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# WRESTLER'S PERFORMANCE ANALYSIS THROUGH NOTATIONAL TECHNIQUES

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## INTRODUCTION

The coaching process is about enhancing performance by providing feedback about the performance to the individual athletes or team (James, 2009). In any sporting situation, especially sports with opposition presence, it is difficult, if not impossible, for coaches to notice and remember all the key events occurring within a training session or match, equipped only with their knowledge of the sport in question and their innate powers of observation (Coleman, 1998). In this regard, Tünnemann pointed that "The key question for the further enhancement of performance in combat sports is the increase in training efficiency (...). Starting point for an effective training control is the description of a target performance, a performance structure which corresponds with performance prognosis" (1996).

**The techniques associated with measuring sports performance are often referred to as Performance Analysis (PA)** and usually take the form of video analysis, using either hand or computerized systems both during and post-event, from either a technical, tactical or movement analysis perspective (James, 2009). Essentially, PA is about creating a valid and reliable record of performance by means of systematic observations that can be analyzed with a view to facilitating feedback. The practical value of performance analysis is that well-chosen performance indicators highlight good and bad techniques or team performances. They help coaches to identify good and bad performances of an individual or a team member and facilitate comparative analysis of individuals, and teams (Hughes & Franks, 2008).

Performance analysis consists of two complementary types of analyses:

- **Notational Analysis** (also called "Match Analysis"), which uses means to record critical events (movements, situations, interactions, techniques and tactics, even intervention of referees) in that performance can be quantified in a consistent and reliable manner, usually to build a database of such events.
- **Biomechanical Analysis**, concerned of quantitative assessment of spatial and temporal parameters of body movements, in order to determine fine details about individual sports techniques in comparison to notational analysis.

Both notational as biomechanical analysis provide an evaluation of several aspects which could not be accurately or objectively assessed through simply watching the performance when it happens (Alderson, Fuller & Treadwell, 1990, mentioned by Tenga, 2010) The present lecture has the aim of exposing the applications Wrestling Performance Analysis can have based in notational analysis, showing concrete recent results of stood out wrestlers, as well as different options and requirements to execute these studies.

## MATCH ANALYSIS: TYPES AND USAGE

PA is an integral part of the coaching process (Figure 1). Technological advances and declining costs have given coaches access to laptop computers, digital cameras and analysis software, even smartphones, making the whole process of PA simpler and less arduous.

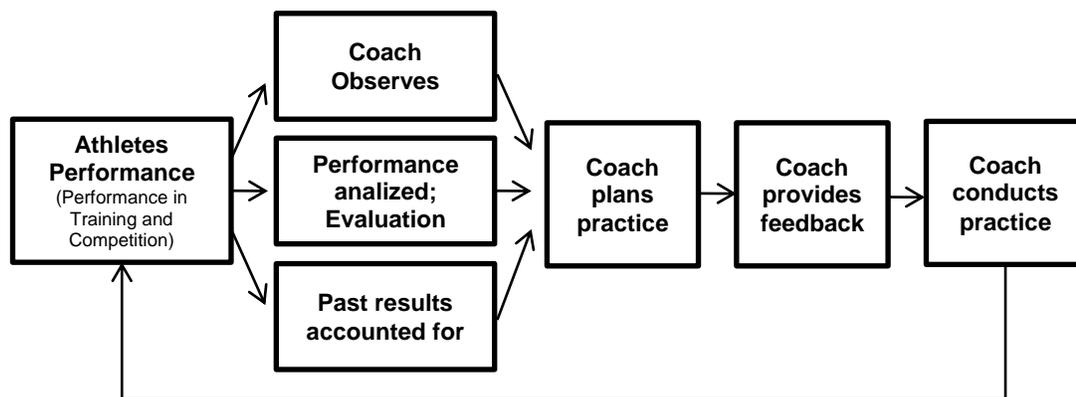


Figure 1. Scheme of coaching process (modified from Franks et al, 1983).

In literature different kind of analysis are found, based in the notational technique, whose differences strive in the quantity of registered and analyzed information, all of them with important applications for the wrestler's preparation as well as the evaluation of their performance. These types of analysis are:

- a) Score analysis
- b) Technical-Tactical Characterization
- c) Time motion analysis (López-González & Miarka, 2013).
- d) Technical-Tactical performance analysis

Their main characteristics are summarized in the table 1.

In strict sense the match analysis comprehends the first three types (score, technical characterization and time motion analysis). The last, the technical-tactical performance analysis was implemented and used recently to analyze the best wrestler's performance in the World Championship 2011 in freestyle and female wrestling through 8 quantitative indicators (López-González, Alonso-Rodríguez, Bárcenas & Rodríguez-Alonso, 2012), and based on more recent analysis made in Greco-Roman style, has been added one more indicator. For the huge quantity of information that it provides, the procedure will be deeply explained, variants and indicators of technical-tactical performance analysis, starting for its mains applications, they can be part of different training process phases of the wrestler's:

Table 1. Some variants of Notational Analysis in Wrestling.

Analysis Type	Main interest	Usage (applications)	Variables
<b>Score analysis</b> (live and after competition)	Technical Points	Know general acting tendencies	- Technical Points - Wrestling Position - Technical Group - Total Bout Time
<b>Technical-Tactical Characterization</b> (after competition)	Technical and Tactical Features of specific TTC	Consequences of technical-tactical interactions in a bout.	Previous ones plus Technical-Tactical Characterization Model:Socio-Motor role - Technical Classification (a. Lafon's Technical Body-Movement; b. López-González Technical Classification) - Set-Up type (Distance) - Tactical Proactivity - Execution Structure - Tactical Risk
<b>Time Motion Analysis</b> (live and after competition; the second one have higher accuracy)	Development of a particular bout	Analyze the time spent in different conducts and situations considered in classification.	- Time Motion Analysis (López-González & Miarka's 11 categories model)
<b>Technical-Tactical Performance Analysis</b> (after competition)	Performance through bouts	Consequences in a tournament. Causal relationship of a result. Comparison with opponent's performance.	The same used in Score analysis and Technical-Tactical Characterization , plus: - Passivities - Challenges - Cautions With the intention to calculate: - 9 Technical-Tactical Performance Quantitative Indicators

- **Target Parameters.** To determine quantitatively the technical-tactical values of the wrestler's "Peak Athletic Shape", and help establish performance profiles for modeling.

- **Scouting.** To elaborate a profile of the best wrestlers in the world and other wrestlers of interest (i.e. specific opponents), and study their weakness and strengths.
- **Evaluation of Training Efficiency.** To assess the impact of training programs.
- **Wrestler's selection criteria.** To provide objective criteria for evaluating the performance of athletes during the national teams selection processes, even taking into account specific aspects of concrete opponents.
- **Performance Prognosis.** To facilitate performance forecasting, based on longitudinal analysis of the performance of the athletes themselves and their opponents and to design intervention strategies for major competitions.

Numerous examples will be described in the 4th and 5th sections.

## REQUIREMENT AND PROCEDURES TO DO MATCH ANALYSIS

**Requirements** It is necessary to have in mind several aspects in relationship to the video and software to use, depending of the type of analysis to execute. On the opposite side, characteristics of software are available and the stored videos limit the studied possibilities.

**a) VIDEO.** In order to perform after-competition analysis. This type of analysis is useful to build a database and video archive with multiple applications and can be an essential tool for a club or national team.

- **Type of file:** due to the huge quantity of information and storage space needed to perform the exhaustive analysis, it is recommended to use compressed formats like MP4 or WMV (Windows Media Video).
- **Frames per second (fps):** not less than 25 fps (european format).
- **Storing video files.** Is recommend to store the videos on a computer dedicated solely to match analysis. They can also be stored on a hard disk just for that function.
- **Zoom:** the frame around wrestlers must allow to observe plentifully technical actions and their details. Therefore, zoom cannot be so wide or close (Figure 2). The videos recorded by Videoteam FILA are the best example.
- **Official decisions:** if the analysis is made with competency videos, it is indispensable the video to be registered in certain way the OFFICIAL DECISION of the referees, to avoid subjectivity, for example, if the resultant indicators will be used as selective criteria to integrate a team. It is especially important for the control of cautions. Ideally, scoreboard must appear on the screen, or at least that video shows the confirmation from the judge or the mat chairman.
- **Official time:** Except for the technical analysis, it is indispensable to observe the official time in order to calculate the different indicators.

**SOFTWARE:** the software to analyze the video must ideally offer the following features:

- **Video recording** (it is usually required an additional device, except if there is a smartphone).
- **Video playing:** As many formats of video are compatible, the better. It is preferably should have slow motion feature (frame by frame).
- **Tagging system:** The most complexity and options of tagged system, the most detailed information that can be analyzed at once.
- **Real time analysis.** To make a quick control, with a few variables, like Score Analysis or Time-Motion Analysis.
- **Results report generator (tables and graphics):** Always depend on tagging possibilities.



Figure 2. Amplitude of frame rounding wrestlers in video for analysis used by FILA Videoteam. a) Wrestlers are centered, their heads are below but not too close of the integrated score board. b) and c) lateral space around wrestlers is a good range in case of a suddenly action. d) Frame by Junior World Championships webcast, with the official scoreboard in a corner. Zoom is constantly changing, but could be possible made most of analysis, except technical or biomechanical when zoom is too close or too open.

In the Table 2 the types of analysis are related with the minimum essential characteristics of video and software. In the table 3 are listed some software and apps for smartphones as well, their characteristics and the type of analysis where they can be used. Although there are more software in the market, the listed ones were chosen by its accessibility regarding their price.

### Match Analysis Procedure

It is described, in a general way, the general procedure for the accomplishment of the Match Analysis after bout, considering the software Longomatch version 0.18.13 as the best available software to perform it.

