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Opatija, Croatia, September 3 – 6, 2014**

BOOK OF ABSTRACTS

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Goran Sporiš, Zoran Milanović, Mike Hughes, Dario Škegro

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FOREWORD:

The Book of abstracts is a collection of papers presented at the X. World Congress of International Performance of Sport held in Opatija, Croatia September 3 – 6, 2014.

It is presented for the kinesiologists, coaches, athletes or for anyone who wishes to apply the analysis of any aspect of performance operations.

Topics covered by abstracts are Tactics and technique, General Performance Analysis, Process of Performance Analysis, Work rate, Patterns of play and other topics.

We would like to thank all those contributors who have made the effort of communicating their abstracts and remind all participants that they have the possibility of publishing their full papers in the ***Performance Analysis of Sport X Book***, which will be published by Rutledge.

It is our great pleasure to announce the Soccer Workshop, which is organized under the patronage of Croatian Football Federation and will be dedicated to World Cup, Brazil, 2014. It will be a great opportunity to see the new technologies in using analysis in preparation for training in soccer.

We would like to take the opportunity to thank International Network of Sport and Health Sciences for the support.

Special thanks goes to the Organizing and Scientific committee for their hard work in preparation of the Congress.

Scientific Committee President

Prof. Goran Sporiš, PhD.



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INVITED LECTURES



A strategic partnership of centres of performance analysis of sport

Mike Hughes

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Abstract

We have now informal contact with nearly 20 universities in the discipline of Performance Analysis of Sport (PAS). Some of these universities have thriving Centres of PAS, others, just one or two members of staff struggling on their own - there is an acknowledged demand for further development of the subject area in an applied and cooperative way. The aim then is to formalise the formation of Centres of PAS, enable supporting accreditation and then create a sustaining, interactive network centred across Europe but servicing the world.

The outcomes of the Partnership are to:

- Create a more cohesive, vocation orientated, educational and training environment in PAS, for young people emerging from universities. We aim to do this by creating and running Intensive Programmes in PAS for students and staff of all the Centres, and then tying this into the international exchange of these students between the Centres, for supervised work placements of 12 months.
- These courses and work experiences will be recognised and integrated into the accreditation processes of ISPAS for individuals and the Centres.
- By developing and managing these schemes over the three year period, and formalising all the teaching materials, lectures, handouts, software, assessments and so on, and developing and testing and retesting the accreditation process for ISPAS, we then intend to expand these training structures to the rest of Europe and the world.
- The courses will then be run by the experienced European universities, with the students paying appropriate fees to maintain the sustainable development of the whole system.
- All universities sign bilateral Erasmus agreements with as many other universities in the partnership as possible.



- The Centres will all be accredited (self-assessed and confirmed) twice each year in an INTERACTIVE ongoing process, currently being designed and test-driven by ISPAS, depending upon staff expertise, research publications, consultancies, hardware, software, contracts with software firms and so on.
- Each university will recruit students (level 2 or 3) who are enthusiastic about a career in PAS – without European support the courses will cost about 1000 euros, but this is tied in with a 12 month internship in another country, and guaranteed accreditation by ISPAS.
- Distribute the trainees (Erasmus + Interns) around other Centres around Europe, September 2015, for either 6 or 12 months .
- Run Intensive Programmes in Scientific Writing and Research Methods (SWARMS) for postgraduates and staff of all the Centres to increase their potential for publications (also December, 2014 and April, 2015).
- Distribute the staff (Erasmus Exchange) around other Centres around Europe (for short periods), exchanging ideas, knowledge, experience of the different techniques, sports and equipment developed in the different Centres, creating research projects and sharing publications.

The whole structure, its developments and the inherent implications will be presented and discussed.



Health and safety issues in match analysis

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Abstract

Sports governing bodies and professional sports organisations employ performance analysts as part of their sports science support for coaches, athletes and teams. This keynote presentation discusses the health and safety issues involved in the professional practice of sports performance analysts. There are many purposes of sports performance analysis and so this keynote address focusses on one particular purpose which is match analysis. Match analysis can include team performance, opposition analysis and individual player performance. Some match analysis positions have been reported as involving excessive hours for the pay the analyst receives and some positions are unpaid (<http://www.independent.co.uk/sport/football/news-and-comment/unpaid-bad-hours-and-you-have-to-watch-reading-is-this-the-worst-job-in-football-8569387.html>). The long hours may suggest that there is a staffing problem in match analysis that needs to be addressed by recruiting further analysts to fully provide this service. The long hours experienced by some analysts may lead to sleep deprivation and further health and safety risks as a result. The UK's Health and Safety Executive identify seven areas to be covered in risk assessments of offices (<http://www.hse.gov.uk/risk/office.htm>) including the use of computers and other electrical equipment, working at height and the health of workers. Match analysis is conducted at a variety of venues which brings additional health, safety and security risks beyond those in offices.

