Decoding (un)known opponent's game play, a real-life badminton eye tracking study

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1. Introduction

This study filtered the advance cues extracted by expert and amateur players when paired with an opponent whose game play is familiar to that of an unknown opponent. Analysis of data like eye gaze collected from players engaged in real-time naturalistic game play can provide an accurate reflection of player behavior. Inferences on the underlying cognitive and motor skills can be derived to a certain extent from two main indices, visual search patterns and fixation duration in the preparatory, anticipatory and execution phases of the game play. In this study we report scan path analysis reflecting the visual search in later two phases with emphasis on the quiet eye period in the preparatory phase. We do this by comparing data from three players paired against opponents with whom they have played before and others whose game play was unknown.

2. Methods

- Two higher level players(P1,P2) and an intermediate ranked player(P3)
- Three higher level opponents (O1-O3) and three intermediate ranked players(O4-O6)
- Sets of known players - P1-O1, P1-O2, P2-O1, P2-O2, P3-O1, P3-O3 (Other sets consist of unknown players)
- Main regions of interest - the opponent's torso, feet, racket and the shuttle
- First, second, fifth and the eighth serves observed in particular for all the sets

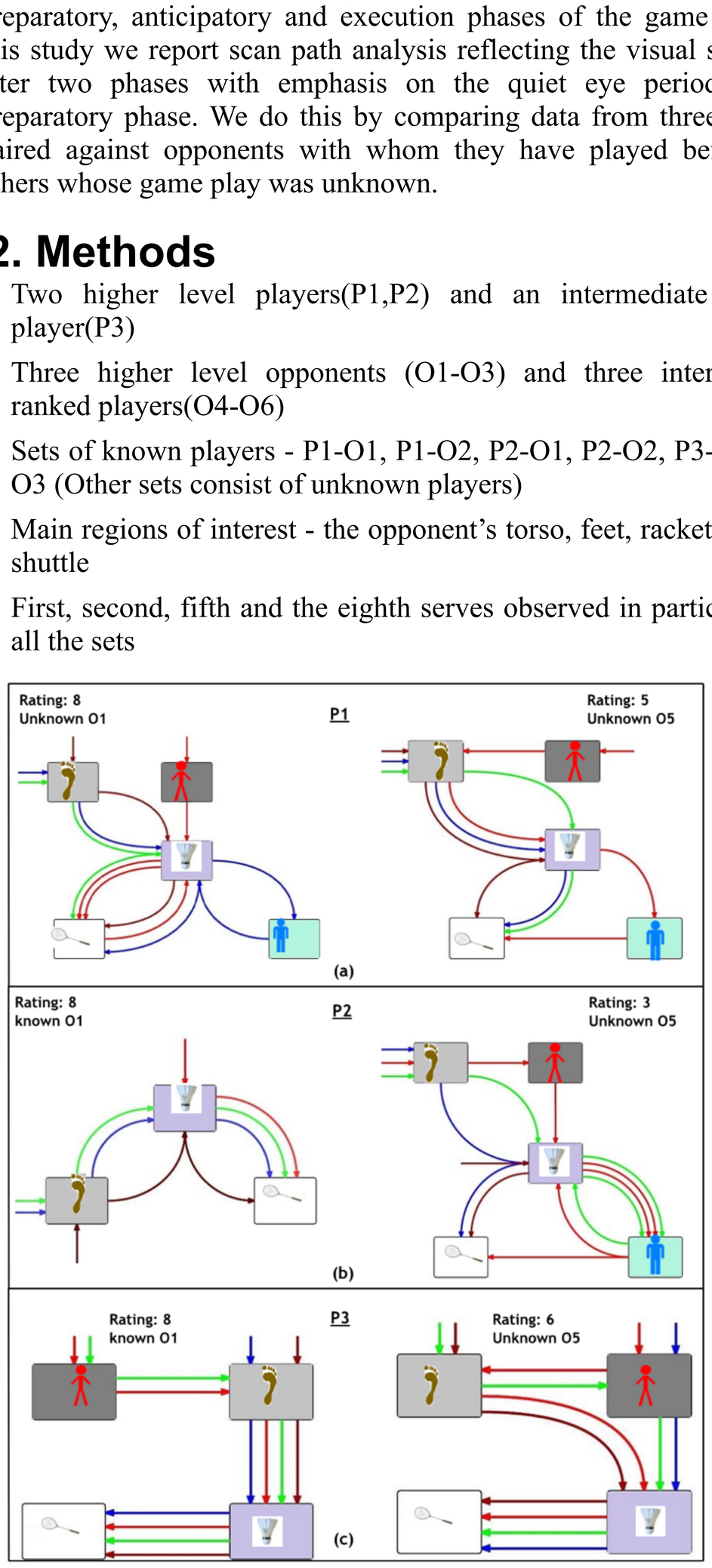

Figure 1: State diagram representing the scan path from preparation to execution. Red: s1 (serve 1), Blue: s2, Green: s5 and Brown: s8.. opponent (before serve) – dark grey. Opponent's feet (before feet) – light grey. Opponent's racket – blank/white. Shuttle – lavender. Opponent (after serve) – green.