**Phase 1: Analysis preparation** (tools: video files, computer equipment or smartphone, analysis software, software for video edition).

- Determine the **type of analysis** that is required to perform. As already mentioned the example will be done for the Technical Tactical Performance Analysis.

Table 2. Types of Analysis and minimum requirements of video and software.

Type of Analysis	Video content		Software Features				
	Official decision	Official time	Video recording	Video playing	Tagging system	Realtime analysis	Inform generator
Score Analysis	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable
Technical-Tactical Characterization	Not necessary	Not necessary	Suitable	Indispensable	Suitable	Suitable	Suitable
Time Motion Analysis	Not necessary	Suitable	Suitable	Indispensable	Indispensable	Suitable	Indispensable
Technical-Tactical Performance Analysis	Indispensable	Indispensable	Suitable	Indispensable	Indispensable	Not necessary	Indispensable

- Determine and if necessary design the **variant templates** (software) or the **printed format** (manual capture).
- **Video preparation:** For a simple practice, a video of only one bout is enough, for a more serious analysis of a group of wrestlers (for instance, a complete weight category in a championship), it is recommended to create an only video file made of all the involved bouts. It is done with any software video such as Windows Movie Maker or Corel Video Studio. When the video files do not contain the data of beginners, the round or outcome, it is really useful to include signs with this data in each bout.
- **Create the project** in the software. The variables template and the prepared video as well should be uploaded.

**Phase 2: Search and labeling** (tools: analysis software, uploaded video)

- **Searching sequences, actions or behaviors to analyze.** Depending on the type of analysis, it is necessary that the analyst stay alert to stop the video as soon as the behavior to observe appears. If it is possible with the software the video should be seen slowly forward and backward so as to pause in the right moment that the analyst considers to start the video sequence.
- **Tag the behavior.** The button that corresponding to the behavior, situation or detected sequence is pressed. A sub- categories template can be used to register the behavior's detail. When the program does not let establish as many categories as the needed ones, only the essential ones can be configured, so as to do the complete characterization in a manual way in the phase 3.
- **Delimit the sequence (only possible in Longomatch).** In the Longomatch software, it is possible to delimit in a graphic way the beginning and the end in each sequence, using the "Timeline widget".

**Phase 3: Database creation** (tools: analysis software, uploaded video, spreadsheet or print to make manual record).

- **Characterizing each sequence.** Working simultaneously with Analysis software and spreadsheet or scoring print, the corresponding characteristics will be scored in each sequence. Database as long as the different characteristics that need to be controlled.
- **Generate summary tables.** Depending on the analysis type, summary tables will be generated with the data that need to be studied. Some tables are done by different software. If other different are required or needed, they could be done in spreadsheets.

**Phase 4: Data utilization** (indispensable tools: summary tables; in case of detecting any inconsistency, it could be necessary to check the initial database, and the video sequences in the analysis software).

- **Data Analysis and Report Elaboration.** According to the type on analysis that is being done, it could be necessary to elaborate some graphs to illustrate more effectively the relationship among the different indicators. The preparation of reports from tables and graphs will depend on the analyst experience and the purpose of the analysis.
- **Presentation of results.** Although the results, conclusions and recommendations can be conserved for a selected group of people members of the closest staff to the couch or managers, if they are wanted for the feedback and the athletes study, it is very useful to make a presentation with the selected videos. Longomatch can generate playlists to order.

It is recommendable to delegate a technic staff member, within each national wrestling government body, who should be specialized in these kinds of analysis.

Table 3. Recommended Software for Match Analysis in Wrestling

Software (Price)	Operative System	Device (Hardware)	FEATURES						Analysis type
			Video recording	Video playing	Tagging system	Real Time Analysis	Reports generator	Other features	
<b>Longomatch (Free software)</b>	Windows, Mac, Linux	Desktop Computer, Portable computer	Yes (additional device)	Yes	Yes (powerful)	Yes	Yes (in .csv file, and quick graphics and tables)	Slow motion, video format converter, drawing tools, playlist, and more.	<ul style="list-style-type: none"> <li>• Score Analysis</li> <li>• Technical-Tactical Performance Analysis</li> <li>• Time-Motion Analysis</li> </ul>
<b>FILA DartfishTV (Free, videos uploaded by FILA)</b>	On-Line	Desktop Computer, Portable computer (internet conection)	Video On-Line	Yes (video on-line)	Yes (simple by text notes)	No	No (Manually)	Allowed print the still shots with notes. Slow motion. Option to download the video	<ul style="list-style-type: none"> <li>• Score Analysis</li> <li>• Technical-Tactical Performance Analysis (with spreadsheet)</li> <li>• Time-Motion Analysis</li> </ul>
<b>Dartfish Express (Around \$6.00 USD)</b>	iOS	Smartphone, Tablet	Yes	Yes	Yes (simple by text notes)	No	No (Manually)	Allowed upload (by a price) to Dartfish TV. Slow Motion	<ul style="list-style-type: none"> <li>• Score Analysis</li> <li>• Technical Analysis</li> <li>• Technical-Tactical Performance Analysis (with spreadsheet)</li> <li>• Time-Motion Analysis</li> </ul>
<b>Dartfish Easytag (Free app)</b>	iOS, Android	Smartphone, Tablet	No	No	Yes (4 to 40 customizable tags)	Yes	Yes (in .csv file and brief tables)	Allowed create many templates to different analysis.	<ul style="list-style-type: none"> <li>• Score Analysis</li> <li>• Time-Motion Analysis</li> </ul>
<b>Platosport (Around \$1.0 USD)</b>	iOS	Smartphone, Tablet	No	No	Yes (1 to 11 customizable tags, with two layers each)	Yes	Yes (export graphics and .sql files)		<ul style="list-style-type: none"> <li>• Score Analysis</li> <li>• Time-Motion Analysis</li> </ul>
<b>TimeMotion (Free App)</b>	iOS	Smartphone, Tablet	Yes	Yes	Yes (1 to 6 customizable tags)	Yes	Yes (export tables in image format, text and e-mailed tables)		<ul style="list-style-type: none"> <li>• Score Analysis (just score or actions, not both at the same time)</li> <li>• Time-Motion Analysis</li> </ul>

## CHARACTERIZATION MODEL OF THE TECHNICAL-TACTICAL COMBINATIONS (TTC)

The conducted and published studies during the last olympic cycle 2009 - 2012 (López González, 2011a, 2011b, 2013a, 2013b; López-González & Alonso-Rodríguez, 2011; López-González et al, 2012) have helped to conceptualized and to perfect a set of variants so as to make the technical-tactical analysis that have been useful to determine a set of tendencies whose knowledge could get great relevance for the general wrestling development in the world, and particularly to strengthen our sport around the opportunity of growth that has implied "12F" (the IOC recommendation to drop wrestling from the 2020 Olympic Games, released early this year on February 12).

Specifically, there are six technical-tactical characteristics conceptualized to study what Lafon called "Technical-Tactical Combinations", hereinafter TTC (2008), a concept that encompasses the relationship between the different phases of moves to make technical points. These phases and its characteristics are shown in Figure 3 and are described as follows

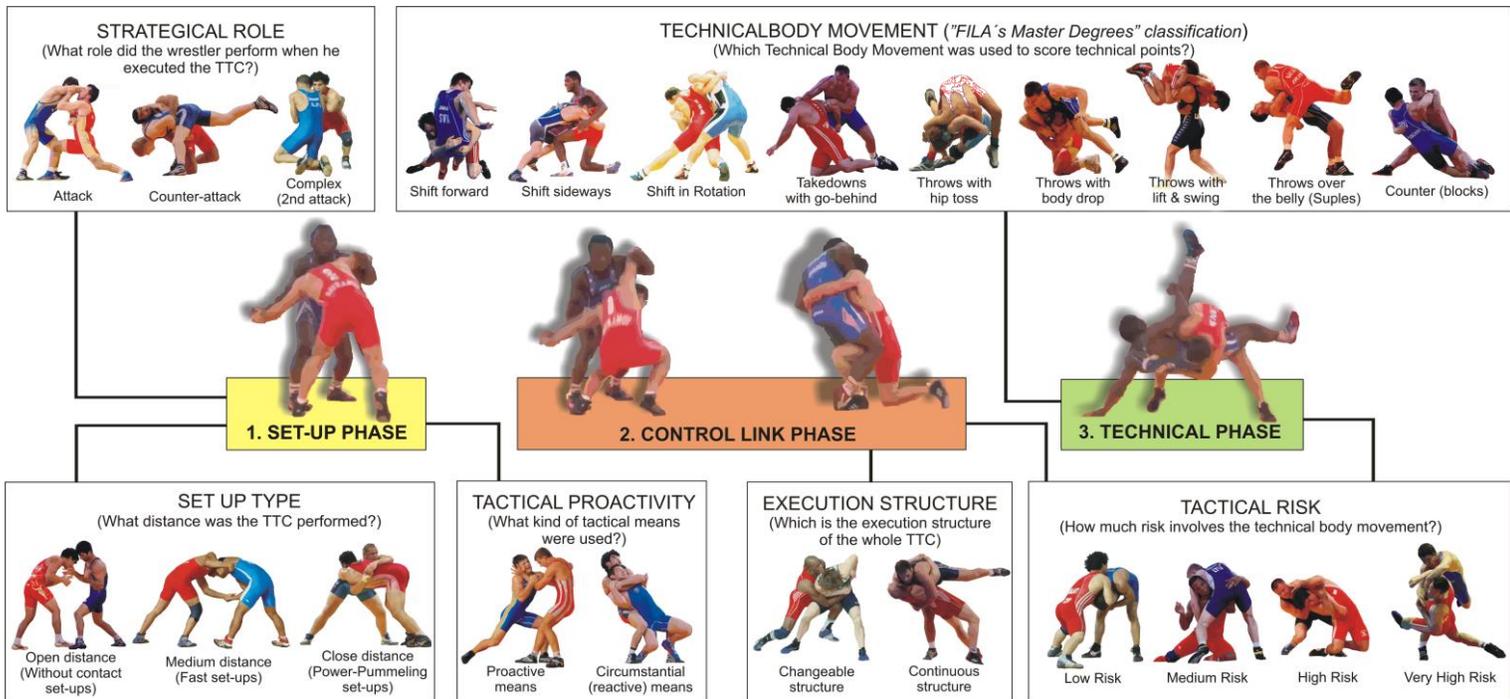


Figure 3. The Six Categories of Technical-Tactical Features Characterization Model (López-González, 2013).