With respect to the use of computer screens, analysts should change activity on a regular basis and take regular breaks during the coding and labelling of match videos. The governing bodies or sports organisations that employ the analysts should pay for eye tests and spectacles that are specific for visual display unit use. The most serious issue facing analysts may be that they feel vulnerable and unable to raise health and safety concerns with employers. Where risks involved in match analysis work remain unaddressed, there is a risk of industrial accidents.



Tools and techniques in table tennis analysis: An overview and selected examples

Arnold Baca

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Abstract

Performance in table tennis depends on a variety of factors. Malagoli Lanzoni, Di Michele and Merni (2012) have summarized the most important indicators proposed in literature. In particular, they divide performance indicators into the categories *player* (e.g. height, grip), *technique* (e.g. stroke and steps), *tactic* (e.g. impact position of the ball on the table), *equipment, playing conditions and facilities* (e.g. table, ball) and *others*, such as biomechanical and psychological parameters. Within the presentation contemporary methods for analysing tactical, technical and biomechanical parameters as well as for assessing properties of the equipment will be addressed. Selected examples include an approach for investigating the effects of neuromuscular fatigue on whole body kinematics, systems for automatically determining trajectories and impact positions of table tennis balls, tools and software for collecting data describing the course of a game such as type of stroke or type of error, methods for studying the effect of changes in the equipment on the players and the game as well as a device for quantifying the unbalance of table tennis balls.

Reference

Lanzoni Malagoli, I., Di Michele, R., Merni, F. (2012). Performance indicators in table tennis: a review of the literature. International Journal of Table Tennis Science, 8, 71-75.



Using player and ball locations to quantify instability in football

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Abstract

The dynamical systems perspective offers an alternative methodology for the analysis of sporting events including football (e.g. Siegle & Lames, 2013). This approach views game play as a total system (players, ball, referee, pitch, crowd etc.) which fluctuates between situations labelled stable (no tactical advantage for either team) and unstable (an advantage for one team). The premise is that an action by any component within the system (called a perturbation) e.g. a player making a tackle can cause some reaction which permeates the whole system and hence a relatively stable situation can become unstable. To date published research has not attempted to quantify these terms (stable, unstable, perturbation) beyond descriptions that are difficult to reproduce in other studies. Indeed the importance of reliable operational definitions has been well established in the performance analysis literature (e.g. Mackenzie and Cushion, 2013). This paper will attempt to quantify the stable – unstable continuum in football using player and ball locations weighted in relation to proximity to the opponent's goal to see whether this approach could facilitate the identification of perturbations. Video recordings and synchronised Amisco 2D representations of goals (n=64) scored in Swansea City AFC English Premier League (EPL, 2012/2013) matches (n=20) were analysed. The X and Y coordinates of all 22 players and the ball were recorded in an Excel spreadsheet designed to calculate instability values for each. The basic logic used was that if an attacking player was near the opposition goal then the game situation would be more unstable than if further from the goal. On this basis individual heat maps were derived for attacking and defending players and the ball using 340 cells (20x17) for the pitch. Pilot testing was used to modify these maps (adding more rules to account for different situations) with an additional value related to the proportion of attacking players relative to defending players in line or goal side of the ball added to the final instability (I) equation. Each goal was then analysed by rewinding the clip from the goal being scored to a point where the authors agreed the play could be judged to be relatively stable. At this point in time the 2D image was used to gain the X Y coordinates for all players and the ball. The clip was forward wound one second and the process repeated until the goal had been scored. This resulted in I values between 0 and 100 for every goal, sampled every second during the build up to the goal. The I values for each goal were recorded by goal type (through the middle, played out wide, shot from outside the 16 yard box, long ball, set piece, mistake). Maximum I values ranged from 13.44 (played through the middle) to 99.00 (played out wide and a set piece). These values suggest that goals in the EPL are not necessarily preceded by high I values because of the ability of



some players to score from relatively stable situations. This may not be the case for lower standard football. With refinement this method may provide a useful quantifiable measure of instability and to aid understanding the complex nature of football.

