HANDLING, THROWS, CATCHES AND COLLABORATIONS IN ELITE GROUP RHYTHMIC GYMNASTICS

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Abstract

Apparatus technique is crucial in the Rhythmic Gymnastics (RG) performance evaluation because of its high impact on the final score and it is the particular requirement of this sports. The technical vigour required in the use of apparatus evidences the need to study the composition of high level routines. An analysis of the apparatus work in high level group routines will give a new insight in the understanding of RG. With this in mind, we used the groups' composition forms submitted during the Portimão World Cup series from 2007 to 2010 to analyse the apparatus difficulty profile of the RG high level group routines. A total of 126 group routines from 28 countries were analysed. It is concluded that hoop routines had the most balanced apparatus technique whereas the poorest technical apparatus work was seen in clubs maybe because is the only double apparatus. According to the competition success analysis, success in high level RG group competition could be explained by: higher training volume (hours per week) (43%), higher use of throws (6%) and collaborations with risk (16,5%). These risky technical elements performed by the higher level groups require an anticipation coincidence ability that is linked with the loss of visual contact with the apparatus.

Keywords: *apparatus handlings, throws, catches, collaborations, group rhythmic gymnastics.*

INTRODUCTION

Group rhythmic gymnastics (RG) was included in the Olympic Games for the first time in 1996 in Atlanta, Georgia, United States. Since then, the standards of group performance have progressively improved. The RG Code of Points (CoP) of the International Federation of Gymnastics (FIG) provides the universal guidelines established by the scientific and technical committees with the objective to evaluate the performance and promote the development of the sport.

As the CoP changes every Olympic cycle, the routine requirements become more demanding and increasingly difficult (Lisitskaya, 1995). According to Bobo (2002) the RG performance evaluation is a judgment process and not an arbitration. The author explains that the main difference is that in RG there is no direct confrontation between gymnasts, the judge is not involved in the routine development, and the judge has to evaluate the performance according to a set of agreed guidelines namely the

CoP. In addition, the judge evaluates simultaneously technical and artistic/expressive parameters (Bobo, 2002). This requires high intellectual activity and experience. Aesthetic and technical judgment share emotional perception, as well as detailed and objective analysis of the routine. This process requires a comprehensive and analytical understanding of RG, difficult to reconcile issues in a single perception (Bobo, 2002).

The RG performance is evaluated in a competition setting by a final score that includes 3 sub-scores: Difficulty, Artistic and Execution (Fédération International de Gymnastique, 2009a). The main liability of the final score depends on the apparatus (one component of Difficulty) and Artistic score (Lebre, 2007). This is why RG is a sport that requires increased coordination of body and apparatus movements (Tsopani, Dallas, Tasika, & Tinto, 2012).

The increasing apparatus demands have made this component of the final score more precise in last modifications of CoP (Avila-Carvalho et al., 2008). Apparatus difficulty is crucial in the performance evaluation because of its high impact on the final score. According to Avilés (2001), the current trend in the routine composition is the increase in variety of both body and apparatus movements, an originality search, a high level of technical skill in apparatus handling together with a high execution efficacy in specific technical elements, the development of a strong identity based on the individual or group characteristics, an increase in the number of risk and outstanding elements in the composition, and the increase in artistic value of the composition. According to Lisistskaya (1995), the virtuous interaction to the gymnasts with the apparatus increased the difficulty of the apparatus elements in the RG routines that characterizes the evolution of the sport. In group routines the success is achieved when there is a high degree of synchrony between the gymnasts and apparatus movements (Lisitskaya, 1995).

The high technical requirements in RG for both body and apparatus movement require coach's constant attention to guarantee appropriate execution not allowing an automation of incorrect movements (Botti & Nascimento, 2011). A correct distribution in space and a balanced conceptual and emotional expression of the different group work are also according to Lisitskaya (1995) success requirements in RG group routines. In RG practice, there is a concern both with refinement and improvement of technique, and with the physical and motor performance of the gymnasts (Botti & Nascimento, 2011). According to the authors, the RG practice sessions were generally long, homogeneous, and repetitive. Gymnasts are required to apply high level technique in order to achieve the specific movements' complexity while also demonstrate creativity, beauty, feelings, sensations, behaviours and actions (Botti & Nascimento, 2011).

