MODELING THE FINAL SCORE IN ARTISTIC GYMNASTICS BY DIFFERENT WEIGHTS OF DIFFICULTY AND EXECUTION

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Abstract

The aim of this research is to investigate how different calculations of the final score may change the ranking orders among gymnasts. Fourteen different calculations were taken into consideration and then compared with official results from the 2011 Men's European Championships in Berlin. The proportion between difficulty and execution scores, according to different formulas, can range from 17% to 67%. With the different proportions in the final score calculations the number of changes in rankings is high: in C1 81%, in CII 61% and in CIII 35%. The formula D score + Sum (Middle four E scores) and formula D score + Sum (Middle three E scores) have the highest impact on the changes of qualifiers towards competitions CII and CIII. The above mentioned two formulas also specifically support the Men's Code of Points (articles 15 and 20) which state that gymnast is expected to include in his exercise only elements that he can perform with complete safety and with a high degree of aesthetic and technical mastery.

Keywords: ranking, gymnasts, finals, qualifiers.

INTRODUCTION

The International Gymnastics Federation (FIG) symposium in Zürich 2011 brought into awareness the problem of the final score in Artistic Gymnastics and its proportion between difficulty and execution scores. For better understanding, some history of how the final score is calculated in gymnastics is needed. While for the competitions before World War I it is difficult to know the judging rules, we can extrapolate some of them from the published results. According to Wallechinsky (2004), in the Olympic Games (OG) 1896 only rankings are known, in the OG 1900 the all around (AA) winner scored 302 points (from 11 events, including long jump and weightlifting) and concerning other results from the early OG we cannot extrapolate the calculation system of scores.

Štukelj (1989) wrote his biography, which includes some very valuable data on how the judging was conducted between the World Championships (WC) 1922 in Ljubljana and the OG 1936 in Berlin. In the WC in 1922, gymnasts were evaluated by two judges per apparatus with a maximum score of 10 points and he scored the maximum of 20 points on parallel bars (compulsory and optional exercises). In the OG 1924, the maximum score was 11 points for exercises and the maximum scores were given to Zamporini (ITA) for his optional exercise on parallel bars, also to the optional

exercise from Štukelj (YUG) on rings and to Segiun (FRA) on compulsory vault. In the WC 1922, the jury was composed of three judges and the formula for the final score was the sum of all three scores divided by 2 plus up to one point for deportment. The maximum score of 16 points was achieved by Štukelj on his optional exercise of rings. In the OG 1928, the final score was calculated as the sum of all three judges and Mack (SUI) obtained the maximum score of 30 points on vault over pommel horse (the apparatus from that time). For the final score calculation in the WC 1930 it was again the sum of three judges divided by two plus up to 1 point for deportment and the maximum score of 16 points was achieved by Pele (HUN) for compulsory and optional exercises on high bar. Other maximum scores were obtained by Peter (HUN) and Štukelj (YUG) both on their optional exercise on high bar, also by Loeffler (TCH) for compulsory and optional exercises on rings and Primožič (YUG) on his compulsory exercise of pommel horse. In the OG 1936 the jury was comprised of four judges on each apparatus and the final score was established as 10 points. Based on the results it is hard to presume how the final score was calculated.

With the increasing number of judges involved in judging, the researchers began looking to the bias, reliability and validity of judging. It can be stated that judging is very reliable and valid (Bučar et.al. 2011, Leskošek et.al.2010).

In the OG 1948, the maximum score was 20 points per apparatus and from the OG 1952 until the OG 2004, the maximum score established was 10 points (Wallechinsky, 2004). From the OG 1936 up to OG 1988 four judges per apparatus were used (final score was the average of the middle two) and from OG 1992 up to OG 2004 six judges were used to evaluate the gymnasts' performances (final score was the average of middle four). From 2006 (FIG 2006) the difficulty (D score) has been evaluated by two judges and the exercise presentation (E score) by 6 judges (final score is the D score plus the average of

middle four E scores), and with the new rules from 2011 (FIG 2011), in the WC and OG there are two judges for difficulty, five judges for exercise presentation and two reference judges. The final score is the sum of the D score with the average of the middle three E scores.