References

- Mackenzie, R. & Cushion, C. (2013). Performance analysis in football: A critical review and implications for future research. Journal of Sports Sciences, 31(6), 639-676.*
- Siegle, M. & Lames, M. (2013). Modelling soccer by means of relative phase. Journal of Systems Science and Complexity, 26(1), 14-20.*



Correlations between situational, morphological and motor parameters in soccer and futsal players

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Abstract

Soccer and futsal are at the first look very similar sports in performance characteristics. Both sports require high-intensity intermittent activities and good skill performance. While futsal is playing on smaller field area than soccer, average intensity during game is similar. The purpose of this study was to determine correlation between situational, morphological and motoric parameters in soccer and futsal players. 82 subjects participated in this study: 40 male futsal players and 42 male soccer players. Canonical correlation analysis showed that there are no statistically significant correlations between situational, morphological and motor variables in futsal and soccer players. The same results were obtained when each parameters of situational efficiency treated as a criterion. These findings suggest that situational, morphological and motor abilities in futsal and soccer players' should treat as independent performance with limited transfer to each other.

Key words: futsal, soccer, team sport, performance analysis



Comprehensive Performance Analysis

Martin Lames

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The aim of the presentation is to analyze the conceptual framework performance analysis is acting in. In some regards the actual problems of performance analysis, like for example recently stated by Mackenzie and Cushion (2013), are due to a missing comprehensive concept. In a first part, some too often neglected areas of performance analysis are pointed out. In the second part, the problem of generating useful information for sports practice is addressed from a theory of science perspective and a model of comprehensive performance analysis (CPA) in the framework of practical diagnostics in sport is developed.

Neglected activities

Studies in other sports than game sports

Often it is tacitly assumed that performance analysis deals only with game sports like football and tennis. Sometimes, the terms “game” and “sports” are used synonymously. On the other hand there exist many other sports where competition is subject to scientific analyses and thus meet the definition of performance analysis. A classification developed in former GDR lists five groups of sports with their different performance structure as classifier: endurance and strength sports, combat and game sports as well as skill sports. All these require different approaches for analyses of competition but should nevertheless be regarded altogether as objects of performance analysis.

Assessing the quality of commercially supplied data

In game sports, action and movement profiles are a methodological standard. More and more, performance analysts use data provided by commercial suppliers for their scientific studies. This is beneficial since, once there is access to this data, large volumes are accessible with low effort. Nevertheless, this should not leave to two undesirable consequences. First, other sports, women’s football and youth football should not be neglected only because there is no commercially available data in these sports. Second, ubiquitous availability of data from companies does not replace critical investigations in objectivity and reliability of this data. The problem with commercial suppliers, though, is that they are not interested in external testing of the quality of their data. Very often, it is not possible for researchers to efficiently assess the reliability of data from these sources. The companies refer to reference studies demonstrating the correctness of their system’s



measurements. So, some of these studies are frequently cited in literature but show on the other hand methodological flaws that are hardly tolerable.

In position detection only few studies exceed the gold standard of light barriers in assessing the precision of measurements. This allows only summative comparisons of distance covered and speed at discrete points of linear runs. The capability of correctly measuring acceleration and deceleration is not addressed though permanently present in football. Neither are typical problems of image detection in football like player overlay, difficult weather conditions, problematic camera positions and others. Siegle, Stevens and Lames (2013) used position tracking with a laser device as gold standard being able to check measurements continuously including accelerations and decelerations. Nevertheless, this method is still restricted to linear movements. Ogris et al. (2012) checked the accuracy of position detection using a VICON system. This allows controlling movements of all kind all over the pitch but is far away from a realistic field setting.

In action detection we often face similar problems. Companies use definitions and operationalizations that are sometimes not known but always not subject to change and improvement. Again, studies in literature on precision of commercial action detection demonstrate considerable flaws. For example, if one is interested in how far certain definitions are obeyed it is of no use to assess this by inter-observer agreement. Rather, one should look for some sort of gold standard to compare commercial measurements with. Moreover, we have two sources of errors in this situation. First, an event may be recognized by the two measurements or not. Second, only if recognized by the two measurements, we can compare agreement in the chosen categories. In the first case traditional Cohen's kappa must be replaced by more appropriate statistics.

Despite conflicting interests of companies who offer action and position detection in game sports it should stay an ongoing struggle for performance analysis research to check for the quality of this data. More open companies estimate these studies as a means for improving their procedures.

Investigating the nature of game sports

It is widely acknowledged that from a conceptual point of view game sports should appropriately be considered as dynamic interaction processes between two parties each going for its aim (scoring) and preventing the opponent to do so (McGarry et al., 2002; Lames & McGarry, 2007). In this context, the notion of complex dynamical systems is frequently introduced. Self-organization is declared as the essence of the interactions between and within teams.

On the other hand one must acknowledge that the overwhelming majority of studies apply traditional methods of data analysis from the general linear model, e.g. analysis of variance and its derivatives. Especially a search for the predictive capabilities of certain behaviors for the outcome, as has been mentioned frequently as a main task of PA (McGarry, 2009), with these linear methods ignores the above cited assumptions on the nature of game sports. Seen in this light, it is not surprising that results of studies with



this concept show frequently ambiguous results, variables do not show sufficient stability, and explaining potential is low.

