

# Effect of Wait on Volleyball Skills

John Abou Jaoudeh

Department of Electrical and Computer Engineering  
American University of Beirut  
Beirut, Lebanon  
john7@live.com

**Abstract**— Volleyball is a game that highly depends on tactics; teams with higher understanding of other teams have a better chance of winning. Teams are also interested in analyzing their own squad to improve their weak points. These analyses are based on statistics, and video analysis of both, the home team and the opponent team. In this paper, we will cover the effect of wait on a player's performance in each volleyball skill. Our analyses will be done on 79 matches played by volleyball national teams, and clubs from the following countries: "Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Oman, Qatar, Saudi Arabia, Syria, Tunisia" in local, regional, and international competitions listed here: "FIVB Men's World Championship 2014 Qualifications, Al Rashid International Volleyball Tournament, Arab 30<sup>th</sup> and 31<sup>st</sup> Championship, Lebanese Championship 2012, 2013, 2014" on 50,130 recorded statistics done by the Lebanese statistics team led by Coach John Abou Jaoudeh, and Coach Spyro Klitira.

**Keywords** — Volleyball, Data Mining, Sequence Mining, Pattern Mining, Sport Statistics, Volleyball Patterns.

## I. INTRODUCTION

There have been many attempts to understand the dynamics of play in volleyball [2]–[12]. Technically the game can be seen as a cycle of the following skills: Serve, Reception, Set, Attack, Block, and Dig. Each skill has several statistical judgments [1]. Hernández González et al. [13] give an overview of repeated patterns in volleyball, a ball starts with a (a) serve, followed by (b) reception, (c) set, (d) attack, (e) block, (f) defense, and then back to (c) set, then d-e-f and so on. This is just a shallow look with no skill judgments.

Our goal in this paper is to find the effect of a player waiting a certain number of attempts on the performance of his next skill. J.Afonso et al. have already studied several factors that may affect the skills in a volleyball game such as:  
- Home court effect on teams [14].  
- Attack Tempo/Attack Type as predictors of attack point. [15]  
- Dig and Attack efficiency's effect on a set result [16]

We will start by explaining the techniques used in acquiring the statistics, and how the skills are judged. Then we will analyze the data present and show the effect of wait on each volleyball skill. The results will show the percentage of performing well in each skill.

## II. LITERATURE REVIEW

After watching the games, the statistics team converted the games into skill judgments. We will now state and explain each skill, and state the judgments used. As previously discussed volleyball is composed of the following skills: Serve, Reception, Set, Attack, Block, and Dig.

**Serve:** "A serve begins each rally. A player must hit the ball with his or her hand over the net to land inside the lines of the court." [17]

**Reception:** The reception is a forearm pass that is used to control the ball and pass it to the setter at the net. This action is done right after the serve.

**Set:** The set is an overhead pass used to change the direction of the reception/dig and put the ball in a good position for the attacker.

**Attack:** The attack is when the ball is hit across the net.

**Block:** "This is the first line of defense in Volleyball. The objective of the block is to stop the spiked ball from crossing the net or to channel the spike to defenders." [17]

**Dig:** The dig is a forearm pass that is used to control the ball and pass it to the setter at the net. This action is done right after the opponent's attack, a block might occur in between.

## III. PROPOSED METHODOLOGY

In statistics, the following judgments of skills were used:

Serve (s):

- Error (0): Serve Lost
- Not Efficient (1): The opponent was able to play any combination.
- Efficient (2): The serve limited the opponent's choices.
- Ace (4): Serve Won

Reception (r):

- Error (0): Reception Lost

- Not Efficient (1): The setter is able to set to only one attacker.
- Efficient (2): The setter is able to set to more than one attacker, but not all.
- Perfect (4): The setter is able to play all combinations.

Set (w):

- Error (0): Set Lost
- Triple/Double Block (2): The attacker had double/triple block.
- No/One Block (4): The attacker had no/one block.

Attack (a):

- Error (0): Attack Lost
- Efficient (2): Attack defended.
- Ace (4): Attack Won

Block (b):

- Error (0): Block Lost
- Passed (1): Blocker did not touch the ball.
- Opponent Defended (2): Blocked and defended by opponent.
- Team Defended (3): Blocked and defended by team.
- Won (4): Block Won

Dig (d):

- Error (0): Serve Lost
- Not Efficient (1): The team is unable to produce an attack from the dig.
- Efficient (4): The team is able to produce an attack from the dig.

We then do statistics on volleyball matches, where entries will look as follows:

- "15a4": Player number 15 won the attacked ball.
- "2s0": Player number 2 lost the serve.

Our next step is to analyze the data. We start by taking each team's statistics alone for each game. Group the statistics in tables for each skill alone. A sample output of attack sequences with skill judgment can be found below in Figure 1.

19	6	6	1	19	10	19	12	10	6	1
12	19	10	19	6	19	19	7	6	7	7
6	12	19	6	7	1	7	19	1	6	12
19	1	1	19	19	6	6	19	12	19	1
19	19	6	12	19	6	19	6	19	19	6
10	19	6	7	19	12	19	19	1	10	10
10	1	19	10	6	12	19	19	19	19	12
10	19	7	12	19	19	6	6	19	6	6
7	19	1	10	19	19	19	6	6	19	6
19	6	19	19	12	19	19	19	1	19	19
12	1	19	19							

Figure 1 — Attack sequence for a team during one game. White means the attack was lost, grey means the attack was

defended, and black means the attack was won. The number inside each square represents the player doing the attack action.