It is interesting to analyze the calculation system of the results from different sports. The results from fights and combative sports (e.g. judo) are expressed only in Bolean value win-lose (IJF, 2003), the same for some team games e.g. basketball (FIBA, 2010), while others e.g. soccer (FIFA, 2011) have also the possibility of a third value (win-draw-lose). Swimming (FINA, 2011) and track and field (IAAF, 2010) have competitions where all the athletes start together (marathon), or compete in subgroups and the best ones continue to the next level of competition (if they achieve the required result, or win in its subgroup).

From a historical overview many different ways of calculating the final score were used to evaluate gymnastics. In the past (Fink (1986, 1991a, 1991b, 1992) Bučar, (1995)) suggested multiplying exercise presentation by D score, but it was never implemented in the official FIG competitions. This solution was used successfully at some 200 competitions in Canada between 1993 and 1996 and tested with »shadow« panels of judges in the major international competitions in Japan, Hungary and the WC 1993. The solution continues to be of interest but for wide-spread use would require the D score to be significantly lower than the computed E score – which is not the case in the current Code of Points - otherwise it is too tempting for gymnasts to increase difficulty at the expense of execution if judges evaluate both factors leniently. In any case, the political will for such a drastic change did not exist at the time.

Since OG 1936 and up to the so-called "open ended" COP (FIG, 2006), the proportion of the evaluation parameters related to the exercise content (difficulty and execution) was approximately 50:50.

With the COP (FIG, 2006), the proportion changed in favor of execution, also in accordance with the philosophy of the new COP (FIG, 2009c), which states in its article 15 and 20 that the gymnast is expected to include in his exercise only elements that he can perform with complete safety and with a high degree of aesthetic and technical mastery. Very poorly performed elements are not recognized by the D-jury and are penalized by the E-jury. According the article 20 of the COP (FIG, 2009c), the responsibility for the gymnast's safety rests entirely with him and it is required of the E jury to deduct very rigorously for any aesthetic, execution, composition and technical errors. The gymnast must never attempt to increase the difficulty or "D" score at the expense of aesthetic and technical execution.

It is worth noting the many concerns for the gymnast's health such as the increased risk that high difficulty brings if not well performed. Some sports have different proportions between content and execution (table 1) and can be from 4% (diving) up to 50% (synchronized swimming), while in AG is between 61% and 72%. According to the results of WC 2010 in Rotterdam, the proportions of the difficulty for the final score were between 36.7% and 51.4% (Table 2) .

Table 1. *Percentage of difficulty components of final scores for selected artistic sports.*

Sport	Content Components (Difficulty (D), Requirements), high level score		Performance Components (Execution (E), Artistry (A), etc), high level score		High Level Final Sc.	Difficulty % of Final Score	Final Score Calculation
Rhythmic	(Delements+Dapparatus)/2 = (10+10)/2 =10	9.5	E+A = 10+10 = 20	18	27.5	33% (50% for group)	D+2E
Acrobatic	D→10+	9.5	E+A = 10+10 = 20	18	27.5	33%	D+2E
Aerobic	D/1.9 or D/2.0→4.5+ (women 4.0+)	4.0	E+A = 10+10 = 20	18	22men, 20women	16-20%	D/2+2E
Men Artistic Gymnastics	D→7.0+	6.5	E = 10	9	15.5	42%	D+E
Women Artistic Gymnastics	WAG D →6.0+	5.5	E = 10	9	14.5	37%	D+E
Trampoline Routine 2 with Time of Flight (TF)	Dmen→16+, Dwomen→1.5+	15	E+E+E+TF =10+10+10+17≈ 47	44	60men 55women	25%	D+3E+TF Routine 1 has much lower D (≈3.0) and higher E (= 47) → D = 6%
Double Mini Trampoline	Dmen→9+,		E+E+E = 10+10+10 = 30	27	38men	20-25%	D+3E
	Dwomen→6.5+		E+E+E = 10+10+10 = 30		35 women	15-20%	D+3E
Tumbling	Dmen→11+, Dwomen→7.0+		E+E+E = 10+10+10 = 30	26	38 men 34women	20%	D+3E
Diving	D→3.5+	3.0	5of7X3/5=E+E+E = 30	25	75	4%	Equivalent to Dx3E Note multiplication
Synchronized Swimming	Technical Merit = 5x10	45	Artistic = 5Ex10 = 50	45	90	50%	D+E
Aerial ski	D→4.5+	4	3of5 Air=7+Land= 3x3=3E=30	25	100	5%	Equivalent to Dx3E Note multiplication