Instead of looking for proofs for sufficient stability of game behavior or even continuing the old tradition of merging several games in order to arrive at stable profiles (Hughes, Evans & Wells, 2001) one should look for evidence compatible with the conceptual assumptions on the nature of game sports. This must go beyond merely treating quality of opposition as another variable in the linear model (Tenga et al., 2010). There is, for example, much evidence that the intensity of a game is hardly the result of physical capabilities of the teams but rather that it is negotiated between the teams during the ongoing match. Also, the relation between shots at goal and goals scored is that of a weak correlation from the linear standpoint. But it could also be interpreted as sign of non-linearity realizing that, for example, 15 shots at goal resulted in anything between 0 and five goals. Furthermore, the involvement of chance in goal scoring in football (Lames, subm.) sheds an interesting light on the nature of the sport. It seems to be something like a natural constant in football that some aspect of luck or not controllable circumstances are found consistently in almost half of the goals.

Search for adequate descriptions in the non-linear paradigm

Despite an overwhelming majority of studies based on the general linear model one could notice a growing number of alternative approaches. These have in common to try to analyze spatial and temporal structures of the game with instruments of complex systems theory. Relative phase is a typical example as well as entropy measures or studies of perturbations in a game (McGarry et al., 2013). Although there is much creativity in the search for new approaches these should not be driven by the content of statistical software libraries but should rather realistically promise an enhanced understanding of the game under investigation. For example, the expectation that perturbations could be identified by sudden changes in relative phase was disillusioned. The general findings of in-phase coupling in invasion games and anti-phase coupling in net games was an interesting finding as such but above that it did not lead to any augmented insight in the nature of the games.

In our own studies we are currently working with descriptive approaches from complex systems methodology. A recurrence analysis identifies similar patterns in a later phase of the game. One might well expect that this new type of analyses will result in performance indicators describing whether the game was a hectic or a smooth one, whether game behavior was more structured or chaotic, and – with a certain potential for practical purposes – whether, how many and which plays were repeated almost identically during a game.

Giving answers to contingency

At the present state of knowledge it could be helpful to distinguish between two levels of football behavior. The first is the strategic level where plans and predictable, law-like behavior takes place. For example, game analysts may give an explanation for each move of a player and even assess the quality of this move. But there is also the operational level



where we find chaos and contingency. Who can tell in advance where the ball will be in ten seconds? Will the result of this cross be a chance? Will this chance be converted?

One must admit that in a typical football match each team will have some scoring opportunities. Maybe the number is quite unbalanced between the two teams when there is a large difference in level. But even then the inferior team will in general have a few chances, say 2 vs. 10 of the dominating team. Taking into account the non-linearity of chances and goals the result of this game might be anything between 0-2 and 10-0. Of course, there are results with a higher and others – including the extreme ones cited – with lower probability. But the fact that all of these results may happen in principle is what has to be called contingency.

To start reflections on the nature of game sports in an interdisciplinary effort with philosophers being experts on the nature and meaning of contingency would deepen very much our understanding of these events.

Theory and practice

Comprehensive performance analysis: basic as well as applied science

Much of the interesting debates in Mackenzie and Cushion (2013) is on how to derive meaningful information for practice from performance analyses. The suggestion here is to arrive at a comprehensive performance analysis by distinguishing between something one could call theoretical performance analysis (TPA) and something to be named practical performance analysis (PPA) (Lames & McGarry, 2007). These different projects in performance analysis could well be distinguished by their aims. While TPA is aiming at establishing general laws on performance, especially trying to take into account the impact of the “myriads” (Mackenzie & Cushion, 2013) of context variables, PPA deals with performance analysis that is conducted in a practical context to serve the needs for a football team, for example.

It is very obvious that both activities use different methods, aims and research designs to achieve their different aims. While TPA needs large, representative samples, uses quantitative statistical methods, and preferentially relies on cross-sectional, correlative designs this is quite different for PPA. Here we have only one relevant sample, one’s own team. We come to our conclusions based on qualitative assessments but even more important on qualitative judgments e.g. on strengths and weaknesses of our team in the last match (Lames & Hansen, 2001). Research designs in PPA comprehend the spectrum given by evaluation research because essentially we try to assess with scientific methods a practical intervention.

Comprehensive performance analysis in practice

Finally, a last shortcoming of contemporary practical performance analysis needs to be mentioned, namely its lack of a comprehensive approach. The purpose of diagnostics in sports practice is to produce information that is valuable to give practical hints for



training. This information may consist of the identification of aims to target at in training, especially those with highest priority.