### Socio- Motor Role

- **Concept:** A set of behaviors associated to a specific socio-motor status in a sports activity (Parlebas, 2001, p. 399). In the case of combat sports, the roles are mutually exclusive.
- **Classification (types, scales):** three nominal categories:
  - 1) Attack
  - 2) Counterattack
  - 3) Complex (functional complex or second attack)
- **Background:** When analyzing combats in function of the timing sequence interaction, it can be seen that some combats are won by marking technical points almost exclusively by counterattacks. It is generally about encounters where a wrestler makes deficient attacks, executed under no ideal conditions to succeed or with a significant physical capability declined. Unpublished combat analysis among promising wrestlers in youth category that did not succeed in the senior category show that several of these cases corresponded to wrestlers whose opponents made deficient attacks, developing in the first ones counteroffensive skills but not offensive skills.

## Technical Body Movement

- **Concept:** "Fundamental biomechanics actions (...) whose (...) can be (...) characterized by the system of forces used (nature, direction, and the ways of used forces) and by the center or axis of rotation around which the unbalance will be produced. (...) can be associated by the categories according to their general characteristics" (Lafon, 2008 , p. 21).
- **Classification (types, scales):** 15 nominal categories, grouped by wrestling position and common bio mechanical characteristics (Table 4):

Table 4. Body Movements classification (Lafon, 2008).

WRESTLING POSITION	Standing Position		Par-Terre Position	
GROUPS	Shifts	Throws	Turning over exposures	Lifts
<b>TECHNICAL BODY MOVEMENTS</b>	1) Shift forward 2) Shift sideways 3) Shift in rotation 4) Take down	5) Body drop 6) Hip toss 7) Lift and swing 8) Suplex	9) Forward roll 10) Turn 11) Backwards tilt 12) Bridging 13) Arched	14) Lift and tilt 15) Lift and suplex

- **Background.** The wrestling technique is characterized by its complexity and its bio mechanical richness. One of the aspects where this characteristic is reflected is in the different classifications of the wrestling technique that can be found in the literature. In this sense, FILA published in 2008 the program "FILA´s Master Degrees", in which was established a complete framework for the study of the wrestling technique. The concept "Body Movement" refers to the specific execution movements whose "correct" realization is awarded with technical points by the refereeing body, and that are distinguished by starting when the wrestler has an execution hold by which takes down the opponent or exposes the opponent back to the mat. The execution hold is obtained in the previous phase to the Body Movement.

### Set-Up Type (Distance)

- **Concept:** synergy between the height if standing stance (high, medium or low stance), distance (open, medium or close distance) and seized attack areas (arms, head and torso) by the wrestler before starting the execution of the TTC. The characteristic that mainly determines the rest is the distance.
- **Classification (types, scales):** 3 ordinal categories, originally named because of subjective assessment of the time and the energy expenditure that helps to get ideal conditions to execute the technique:
  - 1) Non contact
  - 2) Fast set-up
  - 3) Power set-up.

As criteria and procedures were not able to be determined yet to objectively measure the spent time in the preparation of different actions, new denominations were implemented, more operational, based on the distance and Tie- ups:

- 1) Open distance (non-contact) set-up
- 2) Medium distance (palm contact) set-up
- 3) Close distance (Power- Pummeling) set up

Published studies from 2009 to 2012 considered a fourth category: "unprepared", only used for the actions in the standing position from the ordered hold or "clinch" in the free style .

- **Background:** This characteristic and its classification scale, first mentioned in a published study in early 2011, had its origin in a set of comparisons from informal observations to the japanese wrestlers' technical arsenal among others. S. Yoshida, the sisters K. and Ch. Icho, and S. Yamamoto. This comparison was made with mexican and central american wrestlers. This exercise let us realized that the japanese wrestlers made contact just prior most of their attacks execution, different from the Latin-American that were looking for Tie-ups in short distance. With the aim of monitor more objectively this characteristic, the scale previous mentioned was created.

## Tactical Proactivity

- **Concept:** tendency towards tactical initiative or the tactical opponent's mistake in order to obtain a right change to engage a TTC.
- **Classification (types, scales):** dichotomic classification:
  - 1) Proactive
  - 2) Reactive (formerly "circumstantial")
 In turn this classification comes from the group of seven Tactical Means found in a published study in the year 2011 (Figure 4).

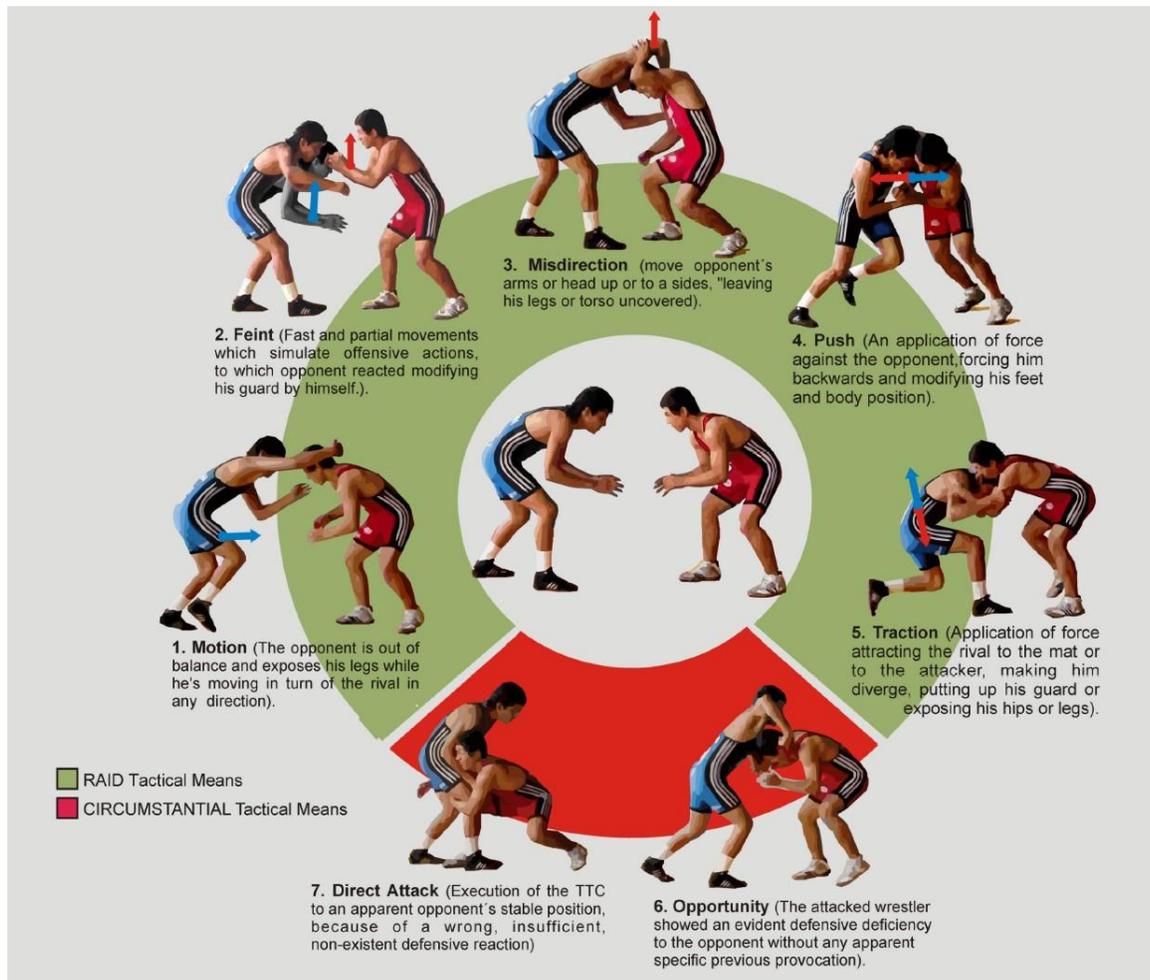


Figure 4. Tactical Means classification (López-González, 2011a).

- **Background:** In a comparative analysis in cadet and junior age categories in Mexico, it was observed that many of the best wrestlers in Mexico got several technical points "directly", without a conventional preparation phase. It was observed that many of these cases were explained by defensive deficiencies made by the opponents more than the attackers' offensive skills. This gave basis to formulate the notion of "tactical proactivity"

Years later a Wrestling classification of Tactical Means was made, that was published in the end of 2011. The corresponding study consisted of registering all technical effective actions executed by free-style wrestlers in World Championship 2010, for further revision of each action in two rounds: the first one aimed to describe in detail the preparation phase or precedent situation in the beginning of technical movement; and the second one appointed to refine the description to the minor quantity of possible terms. Resulting classification released 5 Tactical Means where the executant takes the the initiative to get ideal conditions for technic (proactive Tactical

Means), and 2 more Means that describe given opportunities by the opponents which the wrestlers that scored technical points reacted to take advantage of them and sum opportunities (reactive Tactical Means).