Table 2. *Proportion between difficulty and final score (proportion = difficulty/final score) (CI) at WC Rotterdam 2010.*

MAG	WorldChampion	Range of Difficulty %
Floor	42.0%	40.1% - 46.3%
P. Horse	42.3%	41.1% - 44.5%
Rings	42.8%	41.8% - 43.9%
Vault	42.6%	41.3% - 43.4%
P. Bars	42.0%	39.5% - 45.4%
H. Bar	46.4%	44.5% - 51.4%
WAG		
Vault	39.8%	36.7% - 41.5%
U. Bars	43.2%	40.9% - 48.6%
B. Beam	42.3%	40.5% - 45.1%
Floor	39.8%	37.7% - 45.7%

The aim of our work is to investigate how different final score calculations may change the ranking orders among gymnasts and to identify the most effective variations.

METHODS

Our sample was comprised by gymnast's scores from the European Championships 2011, both men and women, during the qualification round (CI), all around finals (CII) and during event finals (CIII) on all men's apparatus (deductions from judges chair were not evaluated) . On each apparatus the jury was composed by 2 D judges and 6 E judges.

We used the following formulas for calculating the final score:

1. A1 - D score + Average ((Middle four (E judge1:E judge6))(Escore < 10)
2. A2 - D score + Average (Middle two E judge1:E judge6) (Escore < 10)
3. A3 - D score + Sum (Middle two E judge1:E judge6) (Escore < 20)
4. A4 - D score + Sum (Middle four E judge1:E judge6) (Escore < 40)
5. A5 - D score + 2 x Average ((Middle four (E judge1:E judge6)) (Escore < 20)

6. A6 - D score + 3 x Average ((Middle four (E judge1:E judge6)) (Escore < 30)
7. A7 - D score x Average (Middle four (E judge1:E judge6)) (Escore < 10)

To simulate the current official size of the jury's panel for OG and WC which is composed of 2 D judges and 5 E judges we removed all the scores from the judge number 6 and the final score was calculated according the following formulas:

8. B1 - D score + Average ((Middle three (E judge1:E judge5)) (Escore < 10)
9. B2 - D score + Average ((E judge1:E judge5)) (Escore < 10)
10. B3 - D score + Middle score (E judge1:E judge5) (Escore < 10)
11. B4 - D score + Sum (Middle three score (E judge1:E judge5)) (Escore < 30)
12. B5 - D score + 2 x Average ((Middle three score (E judge1:E judge5)) (Escore < 20)
13. B6 - D score + 3 x Average Middle three score (E judge1:E judge5)) (Escore < 30)
14. B7 - D score x Average Middle three score (E judge1:E judge5)) (Escore < 10)

We established the rankings of each gymnast based on their final score according to different formulas and analyzed the

number of changes compared to the ranking based on the official method for calculating the final score. In the C1 we also separately observed the number of changes in rankings among the top 8 (qualification for apparatus final) and top 24 gymnasts (qualification all around final), and determined the Kendall Tau b rank correlations between all new versions of the final score. Between the number of changed qualifiers for CII and CIII and the average proportion between difficulty and execution the Pearson correlation was calculated. All the results were calculated in MS Excel.