Anticipation and synchronicity are additional required and trained abilities that RG gymnasts must develop in order to achieve a successful apparatus technique. This is the ability to anticipate the trajectory of a visual stimulus moving in space, and to organize a motor response based on temporal anticipation (Rodrigues, Vasconcelos, Barreiros, & Barbosa, 2009). This capacity allows, for example, the interception trajectory, such as a ball passed between two opposing athletes (Rodrigues, Carneiro, Cabral, Vasconcelos, & Barreiros, 2011). In RG throws, catches and collaborations the apparatus trajectory and speed drive the body action and amplitude necessary for an error free catch of the apparatus. The general criteria of judges assessment are quantitative (number and variety of body and apparatus elements) and qualitative (difficulty level and execution quality) (Bobo, 2002).

The technical vigour required in the use of apparatus evidenced the need to study the composition of high level routines. However, the literature on apparatus technical analysis is sparse. There are very few studies (Lebre, 1993, 2007) including our previous apparatus studies, related to the specific requirements of this sport. An

analysis of the apparatus work in high level group routines will give a new insight in the understanding of RG. With this in mind, we used the groups' composition forms submitted during the Portimão World Cup series from 2007 to 2010 to analyse the apparatus difficulty profile (handling, throws, catches and collaborations) of the RG high level group routines.

METHODS

A total of 126 group routines from 28 countries were analysed. Data were collected during 4 years (2007 to 2010) during the RG World Cups in Portimão, Portugal. This study was approved by the FIG Scientific Committee and World Cup Organization. The analysis of the apparatus elements in each routine composition was carried out based on the information provided by the competition forms that each group has to provide prior to the competition. We worked based on the forms instead on the video recording because in order to ensure that the analysis would not be affected by mistakes made during the group's performance in the competition.

First, the sample (126 group routines) was split in four groups according to the type of apparatus (rope, hoop, clubs and ribbon). Each RG group had to perform two competition routines, one with five similar apparatus and other with two different apparatus. Once the sample was was split according to the apparatus type then we grouped the 189 different routines was split by apparatus types into two apparatus routines. Then we further classified all the apparatus handling in three main categories according to the arm movement amplitude (short and large handlings), and if the apparatus movement was performed on the gymnasts' body or on the floor. Table 1 presents the included apparatus movements in the different handling categories by apparatus.

Table 1. *Handling categories by apparatus.*

Apparatus/ Handlings	Short Handlings	Large Handlings	On body or Floor Handling
	Skips/hops into the rope	• Passing into the apparatus • Handling (swigs, 8 movements, circumduction) • Tosses • Rotation with open and stretched rope held in the middle or in end	• All apparatus movement without hands • All apparatus movement on the floor
	Hand rotations Rotations around them axis	• Passing into the apparatus • Handling (swigs, 8 movements, circumduction)	• All apparatus movement without hands • All apparatus movement on the floor • Passing over the apparatus • Roll on the floor • Roll on the body
	Mills	• Asymmetric movements • Handling (swigs, 8 movements, circumduction)	• All apparatus movement without hands • All apparatus movement on the floor
	Snakes Spirals	• Tosses • Handling (swigs, 8 movements, circumduction) • Boomerang	• All apparatus movement without hands • All apparatus movement on the floor • Snakes on the floor • Spirals on the floor

Legend:  - rope,  - hoop,  - clubs,  - ribbon

A ranking analysis was then done according to the 2010 Moscow World Championship placements in order to examine if the choice of handling elements and the weekly training volume (training hours per week) had a relationship with the performance result. Weekly training volume was determined by the training hours per

week via questionnaire with two questions (How many training sessions have you per week? How many hours you train in each training sessions?). To this end, we grouped the competition routines into two groups according to their ranking. The finalists group included the top eight groups and the non-finalists group included all remaining competition routines. Then we compared the total number and difficulty value of throws and catches between finalists and non-finalists. Apparatus throws and catches are a fundamental technical movements to RG apparatus, it will be considered a throw when the gymnasts projects the apparatus in the air, in coordination or not with body movements, catches will be considered only those performed by the same gymnast that throw the apparatus. Additional criteria that increase the apparatus difficulty in throws and catches elements score according to the CoP were also considered. These common throws and catches additional criteria were: 1) without hands help, 2) outside of visual contact, 3) during a flight, 4) during a body rotation, 5) below the leg(s), 6) with a total or partial body passing in the apparatus, and 7) in floor position. The special throws categories were: 1) re-throw, and 2) without hands with other apparatus.