We fall short if we try to identify these aims merely based upon results of classical performance analysis. As mentioned above, PPA relies on qualitative assessments taking not only actual performances into account but also the level of performance prerequisites. For example, if a player is found having been too slow in some situations in a match, it is absolutely necessary to know his sprinting speed in order to draw meaningful conclusions for training. If he worked at his physical limits it is mandatory to extend those, if he didn't, some other explanations for deficient action velocity must be taken into consideration and result in different hints for training.

Also, information on the current training process is indispensable. If a behavior has been trained excessively in the past and remains still an issue in performance analysis it is a good idea to circumvent these problems by other measures than addressing this behavior directly in training. Also, the level of general fatigue induced by the last training sessions may be an explanation for behavioral states we see with the methods of performance analysis.

As a conclusion it is to be stated that there are important arguments in favor of a comprehensive performance analysis (CPA) in practice including assessment of levels of skills and abilities as well as assessment of training. Only if these diagnostic activities in sports practice are addressed in common performance analysis will unfold its full potential.

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Analysis of players' movements in offense compared to the coach desired template: a case study using the Slovenian National basketball team

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Abstract

Performance analysis is generally used to improve athlete or team performance and consequently a wide range of parameters which can be measured throughout match play are considered. This is especially the case in complex sports such as basketball. Studies which have addressed game statistics variables suggest that teams with a higher percentage of successful 2 and 3 points shots, higher number of rebounds, assists, steals and turnovers will have significantly greater chances to win a match (Ibanez, Garcia, Feu, Lorenzo & Sampaio, 2009). However this data cannot provide detailed information of the technical or tactical performance of individual players or the team and hence cannot provide coaches with information on what and how exactly things went well or badly during the match. On the other hand, time motion analysis not only provides information on physical requirements, essential for developing an appropriate training regime (Ben Abdelkrim, El Fazaa & El Ati, 2007) but can also serve as an opportunity to measure coordination dynamics between players and teams (Bourbousson, Seve & McGarry, 2010). Basketball seems to be a perfect game for this type of study because players tend to execute an offensive strategy which is based on predefined roles that involve positioning and movement dependant on the specific tactics for a play. This study will therefore quantify movement of players in elite basketball during different stages of match-play, such as defence or offence, and whilst playing against zone or man to man defence. A semi-automatic tracking system (25 Hz) with synchronised notational analysis was used to analyse player movements and passing patterns in all of the Slovenian team's matches in the preliminary round (n=5) at the 2013 European Basketball Championships.. Matlab software was used to filter the final data on players' movements for the different stages of play (Slovenian team in defence and offence, or when the clock for ball in play and 24 second attack was running). Under the supervision of the national assistant coach a template of "accurate" players' movements for the two most frequent plays (one against zone and one man to man defence) of the Slovenian team was put into the system for evaluation of effectiveness of tactical performance. All defined attacks were then evaluated in real match situations.



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ROOM 1



Knowledge based analysis of individual performance skills in team sports

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Abstract

Contemporary performance analysis (PA) research often investigates variables as a result of availability rather than to develop a deeper understanding of performance. Therefore, PA studies often fail to provide meaningful information for the coaching practice due to the multifaceted, complex and largely unpredictable behaviour in team sports like football. Thus, holistic approaches are needed that include more naturalistic and qualitative methods such as case studies, interviews and mixed methods. (Mackenzie & Cushion, 2013)

This article addresses a knowledge-based approach of a recently started research project, carried out by sport and computer scientists, aiming to semi automatically analyse individual performance skills in team sports based on quantitative position measurement data that are supplemented by qualitative expert judgements.

The approach is based on a local positioning measurement system (Ogris et al., 2012), which is used to capture high precision position data in small-sided football games. Simultaneously, expert based qualitative judgements of individual player performances are collected from coaches by means of interviews and content analyses (Tenenbaum & Driscoll, 2005). As an example, for the action “pass” the criteria “preparation”, “decision” and “quality” as well as the “difficulty” of the situation (defined by the opponent pressing and the size of the passing gap) are considered. In order to assess the players’ performance in certain situations supported by computational models, appropriate knowledge-based methods such as probabilistic graphical models and semantic concepts are utilized to represent these criteria in a formal way. The project currently focuses on building a computational model for small-sided football games based on position data. Starting from elementary actions, more complex interactions are described by probabilistic rules obtained through inference. The set of rules forms the basis of a knowledge base which represents a general view on player performance.

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Key-words: performance analysis; expert judgement; qualitative method; computerised analysis.