### Execution Structure

- **Concept:** Complexity of movement sequence to score technical points, from preparation phase until getting the take down, go-behind or back exposure.
- **Classification (types, scales):** Two dichotomic categories:
  - 1) Continuous structure (composed by two phases a-preparation and b-body movement)
  - 2) Variable structure (composed by three phases a-preparation, b-control link movement and c-body movement).
- **Background:** When preparing the method of making characteristics analysis of World Championships Senior 2009, 2010 and 2011; there were used simultaneously two technical classifications. The one proposed by Lafon for "body movements" considers apart the "control link movements" as well as a back arch throw is classified as "throw with suplex", but does not describe the way to obtain the execution hold. For example, even the execution hold was gotten during preparation phase or the wrestler executed before an aimed waist shot to control it. Both possibilities imply different preparation phases and tactical risk. For this reason it was recently implemented during current year the concept of execution structure.

### Tactical Risk

- **Concept:** Possible disadvantage when executing certain body movement regardless of effectiveness or not.

**Classification (types, scales):** 4 Ordinary categories:

- 1) Low risk
- 2) Medium risk
- 3) High risk
- 4) Very high risk

For parterre position wrestling there were proposed 3 categories, but the characteristics of the third one in this position are equal with the 4th one in standing position wrestling.

**Background:** It is widely known in wrestling world that some techniques represent a higher risk than others in case of failure. Most of them are as well spectacular when resulting successful. A common example is cement-mixer, or "front headlock rolling". Some wrestlers lose combats when trying that technique. It is obvious that these high risk actions imply considerations from tactical and strategic type. This reasoning headed to create a classification of tactical risk in order to evaluate its relationship with competitive results of wrestlers.

### QUANTITATIVE INDICATORS OF WRESTLER'S TECHNICAL AND TACTICAL PERFORMANCE

In search of setting high informative indicators of wrestler's performance, that cover the fundamental requirements of sport methodology, pointed by Tarakanov (1986, in Kalmykov et al .2007, p.45), there were set 8 quantitative indicators of wrestler's technical and tactical performance (López-González et al, 2012) to evaluate the performance on 140 wrestlers in World Championship Senior 2011, held in Istanbul, capital of Turkey. The informative value of conceived indicators was set by factorial analysis and correlation coefficients, considering variables frequencies of characterization model technical-tactical, the value of technical points of executed TTC, as well as the result of wrestlers (1st to 10th places in 7 weight categories of each free and female styles). A 9th indicator was conceived and used in early 2013 to describe technical characteristics of executed TTC in standing position wrestling Greco-Roman style during London Olympic Games 2012.

Calculation of that set of 9 quantitative indicators is objectively interpreted in accordance to executed factorial and correlation analysis, and used formulas are relatively simple, in that way an expert wrestling trainer can calculate the values of a wrestler with affordable devices like cellphone with video camera, or notational analysis apps, and simple calculator. Analysis can be even more precise and efficient by using tools like excel sheet. These indicators can have among others applications:

- Analysis of **performance profile** of best wrestlers in the world.
- Determination of arrival to the **sporting (peak) shape** specific to the wrestler.
- Making of **performance forecast** on tournament, based on longitudinal base of performance of athletes and their opponents, and subsequent strategies modeling to participate in most important championships.
- **Valuation of effects of training programs** in technical and tactical performance.
- **Criteria setting** in valuation of performance of wrestlers during selective processes (i.e. to form a national team).

Each indicator will be described next, as well as variables and formulas for its calculus.

**Average Indicators (Activity per Minute)**

**Diversity**

- **Concept:** Quantitative manifestation of technical-tactical arsenal (variants or different TTC) that the wrestler is able to use in a particular competitive unit (combat, tournament, season training cycle).
- **Units of measurement:** Quantity of technical variants (in both wrestling positions) per minute of combat in a tournament.
- **Data to make calculation:**
  - 1) Total time of wrestled decimal minutes
  - 2) Sum of distinct technical variants (it has been valued as necessary to consider the characterization of the variant by describing 3 to 4 key elements, according to the case: a) Preparation hold, b) Tactical Means, c) Control Link Movement, and d) Body Movement (Lafon, 2008; López González, 2013b). On par-terre position is not considered the Control Link Movement. In standing position wrestling, continuous structure actions do not have control link movement.
- **How to calculate it:** Dividing sum of technical variants by decimal wrestled minutes.
- **Relationship with wrestler's performance:** Diversity indicates the quantity of TTC different than the wrestler can execute. In empiric way it has been observed different types of diversity, in can be related to totally different TTC, or a same control link movement ending in distinct body movements, or a same group and type of body movements prepared with different Tactical Means and preparation holds. This last way was described by Shakhmuradov under the concept of "law of variability and stability of attacking moves":

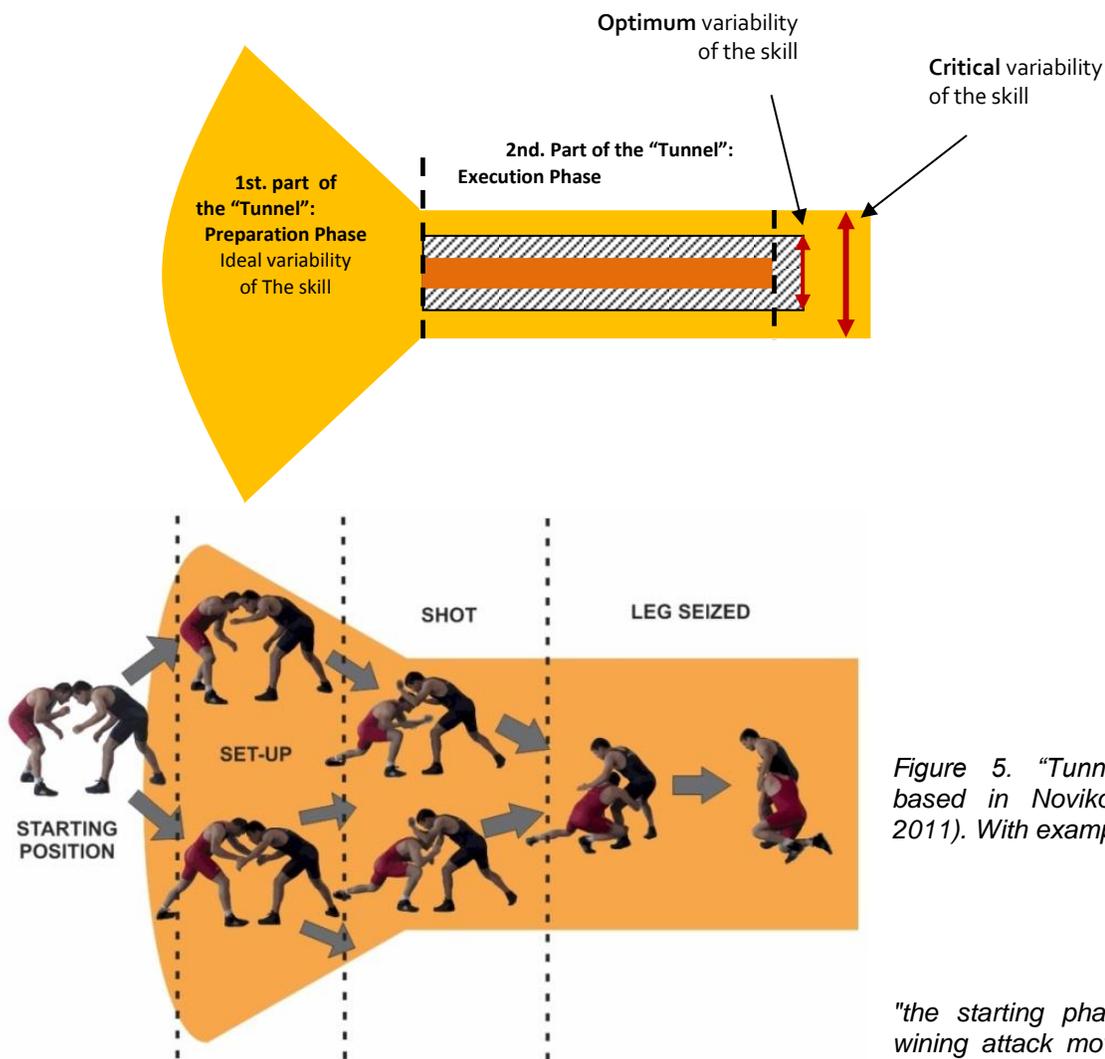


Figure 5. "Tunnel Scheme". Scheme based in Novikov (in Shakhmuradov, 2011). With example with a single leg.

*"the starting phase of the wining attack move, that is the strategy of distracting the rival, must be as variable as possible, in other words, the athlete should master as many*

*techniques of distracting the rival as possible. But at the same time, the key component of the winning attack should be as invariable as possible, that its main parameters, such as time, space and force, should be stable within the optimum variation range. A. Novikov compared the effect of this law with a tunnel" (Shakhmuradov, 2011, p.8).*

Novikov's "Tunnel Scheme" (Figure 5) provides that the first section of the tunnel is wider, representing the many possible variations to reach the second section: the effective body movement, which rivals and fans already known as a typical technique of a particular wrestler. This second section of the tunnel is the part that is considered to be as stable as possible, while the first section corresponds to the tactic and strategy.

