pre-marked zone on the back wall (within 31 inches from the side wall). It can hit the side wall before the back wall as long as it hits in the zone."

Timed Portion

In the timed portion, there will be one experimenter in the court. Subjects will have 120 seconds to complete as many successful serves as they can. The experimenter will act as a ball handler and retriever, to return the ball back to the server. (Three balls will be used in the timed portion, with the experimenter always having control of two balls, so the server never has to wait to be tossed a ball to begin a serve.) The recorded time will begin when the server is handed the first ball. (If the server or experimenter still miss-handles the ball, recorded time will stop until he has regained possession.) The second experimenter will be a serve recorder , who will be positioned outside the court visually recording the number of 'successful' serves. A serve not delivered,

(from the beginning of the service motion) in within the time constraints will count as a ‘miss. Portions of the process will also be recorded on video. See below for an exact script of instructions that was read to each subject.

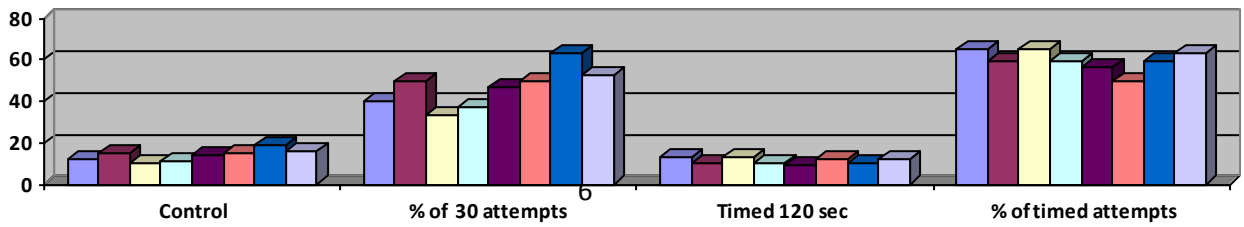
“You have 120 seconds to complete as many successful serves are you can. I will be feeding you balls so you won’t have to chase them. A successful serve has two criteria. It must first bounce on the floor past the short line, and hit the pre-marked zone on the back wall (within 31 inches from the side wall). It can hit the side wall before the back wall as long as it hits in the zone. Time starts when I had you the first ball. I will say ‘time’ when the 90 seconds is up”

The expectation is that the results will duplicate Beilock's and Gonso’s results in the time constraint portion described in the paper ““Putting in the Mind versus putting on the green: Expertise, performance time, and the linking of imagery and action. “ (Quarterly Journal of Experimental Psychology, 1-13, 2008) In those results, the experts’ performance’s increased during tasks performed under a timed variable, and decreased under the un-timed variable.

Results

The expectation is that the experts will perform better under time constraints than without time constraints. The results are displayed in the graph below.

The untimed (control) and the percent of successful serves for each subject are shown in the first two columns, while and the timed task (variable), and the percent of successful serves per attempt is shown in the last two columns.



The expectation that subjects' percentages will improve under the timed portion proved correct. As shown by the chart above. Percents in the timed portion increased for by an average of 12.8 percent.

Review of Literature

The limitation of this experiment was the relatively low number of subjects and the low number of trials per subject. Interestingly, in simple observation of subjects during the un-timed portion, all the servers used a discernable rhythm of the serve preparation and motion, even when they could take as much time they wanted. The explanation is that experts have had success performing these and other sensorimotor skills more successfully, with a rhythm after developing the muscle memory, than without a rhythm. Perhaps these experts are instinctively trying to allowing the automaticity to take over, because of the years of experience which helped them to become the expert in the first place. (Maybe the 'experts' were not as susceptible to conscious intervention because of the experience that undoubtedly allowed them to become experts). In further support of this idea, anecdotal recounts show that not one server did any obvious deviation or disruption of their routine, except to glance at the target zone at the back wall. The subjects could have done any number of conscious, non-rhythmic, non-standard actions to try to increase their performance, such as moving their position in the service box, standing straight up, hitting significantly slower and a more simple stroke or walking up to the front or back wall to more closely examine the 'lines' or 'target', as in golf putting; but not one subject did any of these things.

A potential test of the idea that experts know to try to do the task with their unconscious, is to test of experts in athletic tasks versus experts in cerebral tasks to see if all experts (in any field) instinctively take steps to allow automatic process to take place during the task, (whether it be racquetball serving or flashcard multiplication problems). My expectation is that experts in any field have experienced success under automaticity, and therefore know, that if they already have the muscle memory or acquired skill, that automaticity is the optimal way to perform. The questions then, are these. When a person doesn't have the acquired skill, or muscle memory, how do they best perform? What combination, or rather ratio of attention (conscious versus unconscious processes), focus, and type (external, internal) are best for what levels of expertise? Beilock's and Garr's study of novel task constraints(4), (2002) suggests that non acquired skills are dominated by conscious processes. To further explore this concept, we could test novices, (who are not experts in any field and do not have muscle memory at any skill) at new and unlearned skills, against expert athlete **and** expert non-athletes at the same new and unlearned skills, to see if the novices (non-experts in any field) try to produce some sort of automaticity in skills they don't have.

The next concept to explore is this. At what point does a skill or muscle memory make the switch in originating from conscious processes (pre-motor cortex) to un-conscious processes (sensori-motor cortex), Remy's paper (2008) "How Acquisition Of New Motor Skills…' (4) supports the theory that different parts of the brain are recruited during different times in the stages of learning a new skill. Remy found that "Several regions in the brain become activated when controlling our movements, and these regions differ according to the mental effort that is required to perform them. Accordingly, brain areas involved in skillful performance are not identical in early and late practice phases."

At what point in the skill acquisition, do the brain processes used during the task switch from the conscious to the unconscious. Is it the number of repetitions? Is the athlete aware of the switch? When did it happen? Does it feel different to the athlete? How? Can we create a measurable, replicable scale? The Reinvestment scale, (Jackson, Ashford, Norsworthy 2005) (5) was created from the Self Conscious scale,(Fengstein,1975) (6) Rehearsal Factor of the Emotional Control Questionnaire,(7) and Cognitive Failures Questionnaire (8). It was successfully used to provide data on three tiers of consciousness, and to correlate the use of attentional cues to each subjects' personality traits.

One inherent challenge is how we can determine the direction and degree of focus by each athlete during the tasks. It would seem one way to acquire a helpful tool to improve performance is to create a scale that is measured in the athlete's perception. Then we can compare these perceptions to the athletes individual performances. A ratio of focus of 60/40 would represent 60 percent of focus is directed internally-on the process, and 40 percent directed externally- on the score, for a rough example.

And if the assessment is successful, can we then use that scale as a teaching tool during performances? Can controlling the ratio of conscious /unconscious process be taught, and how? The first step may be to teach self awareness tools and self assessment techniques to the athlete, which they could practice using ratio during normal everyday tasks. Then use the same athletes in experiments in their usual sport.

Additional Research

We already know the vocabulary that athletes use to describe the unconscious feeling of optimal performance (Csikszentmihalyi 1988) automatic, cruise control, flowing, effortless (9). Further research into the self descriptions of the automatic feeling and perhaps a way to convert to a measureable ratio could help understand the neural processes, and could help athletes assess themselves, and therefore lead to more frequent optimal performances.

References

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4) Remy, *How Acquisition Of New Motor Skills Impacts Upon Our Pre-Existing General Motor Repertoir*, ScienceDaily (May 12, 2008)

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6) Self Conscious scale, (Fengstein Scheier, and Buss (1975) developed the Self-Consciousness Scale (SCS), et al, 1975)

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