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Performance factors in Group Competition of Rhythmic Gymnastics

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Abstract

The aim was to clarify which quantifiable factors influenced the performance of the eight finalists in the group competition with three ribbons and two hoops at the World Championship 2011 (Montpellier, France) and to what amount.

For this purpose choreographies have been analysed by means of the software, SIMI Scout (SIMI GmbH, Unterschleissheim, Germany). Parameters have been grouped as follows: body elements (movements without flight phase, that is balances, pivots and flexibilities/waves and movements with flight phase, that is jumps); apparatus techniques (techniques where the apparatus is permanently controlled by the body and techniques where the apparatus abandons the body); apparatus exchanges; catches; distances overcome by the gymnasts; execution synchrony (group synchrony while performing body elements and group synchrony by performing apparatus elements). A PCA has been conducted by means of PASW 18.

Results showed that the performance of the composition with three ribbons and two hoops at the WC 2011 has been influenced by three factors. Factor 1 (apparatus techniques where the apparatus abandons the body, apparatus exchanges, catches, and distances overcome by the gymnasts) explained the 31% of the whole variance of the performance. Factor 2 (other movements, apparatus techniques where the apparatus is permanently controlled by the body, and body synchrony) represented the 21% of the variance. The third factor corresponded to jumps and apparatus synchrony and accounted for 14% of the total variance. The remaining 34% represents the no explained variance.

In a previous study concerning the competition with five balls (Liviotti et al. 2014) the performance has been influenced by three defined factors [Factor 1: apparatus techniques; Factor 2: synchrony / body techniques; Factor 3: distances (Liviotti et al. 2014)]. On the contrary, in this research it has not been possible to give a name to the three factors. The same happened in relation to the competitions of the years 2009 – 2010 (Liviotti, 2013). In spite of this, the artistic component (apparatus techniques) seemed to be more characterizing and/or influencing the performance also in the competition with two different kind of apparatus, as they represent partially both, the first and the second factor.

In conclusion the results of the CPA are different depending on the use of the same apparatus or two kind of apparatus (three ribbons and two hoops) contemporary. The interpretation of the results of the analysis of the competition with five balls was more easy due to the similar difficulties gymnasts had to perform in relation to the same apparatus. On the contrary, in the competition with two different kind of apparatus gymnasts have to perform different body as well as apparatus techniques due to the different characteristics of the apparatus themselves.

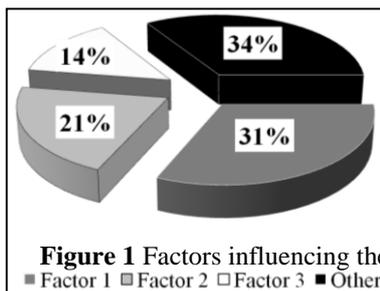


Figure 1 Factors influencing the performance

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An analysis of errors and inter-shot time of ground strokes in women's tennis

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Abstract

In recent years, tactics of tennis has been changed. Ground strokes became more important techniques than ever because of rackets development. The authors showed the importance of inter-shot time of ground strokes (Takahashi et al., 2013). This study showed we could evaluate which player had the advantage in baseline play with analysis of inter-shot time of ground strokes. In current study, we analysed the kinds of errors and inter-shot time of ground strokes in women's tennis matches.

The subject matches in current study were collected from world top ranked women's players and regional collegiate players in Japan. We analyzed the results of each rally, kinds of errors and inter-shot time of ground strokes with computerized scorebook for tennis (Takahashi et al., 2006). Errors were classified to net, side-out and back-out. Those results were compared between world top ranked players and regional collegiate players. As a result, the errors on forehand strokes showed significant differences in errors (Fig 1).

