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Injury Prevention for B-Boys and B-Girls in Breaking via Time-Motion Analysis

Alberto Pérez-Portela [1], Adrián Paramés-González [1], Iván Prieto-Lage [1,*], Juan Carlos Argibay-González [1], Xoana Reguera-López-de-la-Osa [2,*] and Alfonso Gutiérrez-Santiago [1]

[1] Observational Research Group, Faculty of Education and Sport, Universidade de Vigo, 36005 Pontevedra, Spain; bertinosxd@gmail.com (A.P.-P.); aparames@uvigo.es (A.P.-G.); juan.carlos.argibay@uvigo.es (J.C.A.-G.); ags@uvigo.es (A.G.-S.)

[2] Education, Physical Activity and Health Research Group (Gies10-DE3), Galicia Sur Health Research, Institute (IIS Galicia Sur), SERGAS-UVIGO, 36208 Vigo, Spain

* Correspondence: ivanprieto@uvigo.es (I.P.-L.); xreguera@uvigo.es (X.R.-L.-d.-l.-O.)

Abstract: Time-motion analysis has been used to quantify the external load of competition and as a strategy to prevent injuries. The objectives of this study were to determine the external load of competition in breaking, using time-motion analysis, and to establish a battle model to help determine training load and prevent injuries. Using observational methodology, we analysed all the battles of 56 b-boys and 56 b-girls who participated in the Red Bull BC One from 2018 to 2021 (n = 112). To obtain the results we used different analysis techniques. The significance level established was $\rho \leq 0.05$. The results show that the time and sequence values have increased in recent years. The total battle time reaches 195 s for bboys and 170 s for bgirls. Men show greater strength and explosiveness, with higher values in total time and sequentiality, using more powermove. Women have higher split time values, showing greater endurance in the movements and using more footwork. The first two rounds have the longest duration for both sexes and the most used categories are also the most injurious in this discipline. Women use less powermove than men and have a lower injury rate. With these results, breaking professionals will be able to elaborate adequate training for their athletes. We conclude that there are significant differences between sexes when it comes to dancing, diminishing as the tournament progresses. We propose a model of temporal and sequential structure individualised by sex. The most damaging elements of breaking (powermove and footwork) should be taken into account when analysing the results and preparing the athletes.

Keywords: breaking; time-motion; gender; dance; hip-hop; injury prevention; performance

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1. Introduction

In breaking, the effort of the athletes and their rest are of indeterminate duration. While one artist intervenes (makes the effort), the other rests (pauses), and then the roles are exchanged. The effort time of the dancer implies the pause time of the opponent [1]. The pauses and actions performed by the athlete condition the effort and determine the movements to be performed by the opponent so fatigue depends on the number of rounds and the opponent's strategy. Knowing all these attributes of the dancers implies a knowledge of the load of the competition, which in turn will help to determine the most appropriate training structure and load for the athlete. For this reason, numerous authors [2] have attempted to quantify these demands by determining a temporal structure, which defines the distribution of effort and recovery times. This knowledge makes it possible to create training sessions that simulate the demands athletes are subjected to during competition, minimizing the risk of injury afterwards [3].

It is not surprising that time-motion analysis has been successfully carried out in numerous disciplines: racket sports [4], combat sports [5], team sports [6], individual sports [7], etc. This type of study would allow us to know the movements and efforts made by the athletes, i.e., the competition load.

Therefore, we consider it a priority to know the competitive load of breaking, as it will allow us to conveniently adjust the workload while training. And it is even more crucial if we consider that an inadequate training load can cause a high incidence of injuries [8]. For this reason, proper control of training loads can help to minimize risks. Thus, research has studied time-motion analysis as a tool to quantify external competition load [9]. Furthermore, time-motion analysis has determined the risk of injury in sports [10] and has been presented as a strategy to prevent injuries [11].

Physical activity is very beneficial for health, but, if not performed properly, it can lead to injuries [12]. Studies on the epidemiology of injuries in breaking [13–16] show that in this discipline, athletes push their bodies to the limit, performing ballistic and potentially injurious movements [17,18]. These injuries can be caused, among many other factors, by excessive physical load [19] or poor-quality movement patterns [20]. Thus, the quality of the movement patterns is an accurate predictor of injury risk [21]. Furthermore, quantifying the load of competition is essential to developing appropriate training programmes and reducing the risk of injury [22]. Also, there are differences between the sexes when it comes to training. Men have a better response to strength and hypertrophy training while women benefit especially from aerobic training. It should be noted that the greatest differences between sexes are found in those sports disciplines that require peaks of maximal strength, explosive strength, or a combination of maximal aerobic and glycolytic-anaerobic capacity. Breaking meets all these factors [16]. Biologically, there are also differences in motor skills and abilities between sexes [23]. Knowing this, the planning and load in the training of bboys and bgirls should be individualised both by sex and by the specific skills and qualities of each performer. In terms of injuries, both men and women will benefit equally from physical preparation and strength training, improving their capabilities and reducing the risk of injury [16,17]. However, it is true that women seem to have a faster recovery capacity than men and less chance of injuring themselves when it comes to breaking [17,23]. This may have to do with one of our hypotheses about using powermoves.

Our first hypothesis is that there are significant differences between men and women when dancing. The second hypothesis of the research is that women have a lower injury rate because they use less powermove than men, which is the most damaging element of breaking [17]. Our last hypothesis is that the timing and sequences of breaking have evolved towards higher energy demands.

For all these reasons, the objectives of the present research are to specify the external load of competition in breaking using time-motion analysis, express the movements performed by these athletes and their duration, as well as to discuss their evolution in recent years.

We also want to establish a battle model for both sexes to help determine the most appropriate training load for these "sport artists" to prevent injuries in this new sport.

2. Materials and Methods

2.1. Design

We conducted an observational study to determine the temporal and sequential structure of b-boys and b-girls during breaking. To do so, we used observational methodology [24]. The observational design [25] employed was nomothetic (all battles/outs), follow-up (analysing behaviours in the battles throughout the championship), and unidimensional (analysing a single level of response). Several decisions about the participants, the observation and recording instruments, and the analysis procedure are derived from this observational design style.

2.2. Participants

The sample consisted of all b-boys and b-girls who had participated in four Red Bull BC One tournaments from 2018 to 2021. The year 2018 was the first year where the female modality competed separately from the male modality, a structure maintained until today. In total 112 subjects participated (n = 56 male dancers, n = 56 female dancers). In all tournaments, 16 male and 16 female dancers competed, except in 2020 where, due to COVID-19, 8 b-boys and 8 b-girls took part. A total of 104 battles were analysed (52 male and 52 female). Informed consent of the participants was not required [26] because the data were not generated by experimentation and the video material was obtained secondarily (from the official Red Bull BC One Youtube channel). The study was approved by the Ethics Committee of the Faculty of Education and Sport Science (University of Vigo, Application 02/0320).

2.3. Instruments

To carry out this study, we developed an ad hoc observational instrument (see Table 1) that allowed us to efficiently analyse the movements of men and women in all the tournaments. This instrument consists of a comprehensive and mutually exclusive category system [24] called Observed Temporal System for Breaking v2—OTSB v2, and it is a revision of another instrument used in a pilot study [1]. The categories of the instrument were reassigned by considering Trivium, the assessment system selected for the Paris 2024 Olympic Games [27]. The construct validity of the instrument was assessed through its consistency with the theoretical framework [28] and through consultation with three experts in breaking who had to show their degree of agreement with the instrument, reaching a satisfaction rate of 95%. The data were recorded using LINCE PLUS v2.0 software [29].

Table 1. Observational instrument. Observed Temporal System for Breaking v2 (OTSB v2).