RESULTS

The analysis showed that the differences between all apparatus, in most cases the proportion between difficulty and execution is similar regardless of the formula we used to calculate the final score; it changes significantly when we use formulas with more weight on execution. The lowest proportion observed was with formula A4= D score + Sum (Middle four E judge1: E judge6), where the proportions ranged between 0.16 (parallel bars) and 0.18 (pommel horse), followed by A6 and B4 with proportions between 0.21 (parallel bars) and 0.24 (pommel horse) and A3 and B5 with proportions between 0.32 (parallel bars) and 0.35 (pommel horse).

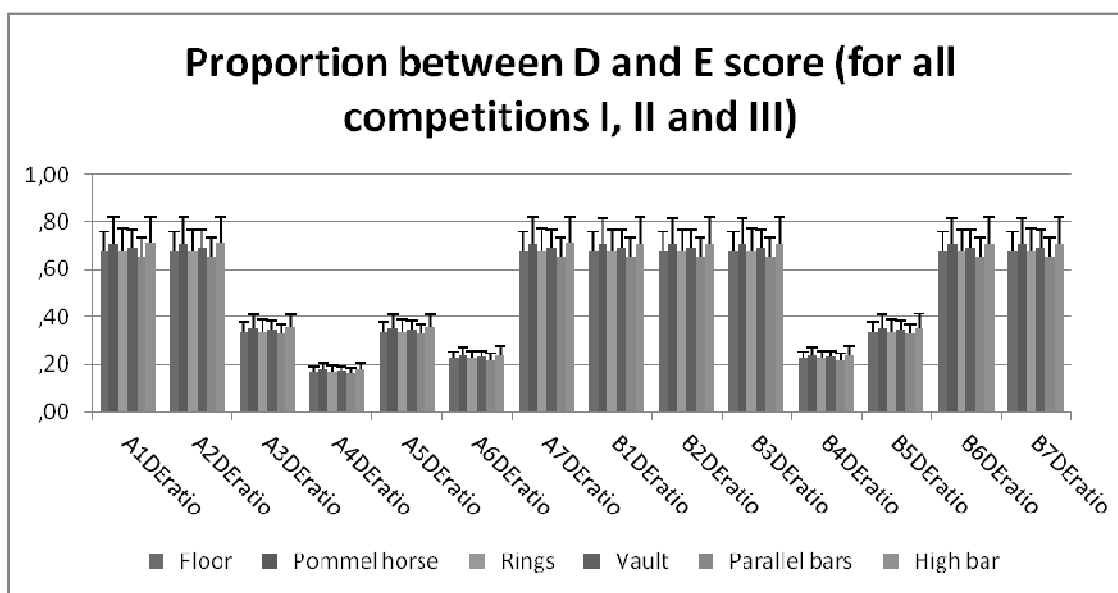Figure 1. *Proportion between D and E score (results from all competitions I, II and III).*

With these observed changes in the proportions, there appeared also a significant change in the rankings of all apparatus in all competitions (Table 3). In general

most of altered rankings would occur in CI, then in CII and at last in CIII. The most stable rankings would be in CIII, but still with notably changes.

