

# An examination of the factorial structure of the unforced-error measure in collegiate women tennis players in Japan: A comparison between players and coaches

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ABSTRACT

Unforced errors are a significant issue in producing high performance in tennis. Identifying the causes of these errors in important to guide interventions to reduce unforced errors. The purpose of this study was to examine the different causes of unforced errors (UE) of Women's Collegiate tennis players from the perspectives of coaches and players. Specifically, and based on previous research (Hirata, Sato, Murakami, Sato, & Saijo, in press; Shibahara, Tamaki, Hirata, Sonobe, Morii, & Saijo, 2015), a measure was developed to collect data on UE. The factor structure was examined using data collected from 283 Collegiate women tennis players and 77 coaches of women tennis players. These participants were divided into High-Skilled (HS) and Low-Skilled (LS), where the criteria for such selection was based in the competition level played in different Competitions. In order to access the HS competition, players needed to be winners of the LS competition. Comparing and contrasting both groups are in the basis of the current research study. Key words: Tennis, error, factor analysis, Received: 12 Dec 2016 Accepted: 07 Feb. 2017 Corresponding author: Daisuke Hirata Email: hiratadaisuke47@gmail.com

## **INTRODUCTION**

There are two types of error in tennis, an unforced-error (UE) and a forced-error. The unforced-error is caused in the situation the player is able to select the shot and is in control of a point or a game. On the other hand, the forced-error is characterized as a miss caused by an opponent's superior play. It is important for coaches to assist players to reduce UE in tennis.



Figure 1. Results of the causes of UE from interviews by players.

Hirata et al. (2014) found several causes of UE in collegiate women tennis players: (a) situational decision-making processes, (b) skill issues, and (c) psychological issues (see Figure 1).

There were differences in players' and coaches' perceptions of UE. It was considered that the cause of the UE was different when coaches thought the cause of player's UE. The cause of this as the UE is the variety, to know the cause of the UE of players and coaches are considered to be a valid information for coaching.

In the present study, several items representing the different elements of UE as identified in previous research (Hirata et al.,

2017; Shibahara, Tamaki, Hirata, Sonobe, Morii, & Saijo, 2015) study were developed. Subsequently, the factor structure of a measure of UE was examined to establish validity of the tool using data from women's collegiate tennis in Japan.

			Playor	
Skill Level	Number	Age(year)	Experience in Tenris (year)	Centesr Result
HS Players	89	$20.12{\pm}1.18$	12.28±2.37	Intercol egiate Lennis Champions
LS Players	194	19.64+1.21	10.49+3 31	State Tennis Tournament
Tatal	233	19.80±1.22	11.08±3-16	
			Coaches	
Skill Level	Number()=women	Agetyear)	Coaching Experience in Termis (year)	Centest Resalt of player
Coaches of HS Players	39 (9)	45.31±8.57	19.34±8.81	Intercollegiste Level
Coathes of LS Flayers	38 (4)	34.42 12.08	11.58 9 55	State Level
Fatal	77 (15)	40.04=11.61	15,49±9.92	

## Table 1. Groups details of players and coaches. METHOD

The participants included 283 of collegiate women tennis players who belonged to a university tennis team and 77 of coaches who coached women tennis players in Japan (see Table 1 for demographic details the study participants). The criteria adopted to peer up players into High skilled (HS) and low skilled (LS) was based in their participation in Japan intercollegiate tennis championship or state tennis tournament, recognizing that the access of intercollegiate tennis championship is reserved for the winners of state tennis tournament. Coaches were also organized depending on the Championship played by their athletes. Ethical approval for this study was granted by Senshu University institute of sport ethics committee.

Table 1. Groups details of players and coaches.

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Based on previous research (Hirata e al., in press; Shibahara et al., 2015), 47 items were developed representing four factors (Distraction, Delay, Hesitation, and Anxiety). Sample items from the Distraction factor were: "I played sloppy" and "I was careless". "I was too confident with my shot" and "I was uncertain with my shot selection" were sample items of the Hesitation factor. Sample items from the third factor (Delay in the ready) included: "I was slow to regain possession" and "My timing was late with my stroke". The fourth factor (Anxiety) included the following sample items: "I was unconfident with my shot" and "I was shot" and "I was unconfident with my shot".

In the measure, players responded to the following stem: Player answered to remember the cause of UE in singles game and coaches responded to the following stem: Coach answer about UE of player coached by coach.

For each item, players and coaches were asked to rate Likert scale 1-5 with 1 representing "not at all" and 5 representing "always".

The analysis of items was analysed using exploratory factor analysis (EFA) was conducted. After this initial EFA, a Confirmatory Factor Analysis (CFA) was conducted to examine the factor structure of the measure using Amos 23.0. A comparison of players' and coaches' scores were analysed by a one-way ANOVA using SPSS 23.0.