Category	Subcategory	Code	Description
TOPROCK		TR	It encompasses any movement executed while standing to keep up with the rhythm of the music or the beats that the song marks. It usually marks the beginning of a round.
DOWNROCK	Drop	D	A short transition that involves changing from toprock to another move (usually within downrock) and is used to reach the floor originally. Usually, it follows the beat.
	Footwork	FW	Movements on the floor using feet and hands as support. It can follow the beat directly or not, and it has multiple levels and approaches. It is not essential to be constantly touching the floor with an extremity. Floorrock is one of the common levels of footwork, movements that are in direct touch with the floor, on the back, chest, shoulders, etc.
	Spin	S	Every spin with a minimum of 360 degrees while on the floor is considered a spin. When the breaker spins several times in the same move, it becomes part of the family of powermoves.
	Powermove	PM	An explosive and complex set of fine movements using centrifugal power and dynamic balance. They have more than one axis of action (sagittal, longitudinal, and transversal) and often lead to a circle. All those movements of 1 to 4 support have the possibility of an aerial phase and a reception while moving. They can follow the beat or not, and they can be linked in combos that we will register as several powermoves in a row.
	Blowup	BU	Combinations of fast and unexpected movements that surprise within the set of the dancer. They can contain freezes, powermoves, or flips.
	Acrobatic	AC	It includes all movements without floor contact and has a well-defined aerial phase. Flips and gymnastic stunts are a strictly within this definition. It can follow the beat or not.
	Transition	T	The main function of these movements is to link between different categories. It depends on the imagination of the dancer, adding originality and creativity to the round.
FREEZE		FR	Poses in which the dancer stops moving completely in the middle of a set. It provides control and pace to a dancer´s round. Inside the freezes, there can be tricks or combos that we register as several freezes in a row. They can follow the beat or not.

2.4. Procedure

After training with the instruments described above and following the methodological recommendations of other authors [24], two expert observers performed pre-registration reliability tests with the LINCE PLUS software. To perform a rigorous recording [30] we controlled the quality of the recorded data by calculating the intra- and inter-observer agreement using Cohen's kappa coefficient [31] calculated with the LINCE PLUS software. The calculation of the kappa coefficient was applied in concordance to all the categorical variables of the observation instrument, obtaining the mean value of all of them. This calculation was carried out with subjects who did not belong to the study sample in a number equivalent to one-third of the final sample (n = 35). First, we calculated intra-observer agreement, achieving kappa values of 0.92 and 0.94 for observers 1 and 2, respectively. Secondly, we calculated inter-observer agreement, achieving a kappa value of 0.89. After passing the reliability tests, data recording was performed by observer 2.

We looked at all the battles. The b-boys' battles have 6 (3 per dancer) and the b-girls' battles have 4 rounds (2 per dancer, except for the final, which has 3 rounds, and the 2020 tournament, which had 3 rounds due to fewer participants). We recorded the duration and the movements performed individually by each athlete. After analysing all the battles, we created an Excel file with the sequencing and timing of all the movements studied. The versatility of this file allowed us to carry out successive transformations for the different analyses.

Finally, knowing the study results, we elaborated a "type" model of the temporal structure of the battle in men and women. These models were built by the consensus of a breaking expert and a time-motion expert with ample experience in constructing other temporal structure models [1].

2.5. Data Analysis

For all statistical analyses, we used IBM- Statistical Package for the Social Sciences, version 25.0 (IBM-SPSS Inc., Chicago, IL, USA). We performed a general descriptive analysis and other stratified analyses by sex, by phase of the competition (top 16, top 8, semifinals, and finals), by rounds of the battle (rounds 1 to 6), and by competitive periods (2018–2019 and 2020–2021) for each of the variables under study, using measures of central tendency (mean and standard deviation). The normality of the sample was tested using the Kolmogorov–Smirnov test (with the Lilliefors correction) for variables with more than 50 cases and with Shapiro–Wilk for variables with 50 or fewer cases. To determine the existence of differences between men and women, and between both competitive periods, a t-test for independent samples (when the sample was normal) or a Mann–Whitney U-test (when the sample was non-normal) was performed. To detect differences between the different rounds (rounds 1 to 6), the Kruskall–Wallis test was used, confirming that, in this case, the sample was non-normal. The significance level was set at $p \leq 0.05$. In addition, we calculated the effect size by Cohen's d when the sample was normal and by Hedges' g when the sample was non-normal, considering the following values: d or g < 0.2 (null), d or g = 0.2–0.49 (small), d or g = 0.5–0.80 (moderate) and d or g > 0.8 (large).

3. Results

3.1. Analysis of the Temporal and Sequential Parameters of the Breaking Battles: General Description by Sex, and Comparison between Sexes

In Table 2, we introduce a description of the temporal and sequential parameters of the breaking battles. The data are presented generically and stratified by sex, as well as with a comparison between b-boys and b-girls. When we compare both sexes (effect size in brackets), the results reveal that the overall temporal parameters show significant differences in seven variables (with higher values for men): total battle time (moderate), drop (small), spin (large), powermove (large), blowup (moderate), transition (moderate), and freeze (moderate). In the overall sequential parameters, significant differences were found in nine variables (with higher values in men): total number of elements (large), toprock (large), drop (moderate), footwork (large), spin (large), powermove (large), blowup (large), transition (moderate), and freeze (large). In the partial temporal parameters, we found significant differences in six variables (with higher values in women): single-element time (large), toprock (large), footwork (large), powermove (large), blowup (moderate), and freeze (small).

Table 2. Analysis of the temporal and sequential parameters of the breaking battles: general description (Total), by sex (men and women), comparison between sexes, and effect size.

