

QUALITY OF JUDGING ON THE BALANCE BEAM AT THE EUROPEAN CHAMPIONSHIP 2014

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SUMMARY

The aim of our research was to analyze the reliability and validity of judges' E scores and artistry deductions on the balance beam in the qualifying competition (C - I) of the 2014 European Championship in senior (n=89) competition. The following reliability and validity statistics were then calculated: Interclass Correlation Coefficient (ICC), Cronbach's alpha, Kendall coefficient of concordance W and repeated measures ANOVA. All data were analyzed using SPSS 20. The most of the results are satisfying, but correlations between judges for the artistry deductions are smaller than .90 so we can report that the quality of judging artistry was on the lower level comparing to the E score. The results of our investigation showed the need for better definition of the artistry deductions during the next Olympic cycle. Some of the authors suggested that computerized systems for the artistic gymnastics judging should be tested in order to reduce differences between judges.

Keywords: Artistic gymnastics, Reliability, Validity

INTRODUCTION

Balance beam is one of the most difficult apparatus in the Woman's Artistic Gymnastics. In defining exercises and skills on this apparatus it can be noticed that a large number of skills were taking over from the floor, but an important fact is that the construction of the apparatus is dictating the technique of execution. Gymnasts perform elements on the limited support area: 10 cm width, 1.25 m height and 5 m length, so balance is one of the most important skills for success and high level execution (Hars et al., 2005).

Exercising on the balance beam includes maintaining balance in different positions with legs and arms supports, movements, transitions and gymnastics elements on the balance beam, and also mount and dismount of the balance beam. During maintaining positions, optimal angles of the body segments and tonus of the muscles are very important in order to resist external forces. Position of hands and feet can also be a factor of success in secure and stabile performing and landing.

During complex, highly valued elements, gymnasts' body is moving by mechanisms associated with the laws of displacement of a body in space.

Keeping the direction of movement is crucial because of the characteristics of the balance beam. Small body compensatory movements are necessary in order to maintain balance and bring the center of gravity of the body above the support. If these movements are accompanied by additional movements of arms, legs, torso or the whole body, in order to prevent the fall off the devices, they will be sanctioned by the judges of the E (Execution) panel (FIG, 2013-2016).

Over time the balance beam has undergone various changes from the original to the bench today - a modern balance beam. The balance beam has a stand and an aluminum center. The upper surface is specially treated elastic and padded leatherette, which prevents slippage (Sands, 2000). These changes are affected by the elasticity of the balance beam, and they enabled realization of complex elements, as well as the safety in exercising and reduced number of injuries. It is essential that gymnasts have good explosive power of legs to perform elements with control. Plyometrics and progressive training helps developing explosive power and speed of the leg muscles in gymnasts (Mohamed, 2010).

According to the regulations of the International Gymnastics Federation (Code of Points, 2013-2016) evaluating of the composition on the balance beam begins with the take-off from the board or the mat. Exercise duration is 90 seconds and the end of the exercise is when the gymnast touches the mat after dismount. Ten seconds before the end of the time for exercise "gong" warns gymnasts. The deduction for overtime of the exercise is 0.10 points. After the fall off the devices gymnast has ten seconds to continue the exercise or the exercise is considered completed. This time is not included in the total duration of the exercise.

The content of the composition of the beam is evaluated by D - panel (Difficulty Value), consisting of the difficulty value of the exercises (maximum 5 acro and minimum 3 dance elements), specific requirements and the connections value. Difficulty value - DV consists of eight heaviest elements, including dismount. These values should include acrobatic elements with or without hand support and leaps, jumps, turns, "endurance" and "wave" body elements from a Code of points - table of elements.

The value of every requirement is 0.50 points and all except dismount must be performed on the balance beam. The value of the connection (CV) can be obtained only for direct connections between the elements, according to the formulas in the Code.

On the European Championship, The FIG Technical Committee is evaluating the quality of judging by evaluating E judges, calculating the difference between the final score (average score of middle 3 judges, after rejection minimal and maximal E score) and the individual judges' score. Judging system in gymnastics is influenced by several factors. One of the factors emphasize on difficulty and acrobatics association with the risk of injury. Moreover, increasing number of judges involved in judging could influence the reliability of

scores. Accordingly, the researchers have been recently looking to the bias, reliability and validity of judging. Therefore, the aim of our research was to analyze the reliability and validity of judges' E scores and artistry deductions on the balance beam in the qualifying senior competition (C - I) of the 2014 European Championship.

METHODS

Judges' E scores were obtained from the official book of results. There were five E judges and two references judges giving E score and Artistry deduction. Senior gymnasts (n=89) performed in the qualification on the balance beam. For each set of analysis we calculated statistics for the E score and Artistry item (individual judge) and scale (final E score on the competition) scores. The following reliability and validity statistics were then calculated: Interclass Correlation Coefficient (ICC), Cronbach's alpha, Kendall coefficient of concordance W (Leskošek, Čuk, Karácsony, Pajek, & Bučar, 2010). Differences in mean E scores between judges were tested using repeated measures ANOVA. All data were analyzed using SPSS 20.

RESULTS

In the Table 1 are the results of the descriptive statistics of all judges' scores. Mean E scores are normally distributed. Distributional statistics (mean and standard deviation) were calculated for raw E scores for every judge, but on the competition the minimal and maximal E score were thrown out and here we have mean score from three judges. Reference judge ER1 and ER2 have one mean score ER and only when we have big deviations between judges, then ER score inputs to calculation of the score. We put all judges into consideration in order to examine their scores, and not final score.