Generally, high values of diversity would indicate a superior ability to apply a few possible body movements with a high variety of means. In a unpublished study about the diversity differences of leg attacks between medal winner wrestlers (1st to 3rd place) and non medal winners (5th to 7th place) of World Championship Senior 2011 it was found, in the free style, a significant difference favorable to medal winners (Figure 6) such as value per minute (0.21) is pointed to a technical and tactical arsenal and an enough experience to execute more than one different leg attack each 6 minutes, what suggests a major difficulty to anticipate defensively to the medal winners. Non medal wrestlers, did not average a depreciable score in fact. An average of 0.15 variants per minute, theatrically were able to execute almost a different attack every 6 minutes. Even medal or non medal winners female wrestlers averaged very close scores like male, with slight superiority of medal winner females.

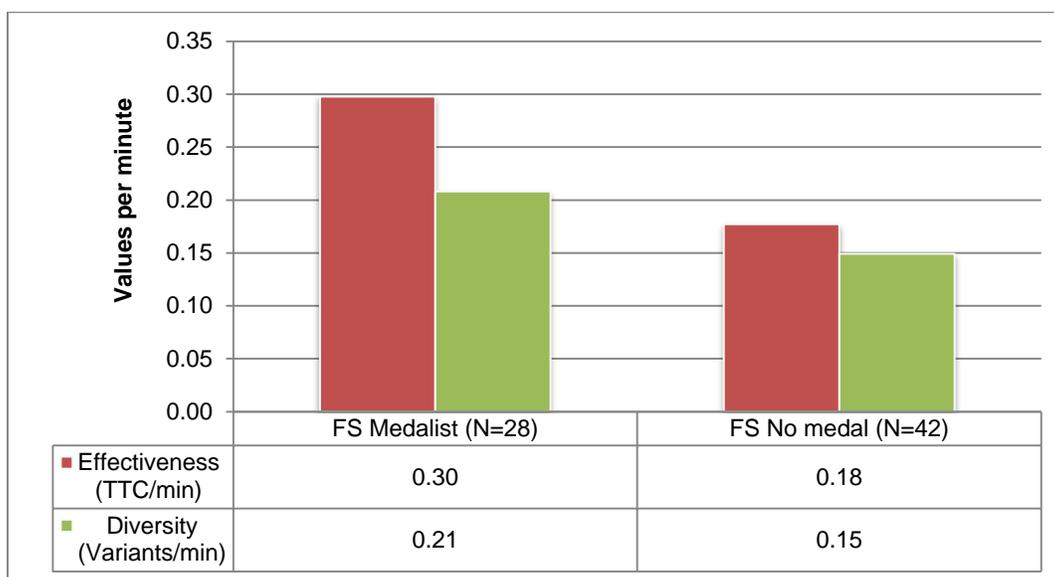


Figure 6. Mean of 2 quantitative performance indicators (Diversity and Effectiveness) of two groups of freestyle wrestlers (medal winner and no medal winner).

### **Effectiveness**

**Concept:** Average of effective TTC performed per wrestled decimal minutes.

- **Unit of measurement:** TTC effective per wrestled decimal minutes
- **Data to make calculation:**
  - 1) Total time of wrestled decimal minutes
  - 2) Sum of frequencies in effective TTC either on standing position as well as par-terre position (regardless of diversity)
- **How to calculate it:** Divide the sum of frequencies of TTC by wrestled decimal minutes.
- **Relation with wrestler's performance:** The effectiveness per minute has been significantly related in positive way with wrestlers ranking of free and female style (López-González, 2011b). For example in study of performance of attacks to legs of winner and non winner medal wrestlers in World Championship Senior 2011, winner medal male averaged 0.30/min effective leg attacks (Figure 6); even the combats lasted maximum effective regular time established in such a regulation (6min per bout as a product of 3 periods in 2 minutes). The medal winners' performance in translated into almost 2 effective leg attacks per bout, being habitual to wrestle 4 to 6 bouts to get a medal. The significant difference from previous groups regarding non medal

wrestlers indicates a considerable minor effectiveness of them, 0.18/min effective leg attacks, slightly over 1 effective attack per bout. Referring to female wrestlers, even not finding statistically significantly difference, there is a clear superiority in effectiveness of the medal winners group (1.5 effective leg attack/6min). Regarding female wrestlers that scored in final classification between 5th and 10th place (slightly less than an effective attack/6min) when translating effectiveness into technical points, it is clear that the most effective wrestler can aspire to reach scores that secure the win every time his defense is enough to get the advantage.

### ***Productivity***

- **Concept:** Average of scored technical points per decimal minutes
- **Unit of measurement:** Average of technical points scored per wrestled decimal points
- **Data to make calculation:**
  - 1) Total time of wrestled decimal minutes
  - 2) Sum of all scored technical points by TTC either in standing position as well as par-terre position (points by caution are not counted, confirmed challenges nor passivities)
- **How to calculate it:** Divide the total of technical points scored by decimal minutes.
- **Relationship with wrestler's performance:** Tünnemann findings through several olympic cycles have shown the importance of cumulating technical points to succeed in wrestling. However, the indicator of productivity conceptualized by López-González et al (2012) is looking to highlight the capability of the wrestler to obtain as many as technical points as possible in relationship to the effectiveness indicator. In other words: wrestler in a certain action, is looking forward the danger position each time he has the opportunity, besides scoring the extra point for 5 sec retention, and each opportunity in offensive par-terre wrestling scoring points.

An outstanding example of high productivity in World Championship 2011 is featured by multi World Champion, three times Olympic Champion and Guinness Record, S. Yoshida (Japan), getting a productivity register of 2.51 pts/min only with technical action, the highest cypher in this indicator among 7 champions. Taking into account that her effectiveness in same tournament was 1.45 TTC/min, those numbers indicate that Yoshida was able to score an average of 1.73 technical points per each effective TTC, thanks to a noticeable ability in both wrestling positions to maximize her productivity.

To get an idea of how effective is the Japanese wrestler, in the same event J. Burroughs, champion of 74Kg category free style reached 1.25 pts/min in the same indicator. This difference of 1.26 pts/min favorable to Yoshida is explained because she scores 3 to 6 technical points in a single attack sequence starting from standing position, even the back exposure of her opponents, usually gets the retention and scores 2 more points with spins from the same legs control that used to defeat her opponents (i.e. "ankle laces"), meanwhile Burroughs did not stand out in World Championship in 2011 with his defensive on mat.

### ***Defense Efficacy***

- **Concept:** Average of negative technical point (against) per decimal minutes.
- **Unit of measurement:** Average of negative technical points (against) per wrestled decimal minutes.
- **Data to make calculation:**
  - 1) Total time of wrestled decimal minutes
  - 2) Sum of all scored technical against points, including passivities, confirmed challenges and cautions.
- **How to calculate it:** Divide the total of against points by the wrestled decimal minutes.
- **Relationship with wrestlers performance:** When setting quantitative performance indicators technical-tactical in the study of performance of the 1st 10 qualified in free and female styles in World Championship 2011, only the defensive efficacy was significantly related with the final ranking in both analyzed styles (female wrestling  $r_s=.402$ ,  $p<.01$ ; wrestling,  $r_s=.482$ ,  $p=.00$ ). Besides, when checking the indicators of 7 champions of free style, it was found that 5 of them reached very high scores in this parameter (0.10 and 0.35 negative pts/min, equivalent to yield between 0.6 and 2.1 technical points in a 6min bout). In free style, none average indicator showed a marked technique. In case of female wrestling, the tendency of defense was similar for olympic category champions (between 0.00 and 0.40 negative pts/min), but it was detected a clear tendency in other indicators of medal winners. That data means that in Istanbul, the defense was a basic condition for victory in free style, but in female style, the offensive had a key role.

In greco-roman style this characteristic was found, in a brief recent study, made with data of the weight category 60Kg in recent World Universiade in Kazan, then, with the promulgated rules in May 2013. In a further section of this conference, it will be mentioned with more detail the topic of defense.

### Technical-Tactical Indicators, Rate-Coefficient Type

#### **Standing-Parterre Coefficient**

- **Concept:** Percentage of effective TTC made in standing or par-terre position. It was described by Podlivaev (2010).
- **Unit of measurement:** a decimal value, ranging from 1.0 (any effective par-terre TTC) to 0.0 (all effective TTC in parterre position).
- **Data to make calculation:**
  - 1) Amount of TTC performed in standing position;
  - 2) Amount of TTC performed in par-terre position.
- **How to calculate it:** The amount of TTC performed in standing position divided by the sum of both positions frequencies.
- **Relationship with wrestler's performance:** The coefficient foot-mat is an indicator that points out in a very practical way the position which wrestler was more effective. Podlivaev (2010) refers a range from 0.50 to 0.70 for the best free style wrestlers in Russia. Those ranges near 1.0 indicate that the wrestler did not score any point in the bout on the mat (that means: 100% of successful TTC were executed in standing positions). The coefficient of champions in free and female style in World Championship Senior 2011 coincide with such ranges: the 7 males averaged 0.82, and female of olympic weights 0.69, that can be interpreted like a major cooperation of the actions on the mat with female competitors. The exception in this championship was the Ukrainian G. Vasylenko, gold medalist in 59Kg (non olympic weight category); her coefficient foot-mat was 0.14, which means a rare activity in standing position wrestling but noticeable on mat. Vasylenko had a high effectiveness executing counterattacks to leg attacks, mainly from the head and arms holdings in front over, that means, depending from her opponent's mistakes.

It is evident that the range suggested by Podlivaev, in the practice, it lets the wrestler to obtain an effective resource balance in both wrestling positions, fundamentally to take advantage of different opportunities that can occur through the whole tournament.