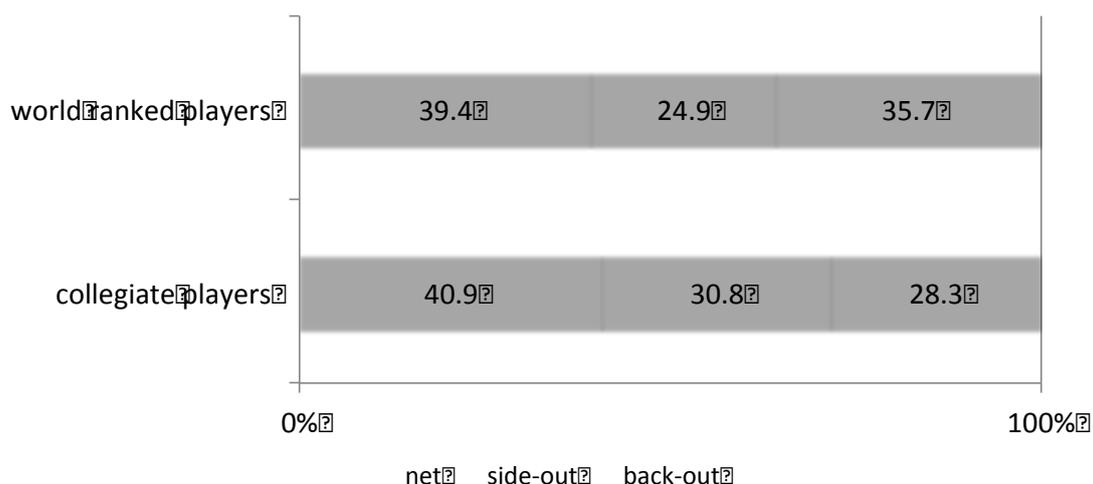


Fig 1. The ratio of errors in forehand ground strokes

Collegiate players showed high ratio in side-out and low ratio in back-out than world top ranked players. Generally, world ranked players would placed ground strokes in middle



area of the court because of reduction of errors. On the other hand, collegiate players had less accuracy in control of ground strokes. They made errors on offensive situation in rally.

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Relationship between impulsiveness and tactical performance of U-15 youth soccer players

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Abstract

Impulsiveness has been suggested as being a factor of interference on general perceptual-motor performance (Barratt, 1967). However, studies that investigate the influence of this variable on soccer performance are apparently scarce. Thus, this study aimed to examine the relationship between impulsiveness and tactical performance of U-15 youth soccer players. The sample comprised 100 U-15 youth soccer players. Impulsiveness and tactical performance were assessed, respectively, through the Continuous Performance Test-II (Conners, Epstein, Angold, & Klaric, 2003), and FUT-SAT (Teoldo, Garganta, Greco, Mesquita, & Maia, 2011) which enables the assessment of players' tactical performance through 10 tactical principles. Tactical performance values were obtained through the Game Tactical Performance Index (GTPI), Offensive Tactical Performance Index (OTPI) and Defensive Tactical Performance Index (DTPI). Kolmogorov-Smirnov and Pearson's Correlation tests were performed ($p < 0.05$) through SPSS, v.18.0. We observed a positive correlation between impulsiveness and GTPI ($r = 0.226$; $p = 0.018$). Results can be explained by the need of the quick performance regarding the tactical demands, since impulsiveness can be classified as functional and is not always a negative factor (Dickman, 1990). It is concluded that impulsiveness is related with the tactical performance of U-15 youth soccer players.

Keywords: Soccer; Impulsiveness; Tactics.

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Necessity of Goal Line Technology in Soccer

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Abstract

This study examines the frequency of goal-line-critical decisions and subsequent questionable goal decisions in soccer in order to judge the necessity of Goal Line Technology. Scientific research concerning goal line technology mostly centers on technological issues (e.g. Spagnolo, Leo, Mazzeo, Nitti, Stella and Distante, 2013). Up to now, no research has investigated whether such technology is deemed necessary. Particularly, the question to what extent such an innovation would add value to the game and avert wrong decisions. The study was commissioned and funded by Deutsche Fußball Liga (DFL, trans. German Football League). 1167 games of the 1. and 2. Bundesliga have been analyzed from round 18 of the 2011/2012 season to round 20 of the 2012/2013 season. All critical goal-line decisions were collected, including goals scored as well as goal critical situations that have not resulted in a goal. Furthermore, all phases leading to goals were screened for offsides, hand-balls and other fouls. Additionally, all penalties were evaluated. Evaluating whether calls have been right, researchers reviewed all critical decisions, including penalties. Subsequently, the tv review process revealed whether the call could be adequately resolved by video analysis. Of the 64 goal-line-critical decisions, 76.3 % could directly be resolved by tv-review. On average, 5.2 and 2.8 cases were found respectively in the 1. and 2. Bundesliga that could justify goal-line technology. 5.0 % of all critical calls concerned goal-line decisions (Offside: 84.3 %; Handing: 3.3 %; Foul: 7.3 %). Furthermore, 20.6 % of penalty calls (i.e. one per match day) were rated "doubtful". Introducing tv-reviews might be advantageous, in view of the diminishing number of goal-line-critical decisions and their share compared to remaining decisions. Although goal line technology could be useful in some rare instances, tv-



reviews have a clear advantage for assessing foul play, hand-ball, offside or other situations.

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Performance analysis in recurve archery: the potential role of timing stability and variability of movement phases

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Abstract

Precision of timing of arrow release in highly skilled recurve archery has been shown to be an important factor for shooting performance. In more detail, the consistency of clicker times, i.e. the time between the sound the clicker makes when an archer pulls the arrow back at the end of the aiming phase and the release of a shot, were in line with the mean scores at 18m indoor. This suggests that better performers have the least deviations in the timing process of arrow release (Heller, 2012). Measuring fronto-cortical electroencephalographic patterns of several athletes during arrow release, Barfoot, Casey and Callaway (2012) came to similar conclusions for the timing of the motor program of release.