Table 1. Descriptive Statistics seniors						
	Mean	SD	Skew.	Kurt.	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1	7.01	1.07	-.665	.003	.926	.982
2	7.09	1.22	-.963	.716	.936	.981
3	6.96	1.07	-.292	-.210	.749	.988
4	7.16	1.05	-.631	-.296	.852	.984
5	7.15	1.13	-.840	.492	.963	.980
6	7.04	1.12	-.870	.323	.939	.981
7	7.07	1.19	-.759	.166	.950	.981
1	.2562	.08	-.135	-.285	.793	.926
2	.2303	.15	.233	-.817	.836	.917
3	.3438	.13	.516	1.558	.667	.932
4	.1854	.14	.138	-1.052	.836	.916
5	.3157	.11	.015	-.386	.802	.919
6	.2551	.11	-.301	-.113	.793	.921
7	.3876	.14	-.198	-.492	.851	.914

Table 2 shows correlations between judges' scores and Table 3 between the artistry deduction. The most of the results are satisfying, but we have smaller correlation values from .90. This score was thrown out from the calculation and didn't affect the final score at the competition, but it is important for our analysis. Correlations between judges for the

artistry deductions are smaller than .90 so we can report that the quality of judging artistry was on the lower level comparing to the E score. In the Table 4 there is the result of reliability analysis. Reliability of judges scores (Cronbach's Alpha>0.90) are on the satisfying level.

Table 2. Correlations between scores						
1	2	3	4	5	6	
.933**						
.814**	.837**					
.888**	.908**	.798**				
.953**	.958**	.857**	.902**			
.942**	.926**	.849**	.898**	.960**		
.948**	.952**	.839**	.907**	.964**	.952**	
**. Correlation is significant at the 0.01 level (2-tailed).						

Table 3. Correlations between artistry						
1	2	3	4	5	6	
.698**						
.479**	.600**					
.746**	.743**	.633**				
.704**	.741**	.550**	.717**			
.666**	.693**	.636**	.698**	.680**		
.784**	.792**	.582**	.752**	.737**	.712**	
**. Correlation is significant at the 0.01 level (2-tailed).						

Table 4. Reliability and validity measures for the balance beam E scores and artistry deductions					
	Cronbach's Alpha	ICC _{average}	ICC _{single}	Kendall's W	ANOVA F
E scores	.985	.985	.903	.040*	3.677
Artistry deductions	.931	.931	.660	.040*	84.218

DISCUSSION WITH CONCLUSION

There are numerous objective and subjective factors for these differences e.g. the number of competitors in a session, judges' seat positions and view angle to the gymnast, and the judges' experience. At the moment as there is only sum of deductions presented in the judges' score it would be advisable if E judges could be evaluated according to what deduction was taken in time of gymnast's exercise (Leskošek et al., 2010). Subjectivity of judging artistry, especially confidence, personal style and uniqueness of the gymnasts, but also insufficient variation in rhythm and tempo in movements, influenced the shown results correlations between the judges.

There have been numerous investigations about gymnastics judging so far (Bučar, Čuk, Pajek, Karacsony, & Leskošek, 2012; P. M. Bučar, 2015; Dallas & Kirialanis, 2010; Leskošek, Cuk, Pajek, Forbes, & Bucar-Pajek, 2012; Leskošek, Čuk, Karácsny, Pajek, & Bučar, 2010; Massidda & Calò, 2012; Pajek, Cuk, Pajek, Kovač, & Leskošek, 2013;

Plessner, 1999). Continuous monitoring of the quality of judging (incorporating reliability and validity) is a necessity in order to achieve reliable and objective judging (Pajek et al., 2013). Leskošek et al. (2010) define reliability as achieving the same results with several measurements of the same subject under identical conditions. A special case of reliability, called inter-rater reliability or objectivity is defined as achieving the same results from different persons who evaluate the same performance. This later aspect of reliability is especially important in gymnastics. As most of the reliability measures are based on inter-item correlations, they could not detect validity of judging, i.e. if there is any systematical bias in judging, e.g. systematical under- or overestimation of particular judge or competitors of certain nationalities. Reliability of judges scores on European Championship (Cronbach's Alpha>0.90) are on the satisfying level, similar to results of the earlier studies (Bučar et al., 2012; Bučar, 2015; Leskošek et al., 2010).

Pajek et al. (2013) published the first comparative report of reliability and validity of

judging at two major gymnastics events of different levels. Overall, for the European championship the indices of consistency are satisfactory. Except for the vault and floor all around finals and floor apparatus finals Cronbach's alpha is above 0.95, minima of item total correlations are above 0.8, and the ICC of average scores and Armor's theta coefficients are at or above 0.95, which are all good values.

The latest regulations of the International Gymnastics Federation (Code of Points, 2013-2016) emphasizes the importance of composition and artistry during exercise on the beam. The most difficult elements of acrobatics should be balanced with elements of choreography in order to create a continuous flow of unique abilities, style and personality of gymnasts during exercise. Break and pauses between the length of the beam must not be longer than one second, and it is necessary to move sideways, close to the beam and throw entire apparatus, to give the creativity in choreography. Judging on the balance beam became very difficult with inclusion of separated deductions for exercise and artistry. In the beginning of the cycle, coaches didn't pay attention on this part of the presentation, so artistry deductions were very high. E panel judges can deduct faults for Artistry of Performance that includes: confidence, personal style and uniqueness; Insufficient variation in rhythm and tempo in movements; Performance of the entire exercise as a series of disconnected elements and movements; Lack of creativity of movements and transitions; Lack of directional changes (forward, backward, sideward); Insufficient use of entire apparatus; Mount not from the table of elements and one-sided use of elements.

The results of our investigation showed the need for better definition of the artistry deductions during the next Olympic cycle. Some of the authors suggested that computerized systems for the artistic gymnastics judging should be tested in order to reduce differences between judges (Bučar et al., 2012), but artistry is the part of the score on the balance beam and the floor where human perception is necessary.

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