#### **Standing Tactical Proactivity Coefficient**

- **Concept:** In standing position, wrestler's tendency towards the active creation of favorable conditions for the offensive or taking advantage of opponent's mistakes.
- **Unit of measurement:** A decimal value, ranging from 1.0 (all TTC started from proactive means) to 0.0 (all effective TTC executed taking advantage of opponent's pitfalls).
- **Data to make calculation:**
  - 1) Amount of standing TTC prepared by proactive means;
  - 2) Amount of TTC not prepared but taking advantage of opponent's pitfalls.
- **How to calculate it:** The amount of standing TTC with proactive tactical means divided by the sum of total frequencies of TTC in such position.
- **Relationship with wrestler's performance:** It has been found a close relationship between tactical proactivity and some technical groups and concrete body movements. I. e. Standing Tactical Proactivity was positively correlated with Double leg and Bridging Technical Groups (i.e. gut-wrenches, ankle laces), and without contact set-ups. These technical features are similar to those reported by Tünnemann in 2010 World Senior Championships, but now we have tactical features to explain their preferred usage (López-González et al, 2012). Most champions in 2011 in Senior World Championship had values above average in this indicator, as the Japanese champions in female wrestling (Obara-Sakamoto, Yoshida and Icho), and american Burroughs, all of them reaching values above 0.80.

In freestyle, low values of proactive tactical means were related to actions of the group of projections executed as counterattacks, as well as push-outs, blocks and actions from the holding position to a leg (clinch). In other words: those wrestlers that get a low percentage of prepared actions depend of a favorable tournament or of opponent's mistakes. The exception can be in 120Kg division, where it is common that almost all competitors are distinguished by major quantities of actions that started in circumstantial conditions; the analysis performed to the videos in World Championship Senior 2010 and 2011 in freestyle suggested such a thing (López-González and Alonso-Rodríguez, 2011; López-González et al, 2012).

### **Effective Standing Distance Average**

- **Concept:** Average of set-up distance by the effective TTC in standing position.
- **Unit of measurement:** Statistical mean between 1.0 (open, non-contact distance set-ups) to 3.0 (close distance of power-pummeling set-ups). With current international regulations before May 2013, TTCs from holding position in one leg do not belong to this indicator.
- **Data to make calculation:** Frequencies of TTC prepared from
  - 1) Open distance,
  - 2) Medium distance,
  - 3) Close distance
- **How to calculate it:** First, frequency of each set-up distance must be multiplied by their corresponding value in the scale (open distance frequencies for "1", medium distance by "2", close distance by "3"). The resulting values must be summed, and the resultant amount must be divided by the total frequency of effective standing TTC.
- **Relationship with wrestler's performance:** The effective standing distance average is one of the most descriptive and informational indicators in order to characterize wrestlers technically and tactically.

The distance is strongly related with the technical group, giving the athletes and coaches a quick panorama of wrestler's tendencies. For example, low values (below 2.0) indicate high effectiveness in open distance; great examples of this way of wrestling in standing position in 2011 Senior World Championship are Burroughs (1.82) in FS and Yoshida (1.35) in FW. In GR in 2012 Olympic Games, Iranian champion Omid Noorozi reaches 1.75, product of 3 TTC from medium distance and 1 more in open distance. An important inference about high usage of open and medium distance set-ups in such performance requires a low spending of time to obtain ideal conditions to attack, due to outstanding power, speed, strength, capacity and a great success attacking with shots (even in GR like Noorozi showed in London 2012), whose can be finished in many ways.

Values close to 3 indicate a tendency to wrestle in close distance. This kind of performance is typical of "throwers", like Georgian Olympic silver medalist Lashki (the only one wrestler who executed a 5 technical points throw-in in London olympic tournament) and the Hungarian World silver medalist Sastin in WC 2011 who performed 4 throws, 1 block, 1 push-out, 2 takedowns and even 2 leg attacks, all of them in close distance.

Mean values around 2.5 are typical in well balanced wrestlers in respect to the usage of 3 distances, like the values in WC 2011 obtained by Japanese female wrestlers and 2011 World champions H. Obara-Sakamoto (2.77) and K. Icho (2.20), or the Russian freestylers V. Lebedev (2.20) and B. S. Kudhukhov (2.17), both also world champions. In Greco-Roman style an example of balanced effective distance can be found in 2012 Olympic silver medalist T. Loerincz (Hungary) reached 2.33 in London.

### **Standing tactical risk average**

- **Concept:** Tendency towards making most "low risk TTC" or "very high risk TTC" in standing position. The phase considered to characterize its risk is the NEXT TO PREPARATION PHASE (it can be a control-link or a body movement, Figure 3).
- **Unit of measurement:** Statistical mean between 1.0 (low risk) to 4.0 (very high risks).
- **Data to make calculation:** Frequencies of TTC executed with
  - 1) Low risk,
  - 2) Medium risk,
  - 3) High risk,
  - 4) Very high risk.
- **How to calculate it:** The frequency of TTC executed in each tactical risk multiplied by their corresponding value in the scale ("1" to "low", "2" to "medium" "3" to "high" and "4" to "very high"). Then, the values must be summed and the resultant amount must be divided by the total frequency of effective standing TTC.
- **Relationship with wrestler's performance:** In our different researches, "Tactical risk" had significant correlation with technical groups: in the Senior World Championship 2009 we analyzed the Tactical Risk in standing TTC performed in female wrestling, resulting that 100% of the attacks to both legs and 89.7% of projections, 70% of obstructions with leg and 100% of counter attacks. The low risk was the tendency in 100% of blocks and push-outs and 93.4% of takedowns.

The individual values of this indicator in a tournament describes in the same way, the tendency of each wrestler. If the value is close 1. like 1.47 reached by K. Icho in WC 2011, expresses the major usage of attacks through takedowns and counter offensive actions of low risk like defense of legs passing back. Values close 4, rarely frequent, indicate preference for projections with arching, hip hit and high risk counter attack, likewise Venezuelan M. Caripa (3.0). In fact, it can be considered that there are a few wrestlers in Senior World Championship that obtain a medal majorly wrestling with a high risk or very high risk.

### **Structural Variability Coefficient (SVC)**

- **Concept:** Percentage of effective TTC in standing position made with changeable structure, expressed in decimal value.
- **Unit of measurement:** A decimal value, ranging from 1-0 to 0.0. The obtained value describes wrestler's tendency in the usage of both structures, continue and changeable: the higher value, close 1.0, the highest usage of changeable execution structure and vice versa.
- **Data to make calculation:** Frequencies of TTC executed with
  - 1) Changeable structure,
  - 2) Continuous structure
- **How to calculate it:** The structural variability coefficient results from dividing the frequency of technical-tactical combinations performed in standing position with changeable execution structure by the total frequency of successful technical- tactical combinations in the same position.
- **Relationship with wrestler's performance:** This indicator was conceptualized in the beginning of this year when analyzing the TTC in standing position executed in Olympic Games of London in Greco-Roman style. Due to low registered frequency of technical successful actions, it was necessary to look for the implementation of any other variable that revealed tendencies and explained the performance based on standing position. The results of using this indicator showed evident difference in finalist wrestlers (gold and silver medal) in comparison with those competitors that participated in the repechage phase. The first group had a coefficient of structural variability significantly different from the other group (gold and silver = 0.81, bronze and 5th place = 0.44). It is inferred that using changeable execution structure of TTC helps to reach successfully the completion of the technical movements attempted, evading and using opponent's defensive reaction, resulting in higher efficiency.

This indicator has not been used in the performance analysis with freestyle and female wrestlers. However, as leg attacks are the most frequently used TTC, it is almost certainly that the more effective wrestlers on the offensive also record high values of SVC.

### **Specific Interrelationship among indicators**

So as to evaluate integrally a certain wrestler's performance, it is indispensable to take into account specific relationships among indicators. In the previous works, three key relationships have been found:

#### ***Technical Quantitative Potential***

This relationship refers to the potentiated of the wrestler's motion activity during the execution of his TTC. Theoretically, if the wrestler is able to execute only one variant, for instance, "underhook, shot, double leg, shift forward", he is expected to be able to execute it more than once during the tournament if he pretends to get a medal. In the same manner, it is better that in each double leg the wrestler could get, the most possible quantity of points. That way the expected relationship is the numeric potentiation of the previous indicator. In the Figure 7 it is shown the ideal relationship in the S. Yoshida's performance (Japan) in the female style and R. Yazdani (Islamic Republic of Iran) in freestyle during the WC 2011. The first graphic possesses an almost exponential tendency. The second shows an almost linear tendency. A third graphic, that corresponds to the I. Kuylakov (Russia) performance during the World University 2013 in Kazan in the Greco-Roman wrestling, shows a very light growth from the first to the second indicator, to later increase noticeably from the second to the third. These three athletes won the events previously mentioned.

The Figure 8 shows the performance of the same athletes, adding the values on the winners of the 2nd and 5th places who were defeated in the referred tournaments. Yoshida as well as Yazdani were defeated in diversity by a wrestler in each case: H. Maroulis and Jake Varner, respectively. However, the champions potentiated more their activity from the diversity per minute in each bout. In contrast, athletes such as T. Verbeek (Canada) and S. Balci (Turkey) both sub-champions, potentiate to a lesser extent their indicators.

This relationship has started to be studied recently in Greco-Roman style. The analysis in the 60 kilograms category in Kazan shows a tendency practically constant among the first classified wrestlers when their diversity is potentiated in effectiveness: there was a bare difference. This suggests that in the Greco-Roman wrestling is

not common that one solely variant is repeated several times, overall in the standing position wrestling. But the productivity was really potentiated, mainly in the cases of A. Kebispayev (Kazakhstan) and T. Turkishvili (Georgia), both winners of the bronze medal. The champion I. Kuylakov although potentiated his effectiveness, he did not do it in the same scale as the two previous wrestlers. It can be inferred that potentiate the technical quantitative indicators is a characteristic of champion wrestlers. But the highest possible potentiation is not a warranty to obtain a gold medal.