Study Variables	Nor	Total					Men					Women					Comparison		Cohen's d or Hedges' g
		n	Mean	SD	CI-Low	CI-Up	n	Mean	SD	CI-Low	CI-Up	n	Mean	SD	CI-Low	CI-Up	t or U	*p*	d or g
GTP																			
Battle Time	Yes	104	182.52	34.24	175.86	189.18	52	194.98	32.85	185.84	204.13	52	170.06	31.17	161.38	178.74	3.969	0.000	0.778
Toprock Time	No	104	58.43	18.50	54.84	62.03	52	58.85	21.00	53.00	64.69	52	58.02	15.81	53.62	62.42	1305.500	0.762	
Drop Time	No	104	7.28	3.07	6.68	7.88	52	8.02	3.07	7.16	8.87	52	6.54	2.91	5.73	7.35	909.500	0.004	0.491
Footwork Time	Yes	104	67.38	20.30	63.44	71.33	52	66.19	23.11	59.76	72.63	52	68.58	17.18	63.79	73.36	−0.597	0.552	
Spin Time	No	82	4.29	3.89	3.44	5.15	46	5.70	4.43	4.38	7.01	36	2.50	1.96	1.84	3.16	401.000	0.000	0.887
Powermove Time	No	101	14.78	9.42	12.92	16.64	52	18.62	10.41	15.72	21.51	49	10.71	6.09	8.97	12.46	652.500	0.000	0.913
Blowup Time	No	81	7.70	4.82	6.64	8.77	49	8.92	5.27	7.40	10.43	32	5.84	3.33	4.64	7.05	507.000	0.007	0.661
Acrobatic Time	No	45	2.60	2.06	1.98	3.22	27	2.89	2.31	1.98	3.80	18	2.17	1.58	1.38	2.95	205.500	0.365	
Transition Time	No	104	10.60	6.29	9.37	11.82	52	12.42	6.35	10.66	14.19	52	8.77	5.73	7.17	10.37	884.000	0.002	0.600
Freeze Time	No	104	14.14	6.29	12.92	15.37	52	16.17	6.57	14.34	18.00	52	12.12	5.33	10.63	13.60	812.500	0.000	0.673
GSP																			
Number of elements	Yes	104	64.15	18.34	60.59	67.72	52	77.98	13.09	74.34	81.62	52	50.33	10.88	47.30	53.36	11.718	0.000	2.281
Number of Toprock	No	104	8.44	2.66	7.92	8.96	52	9.58	2.61	8.85	10.30	52	7.31	2.20	6.69	7.92	708.000	0.000	0.932
Number of Drop	No	104	7.31	2.91	6.74	7.87	52	8.21	3.17	7.33	9.09	52	6.40	2.31	5.76	7.05	861.500	0.001	0.647
Number of Footwork	No	104	14.99	4.54	14.11	15.87	52	17.12	4.86	15.76	18.47	52	12.87	2.96	12.04	13.69	607.000	0.000	1.049
Number of Spin	No	82	2.87	2.06	2.41	3.32	46	3.65	2.18	3.00	4.30	36	1.86	1.36	1.40	2.32	346.500	0.000	0.951
Number of Powermove	No	101	10.38	7.25	8.95	11.81	52	14.06	7.74	11.90	16.21	49	6.47	3.94	5.34	7.60	465.500	0.000	1.216
Number of Blowup	No	81	2.46	1.52	2.12	2.79	49	3.04	1.59	2.58	3.50	32	1.56	0.80	1.27	1.85	364.000	0.000	1.093
Number of Acrobatic	No	45	1.62	1.19	1.26	1.98	27	1.78	1.31	1.26	2.30	18	1.39	0.98	0.90	1.88	196.000	0.191	
Number of Transition	No	104	8.38	4.48	7.51	9.26	52	9.94	4.67	8.64	11.24	52	6.83	3.71	5.79	7.86	803.000	0.000	0.733
Number of Freeze	No	104	10.08	4.06	9.29	10.87	52	12.06	4.04	10.93	13.18	52	8.10	2.99	7.26	8.93	548.500	0.000	1.107
PTP																			
Element Time	No	104	3.04	0.82	2.88	3.20	52	2.58	0.64	2.40	2.75	52	3.50	0.73	3.30	3.70	510.000	0.000	−1.340
Toprock Time	No	104	7.43	2.61	6.93	7.94	52	6.37	2.24	5.74	6.99	52	8.50	2.52	7.80	9.20	711.500	0.000	−0.888
Drop Time	No	104	1.08	0.27	1.02	1.13	52	1.04	0.19	0.98	1.09	52	1.12	0.32	1.03	1.21	1248.000	0.143	
Footwork Time	No	104	4.70	1.44	4.42	4.98	52	3.96	1.15	3.64	4.28	52	5.44	1.32	5.07	5.81	529.500	0.000	−1.186
Spin Time	No	82	1.52	0.97	1.31	1.74	46	1.59	1.02	1.28	1.89	36	1.44	0.91	1.14	1.75	762.500	0.456	
Powermove Time	No	101	1.51	0.77	1.36	1.67	52	1.21	0.41	1.10	1.33	49	1.84	0.92	1.57	2.10	704.500	0.000	−0.879
Blowup Time	No	81	3.38	1.78	2.99	3.78	49	3.04	1.58	2.59	3.49	32	3.91	1.96	3.20	4.61	553.500	0.022	−0.493
Acrobatic Time	No	45	1.56	0.89	1.29	1.82	27	1.59	1.05	1.18	2.01	18	1.50	0.62	1.19	1.81	228.500	0.696	
Transition Time	No	104	1.18	0.39	1.11	1.26	52	1.13	0.34	1.04	1.23	52	1.23	0.43	1.11	1.35	1222.000	0.207	
Freeze Time	No	104	1.39	0.55	1.29	1.50	52	1.27	0.45	1.14	1.39	52	1.52	0.61	1.35	1.69	1071.000	0.030	−0.464

Nor = Normality; CI = Confidence interval; GTP = Global Temporal Parameters; GSP = Global Sequential Parameters; PTP = Partial Temporal Parameters.

3.2. Descriptive and Comparative Analysis by Gender of the Temporal and Sequential Parameters in Breaking Battles as a Function of the Phase of the Competition

In Table 3, we introduce a description of the temporal and sequential parameters of the breaking battles as a function of gender and phase of the competition, as well as a comparison between the two sexes. When comparing both sexes in the top 16, the values are higher for men in total battle time, drop, spin, powermove, blowup, transition, and freeze, and also in all sequential parameters except acrobatics; and they are higher for women in single-element time, toprock, footwork, and powermove. In the top 8, the values are higher for men in the total time of spin, powermove, and transition, and in the total number of elements, spin, powermove, transition, and freeze; they are higher for women in single-element time, footwork, and powermove. In the semi-finals, the values are higher for men in the total time of drop and powermove, as well as in the number of elements of drop, footwork, powermove, and blowup, and higher for women in single-element time, footwork, and freeze. In the final, the values are higher for men in the total number of elements and freeze, and higher for women in single-element time and footwork.

3.3. Analysis of Temporal and Sequential Parameters in the Rounds: Description by Rounds, Comparison between Rounds, and Comparison between Sexes in Different Rounds

In Table 4, we describe the temporal and sequential parameters in the six rounds of the men's breaking battles, as well as a comparison between rounds. When comparing the rounds, we found significant differences in total round time, toprock, and powermove. The first two rounds have the longest duration, with an average of more than 34 s. Round 4 has the lowest average of the six rounds. The toprock peaked at round 1 and 5, with an average of around 11 s. For powermove, the first two rounds are the most notable, with an average of about 5 s. There are also significant differences in the number of elements, drops, and powermoves. The highest number of elements is found in rounds 1 and 2, with an average of 15 elements. The drop elements stand out in rounds 1 and 2, with almost two elements on average. The powermove stands out in the first two rounds, with almost four elements. Finally, there are significant differences in the time of a spin, standing out in rounds 4 and 6, with 1.86 and 2.08 s on average, respectively.

In Table 5, we describe the temporal and sequential parameters in the six rounds of the women's breaking battles, as well as a comparison between rounds. When comparing the rounds, we only found differences in two categories: in the total start time, with a higher average in the first two rounds, around 40 s; and in the number of elements, with a peak in the first two rounds reaching to about 12 elements and dropping, noticeably, to 7 elements in the sixth round, with the last dancer.

In Table 6, we show a comparison between men and women in the temporal and sequential parameters in the different rounds. There are differences between men and women in the total round time and toprock time in rounds 1, 2, 3, and 4, with higher values for women. The total footwork time shows differences in rounds 1, 2, 3, 4, and 6, with higher values for women. The total blowup time shows differences in round 3 (with higher values for women). The total transition time shows differences in round 1, with higher values for men. There are differences in the number of elements in rounds 1, 2, 3, and 6; in the number of drops in round 6; in the number of powermoves in rounds 1, 2, and 3; in the number of blowups in round 1; in the number of transitions in round 1; and the number of freezes in round 2, with higher values for men. Finally, there are differences in the time of an element in all rounds, in the time of a toprock in rounds 1, 2, 3, and 6; in the time of a drop in round 5; in the time of the footwork in all the rounds; in the time of a powermove in rounds 1, 2, 3 and 6; and in the time of a blowup in round 3 with the values being higher in women.

Table 3. Descriptive and comparative analysis by gender of the temporal and sequential parameters of the breaking battles as a function of the phase of the competition.