The last analysis was in regards to the elements of collaborations among gymnasts according to the CoP. The collaborations are technical cooperation elements unique to the group routines. This kind of group technique can be performed by all gymnasts or by part of the group, in direct contact or by the apparatus, moving in different directions, formations or travelling types. We classified the technical collaborations in three categories: 1) collaborations without apparatus throw, 2) collaborations with apparatus throw, and 3) collaborations with risk. The last must be performed with apparatus throw and loss of visual contact with the apparatus before the catch. With this type of collaborations the group can further increase the technical value if the gymnasts pass above, below or through one or several apparatus or partners during the apparatus flight, or if the gymnasts pass through the apparatus during her flight.

For the statistical analysis we used the Statistical Package for the Social Sciences - Version 20.0 (SPSS 20.0, Chicago, USA).

Descriptive statistics were calculated using the mean values as a measure of central tendency and standard deviation (sd) as measure of dispersion. When data distribution normality was verified by the Kolmogorov-Smirnov we used *student* t-test to determine whether there were significant differences between groups. When data distribution normality wasn´t verified non-parametric tests were applied (Kruskal-Wallis and Mann-Whitney) to determine whether there were significant differences between groups.

Regression analysis was used to analyse the relationship between ranking position (dependent variable), and the independent variables of handling categories, throws and catches, collaboration elements, and training volume (weekly training volume).

Significance level was set at $\alpha = 0.05$ (corresponding to a confidence level of 95%).

RESULTS

Significantly higher value of *short handlings* was found in ribbon compared with all other apparatus (Table 2).

No significant differences were found in *short handlings* between rope and hoop. In the *large handling* category, rope had significantly higher mean value compared with all other apparatus. No significant differences were found in the *large handlings* between ribbon and hoop (Table 2). Significantly higher mean value of on *body or floor handling* category was found in hoop compared with all other apparatus while no significant differences were found in this category between rope and ribbon. Only in clubs we found significant differences in all of the three apparatus handling categories, where a significantly lower value was found in two of the three handling categories (Table 2). In terms of *SUM handlings*, significant higher values

were found in both the ribbon and the rope as compared with all other apparatus (Table 2).

The regression analysis used to further examine whether handling technique in each apparatus was associated with the World Championship ranking position of each group, had shown that only the *On body and/or floor handling* with hoop was significantly positively related to the ranking position (β=0,704; r^2=0,064; *p*=0,046). According to these results, the group routines that had less *on body and/or floor handling* in hoop routines had a better ranking position. On the other hand the regression analysis has shown that weekly training volume was negatively associated with the World Championship ranking position (β=-0,599; r^2=0,424; $p<0,001$) . According to these results, the groups who trained more hours per week had a better ranking position and the weekly training volume explained 42% of the competition results.

Throws and catches quantitative and qualitative values according to the final ranking position are shown in Table 3.

Table 2. *Descriptive and Inferential statistics of handling categories by apparatus.*

Apparatus	Statistics/Categories	Short handling	Large handling	On body/floor handling	Sum handling
(n=63)	mean±sd	2,97±2,35	22,62±8,71	1,83±1,67	27,41±9,76
	Min.- Max.	0-9	5-42	0-7	9-48
(n=63)	mean±sd	4,30±4,30	6,76±4,58	6,87±3,23	17,94±8,24
	Min.- Max.	0-20	0-19	2-16	3-36
(n=35)	mean±sd	7,03±4,00	3,11±2,47	1,00±1,08	11,14±4,55
	Min.- Max.	0-15	0-10	0-4	4-22
(n=28)	mean±sd	22,75±5,67	8,25±5,20	2,71±2,62	33,71±7,65
	Min.- Max.	11-36	0-20	0-10	20-46
Kruskal-Wallis test	P=	<0,001*	<0,001*	<0,001*	<0,001*
Post-hoc comparison (Mann-Whitney test)	$p<0,001$	vs vs vs vs vs	vs vs vs vs vs	vs vs vs vs vs	vs vs vs vs vs vs

Legend: - rope, - hoop, - clubs, - ribbon, *p < 0,001

Table 3. *Descriptive and Inferential statistics of throw and catches according to the final ranking position of the group routine.*