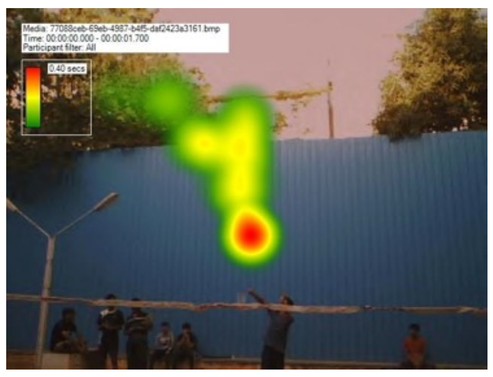

Figure 2: Heat map generated for serve 1 of P1 v/s O1

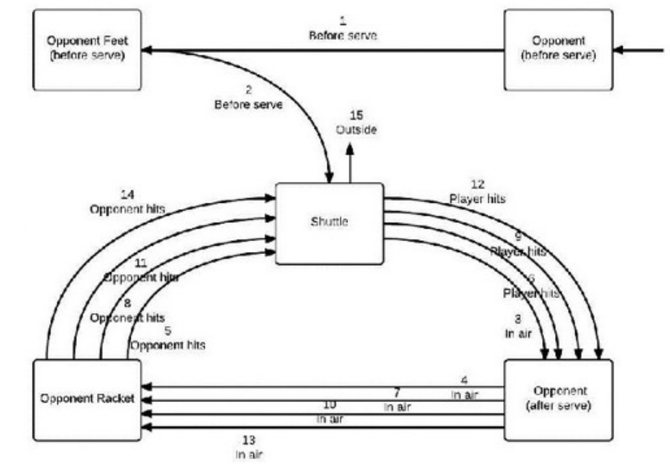

Figure 3: State diagram of rally between P1 and O5

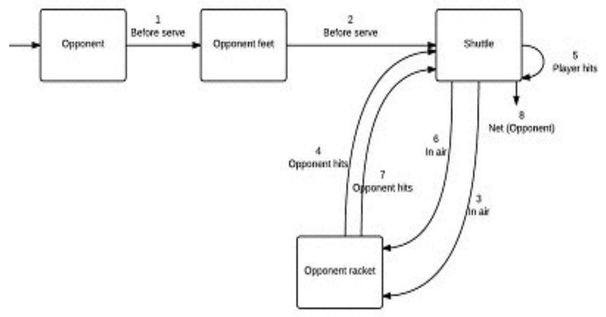

Figure 4: State diagram of rally between P2 and O1

3. Results

- The scan path before and just after the serve is analyzed from two views a) quiet eye during the preparatory phase, and b) the visual search pattern as the game progresses.
- Deviation in the first relevant visual cue gathered by the player in the first serve as against subsequent serves, a trend that is noticed when playing with either known or unknown opponents.
- After the first serve and the subsequent rally from the second serve on, the first landing gaze is the opponent's feet for nearly all pairs
- Could be due to either the player ability to retain a memory of the opponent's facial expressions or from the position of the feet the player could deduce the upper body stance or a combination of both.

4. Conclusions

The better players (P1 & P2) tend to look at the opponent after the serve for some the serves, which could be either a function of the type of serve which requires the player to reconfirm the opponents body cues to gauge motion pattern or the time for response was longer due to in-air flight time of the shuttle and attention shifts to the opponent.Though the scan path pattern from known and unknown opponents was almost similar the preparatory duration or quiet eye period shows that for known and unknown opponents the first two serves were higher across all the three players and by the fifth serve the quiet time was significantly lower. This could be because post the first serve the opponent's upper body is not allocated attention. Additionally the time period for the first serves for known opponent was higher than for unknown and the difference is lower as the game progresses that is, by the fifth serve.

	serve: s1,s2 time (ms)	Serve: s5,s8 time(ms)
Known		
P1	940	515
P2	755	297
P3	779	185
Average	**824**	**332**
Unknown		
P1	721	494
P2	464	387
P3	827	426
Average	**670**	**435**

Table 1: The average fixation duration in milliseconds for preparatory or quiet-time period for known and unknown players.

5. Future Work

Collect data from world ranked players, playing against equally ranked but known players and unranked/unknown players. The final goal is to model a optimal decision making process for the game of badminton.

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