Study Variables	Nor	TOP16						Comparison		TOP8						Comparison		SF						Comparison		FINAL						Comparison	
		Men			Women			U or t		Men			Women			U or t		Men			Women			U or t		Men			Women			U or t	
		n	Mean	SD	n	Mean	SD	*p*	d or g	n	Mean	SD	n	Mean	SD	*p*	d or g	n	Mean	SD	n	Mean	SD	*p*	d or g	n	Mean	SD	n	Mean	SD	*p*	d or g
GTP																																	
Battle Time	Yes	24	196.17	34.94	24	159.42	22.41	0.000	1.252	16	196.38	37.80	16	172.88	40.21	0.099		8	188.75	16.35	8	182.38	25.11	0.557		4	194.75	33.06	4	198.00	26.85	0.884	
Toprock Time	No	24	57.75	24.56	24	55.54	14.39	0.910		16	64.81	17.30	16	57.94	16.21	0.242		8	56.13	16.37	8	64.63	19.49	0.430		4	47.00	18.51	4	60.00	16.99	0.309	
Drop Time	No	24	8.08	3.31	24	6.00	2.19	0.013	0.731	16	7.13	2.68	16	7.50	3.74	0.775		8	9.63	3.50	8	5.88	1.81	0.033	1.272	4	8.00	0.82	4	7.25	4.57	1.000	
Footwork Time	Yes	24	67.50	25.19	24	63.33	12.86	0.474		16	61.00	23.49	16	68.75	17.77	0.301		8	67.25	16.30	8	70.25	15.09	0.708		4	77.00	22.85	4	96.00	20.22	0.259	
Spin Time	No	22	5.00	3.66	15	2.53	1.85	0.015	0.786	14	6.93	5.82	12	2.25	1.54	0.026	1.027	7	6.00	4.12	5	3.60	3.58	0.214		3	4.33	3.21	4	1.75	0.50	0.079	
Powermove Time	No	24	18.67	11.92	23	10.87	5.83	0.013	0.811	16	18.88	9.98	14	10.93	6.55	0.017	0.903	8	17.88	6.27	8	10.38	4.84	0.009	1.267	4	18.75	12.69	4	9.75	10.05	0.248	
Blowup Time	No	23	10.00	6.11	13	5.85	3.51	0.042	0.761	14	8.64	4.40	10	6.20	3.79	0.141		8	6.50	3.66	6	5.33	2.94	0.558		4	8.50	5.51	3	5.67	3.21	0.593	
Acrobatic Time	No	13	3.77	2.80	7	1.71	1.25	0.064		8	2.00	1.31	8	2.00	1.07	0.823		6	2.17	1.60	2	4.50	3.54	0.229		0			1	2.00			
Transition Time	No	24	12.21	6.98	24	8.50	6.20	0.047	0.553	16	12.94	6.44	16	9.19	5.97	0.045	0.589	8	11.75	6.09	8	9.75	4.80	0.672		4	13.00	3.74	4	6.75	4.79	0.083	
Freeze Time	No	24	16.04	6.84	24	10.67	3.74	0.004	0.960	16	16.75	7.12	16	13.38	6.82	0.084		8	13.50	4.54	8	14.00	6.14	0.958		4	20.00	5.72	4	12.00	4.55	0.081	
GSP																																	
Number of elements	Yes	24	79.96	12.90	24	47.33	8.63	0.000	2.973	16	73.00	13.69	16	51.63	12.56	0.000	1.627	8	80.00	14.06	8	54.38	13.97	0.003	1.828	4	82.00	6.38	4	55.00	6.68	0.001	5.713
Number of Toprock	No	24	9.79	2.80	24	6.75	2.09	0.000	1.212	16	8.81	2.83	16	7.19	2.14	0.158		8	10.63	1.85	8	8.50	1.93	0.055		4	9.25	1.26	4	8.75	2.87	0.304	
Number of Drop	No	24	8.17	3.45	24	5.92	2.21	0.015	0.765	16	7.19	2.79	16	6.69	1.74	0.445		8	10.13	3.04	8	6.25	1.91	0.020	1.442	4	8.75	1.89	4	8.50	4.65	0.561	
Number of Footwork	No	24	18.00	5.40	24	12.17	2.68	0.000	1.346	16	14.50	3.74	16	13.25	2.74	0.363		8	18.63	2.67	8	13.00	3.78	0.008	1.625	4	19.25	6.02	4	15.25	3.20	0.384	
Number of Spin	No	22	3.41	1.65	15	1.73	1.16	0.001	1.111	14	4.07	3.12	12	1.83	1.19	0.012	0.889	7	4.00	1.83	5	2.60	2.51	0.218		3	2.67	1.15	4	1.50	0.58	0.115	
Number of Powermove	No	24	13.96	8.33	23	6.04	3.38	0.000	1.215	16	14.25	8.00	14	6.93	4.60	0.006	1.073	8	13.38	5.29	8	6.88	3.18	0.010	1.408	4	15.25	9.91	4	6.50	6.81	0.146	
Number of Blowup	No	23	3.30	1.72	13	1.62	0.87	0.004	1.120	14	2.71	1.64	10	1.70	0.82	0.125		8	3.00	1.41	6	1.50	0.84	0.048	1.163	4	2.75	1.26	3	1.00	0.00	0.076	
Number of Acrobatic	No	13	2.31	1.70	7	1.14	0.38	0.072		8	1.50	0.53	8	1.25	0.46	0.317		6	1.00	0.00	2	3.00	2.83	0.083		0			1	1.00			
Number of Transition	No	24	10.00	5.49	24	6.75	3.99	0.036	0.666	16	10.13	4.21	16	6.81	3.58	0.008	0.826	8	9.38	4.00	8	7.88	3.72	0.393		4	10.00	3.56	4	5.25	3.10	0.108	
Number of Freeze	No	24	12.50	4.55	24	7.67	2.41	0.000	1.306	16	11.44	3.69	16	8.56	3.93	0.025	0.735	8	10.63	3.38	8	8.38	3.11	0.203		4	14.75	2.22	4	8.25	2.22	0.020	2.549
PTP																																	
Element Time	No	24	2.50	0.59	24	3.42	0.65	0.000	−1.448	16	2.88	0.62	16	3.50	0.73	0.016	−0.900	8	2.38	0.74	8	3.63	1.06	0.009	−1.290	4	2.25	0.50	4	3.75	0.50	0.022	−2.609
Toprock Time	No	24	5.92	2.34	24	8.79	2.26	0.000	−1.228	16	7.75	1.81	16	8.56	2.90	0.424		8	5.38	1.60	8	8.13	2.90	0.056		4	5.50	2.38	4	7.25	2.06	0.245	
Drop Time	No	24	1.00	0.00	24	1.08	0.28	0.153		16	1.13	0.34	16	1.13	0.34	1.000		8	1.00	0.00	8	1.13	0.35	0.317		4	1.00	0.00	4	1.25	0.50	0.317	
Footwork Time	No	24	3.96	1.30	24	5.33	1.09	0.000	−1.127	16	4.19	1.05	16	5.19	1.28	0.028	−0.835	8	3.50	1.07	8	5.75	1.91	0.015	−1.375	4	4.00	0.82	4	6.50	1.29	0.028	−2.013
Spin Time	No	22	1.50	0.86	15	1.60	1.12	0.911		14	1.79	1.42	12	1.33	0.89	0.291		7	1.43	0.79	5	1.40	0.55	0.845		3	1.67	0.58	4	1.25	0.50	0.307	
Powermove Time	No	24	1.29	0.46	23	1.96	1.02	0.002	−0.830	16	1.13	0.34	14	1.86	0.95	0.008	−1.027	8	1.25	0.46	8	1.50	0.53	0.317		4	1.00	0.00	4	1.75	0.96	0.131	
Blowup Time	No	23	3.00	1.45	13	3.62	1.26	0.103		14	3.71	2.02	10	3.70	1.57	0.609		8	2.13	0.83	6	4.00	3.03	0.104		4	2.75	0.96	3	5.67	3.21	0.271	
Acrobatic Time	No	13	1.54	0.97	7	1.43	0.79	0.883		8	1.25	0.46	8	1.50	0.53	0.317		6	2.17	1.60	2	1.50	0.71	0.721		0			1	2.00			
Transition Time	No	24	1.13	0.34	24	1.17	0.38	0.686		16	1.13	0.34	16	1.44	0.51	0.053		8	1.13	0.35	8	1.00	0.00	0.317		4	1.25	0.50	4	1.25	0.50	1.000	
Freeze Time	No	24	1.21	0.41	24	1.38	0.58	0.304		16	1.44	0.51	16	1.56	0.73	0.764		8	1.00	0.00	8	1.88	0.35	0.001	−3.309	4	1.50	0.58	4	1.50	0.58	1.000	

Nor = Normality; CI = Confidence interval; GTP = Global Temporal Parameters; GSP = Global Sequential Parameters; PTP = Partial Temporal Parameters.

Table 4. Analysis of the temporal and sequential parameters of the rounds in the men's battles: description by rounds and comparison between rounds.