Ranking	Finalists (n=54)			Non Finalists (n=72)			T-test (a) Mann-Whitney test (b)
Categories	Mean±sd	Min.	Max.	Mean±sd	Min.	Max.	*P*
Throw (nº) (n=51/70)	10,04±4,19	3,00	19,00	9,26±4,11	1,00	20,00	0,307 (a)
Throw (value)	1,09±0,49	0,30	2,30	1,01±0,47	0,10	2,20	0,335 (a)
Catches (nº)	6,06±4,64	0,00	22,00	5,40±4,80	0,00	19,00	0,288 (b)
Catches (value)	0,92±0,65	0,00	2,60	0,79±0,67	0,00	2,50	0,237 (b)

Legend: nº - number, n – sample, value – according to FIG code of points, sd - standard deviation

Table 4. *Descriptive and Inferential statistics of collaboration elements according to the final ranking position.*

Ranking position	Finalists (n=54)			Non finalists (n=72)			Mann-Whitney (a) T-test (b)
Categories	Mean±sd	Min.	Max.	Mean±sd	Min.	Max.	P=
Collaborations without throw (nº)	2,24±1,78	0	6	2,33±1,67	0	8	0,769 (a)
Collaborations with throw (nº)	4,24±2,81	0	12	3,60±2,35	0	9	0,165 (b)
Collaborations with risk (nº)	5,93±2,00	2	10	4,97±1,71	2	10	**0,005* (b)**
Collaborations without throw (value)	0,22±0,18	0,00	0,60	0,23±0,17	0,00	0,80	0,769 (a)
Collaborations with throw (value)	0,96±0,62	0,00	2,60	0,81±0,55	0,00	2,10	0,176 (b)
Collaborations with risk (value)	2,86±0,89	1,00	4,50	2,49±0,81	0,80	5,00	**0,017* (b)**

Legend: nº - number, n – sample, value – according to FIG code of points, sd - standard deviation, * $p < 0,02$

As shown, although the value of *throws and catches* was higher in the finalists' than in the non-finalists' routines this difference was not significant. In addition, the regression analysis had shown that only throws were significantly negatively related with the ranking position both in terms of the number of throws used (β=-0,545; r^2=0,062; *p*=0,006) and of the value of throws used (β=-4,468; r^2=0,057; *p*=0,007). According to these, the group routines that had more throws (number and value) were better ranked.

The quantitative and qualitative results for collaborations according to the final ranking are shown in Table 4.

Only the collaborations with risk (number and value) showed significant differences between the finalists and the non-finalists.

This was confirmed by the regression analysis as only the collaborations with risk was significantly negatively related to the ranking position both in terms of their number (β=-1,924; r^2=0,165; *p*˂ 0,001) and their value (β=-3,469; r^2=0,112; *p*˂ 0,001). According to these, the group routines that had more collaborations with risk in the routines had a better ranking. Furthermore, the number collaborations with risk explained 16,5% of the competition's final ranking.

DISCUSION

This study is one of few that attempted to quantify the apparatus technical elements included in the elite RG group routines. From this analysis it is apparent that the technical apparatus elements used in the routine composition varies according to the type of apparatus. This is consistent with the previous study by Bobo (2002) on individual routines according to which the apparatus choice has to do with both its nature and specific characteristics (Vidal, 1997) (size, shape, weight).

Apparatus Handling

According to our previous studies, (Avila-Carvalho et al., 2008; 2009, 2011) the *passing of the apparatus* and tosses elements were the most common technical elements used by the group routines with 5 ropes in the World Cups of 2007 and 2008. In the present study, these specific rope elements were included into the large handlings, which again was the category of the highest value. The rope technical category with the lowest mean value was the *short and on body or floor* handlings. In general, the rope has been described as the apparatus of a low versatility in terms of apparatus technique (Bozanic & Miletic, 2011). In addition, the *skips and hops* into the rope was less used apparatus category previously reported in 5 rope routines

(Ávila-Carvalho et al., 2009). This kind of elements was included in short handling category and their inclusion in high level group routines was decreased from 2007 to 2008 (Ávila-Carvalho et al., 2011). Rope's physical characteristics, deformable and soft, create a challenge in performing, error free technical elements without hands or in a floor position and this explains the minimal use and low mean value of handling on the body or the floor.

