THE VISUAL SEARCH IN SERVICE RETURN IN TABLE TENNIS

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This work belongs to the field of research that analyzes the relations between visual perception and sports performance.
Theoretical Foundations

- Ecological Psychology
- Cognitive Psychology
- Eye Movements
- Biological Motion
According to some studies the speed of the ball can reach 160 Km/h (Major & Lang 2003) and a spin of 8000 rpm (Ushiyama, e coll. 2003).

The improved technology has decreased the number of hits per rally. For this reason the serve and the immediate return are primary importance. (D.Djokic 2003).

According to some studies the speed of the ball can reach 160 Km/h (Major & Lang 2003) and a spin of 8000 rpm (Ushiyama, e coll. 2003).

On the service return, the motor response is very important, but the visual selection of the significant information at the right time is also important.

There are few studies on table tennis. More information comes from other sports like, cricket and squash.
Ripoll & Fleurance (1988) studied five top-players with eye movements system and they found that only the first part of the ball flight was tracked.

Abernethy (1990) studied squash using a temporal occlusion methodology. He found that expert players were more accurate in predicting stroke force and stroke direction than novices.
Land & McLeod (2000) in cricket, comparing players with different skill levels they found that a short latency for the first saccade distinguished good from poor batsmen, and that eye movements strategy contributes to increase skill in the game.

Rodrigues, Vickers and Williams (2002) in table tennis, show that skilled participants demonstrated an earlier ball tracking and recorded higher performance accuracy than less skilled player.
A practical observation:

It is important to return the service of the opponent with efficacy....
Question: Is there a difference in visual perception between experts and non experts in predicting the trajectory of a ball during service return in table tennis?

How is the information selected by experts compared with novices?
We gave an answer to this questions in two experiments the data were presented in FEPSAC 2007 conference (Bianchi, Agostini, Domini, et al.).

We investigate, in a video based task, how table tennis players can guess the direction of a service and which are the most important cues by using temporal and spatial occlusion.
We found that:

Esp1: temporal occlusion
In general, the performance increase with time this could suggest that there is an increase of the amount of visual information available.
Experts perform always better than novice

Esp2: spatial occlusion
The absences of the ball cause a consistent decrease of the performance.
directions

• Run experiments in natural environment

• Use a metric scale to define the answers

• Use a system in 3D stereo vision

• Study how players detect the spin of the ball
Experiment 3: temporal occlusion
The movies ended at five different times of the service (*variable temporal occlusion*):

1) Begin of the service (-T2)

2) When the ball is on the top (-T1)

3) When the paddle hit the ball (T0)

4) In an intermediate position (T1)

5) On the bounce on the table (T2)
Occlusion Timing

Fps=25  \  1/25=40\ mS

<table>
<thead>
<tr>
<th>Frames</th>
<th>9</th>
<th>7</th>
<th>2</th>
<th>2</th>
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<tbody>
<tr>
<td>Time (mS)</td>
<td>360</td>
<td>280</td>
<td>80</td>
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-T2  -T1  T0  T1  T2
The subjects must perform 120 trials

They have to predict the kind of service
Correct answer as a function of Expertise

- **Experts**
- **Non-Experts**

Correct answer arcsin (rad)

- Expertise
- Non-Experts
Main effects of the variable temporal occlusion

Correct answer (arcsin)
Main effects of the variable temporal occlusion split by expertise

Correct answer (arcsin)

- T2 - T1 T0 T1 T2

Experts
Non-Experts
Regression of $y$ on $x$

- Correlation = 0.81
- $y = 0.0718x + 0.9305$
- $R^2 = 0.6705$

<table>
<thead>
<tr>
<th>Subjects</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>1.57</td>
<td>10</td>
</tr>
<tr>
<td>S2</td>
<td>0.95</td>
<td>2</td>
</tr>
<tr>
<td>S3</td>
<td>1.15</td>
<td>5</td>
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<tr>
<td>S4</td>
<td>1.57</td>
<td>6</td>
</tr>
<tr>
<td>S5</td>
<td>1.15</td>
<td>2</td>
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<tr>
<td>S6</td>
<td>1.36</td>
<td>4</td>
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<tr>
<td>S7</td>
<td>1.04</td>
<td>3</td>
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</table>
Where is the information hidden in space?
Experiment 4: spatial occlusion
4 conditions x 4 services x 6 repetitions = 96 trials

The subjects must perform 96 trials

They have to predict the kind of service
Correct answer as a function of Expertise

Experts vs. Non-Experts

Correct answer (arcsin)
Esp 4  Correct answer as a function of different occlusions

Correct answer (arcsin)

- C0 (T2) complete
- C1 No body
- C2 No ball
- C3 No paddle
Exp1: temporal occlusion  Exp2: spatial occlusion

Main effects of the variable temporal occlusion

Correct answers (rad)

T0  T1  T2

Correct answers (arcsin)

C0  C1  C2  C3

Exp3 Exp4

Main effects of the variable temporal occlusion

Correct answers as a function of different conditions

Exp3

Dir Spin

Exp4

Correct answers as a function of different occlusions

IMPACT
Practical suggestions

...and the next time that you play table tennis...
.. just go around a table and PLAY!

Thanks