Study Variables	Nor	Round1			Round2			Round3			Round4			Round5			Round6			Kruskal–Wallis		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	H	gl	Sig.
GTP																						
Round Time	No	52	37.25	9.94	52	34.10	7.14	52	31.19	9.16	52	29.56	6.05	52	33.06	9.44	52	29.87	6.20	35.209	5	0.000
Toprock Time	No	52	11.35	5.31	51	10.86	5.01	49	9.20	5.36	49	9.08	5.04	51	10.92	6.24	52	8.94	5.29	13.016	5	0.023
Drop Time	No	43	1.77	0.87	43	1.81	0.88	41	1.66	0.91	44	1.45	0.87	46	1.70	1.07	42	1.76	0.96	8.111	5	0.150
Footwork Time	No	52	12.06	6.82	50	10.74	4.98	51	11.98	5.24	51	11.10	4.72	50	11.34	5.82	50	10.70	5.00	1.719	5	0.887
Spin Time	No	24	2.25	1.96	25	2.04	1.86	17	1.82	1.19	14	2.29	1.54	16	2.06	1.24	24	2.54	2.45	1.934	5	0.858
Powermove Time	No	39	4.90	2.72	43	5.14	3.05	34	4.15	2.51	39	3.49	2.22	36	4.19	2.61	37	3.76	2.24	11.320	5	0.045
Blowup Time	No	20	3.70	2.13	17	3.71	1.96	24	2.83	1.52	22	4.05	2.84	22	3.59	1.84	19	3.21	1.69	3.489	5	0.625
Acrobatic Time	No	9	2.22	1.56	10	1.80	1.32	7	1.86	1.86	4	1.50	0.58	6	1.50	0.84	5	2.00	1.00	1.511	5	0.912
Transition Time	No	47	2.96	1.84	45	2.56	1.45	45	2.53	1.83	39	2.33	1.42	42	2.83	2.37	33	2.24	1.46	4.106	5	0.534
Freeze Time	No	50	3.38	2.16	44	3.27	2.06	45	3.13	1.84	45	2.80	1.74	45	2.89	2.24	40	3.43	2.14	4.375	5	0.497
GSP																						
Number of elements	No	52	15.27	4.93	52	14.62	3.55	52	12.52	3.52	52	11.27	3.64	52	12.42	3.76	52	11.88	3.88	35.549	5	0.000
Number of Toprock	No	52	1.79	1.04	51	1.73	1.08	49	1.47	0.74	49	1.49	0.74	51	1.75	0.84	52	1.60	0.69	6.436	5	0.266
Number of Drop	No	43	1.88	1.03	43	1.84	0.81	41	1.66	0.79	44	1.32	0.52	46	1.61	0.80	42	1.60	0.59	13.174	5	0.022
Number of Footwork	No	52	3.04	1.40	50	2.94	1.28	51	2.98	1.16	51	2.82	1.26	50	2.82	1.04	50	2.96	1.18	1.017	5	0.961
Number of Spin	No	24	1.46	0.78	25	1.40	0.76	17	1.47	0.72	14	1.36	0.93	16	1.50	0.89	24	1.25	0.61	2.894	5	0.716
Number of Powermove	No	39	3.72	2.38	43	3.93	2.20	34	3.21	1.95	39	2.62	1.79	36	2.86	1.85	37	2.78	1.65	14.190	5	0.014
Number of Blowup	No	20	1.40	0.60	17	1.29	0.47	24	1.08	0.28	22	1.09	0.29	22	1.18	0.39	19	1.21	0.42	7.839	5	0.165
Number of Acrobatic	No	9	1.22	0.67	10	1.40	0.70	7	1.00	0.00	4	1.00	0.00	6	1.00	0.00	5	1.20	0.45	5.305	5	0.380
Number of Transition	No	47	2.47	1.30	45	2.09	1.04	45	1.89	1.07	39	1.77	0.71	42	2.19	1.31	33	1.85	1.06	10.124	5	0.072
Number of Freeze	No	50	2.54	1.33	44	2.55	1.35	45	2.38	1.48	45	2.07	1.32	45	2.02	1.25	40	2.43	1.39	8.891	5	0.114
PTP																						
Element Time	No	52	2.71	1.21	52	2.48	0.73	52	2.71	1.07	52	2.90	1.11	52	2.83	0.94	52	2.83	1.28	6.132	5	0.294
Toprock Time	No	51	7.33	4.26	51	7.57	4.16	49	7.02	4.91	49	6.71	3.69	51	7.00	3.90	50	6.24	4.18	4.219	5	0.518
Drop Time	No	43	1.09	0.29	43	1.09	0.29	41	1.15	0.53	44	1.07	0.25	46	1.13	0.50	42	1.29	0.86	2.861	5	0.721
Footwork Time	No	52	4.67	3.14	50	3.84	1.66	51	4.67	3.51	51	4.41	2.41	50	4.30	1.97	50	3.76	2.00	4.063	5	0.540
Spin Time	No	24	1.54	1.44	25	1.52	1.64	17	1.24	0.56	14	1.86	1.23	16	1.50	0.89	24	2.08	1.84	12.160	5	0.033
Powermove Time	No	39	1.49	0.72	43	1.23	0.48	34	1.29	0.52	39	1.56	1.37	36	1.69	1.53	37	1.51	1.28	3.950	5	0.557
Blowup Time	No	20	2.65	1.50	17	2.88	1.41	24	2.63	1.41	22	3.86	2.87	22	3.18	1.74	19	2.79	1.27	3.565	5	0.614
Acrobatic Time	No	9	1.89	1.45	10	1.30	0.48	7	1.86	1.86	4	1.50	0.58	6	1.50	0.84	5	1.80	1.10	0.812	5	0.976
Transition Time	No	47	1.21	0.55	45	1.22	0.47	45	1.36	0.86	39	1.41	0.55	42	1.24	0.48	33	1.24	0.44	5.992	5	0.307
Freeze Time	No	50	1.26	0.53	44	1.30	0.46	45	1.40	0.58	45	1.44	0.62	45	1.53	1.04	40	1.63	1.37	4.209	5	0.520

Nor = Normality; GTP = Global Temporal Parameters; GSP = Global Sequential Parameters; PTP = Partial Temporal Parameters.

Table 5. Analysis of the temporal and sequential parameters of the rounds in women's battles: description by rounds and comparison between rounds.