According to Ávila-Carvalho, Palomero, & Lebre (2009), the hoop handling movements (large handling in our study) was the most used skill in the 3 hoops and 4 clubs high level group routines. In our study *the on body or floor handling* was the highest used skill of hoop. However, the large total number of skills included in this category may have influenced these results. Unlike the previous studies, where handling and rotation elements reported the highest mean value in hoop group routines (Avila-Carvalho et al., 2008; Ávila-Carvalho, Palomero, & Lebre, 2010a), in our study were the on *body or floor handling* elements that presents the highest mean value in hoop routines. This means that the handling and rotation elements were executed without hands and on floor position explaining the higher values in *on body or floor handlings* in our study. This suggests that elite RG group routines with hoop present a superior apparatus mastery that is not so evident in the other apparatus. This agrees with previous studies that have reported a higher versatility in hoop technique over that seen in rope, ball and clubs. Versatility in RG means that, using each apparatus, the gymnasts can perform a variety of elements in a variety of combinations, including the use of different body parts (Bozanic & Miletic, 2011).

The clubs was the only apparatus that reported a significant difference compared with all of the others apparatus, in all of handling categories analysed. This suggests that clubs present a higher technical challenge. According to Ávila-Carvalho, Palomero, & Lebre (2011), the asymmetric movements was the least used technical category in hoop/clubs elite group routines in 2007 and 2008. This technique was included in the large handling category of our study that was also the least used apparatus handling for all apparatus analysed. For clubs, the highest technical value was recorded in the category in short handlings, which include only mills, which is characterized by small, repetitive, figure eight rotations, with same amplitude, same speed, in the same direction but executed in different time with both hands. Although mills used in hoop/clubs routines have previously reported high values mills technique decreased from 2007 to 2008 World Cup competitions (Ávila-Carvalho et al., 2011). In fact, clubs was the only apparatus with a lower value in three of the four handling categories analysed. According to Tsopani et al. (2012), the low value of qualitative execution in clubs is because clubs require a clean execution by both hands and this requires a high coordination level (Vidal, 1997). This low qualitative technique in clubs could be linked with internal data memory, otherwise preceded experience (Tsopani et al., 2012). Most humans preferentially use their right hand in daily activities, while about 10% use the left hand (Rodrigues et al., 2009). One factor that seems to affect more or less functional asymmetry is the task complexity. In clubs gymnasts perform the majority of elements with both hands, which requires perfect coordination between them, as well as between the apparatus and body difficulties and between the gymnasts.

In ribbon, the Ávila-Carvalho, Palomero, & Lebre (2010a) study reported higher use of snakes and spirals. In our study these elements were included in the category of short handling, which was also the most used ribbon category and with the highest reported values amongst all apparatus analysed. We think that due to its flexible nature ribbon must be in constant motion in order not to lose its form and result in technical error as specified in the CoP (Fédération International de Gymnastique, 2009a). This constant

apparatus motion may have been the reason for the higher handling values observed in ribbon. On the other hand, snakes and spirals are the typical ribbon handling elements (Bobo (2002).

Apparatus technique by ranking position

In RG, gymnasts are expected to execute a high number of motor skills in order to structure their competitive routines (Tsopani et al., 2012). According to the CoP, the body technical elements are valid only if executed in conjunction with apparatus technical elements leading to a more complex and demanding performance. Thus, for a group to achieve higher ranking position a complex coordination between body and apparatus work is required. To this end, the RG practice sessions are generally long, homogeneous, and repetitive, and are focused on the refinement and improvement of technique, including physical and motor performance of the gymnasts (Botti & Nascimento, 2011). Such sessions result in better recall of information in executing the skills (Tsopani et al., 2012). It was, therefore, not surprising that weekly training volume explained 42% of competition success.