Table 3. *Percentage of changes in rankings compared to the official results.*

Comp.	apparatus	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	XA
	Floor	63%	94%	89%	90%	84%	83%	63%	76%	82%	93%	91%	88%	85%	83%
	Pommel horse	46%	90%	99%	94%	99%	78%	62%	63%	77%	94%	87%	82%	80%	81%
	Rings	51%	89%	95%	85%	89%	78%	67%	68%	76%	94%	90%	83%	85%	81%
CI	Vault	56%	95%	94%	94%	95%	78%	53%	63%	77%	96%	94%	91%	87%	82%
	Parallel bars	47%	90%	96%	92%	91%	90%	60%	64%	70%	92%	91%	87%	90%	82%
	High bar	56%	96%	92%	94%	91%	80%	55%	56%	66%	92%	93%	84%	83%	80%
	Total	53%	92%	94%	92%	92%	81%	60%	65%	75%	93%	91%	86%	85%	81%
	Floor	33%	83%	88%	96%	88%	33%	38%	33%	42%	75%	79%	50%	71%	62%
	Pommel horse	29%	79%	83%	71%	88%	38%	25%	54%	42%	83%	79%	50%	54%	60%
	Rings	50%	71%	92%	63%	83%	63%	42%	50%	63%	88%	79%	46%	58%	65%
CII	Vault	29%	63%	75%	71%	58%	29%	33%	46%	50%	83%	71%	50%	63%	55%
	Parallel bars	29%	67%	88%	71%	71%	46%	33%	29%	54%	75%	67%	46%	54%	56%
	High bar	25%	79%	88%	83%	88%	63%	50%	46%	46%	83%	83%	75%	75%	68%
	Total	33%	74%	85%	76%	79%	45%	37%	43%	49%	81%	76%	53%	63%	61%
	Floor	25%	63%	88%	75%	100%	38%	50%	50%	50%	75%	75%	13%	38%	57%
	Pommel horse	0%	0%	0%	0%	0%	25%	13%	0%	25%	13%	13%	38%	38%	13%
	Rings	13%	38%	50%	50%	50%	0%	13%	0%	38%	50%	38%	0%	38%	29%
CIII	Vault	19%	44%	31%	31%	31%	0%	31%	19%	38%	56%	56%	25%	31%	32%
	Parallel bars	0%	38%	63%	38%	63%	25%	13%	0%	25%	63%	50%	25%	38%	34%
	High bar	25%	50%	75%	50%	75%	25%	25%	25%	38%	75%	88%	25%	50%	48%
	Total	14%	39%	48%	39%	50%	16%	25%	16%	36%	55%	54%	21%	38%	35%
	Floor	55%	90%	89%	90%	86%	71%	57%	66%	72%	88%	88%	76%	79%	77%
	Pommel horse	40%	83%	90%	83%	90%	67%	52%	57%	67%	87%	81%	73%	72%	72%
	Rings	48%	82%	91%	78%	86%	70%	58%	60%	71%	90%	85%	70%	77%	74%
Total	Vault	48%	84%	84%	84%	82%	62%	48%	56%	69%	90%	86%	78%	77%	73%
	Parallel bars	40%	82%	92%	85%	85%	77%	52%	53%	64%	87%	84%	75%	80%	74%
	High bar	48%	89%	90%	89%	89%	73%	52%	52%	60%	89%	91%	79%	79%	75%
	Total	46%	85%	89%	85%	86%	70%	53%	57%	67%	88%	86%	75%	77%	74%

Table 4. *Number of different gymnasts qualified for C II and C III.*

	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7
All around	0	2	4	2	4	1	1	1	1	3	2	1	1
Floor		2	4	2	3			1		3	2		
Pommel horse	1	3	3		3	1	1	1	1	2	2	1	1
Rings		2	2	1	2		1	1		2	2	1	1
Vault	1	1	5	4	4			1		3	3		
Parallel bars	1	1	2	1	2	1	1	1		1	1	1	2
High bar		3	4	1	3	1	1	1	1	3	3	1	1
Total	3	12	20	9	17	3	4	6	2	14	13	4	5
Difficulty/Execution)	.69	.35	.17	.35	.23	.69	.69	.69	.69	.23	.35	.69	.69

$r_{total/(difficulty/execution)}$= -0.95; p<0.01

Table 5. *Kendall tau b correlation coefficient (τ_b or τ_c) for the official scores (A1) with all other calculated scores (all apparatus and competitions).*