Study Variables	Nor	Round1			Round2			Round3			Round4			Round5			Round6			Kruskal–Wallis		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	H	gl	Sig.
GTP																						
Round Time	No	52	41.19	8.39	52	39.85	8.43	52	38.77	8.68	52	36.48	8.05	10	38.40	10.96	10	33.70	6.77	12.930	5	0.024
Toprock Time	No	52	13.71	5.32	52	14.06	5.03	52	13.71	7.10	51	12.08	5.00	10	12.90	6.30	10	11.20	6.29	4.681	5	0.456
Drop Time	No	45	1.71	0.73	49	1.73	0.95	49	1.78	0.80	45	1.60	0.81	9	2.11	1.27	9	1.22	0.44	6.398	5	0.269
Footwork Time	No	52	16.62	5.96	52	16.15	5.08	52	15.19	5.95	52	15.19	4.95	10	13.70	3.86	10	14.90	3.07	5.086	5	0.405
Spin Time	No	15	1.60	0.74	14	1.64	1.28	10	2.00	1.15	15	1.33	0.62	1	4.00		1	2.00		7.216	5	0.205
Powermove Time	No	37	4.22	2.54	31	4.06	2.05	27	3.56	2.28	29	3.48	1.84	6	4.67	1.75	4	3.75	1.71	4.008	5	0.548
Blowup Time	No	10	2.70	1.57	9	3.00	1.12	14	5.07	2.56	8	5.00	2.78	2	4.50	2.12	3	4.33	2.31	10.102	5	0.072
Acrobatic Time	No	9	1.89	0.78	4	1.25	0.50	5	2.00	1.22	1	3.00		1	2.00		1	2.00		4.535	5	0.475
Transition Time	No	47	2.34	1.81	39	2.74	1.48	39	2.62	1.90	42	2.45	1.56	8	3.50	2.88	6	2.33	1.03	4.542	5	0.474
Freeze Time	No	48	3.29	2.10	49	2.69	1.50	50	2.78	1.64	48	3.25	1.64	9	3.44	1.88	4	5.00	2.71	7.638	5	0.177
GSP																						
Number of elements	No	52	12.13	3.52	52	12.37	4.26	52	11.12	3.73	52	11.17	4.02	10	11.10	3.63	10	7.30	3.13	15.085	5	0.010
Number of Toprock	No	52	1.73	0.89	52	1.75	0.88	52	1.60	0.72	51	1.73	0.87	10	1.50	0.71	10	1.20	0.42	4.820	5	0.438
Number of Drop	No	45	1.71	0.79	49	1.65	0.75	49	1.65	0.86	45	1.60	0.78	9	1.44	0.73	9	1.00	0.00	8.845	5	0.115
Number of Footwork	No	52	2.96	1.20	52	3.37	1.39	52	2.75	1.19	52	2.90	1.36	10	2.40	0.97	10	2.20	1.03	10.709	5	0.057
Number of Spin	No	15	1.20	0.41	14	1.07	0.27	10	1.40	0.70	15	1.13	0.35	1	2.00		1	1.00		7.075	5	0.215
Number of Powermove	No	37	2.16	1.62	31	2.65	1.40	27	2.33	1.62	29	2.31	1.31	6	3.00	1.55	4	1.75	0.50	6.487	5	0.262
Number of Blowup	No	10	1.00	0.00	9	1.00	0.00	14	1.21	0.43	8	1.13	0.35	2	1.00	0.00	3	1.00	0.00	5.175	5	0.395
Number of Acrobatic	No	9	1.11	0.33	4	1.00	0.00	5	1.20	0.45	1	3.00		1	1.00		1	1.00		8.148	5	0.148
Number of Transition	No	47	1.72	0.97	39	2.36	1.20	39	2.00	1.12	42	1.86	1.05	8	2.00	1.77	6	1.67	0.52	9.660	5	0.085
Number of Freeze	No	48	2.31	1.17	49	1.92	1.06	50	1.86	0.99	48	1.98	0.91	9	2.22	0.83	4	2.00	1.41	5.907	5	0.315
PTP																						
Element Time	No	52	3.62	1.17	52	3.44	1.26	52	3.85	1.46	52	3.58	1.41	10	3.70	1.49	10	5.80	3.43	7.815	5	0.167
Toprock Time	No	52	9.17	3.90	50	9.36	4.26	52	9.73	5.51	52	8.21	4.58	10	9.60	5.02	10	9.50	4.99	3.582	5	0.611
Drop Time	No	45	1.20	0.46	49	1.24	0.69	49	1.22	0.42	45	1.20	0.46	9	1.56	0.73	9	1.22	0.44	4.358	5	0.499
Footwork Time	No	52	6.12	2.64	52	5.52	2.88	52	6.21	3.31	52	5.92	2.46	10	6.30	2.95	10	9.10	6.35	6.070	5	0.299
Spin Time	No	15	1.33	0.49	14	1.57	1.28	10	1.50	0.97	15	1.13	0.35	1	2.00		1	2.00		6.320	5	0.276
Powermove Time	No	37	2.30	1.58	31	1.68	0.70	27	1.78	0.85	29	1.55	0.69	6	1.50	0.84	4	2.25	0.96	5.704	5	0.336
Blowup Time	No	10	2.70	1.57	9	3.00	1.12	14	4.29	2.05	8	4.50	2.51	2	4.50	2.12	3	4.33	2.31	7.030	5	0.218
Acrobatic Time	No	9	1.67	0.71	4	1.25	0.50	5	1.60	0.55	1	1.00		1	2.00		1	2.00		3.702	5	0.593
TransitionTime	No	47	1.32	0.52	39	1.26	0.59	39	1.26	0.44	42	1.38	0.62	8	1.75	1.16	6	1.50	0.84	2.687	5	0.748
Freeze Time	No	48	1.46	0.74	49	1.55	1.00	50	1.52	0.58	48	1.88	1.35	9	1.44	0.53	4	3.00	2.45	4.713	5	0.452

Nor = Normality; GTP = Global Temporal Parameters; GSP = Global Sequential Parameters; PTP = Partial Temporal Parameters.

Table 6. Comparison between men and women of time and sequence parameters in the different rounds.

Study Variables	Nor	Round1			Round2			Round3			Round4			Round5			Round6		
		U Test		Hedges' g	U Test		Hedges' g	U Test		Hedges' g	U Test		Hedges' g	U Test		Hedges' g	U Test		Hedges' g
		U	***p***	**g**	**U**	***p***	**g**	**U**	***p***	**g**	**U**	***p***	**g**	**U**	***p***	**g**	**U**	***p***	**g**
GTP																			
Round Time	No	916.000	0.005	−0.425	832.500	0.001	−0.731	662.500	0.000	−0.843	687.500	0.000	−0.965	177.000	0.112		167.000	0.075	
Toprock Time	No	1001.000	0.022	−0.442	838.500	0.001	−0.632	714.500	0.000	−0.708	793.500	0.002	−0.593	193.500	0.230		191.500	0.189	
Drop Time	No	963.500	0.971		978.000	0.520		885.000	0.291		836.000	0.140		158.000	0.217		121.500	0.065	
Footwork Time	No	745.000	0.000	−0.706	595.000	0.000	−1.068	851.000	0.002	−0.568	726.000	0.000	−0.840	158.500	0.068		126.000	0.014	−0.872
Spin Time	No	170.000	0.750		154.500	0.483		75.000	0.586		70.500	0.083		1.500	0.157		11.000	0.884	
Powermove Time	No	600.000	0.201		526.500	0.122		401.000	0.395		538.500	0.734		85.000	0.402		70.000	0.859	
Blowup Time	No	75.000	0.264		62.500	0.440		74.000	0.004	−119.000	65.000	0.272		15.500	0.488		19.000	0.338	
Acrobatic Time	No	39.500	0.926		16.000	0.507		13.000	0.411		0.000	0.136		1.500	0.403		2.500	1.000	
Transition Time	No	848.500	0.046	0.335	809.500	0.531		846.000	0.769		801.500	0.864		151.000	0.641		84.000	0.541	
Freeze Time	No	1167.500	0.814		927.000	0.235		997.000	0.329		882.000	0.121		155.500	0.264		46.500	0.165	
GSP																			
Number of elements	No	805.000	0.000	0.727	893.500	0.003	0.570	1045.000	0.045	0.384	1303.500	0.752		204.000	0.282		91.500	0.001	1.198
Number of Toprock	No	1329.000	0.871		1244.500	0.555		1125.500	0.250		1049.500	0.122		214.500	0.388		181.000	0.087	
Number of Drop	No	897.000	0.526		921.000	0.260		981.500	0.837		804.000	0.074		185.000	0.571		85.500	0.003	1.092
Number of Footwork	No	1329.500	0.880		1095.500	0.159		1143.500	0.209		1323.500	0.986		197.500	0.276		160.000	0.066	
Number of Spin	No	153.000	0.321		137.500	0.118		80.500	0.786		102.000	0.827		3.500	0.278		10.000	0.664	
Number of Powermove	No	380.000	0.000	0.751	421.500	0.006	0.667	326.500	0.049	0.476	534.500	0.691		97.500	0.699		50.500	0.289	
Number of Blowup	No	65.000	0.036	0.790	54.000	0.076		146.000	0.256		85.000	0.787		18.000	0.518		22.500	0.391	
Number of Acrobatic	No	40.000	0.936		14.000	0.237		14.000	0.237		0.000	0.046	None	3.000	1.000		2.000	0.655	
Number of Transition	No	710.500	0.002	0.644	776.500	0.343		825.000	0.615		799.500	0.842		136.000	0.372		98.000	0.966	
Number of Freeze	No	1096.500	0.445		781.000	0.017	0.515	919.500	0.106		1024.000	0.648		162.500	0.327		63.000	0.468	
PTP																			
Element Time	No	691.000	0.000	−0.753	687.000	0.000	−0.928	635.500	0.000	−0.879	962.500	0.008	−0.528	163.000	0.049	−0.825	90.500	0.001	−1.654
Toprock Time	No	956.000	0.014	−0.447	954.500	0.029	−0.422	822.500	0.002	−0.514	1044.500	0.117		173.000	0.108		148.000	0.042	−0.745
Drop Time	No	883.500	0.239		975.500	0.296		882.500	0.126		880.000	0.114		133.500	0.006	−0.776	180.500	0.751	
Footwork Time	No	844.000	0.001	−0.493	803.000	0.001	−0.706	819.500	0.001	−0.449	807.000	0.001	−0.615	121.000	0.009	−0.917	84.000	0.001	−1.699
Spin Time	No	162.500	0.507		170.500	0.852		74.000	0.447		70.000	0.052		3.500	0.278		9.500	0.710	
Powermove Time	No	517.500	0.020	−0.659	431.000	0.002	−0.755	310.000	0.013	−0.697	477.500	0.195		108.000	1.000		35.000	0.037	−0.573
Blowup Time	No	94.500	0.803		70.000	0.715		85.500	0.011	−0.973	62.000	0.212		11.500	0.253		14.000	0.148	
Acrobatic Time	No	38.000	0.807		19.000	0.857		13.500	0.459		1.000	0.414		1.500	0.403		2.000	0.752	
Transition Time	No	967.000	0.157		872.000	0.944		877.000	0.995		773.500	0.606		133.000	0.214		86.000	0.505	
Freeze Time	No	1037.500	0.143		952.500	0.245		993.000	0.256		903.000	0.127		192.500	0.785		56.000	0.253	