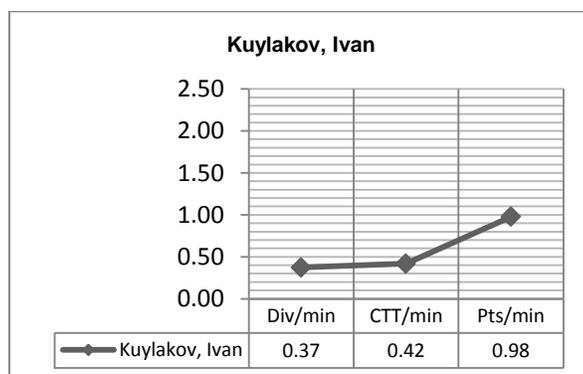
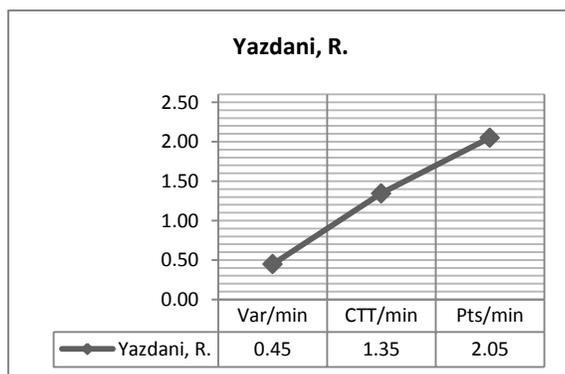
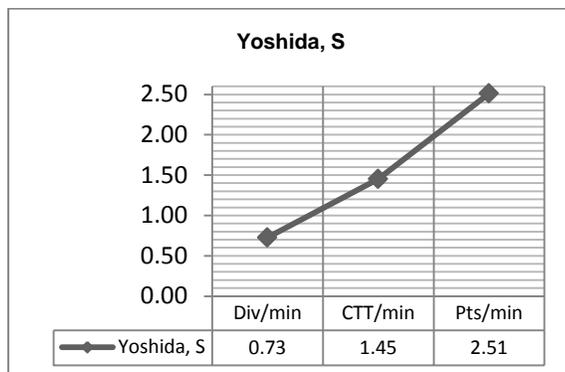
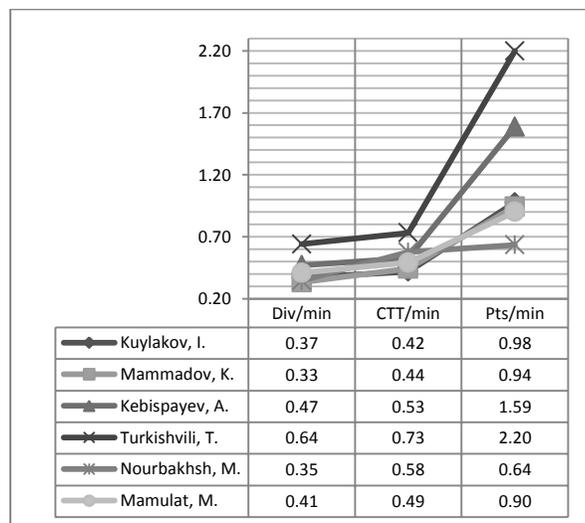
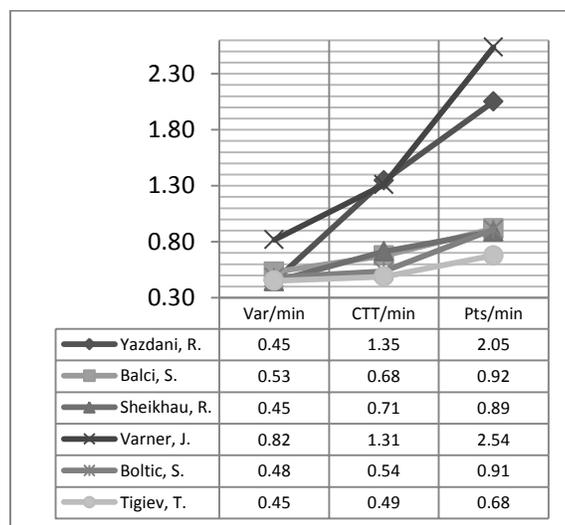
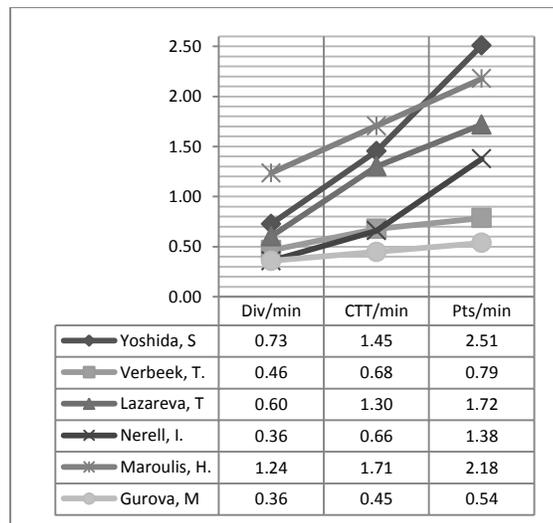


Figure 7. Relationship among values of Diversity (Div/min), Effectiveness (TTC/min) and Productivity (Pts/min) as part of wrestlers' performance. Left: S. Yoshida, Champion, Female Wrestling, WC2011. Center: R. Yazdani, Champion, Freestyle, WC2011. Right: I. Kuylakov, Champion, Greco-Roman, World Universiade 2013.



WC2011, FW, 55 kg. WC2011, FS, 96 kg. WU2011, GR, 60 kg.  
 Figure 8. Relationship among values of Diversity (Div/min), Effectiveness (TTC/min) and Productivity (Pts/min) as part of 1<sup>st</sup> to 5<sup>th</sup> place performance. Left: Female Wrestling (FW) WC2011, 55 kg. Center: Freestyle (FS), WC2011, 96 kg. Right: Greco-Roman (GR), World Universiade (WU) 2013, 60 kg.

### Defensive Weakness Profile

As mentioned before, the defensive effectiveness is the only variant that was significantly related with the obtained place in both wrestling styles. An exhaustive revision to database of the referred investigations could show that the exposed cases in the previous section could be explained by the defense as well. The importance that only one indicator can have in the final wrestlers' performance as is the defensive efficiency has led us to consider complementary indicators to deepen in defense performance.

The solution was implemented, putting into practice with the analysis of the 60 kg category in Greco-Roman style in Kazan 2013 was the elaboration of what was called "Defensive Weaknesses Profile". This consists in the comparison of the negative technical points per minute assigned in the following situations:

- Tec.Pts. by Effective TTC which the opponents scored pts. against the studied wrestler, classifying by the strategic role: attack, combinations and counterattacks.
- Passivities.
- Faults.
- Confirmed challenges (lost).

The profile was graphed adding the productivity values and the total negative points, so as to be able to analyze the possible relationships. In the Figure 9 it can be appreciated that Kuylakov had the best defensive efficiency among the six wrestler, - 0.05 points per minute. (in fact he only gave a point in all the tournament), as a result of a caution for passivity. The fact that the Kuylakov's defensive weakness in the World Universiade 2013 consists only in a passivity that lets deduct that, besides his defensive level in the intended TTC by his opponents, his offensive attitude was sufficiently good to avoid a mayor caution by the refereeing body regarding the cautions for passivity. On the contrary the five remaining wrestlers in this comparison were penalized in more occasions per minute in bout. The profile shows as well that the sub-champion in this event, K. Mammadov (Azerbaijan) assessed several technical points in the attacks from his opponents. A. Kebispayev (Kazajastan) gave points in four different occasions (attacks, complex, passivities and overall counterattacks) contrasting in his productivity. The other bronze medalist T. Turkishvili (Georgia), 5th place, is in a similar situation, having in the passivities is biggest defensive weakness. M. Nourbakhs (Islamic Republic of Iran), further having given points in three different situations, he got a global defensive performance that exceeds in negative points his own productivity. Finally, Mamulat (Moldova) was the weakest wrestler in this group in the defense of attacks against him. With these data, at least for the studied wrestlers' group in Greco-Roman style, the productivity is not as important as the defense to achieve the best outcome in the final classification, and the Defensive Weakness Profile is used to determine the most concrete issues around defensive errors.