Comp.	apparatus	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7
CI	Floor	.984	.86	.76	.86	.79	.92	.98	.97	.96	.79	.85	.91	.91
	Pommel horse	.990	.90	.82	.90	.85	.95	.98	.98	.97	.84	.89	.94	.94
	Rings	.987	.89	.79	.89	.82	.94	.98	.98	.97	.83	.89	.94	.93
	Vault	.988	.85	.71	.85	.76	.94	.986	.98	.97	.76	.84	.93	.92
	Parallel bars	.986	.83	.69	.84	.75	.91	.983	.98	.96	.75	.84	.91	.90
	High bar	.985	.81	.65	.81	.71	.91	.984	.97	.97	.71	.81	.91	.90
CII	Floor	.97	.83	.71	.86	.76	.95	.97	.98	.94	.75	.85	.92	.88
	Pommel horse	.97	.86	.68	.86	.74	.92	.982	.94	.95	.71	.81	.91	.89
	Rings	.96	.83	.63	.82	.67	.91	.96	.96	.96	.67	.77	.93	.93
	Vault	.98	.86	.74	.90	.81	.96	.981	.96	.97	.80	.88	.96	.93
	Parallel bars	.984	.86	.77	.86	.81	.93	.95	.97	.94	.80	.83	.91	.87
	High bar	.983	.82	.56	.80	.67	.91	.95	.96	.96	.63	.74	.92	.92
CIII	Floor	.96	.38	.22	.37	.25	.91	.74	.70	.68	.33	.37	.982	.91
	Pommel horse	1	1	1	1	1	.93	.982	1	.96	.982	.982	.91	.91
	Rings	.982	.91	.86	.86	.86	1	.982	1	.93	.86	.91	1	.91
	Vault	.987	.94	.95	.95	.95	1	.97	.98	.97	.92	.92	.97	.97
	Parallel bars	1	.91	.79	.91	.79	.93	.982	1	.94	.84	.86	.93	.91
	High bar	.93	.47	.29	.40	.29	.93	.93	.93	.74	.33	.50	.93	.86

Table 6. *Kendall tau b correlation coefficient for all scores (all apparatus and competitions, N=775) (all correlations are significant, p<0.01).*

	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7
A1	1	0.98	0.88	0.79	0.89	0.83	0.95	0.98	0.98	0.96	0.82	0.88	0.94	0.94
A2		1	0.89	0.78	0.88	0.82	0.94	0.97	0.97	0.97	0.82	0.88	0.94	0.94
A3			1	0.90	0.97	0.93	0.83	0.88	0.88	0.88	0.93	0.96	0.83	0.83
A4				1	0.90	0.96	0.74	0.79	0.79	0.78	0.94	0.89	0.73	0.73
A5					1	0.94	0.83	0.88	0.88	0.88	0.93	0.97	0.83	0.83
A6						1	0.78	0.83	0.83	0.82	0.96	0.93	0.77	0.77
A7							1	0.94	0.94	0.93	0.77	0.83	0.98	0.97
B1								1	.983	0.97	0.83	0.89	0.95	0.94
B2									1	0.97	0.83	0.89	0.94	0.94
B3										1	0.83	0.88	0.94	0.95
B4											1	0.94	0.78	0.77
B5												1	0.83	0.83
B6													1	0.98
B7														1

The changes in rankings from CI are most important due to the qualification of gymnasts to the CII and CIII finals. While for the CII finals few changes were observed (Table 4) with a maximum of 4 different qualified gymnasts (which represents only 16 %), concerning the qualifiers for CIII the picture is quite different where we found an apparatus with 5 different finalists of a total of 8 (62.5%).

The Kendall tau b correlations of the official scores with other (simulated) scores (Table 5) are progressively lower from CI to CII to CIII. In this sense, it can be supposed that pommel horse already has very high demands on execution, while floor and high bar tend to have a higher disproportion between execution and difficulty.

From Table 5 it can be stated that the A4 formula differs most from the others as it has the lowest correlations.