Nor = Normality; GTP = Global Temporal Parameters; GSP = Global Sequential Parameters; PTP = Partial Temporal Parameters.

3.4. Comparison of Temporal and Sequential Parameters in Both Sexes between Two Competitive Periods (2018–2019 vs. 2020–2021): A Global Study of the Battle and Different Rounds

In Supplementary Material Table S1–S7, we find a comparison of two competitive periods (2018–2019 vs. 2020–2021), both in men and women, for the battle overall (Table S1) and by rounds (Tables S2–S7).

In Supplementary Material Table S1, when comparing both competitive periods (effect size in brackets), men increased, in the second period, the total transition time (large) and freeze (small), and the total number of elements (moderate) and transition (large). In the second period, women decreased in the total spin time (small) and increased the transition time (large) and the total number of transitions (large), the time of a toprock (moderate), and a transition (large).

In Supplementary Material Table S2 (round 1), we found that men, in the second competitive period, increased the total freeze time (moderate) the total number of transitions and freeze (moderate), and reduced the average time of footwork (moderate). In the second period, women reduced the total round time (moderate), footwork (large), and spin (large), but increased the total time of transition (large), and the time of a drop (large).

In Supplementary Material Table S3 (round 2), we observed that, in the second competitive period, men increased the total round time and transition (large), the total number of transitions (moderate), and the time of a toprock (moderate), but reduced the time of an acrobatic (large). Women, in the second competitive period, increased the total transition time (large) and reduced the total number of toprock and drop (moderate).

In Supplementary Material Table S4 (round 3), we found that men, in the second competitive period, increased the total transition time (moderate), the total number of elements (moderate) and transition (large), and reduced the single-element time (moderate). Women, in the second competitive period, reduced the total footwork time (large) and increased the transition time (large), reduced the total number of footwork (moderate) and increased the acrobatic (moderate), and increased the time of a transition (moderate).

In Supplementary Material Table S5 (round 4), we observe that in men there are no differences between the two competitive periods. The women, in the second competitive period, increased the total transition time (moderate), and reduced the freeze time (moderate), and increased the total number of powermoves (moderate), and the time of a drop (moderate).

In Supplementary Material Table S6 (round 5) we observed that men, in the second competitive period, decreased the total footwork time (small) and increased the transition time (moderate) and freeze time (large), decreased the total amount of footwork (moderate), and increased the number of transitions and freeze (moderate). Women reduced the total footwork time (large) in the second period.

In Supplementary Material Table S7 (round 6), we observed that men, in the second competitive period, increased the total round time (moderate) and the total number of elements (moderate), and reduced the time of a powermove (moderate). Women showed no significant differences between the two competitive periods.

4. Discussion

4.1. Discussion of the Results

Time-motion analysis has allowed us to find significant differences between men and women when dancing (which confirms our first hypothesis) and to define the temporal and sequential structure of a breaking battle in both sexes, while specifying the evolution undergone in recent years. This will allow coaches and athletes to determine the appropriate training load to prevent injuries.

Regarding the overall battle data, b-boys have three rounds and b-girls have two, so it is not surprising that the values of most of the study variables are higher in men. The average duration of an engagement is about 194 s for b-boys and 170 s for b-girls, with about 78 elements per battle versus 50, respectively. However, the fact that powermove is more pronounced in men could be related to a better response to explosiveness and dynamic strength, especially in the upper body [1]. The powermove has the highest injury rate [17]. Low levels of strength and explosiveness are associated with higher injury rates, so athletes must condition their bodies through strength training [16] and proper preparation [13].

The collective imagination associates acrobatics with breaking [32], which is why we are surprised by the low relevance of the acrobatic category in both sexes. Women perform movements with a cardiovascular component for longer periods, such as footwork and toprock; probably because they have a greater capacity to sustain effort for a prolonged period of time [1]. Therefore, b-girls perform more elements that do not depend so much on explosive strength (powermove), making it easier for them to control fatigue, and decreasing the risk of injury [17].

The differences between the sexes diminish as the tournament progresses until they almost disappear in the final. The men's top 16 concentrates on increased use of blowup, powermove, and spin. The freeze is usually used as a pause at the end of each powermove, blowup, or spin combo [1]. Transition and drop values remain high, aiming for precise execution [33]. From the top 16 to the final, b-girls take advantage of their endurance to introduce footwork as a structural pillar and common denominator [18]. This behaviour is at the heart of breaking [1] and cannot be underestimated, as it has the second highest injury rate [17], due to constant and rapid postural changes, extreme degrees of joint mobility [34], and many squatting, bending and twisting knee actions, which can induce serious injuries [16]. Phase by phase, both sexes are subjected to a progressively overwhelming workload.

B-boys show a longer total duration in the first two rounds, a small valley in the second two rounds, and a slight rebound in the last two rounds, not exceeding the 30 s threshold. This oscillation shows a strong onset and closure [1]. The toprock peaked at rounds 1 and 5, having been used strategically to manage fatigue [1]. In powermove, we found more peaks of maximal strength. Taking into account its frequency in men and that it is the most injurious type of movement [17], care must be taken in situations of greater physical and mental fatigue (the last rounds and last phases of the competition), as we would have the perfect cocktail for injury. In the first two rounds, we detected more time and a greater number of powermoves. The sequentiality decreases as we advance in the battle, with some small sudden peaks that may indicate an adaptive response to the opponent [33].

B-girls exhibit a predilection towards footwork. Their total round time and the total number of elements are key factors. In descending order, the first two rounds have the longest duration. The total round time is around 40 s on average and we see higher values of the sequential parameters in rounds 1 and 2. The values of the partial temporal parameters are very high; this resistance in specific movements [23] lengthens the round volume, increasing the total time. The neutrality of some partial time parameters indicates a temporal and structural stability that remains similar throughout the confrontation, focusing, again, on a strong opening and ending.

When comparing men and women in the different rounds, the time values are higher in b-girls. Footwork is reaffirmed as its pillar [1] as it stands out in 5 out of 6 rounds. This element requires a powerful lower body, which supports impact and load on the knees, and a strong core that adequately anticipates the contraction of the lower body. A weak trunk is associated with more knee injuries in female dancers [16]. Women have better joint mobility than men due to greater elasticity in tendons, ligaments, and connective tissue [23], resulting in lower injury rates than in boys [35]. However, strength and stability should be worked on in all possible ranges that can be extrapolated to breaking, as it is key to injury prevention [16].

Grosso modo, temporal parameters are higher in women and sequential parameters are higher in men in rounds 1, 2, 3, and 6, using a greater number of elements per battle in shorter but more intense rounds [1]. Considering that less powermove use implies less chance of injury in both sexes [35], and knowing that our results show less powermove use in b-girls, we can affirm that b-girls are less likely to be injured than b-boys, confirming our second hypothesis.