Previous studies on apparatus technique in RG group routines reported higher values related to throws criteria than catches elements (Avila-Carvalho et al., 2008; Ávila-Carvalho et al., 2009, 2010a, 2011). In the routines analysed, the authors reported a generalized strategic decision by elite groups to increase throws difficulties and decrease catches difficulties (Ávila-Carvalho et al., 2011). However, when the routines were performed with two different apparatus more catches elements were performed (Avila-Carvalho et al., 2008; Ávila-Carvalho et al., 2009, 2011). The specific throw criterion that had been mostly used by elite groups was the throw elements during flight (Ávila-Carvalho et al., 2010a; Ávila-Carvalho, Palomero, & Lebre, 2010b). In terms of catches the specific criterion previously used varied according to the apparatus. For flexible apparatus like ribbon and rope, there was higher use of catches during a rotational body element because of the movement fluidity needed to preserve the apparatus' form as per the CoP requirements. For the routines performed with rigid apparatus (hoop), most catches were performed without hands help (Ávila-Carvalho et al., 2010a, 2010b). In the present study there were also higher values related to throws' criteria than to catches' criteria, but with no differences between the finalists and the non-finalists groups. According to the CoP (Fédération International de Gymnastique, 2009b), the use of catches criteria can result to equally high technical values as throws elements. Thus, the choice of apparatus elements depends on the coach's strategy to increase the value of the composition by a less risky way. However, the use of different kind of catches could be more valuable as they can increase the artistic impression of the routine. According to the regression analysis, the group routines that utilized more throws criteria had a better ranking position. The best RG groups presented a more risky apparatus technique that required a momentary loss of contact between gymnasts and apparatus.

Only the collaborations with risk reported significant differences between finalists and non-finalists group routines. Previous studies have also reported high values in collaborations with risk, when the routines were performed with same apparatus like 5 ropes or hoops (Avila-Carvalho et al., 2008; Ávila-Carvalho et al., 2009, 2010a), or during pre-Olympic, preparatory competitions (Ávila-Carvalho et al., 2011). When the competition routines were performed with two different apparatus like 3 ribbons & 2 ropes (Ávila-Carvalho et al., 2010a), or 3 hoops & 4 clubs (Avila-Carvalho et al., 2008; Ávila-Carvalho et al., 2009, 2011) the collaborations mostly used were those performed with throw. However, when we analysed the collaborations according to the ranking position, we didn´t find any difference between groups in collaborations with throw.

The risk in collaboration technical elements is characterized by the loss of visual contact with the apparatus during the throw. This loss of visual contact with the apparatus increases the gymnast's anxiety that may in turn result in coordination and balance difficulties, and reduced focus and attention. This decreases efficiency in processing information by interfering in the sense-perceptive, decision-making and implementation mechanisms (Ariza-Vargas, Domínguez-Escribano, López-Bedoya, & Vernetta-Santana, 2011). These observations induce a strategic choice by the coaches to use risky collaborations in the composition of higher level routines to catch the jury attention and to promote a public surprise. The more experienced gymnasts may experience less anxiety with this visual constraint. According to Davlin et al. (2001), the vision is largely responsible for balance maintenance. However, the role of visual cues for gymnasts is still under debate. Vuillerme et al. (2001) demonstrated that gymnasts are less affected by the loss of vision during balance tasks as they were more capable than other athletes to cope with the lack of vision. The anticipatory timing or coincidence-anticipation (CA) is a term developed by Belisle (1963) and is the ability to anticipate the trajectory of a visual stimulus moving in space, and to organize a motor response based on temporal anticipation (Rodrigues et al., 2009). In collaborations with risk, the gymnasts have to predict the body's rotational movement (displacement and speed) that allows the apparatus interception in the right place at the right time. This is supported by a study by Rodrigues et al. (2011) according to which old groups demonstrated higher accuracy in the execution of complex tasks. This suggests that higher experience and ability to coordinate and modify responses based on the feedback processes of both receptors and effectors can lead to increased accuracy (Rodrigues et al., 2011). If one assumes that the best group routines were performed by more experienced gymnasts, it is not surprising that these routines had more risk elements that require a high AC ability.

The present study has some limitations that should be considered. The CoP adjustments which have taken place every four years (Olympic cycle) introduce some specific changes on the competition routines and in this study we analysed the routines in 2007 and 2008 that were prepared according to a different version of Cop than the routines from 2009 and 2010.

CONCLUSION

It is concluded that hoop routines had the most balanced apparatus technique whereas the poorest technical apparatus work was seen in clubs maybe because is the only double apparatus. According to the competition success analysis, success in high level RG group competition could be explained by: higher training volume (hours per week) (43%), higher use of throws (6%) and collaborations with risk (16,5%). These risky technical elements performed by the higher level groups require an anticipation coincidence ability that is linked with the loss of visual contact with the apparatus.

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