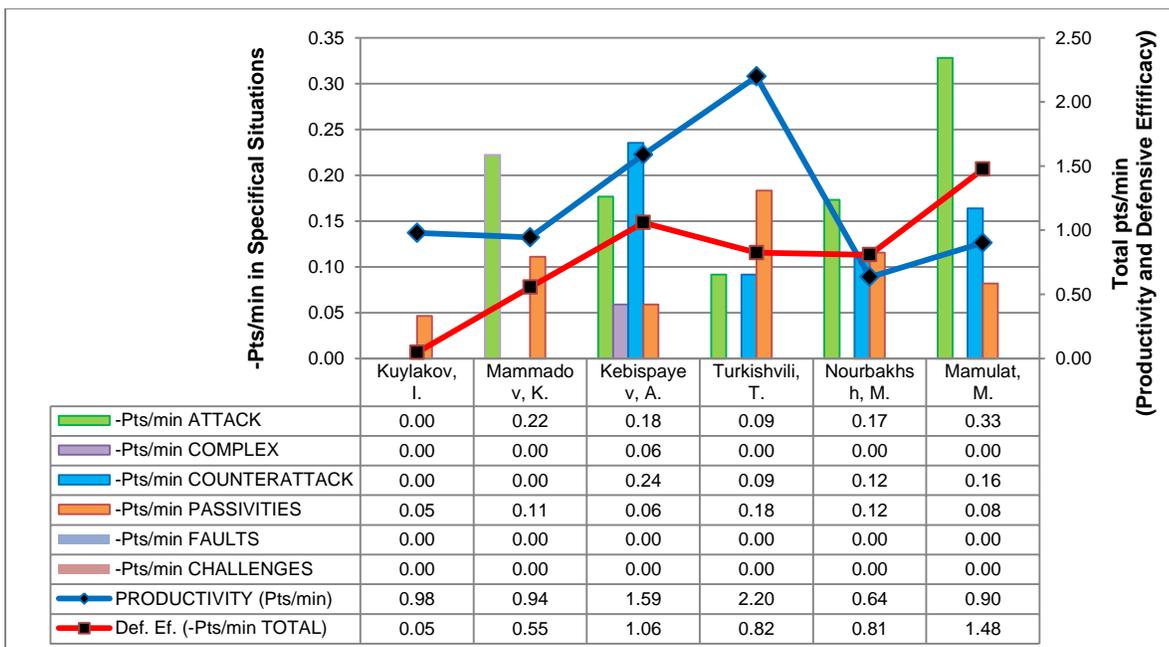


Figure 9. Defensive Weakness Profile among 1<sup>st</sup> to 5<sup>th</sup> place in Greco-Roman 60 kg. at World Universiade 2013 (Kazan)

### Wrestler's Technical -Tactical Characterization

The third type of relationship is the one that appears among the qualitative characteristics and its indicators: the coefficients "standing-parterre", "Tactical Proactivity" and "Structural Variability" as well as the averages in "Effective Distance" and "Tactical Risk". Except the first one, the rest of the positions correspond to the standing position, and the relationships among them can show us useful information for coaches and athletes, with scouting purposes as well as expression of the strategy itself, and to establish synergic models of these tactical characteristics. To graph together these indicators, the coefficients are shown in columns, in so far as the averages are reflected with dotted lines. The lowest value in the scale averages is not "0.00" but "1.00", in the scales of Effective Distance and Tactical Risk the first value is precisely 1.

The Figure 10 complements the performance analysis done to the first six classified 60 kg. weight class Greco-Roman wrestlers in Kazan 2013. The champion in this weight category, I. Kuylakov achieved almost the half of his TTC in each wrestling position (standing- par terre coefficient: 0.44), preparing proactively in standing wrestle a similar quantity of TTC that he performed reacting to his opponents spontaneous defensive errors (Tactical Proactivity coefficient : 0.50). Together with the Iranian M. Nourbakhsh reached the highest value of TTC of variable structure (Structural Variability Coefficient: 0.50). The average effective distance of the Russian wrestler was similar to the rest: 3.0 value that suggests that the promulgated rules the last month of May 2013 have increased the wrestle in full contact, situation had never been seen during the last years in this wrestling style. Finally regarding to the Tactic Risk, Kuylakov averaged 1.75, that can be called a moderate risk taking. The relationship among all these values describes the way this athlete wrestles in the Universiade 2013 as dangerous in both wrestling positions, tending to avoid risks but keeping an important proactive activity; his main technical arms are found between the low risk (through takedowns, defensive, defensive blocks, area removals) and medium risk with variable structure attacks as the "duck under" that preceded an spectacular "behind waist lock, back duplex" executed against Mammadov in the bout to get the gold medal.

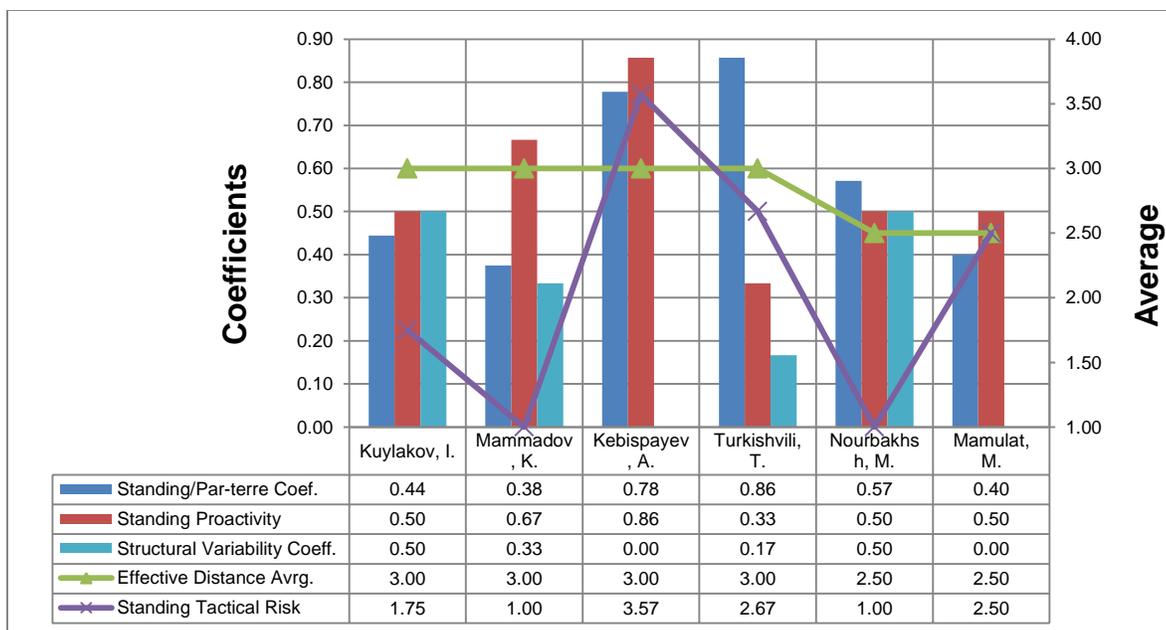


Figure 10. Individual Technical-Tactical Characterization, comparative among 1<sup>st</sup> to 5<sup>th</sup> place in Greco-Roman 60 kg. at World Universiade 2013 (Kazan)

The technical tactical characterization of A. Kebispayev contrasts with the one of the champion of the category. The Kazakh wrestler was by far the most spectacular wrestler in the studied group, thanks to his aggressive standing position wrestling and his abundant productivity through projections. His numbers so indicate it (Standing-ParTerre Coefficient 0.78, Standing Tactical Proactivity 0.86, Tactical Risk Average 3.57 and Structural Variability Coefficient 0.00, all of them extreme values, not reached by the rest of the wrestles that contested the medal). However, and retaking the Defensive Weaknesses Profile (Figure 9), the high risk taken by him and the absolute utilization of continuous structure TTC, can explain perfectly the low defensive efficiency of this wrestler.

The combination of technical tactical aspects of the sub- champion K. Mammadov (Azerbaijan) contrasts with the one of the two previous described competitors in this section. The combination of close distance (distance average 3.00), low Tactical Risk (average 1.00) and low Structural Variability (0.33) indicate this wrestler

executed attacks to go behind or to take the opponent off. It is logical to think that this tactical style influenced to the passivities against him (Figure 9). His Standing-Par terre coefficient (0.38) reveals that most his effective TTC were done in the mat wrestling; the database of the analysis has registered as his: 2 takedowns and 1 push-out; in par-terre: 4 gut wrenches and 1 lift and suplex. It can be considered a modest set of techniques in comparison with Kebispayev and Turkishvili, but was the second best defender in this tournament, therefore he went to the final. The graph of technical-tactical characterization contributes with comparative data easy to interpret once the indicators are comprehended.

## PERFORMANCE ANALYSIS PERSPECTIVES

Thanks to the current devices, accessible software and the on-line video services (including FILA-Dartfish WebTV), the Match Analysis is within reach the coaches, athletes and sport scientists. Considering the above and adding this to our sport, it now is in a new stage of evolution, the following possibilities may arise in application and development of the PA.

- **Adaptation to the Wrestling Rules.** The described video analysis can be a valuable help in the purpose to take the best and most varied strategies to achieve victory with the current rules
- **Show Improvement.** With these tools it is possible to combine effective actions that, while involving a moderate risk to achieve victory, the bouts should be spectacular and attractive to further promote our sport and help to get new fans.
- **Formation, Training and Updated knowledge.** It is a fact that several nations are still lagging behind in the wrestling development in their regions. The wrestlers from several countries with little tradition in international podiums are now demonstrating the potential of their fellow men and women, but in several cases this happens because these outstanding athletes train in other countries or are trained by top foreign coaches, but not necessarily by technical development within their territory. The database generation with actions and interrelationships of the best wrestlers in the world can serve as performance model to design a wrestling curriculum; a project that is already being addressed by the Scientific Commission of FILA.

The quantitative indicators usage in the technical tactical performance can help to avoid the stagnation of both content preparation as well as specific performance that often appears at different levels of preparation (club, state, national team).

- **Multidisciplinary studies.** With highly informative indicators that let quantify even qualitative aspects in the wrestlers' performance, it is plausible to make studies triangulating physiological, psychological and anthropometric data, and other manifestations of psychomotor potential of the wrestler. For instance a lot has been described in the literature about the potency and speediness as a peculiarity of the best wrestlers; probably these athletes use that potency in actions with specific characteristics such as the attack proactive preparation in open distance. In par-terre position, it is known that the most effective executing *gut-wrenches* have high strength levels, but in our database consists that the high frequency in this technique in male senior category is related with specific Tactical Means.

With the new rules, resistance gets more importance. How will the endurance be related with the characteristics and indicators of the technical -tactical performance?

- **Improvement of the Defensive Performance Study.** Although the proposed profile in this document gives new data, it has not been used in a large scale, and it has not been applied in female and free style yet. It is a matter of time and work to get the highly informative data in this sense.

These are only some of the possibilities. We hope this work helps to exhort the reader to apply these procedures, variables and indicators in the unstoppable evolution in our sport.

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