DISCUSSION

Defining the final score in gymnastics is a matter for the Technical Committees to decide and is therefore a political question. In the Code of Points it is emphasized that the exercise presentation is the most important part and it should never be compromised for difficulty. In the practice of competitions we often see exactly the opposite philosophy from gymnasts and their coaches. At this moment, the proportion between difficulty and execution is, on some apparatus, already above 70% (pommel horse, high bar)(Figure 1). If we look at other sports it is clear that the most risky sports (diving, aerial skiing) have very low contributions from difficulty towards the final score while the most aesthetic sports (synchronized swimming, rhythmic gymnastics) have a more balanced proportion between difficulty and execution. As artistic gymnastics is more similar to risky sports due to the difficult acrobatic elements performed (e.g. triple saltos) it is probably only for historical reasons (Bučar, 1998) that the difficulty and execution are balanced since in the past the difficulty elements were much less risky than today.

The Technical Committees were always aware of the importance of risk and difficulty as they expanded the original range of elements from A to C, to include first CR, bonus points for risky elements (FIG, 1979), later introduced the D value and ever further so that at the moment the range goes to G elements (FIG, 2009). With this expanded range of difficulty the proportion between execution and difficulty remained at 50:50 until the COP 2006 with a new formula for the final score calculation. Despite lowering the proportion of difficulty, the coaches continued the drive towards more difficult exercises while execution remained one step behind. Even from the latest World Championships (2011) it is hard to tell which strategy is better. Whereas on floor exercise it is definitely better to perform exercises with minimum errors (1. KOSMIDIS Eleftherios, GRE, 6.600/9.100; 2. UCHIMURA Kohei, JPN, 6.500/9.033; 3. PURVIS Daniel, GBR, 6.500/8.866), on the high bar it seems that difficulty matters more (1. ZHANG Chenglong, CHN, 7.500/8.666; 2. ZONDERLAND Epke, NED, 7.300/8.733; 3. HAMBUECHEN Fabian, GER, 7.100/8.866) (Longines, 2010).

If the gymnastics did not have such a limited number of places in the finals and would just declare the best gymnasts after the qualification round, the method of calculating the final score would not be so important. With the finals by apparatus and all around it matters much more and the ranking in the top 8 or 24 is essential. All the others are out of the competition. For the gymnast ranked in 50th place on high bar a possible change on the ranking is not very frustrating compared to the gymnasts who classified 9th or 10th. The number of changed positions to enter in the apparatus finals is correlated with the proportion between difficulty and execution (table 5), the correlation is very high and negative, which means that a lower proportion between difficulty and execution would often place different gymnasts in the finals. In reality, with a different calculation of the final score, the articles 15 and 20 from COP

(FIG, 2009c) would really have effect. Similar but with fewer changes is the effect on the AA qualifiers.

When comparing the level of competitions, the percentage of rankings which have changed from competition CI (81%), CII (61%) and CIII (35%) decreased. In the apparatus finals, the most stable rankings are those from the apparatus without bonus points for connection (pommel horse, rings, vault, and parallel bars); while in the CI and CII the rankings are similar for all apparatus.

It is important to note that A4 and B4 versions of the final score calculation presented the lowest correlation with others, which shows a really different kind of final score calculation.

CONCLUSIONS

The ideal or preferred system for final score calculation is a matter of political decisions. We compared 14 different models for calculating the final scores, whose characteristics are:

- The proportion between difficulty and execution ranged between 17% and 67%.

- With different final score calculations, the rankings changed severely in C1 (81%), CII (61%), CIII (35%) depending on the calculation method chosen.

- Floor exercise and high bar (CIII) were the apparatus with more changes in the rankings (apparatus where connection bonus points are awarded), It is worth noting that these two apparatus are the most risky ones (it would be important to monitor similar modeling at other competitions to prove if this effect is only because of the connection bonus rules).

- Kendall tau b correlations between different ways of final score calculation are significant and range from low (A4) to very high ones (A3).

- The most different calculation models are A4 - D score + Sum (Middle four E scores) and B4 - D score + Sum (Middle three score)

- The number of changes in the rankings was more severe with formulas A4 and B4 which have the lowest proportion between difficulty and execution,

- With A4 and B4 more changes would also occur in CII and CIII qualifiers.

- With formulas A4 and B4, the expectations stated in articles 15 and 20 from COP (FIG, 2009c) could be more closely observed.

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