A lot can be deduced from Figure 1, such as player number 19 is being given most of the attack, especially in the last part of the game (which is the fifth and decisive set for the game), but our analysis will cover the effects of wait on the performance of the skill (Figure 2), and the chances of performing well if the player did actions consequently (Figure 3).

#	0	1	2	3	4	5	6	7	8	9	>9
19	52.9%	50%	72.7%	50%	0%	0%	0%				
6	40%	0%	40%	100%		0%	0%	0%			100%
1	100%		100%	75%			100%	0%			0%
10	50%		100%		100%	0%		100%	100%		50%
12				100%	100%	100%	100%	100%	50%		50%
7	0%	50%			100%				100%		50%
Total	50%	36.8%	68.4%	72.7%	75%	16.7%	33.3%	50%	75%		42.9%

Figure 2 — Attack - Percentages of winning a ball by each player according to how much the player waited (0-9 and above). Example: Player number 19 had 52.9% of his balls won when he waited 0 attempts (he was given two or more attacks consecutively).

#	1	2	3	4
1	33.3	33.3	0	0
5	77.8	0		
10	100			
6	66.7	100	50	100
12				
11				
Total	60	57.1	25	33.3

Figure 3 — Attack - Percentages of winning a ball by each player according which attempt it was when the attacks were done consecutively by this player (1-4). Example: Player number 5 had 77.8% of his balls won on the first attempts, 0% won on the second attempts.

Figure 2 and Figure 3 are the results of a single team, on a single match. To find a general result, one game is not enough. We need to do the same on all teams, all games, and then do the average of all. This is exactly what we did. We analyzed all 79 matches for each skill (serve, reception, attack, block dig). The set action was not of interest since there is usually only one setter for each team, and the wait of the set action is always 0.

#### IV. MODEL EVALUATION

This section shows our results. The data consists of 50,130 statistical records logged over 79 matches from the following championships: "FIVB Men's World Championship 2014 Qualifications, Al Rashid International Volleyball Tournament, Arab 30th and 31st Championship, Lebanese Championship 2012, 2013, 2014".

Figure 3 displays the effect of wait on each skill. We notice that wait mostly affects reception, the longer a player waits before receiving, the lower the chance of him doing the skill perfectly. Attack and serve on the other hand are not affected by wait. It does not matter if a player attacks two balls consecutively, or waits 1 2 3 or even 10 attempts to perform his attack action.

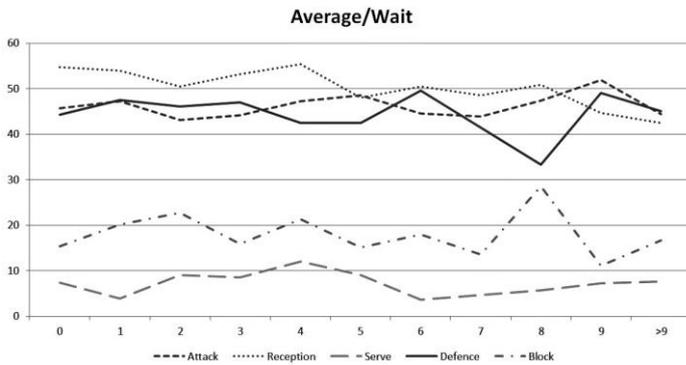


Figure 3 — Percentage average per wait

If a player performs the same actions consecutively 1, 2, 3, or 4 times, how does this affect skill performance? According to Figure 4, mostly all skills are affected. Reception, defense, and block's performance increases when consecutive actions are made. Serve slightly increases, but this is only because only good servers make it to more than 2 consecutive Serves. On the other hand, a player's attack performance decreases after the 3<sup>rd</sup> attempt statistically.

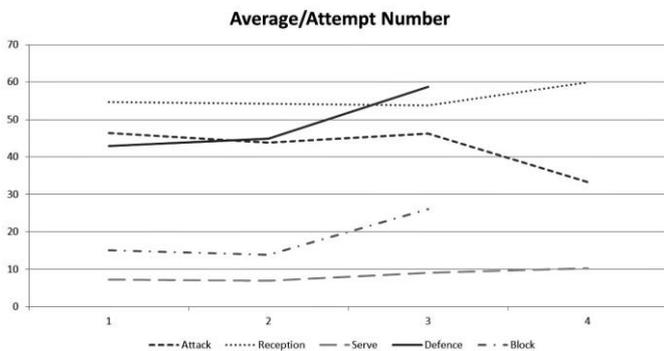


Figure 4 — Percentage average per attempt number (consecutive actions)

Finally, our last study was on the average wait time between each actions of the same skill. Figure 5 states that on defense, a player waits by average 3.84 attempts before performing an action. On attack, serve, reception, block, set, a player waits by average 3.19, 4.58, 2.07, 3.68, 0.21 actions respectively.

Skill	Wait
Defence	3.84
Serve	4.58
Attack	3.19
Reception	2.07
Block	3.68
Set	0.21

Figure 5 — Average wait time per skill

## V. CONCLUSION AND FURTHER WORK

This paper discusses how wait affects the skill performance; we showed that reception was mostly affected negatively whereas other skills were barely influenced. Furthermore, we showed that consequent performing an action also affects performance; attack was influenced negatively whereas all other actions were affected positively.

Future work could include studying the effect of one skill on another. We could also study the effect of positively performing an action on the next action.

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