### RESULTS

The results of the EFA identified four factors contributing to UE (see Table 2).

ltems	F1	F2	F3	F4
F1 : Distraction (α=.755)				
A11 played sloppy.	.794	123	- 094	036
A21 was careless.	.678	.000	088	.056
A3 I played with not enough thought.	.652	098	.201	004
A/11 afforded too much the time before making a hit.	.618	.083	093	218
F2 : Hesitation $(\alpha = .797)$				
B11 was too confident with my shot.	160	.736	.020	.003
B21 was uncertain with my shot selection.	056	.711	.136	065
B3 I hesitated.	.091	.682	197	.205
B41 made a wreng decision.	.180	.652	074	.080
F3 : Delay in the ready ( $\alpha$ =.766)				
C1 I was slow to regain possession.	077	096	.814	.034
C2 My timing was late with my stroke.	010	.039	.691	092
C3.1 was uncoordinated to make my shot.	.055	.017	.585	04
C4 I wasn't prepared before hitting (re-load the limb).	.067	.013	.583	.101
F4 : Anxiety ( $\alpha = .748$ )				
D11 was unconfident with my shot.	165	.006	.068	.881
D2 I was anxious to play.	026	.099	.000	.710
D3 I was not aggressive enough.	.160	069	.024	.561
D4 I was nervous.	.040	.130	079	.415
Factor correlation matrix				
F1 : Distraction	1.000			
F2 :Hesitation	326	1.000		
F3 : Delay in the ready	.449	.504	1.000	
F4 : Anxiety	.323	.349	.387	1.000

Table 2. Results of Exploratory Factor analysis (EFA).

From the EFA, it was found that all four items for each of the four factors loaded appropriately onto their expected factor. Furthermore, the four factors did not show high inter-factor correlations, partially supporting construct validity. Therefore, a CFA was conducted on the same data set. In the CFA, the goodness of fit indices showed a satisfactory fit of the data to this model (GFI=.910, AGFI=.877, CFI=.901, RMSEA=.070). Therefore, there is partial support for the construct validity of

this measure of UE in tennis. The one-way Factorial ANOVA showed there were no statistical differences between the mean scores for low versus HS players for any of the four factors of UE. (see Table 3). However, there were significant differences between mean scores for coaches of HS versus LS players on three factors: Distraction (F (75) =2.26, p.<.05), Delay in the ready (F (75) =2.71, p.<.01), and Anxiety (F (75) =2.33, p.<.05).

	HS players (n=85)		LS players (n=194)		
Factors	Mean Value	SD	Mean Value	SD	F Value
Distraction	9.42	3.38	8.78	2.99	1.58
Hesitation	14.09	3.29	13.74	2.95	D.90
Delay in the ready	13.08	3.43	13.39	3.17	0.74
Anxiety	12.91	3.19	13.21	3.04	0.75
	Coaches of HS r	laver (n=30)	Coaches of LS n	laver (n=38)	
Factors	Coaches of HS p Mean Value	layer (n=39) SD	Coaches of LS p	layer (n=38) SD	F Value
Factors Distraction	Coaches of HS p Mean Value 9.82	layer (n=39) SD 2.96	Coaches of LS p Mean Value 11.45	sD 3.34	F Value
Factors Distraction Hesitation	Coaches of HS p Mean Value 9.82 14.08	layer (n=39) SD 2.96 3.22	Coaches of LS p Mean Value 11.45 13.92	8D 3.34 2.57	F Value 2.26 * 0.23
Factors Distraction Hesitation Delay in the ready	Coaches of HS p Mean Value 9.82 14.08 11.95	SID 2.96 3.22 3.72	Coaches of LS p Mean Value 11.45 13.92 14.00	8D 3.34 2.57 2.85	F Value 2.26* 0.23 2.71**

Table 3. To make a comparison between HS groups and LS groups.

An examination of the data between coaches of LS players and LS players only showed statistically different results for the Distraction factor (F (230) =4.92, p.<.05) (see Figure 2).



Figure 2. To make a comporson players and coaches of low skill group.

#### DISCUSSION

The causes of UE are considered an important issue in producing high performance in tennis. In present study, we found support for the four-factor structure of the UE measure: Distraction, Hesitation, Delay in the ready, and Anxiety. This initial examination of the psychometric structure of the UE measure has shown support for its structure, partially supporting the construct validity of UE. However, further examination of this measure is necessary to provide sufficient evidence of its reliability and validity as measure of UE.



This measure is useful for researchers and coaches because it is important for coaching that coaches identify the causes of such errors. Mainly for LS players that struggle to attribute distraction as a reason for unforced-errors. Due to the simplicity of tactics and strategies in collegiate women tennis (Hirata et al., 2005) provide more space and opportunity for distractions. The role of coaches in such contexts must recognize the n



eed to emphasize the importance to remain focus.

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