The comparison of the competitive periods (Supplementary Material Tables S1–S7) indicates that in 2020–2021 the parameters increased in both sexes, demanding greater physical and artistic load, confirming our last hypothesis. Therefore, this will require in the future the better preparation of athletes, taking into account sex and abilities. Recent years have accentuated the duration and frequency of transitions in b-boys and b-girls, something fundamental to generating fluidity, harmony, and cohesion [27]. Freezes increase in men, involving more pauses in the temporal structure. If placed appropriately, they can catch their breath for a few moments while embellishing the execution of the next movement and maintaining the jury's attention. In the second period, the female time structure also changes, decreasing the total round time, footwork, and spin to give more total time to the transitions, suggesting more dynamism and variety in the rounds by concentrating their aerobic capacity towards more connectivity between categories. The greater use of drop denotes more attention to changes between levels. In the second period, there is a greater frequency of freeze and a reduction in footwork values, economising the movement in the last bars. It happens in both sexes, predictably due to fatigue and as an energetic prioritisation, as in other sports [36]. It is probably also since the last round is sometimes more important than the first one [33]. In powermove, b-boys's total and sequential temporal values increase in the second period and their partial temporality decreases. This is not arbitrary, as their increase in total time is given by a higher frequency of use, giving relevance to content variety versus stamina. In the second period, we find more increases than decreases in the values of the movements. The artistic component gains prominence over the physical-technical component. The permanence of certain categories in both sexes denotes transcendence, through invariance over time [1]. Given the imminent professionalisation of breaking and its continuous evolution, new strategies are needed to avoid unnecessary damage. Knowing the dancers' behaviours and temporality is decisive in preventing injuries [15].

4.2. Study Limitations

Some factors are very difficult to quantify: psychology, adrenaline, nutrition, supplementation or medication, training hours and method, rest and recovery, nerves, sleep quality and circadian hygiene, jetlag, athlete habits, injuries, treatments or operations, etc. [17,19,34,35,37]. The lack of objective understanding of these factors limits the analysis. We have the impression that these actors could influence the direction of the battle. Therefore, the results should be used with caution, so as not to extrapolate them to the whole community.

4.3. Practical Applications

With our results, as there are clear differences between b-boys and b-girls, we have developed a model of the temporal structure of the battle individualised by sex, considering the evolution of breaking in recent years. In addition to the model proposed in Table 7, we recommend, like other authors [38], the use the standard deviation values to increase or decrease the training loads, individualising them for each athlete.

Table 7. "Type" time structure for a battle in men and women.

Men											
Round 1 (bboy 1)		**Round 2 (bboy 2)**		**Round 3 (bboy 1)**		**Round 4 (bboy 2)**		**Round 5 (bboy 1)**		**Round 6 (bboy 2)**	
Cond.	**Time**	**Cond.**	**Time**	**Cond.**	**Time**	**Cond.**	**Time**	**Cond.**	**Time**	**Cond.**	**Time**
TR1	8.41	BU1	3.67	AC1	6	TR1	6.35	PM1	1.41	BU1	2.67
BU1	2.5	TR1	8.95	TR1	6.24	D1	1.05	PM2	1.41	TR1	6.33
D1	1.11	T1	1.25	D1	1.05	BU1	4.63	FR1	1.53	D1	1.1
FW1	3.36	AC1	1	FW1	4.59	FW1	4.5	T1	1.32	FR1	1.63
T1	1.1	D1	1.11	T1	1.23	T1	1.35	TR1	7.23	T1	1.28
AC1	3	FW1	4	PM1	1.18	AC1	1.5	D1	1.21	FW1	3.73
T2	1.1	T2	1.25	S1	1.17	FW2	4.5	FW1	4.29	FR2	1.63
PM1	1.56	PM1	1.26	PM2	1.18	PM1	1.75	S1	1.17	T2	1.28
FR1	1.33	FR1	1.37	FW2	4.59	FR1	1.53	FW2	4.29	PM1	1.16
T3	1.1	PM2	1.26	FR1	1.5	PM2	1.75	AC1	2	S1	1.62
PM2	1.56	S1	2	PM3	1.18	S1	2.2	FR2	1.53	PM2	1.16
FW2	3.36	PM3	1.26	FR2	1.5	FR2	1.53	PM3	1.41	FW2	3.73
PM3	1.56	FW2	4	T2	1.23			T2	1.32	AC1	1
FW3	3.36	FR2	1.37	BU1	2.38			BU1	2.88	FW3	3.73
FR2	1.33										
S1	1.2										
FR3	1.33										
Women											
Round 1 (bgirl 1)		**Round 2 (bgirl 2)**		**Round 3 (bgirl 1)**		**Round 4 (bgirl 2)**		**Round 5 (bgirl 1)**		**Round 6 (bgirl 2)**	
Cond.	**Time**	**Cond.**	**Time**	**Cond.**	**Time**	**Cond.**	**Time**	**Cond.**	**Time**	**Cond.**	**Time**
TR1	9.45	BU1	2	TR1	11.1	AC1	1	PM1	1.6	BU1	4.33
BU1	3.33	TR1	9.43	AC1	2	TR1	8.82	S1	2	TR1	8.88
D1	1.42	D1	1.27	D1	1.25	D1	1.39	T1	1.75	D1	1.29
FW1	5.68	FW1	5.55	PM1	1.58	FW1	5.73	TR1	9.63	FR1	2
FR1	1.5	T1	1.3	S1	1	AC2	1	PM2	1.6	FW1	7.5
T1	1.43	FW2	5.55	FR1	1.55	T1	1.5	FR1	1.57	AC1	2
PM1	2.36	PM1	1.75	T1	1.4	FR1	1.53	S2	2	T1	1.5
S1	1	FR1	1.55	FW1	5.95	PM1	1.38	PM3	1.6	PM1	2
PM2	2.36	PM2	1.75	PM2	1.58	S1	1.2	T2	1.75	FR2	2
T2	1.43	S1	1	S2	1	T2	1.5	D1	1.71	S1	2
AC1	2	T2	1.3	T2	1.4	FW2	5.73	FW1	6.38	FW2	7.5
FW2	5.68	FW3	5.55	FW2	5.95	PM2	1.38	AC1	2		
FR2	1.5	AC1	1.33	AC2	2	FW3	5.73	FR2	1.57		
				BU1	5.4	AC3	1	FW2	6.38		
								BU1	4.5		

Cond = Conduct; Abbreviations in Table 1.

5. Conclusions

Time and sequence have increased in recent years in both sexes, with an average total battle time of 195 s for b-boys and 170 s for b-girls. Dancers prioritise the economisation of movement and the balance between the physical and the artistic parts, giving more importance to the overall round and aesthetics. The differences between the sexes become smaller as the phases of the competition progress. B-boys show higher total and sequential time values (more explosiveness and strength). B-girls have higher partial time values (more endurance in movements). For both sexes, breaking rounds are strenuous with little recovery between rounds, which quickly demands anaerobic energy. The first two rounds have the longest duration for both sexes. B-boys dominantly use the powermove element in their rounds and b-girls the footwork. These elements are the most injurious elements of breaking and must be taken into account in training and conditioning to prevent injuries. Strength and stability (especially core strength in b-girls) are imperative. B-girls use less powermove than b-boys, implying a lower risk of injury. Strategically, the freeze evolves towards the recovery effort by controlling pauses. The same goes for the toprock, which proves to be a key element for catching one's breath between bursts of power.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/app13169350/s1: Table S1: Descriptive analysis (by sex and by competitive periods), comparison of the competitive periods, and effect size of the sequential and temporal parameters of the breaking battles; Tables S2–S7: Descriptive analysis (by sex and by competitive periods), comparison of the competitive periods, and effect size of the sequential and temporal parameters of round 1 to round 6.

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Informed Consent Statement: Informed consent of the participants was not required (American Psychological Association, 2002) because the data were not generated by experimentation and the video material was obtained secondarily (from the official Red Bull BC One Youtube channel).

Data Availability Statement: All the data are contained within the article and Supplementary Material.

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