The aim of the present study was to find whether the same applies to the whole movement pattern divided into separate, but linked, phases from preparation, action to recovery.

Sixteen British recurve archers (11 male, 5 female) of different level (4 national, 12 county) performed 10 ends of 3 arrows shooting at a target over a distance of 18m using their own bow and arrows (according to World Archery). High speed video analysis (210 Hz) was used to detect time periods of movement phases (pre-shot routine, set-up routine, drawing, aiming, and follow through). Additionally, the audible clicker-release times were acquired (Heller, 2012). Means, standard deviations, and coefficients of



variation for all movement phase times were calculated. Forward stepwise multiple linear regression analysis was conducted to identify factors influencing the mean score.

The results of this study show that neither timing of the phases nor clicker-release times could explain variability in scoring. One possible reason for the contradictory results concerning the clicker-release times found in the two studies is that samples were taken from different populations; one from a larger population (experienced British archers of different levels with several individual training careers and coaches), and one from a more homogeneous group (so-called subpopulation), an elite training group with similar training careers and coaches.

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Relationships between pacing parameters and performance of elite male 1500-m freestyle swimmers

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Abstract

Evidence for the effects of changes in pacing profile on endurance performance is sparse. Here we report a method for characterizing pacing in 1500-m freestyle swimming and for relating changes in pacing to changes in performance time.

The swimrankings.net website and other swimming websites provided 50-m split and final race times for 330 swims of 24 elite male swimmers in over 100 national and international competitions between 2006 and 2014. A plot of the log of lap time vs lap number for each swim indicated that the pacing profiles could be characterized parsimoniously by seven parameters derived from a general linear model: linear and quadratic coefficients for the effect of lap number to characterize the overall trend; coefficients representing deviations from the trend in the first, second, penultimate and last laps; and the residual standard error of the estimate, summarizing lap-to-lap variability and other deviations from the trend. Race time was then plotted against each parameter (one plot per swimmer per parameter). A quadratic was fitted to each scatterplot to help identify the value of the parameter associated with the swimmer's optimum performance and to determine how much the swimmer's mean value differed from his optimum.

The average quadratic profile represented a practically linear reduction in pace of 0.9% between the first lap and the nadir in the 28th lap. Times for the first, second, penultimate and last lap were shorter (in percent units) than the time predicted from each subject's quadratic profile by 8.0 ± 1.8 , 0.7 ± 1.3 , 1.7 ± 1.7 and 5.9 ± 2.9 respectively (mean \pm SD, $n=330$), and the residual error was 0.7 ± 0.2 . Most scatterplots showed only weak relationships between the parameter and performance time, but it was apparent that most swimmers could make small improvements (0.6%) in their mean performance by flattening their profiles. A small improvement ($\sim 0.3\%$) might also be possible for some swimmers by reducing the excess swimming speed in the first and second laps by 0.5%. Reducing the error by 1 SD would provide an improvement of $\sim 0.5\%$.



These effects indicate that even and consistent splits represent the best pacing strategy for most swimmers. The two-step linear modeling method might be appropriate to assess pacing in other endurance sports with multiple laps.



Preliminary Investigation of High Risk Movement in Secondary Schools Netball

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Abstract

Netball is an international sport played in more than 80 countries by over 20 million players (International Federation of Netball Associations, 2012) who have a high level of intrinsic injury risk to the lower limb (Fong, Hong, Chan, Yung & Chan, 2007). The primary mechanism being incorrect landing strategy (Hopper and Elliot, 1995). Little research has quantified landing strategies used and suggests the need to analyse this high-risk movement. Landing strategy is influenced by several factors; type of pass, player movement approach to the ball (Otago, 2004), the height of the pass, opposition pressure, landing space available, playing position, balance strategy (King & Zatsiorsky, 2002) and the footwork rule. The footwork rule extolls an external risk to the movement strategies employed, as players use rapid deceleration, stopping and varied landing movements (running, side cutting, balancing and jumping), which are known mechanisms of lower limb injury (Otago, 2004). Presently there is no data on the effect of pressure and stability whilst contesting possession, though they are frequently associated with occurrence of ankle injury. The primary aim of the current study was to understand the landing strategy of secondary school netball participants.

Data (N=193) was collected from the NZ Secondary Schools Tournament and analysed using SportsCode Elite (Sportstec, V9). Operational definitions of behaviours coded were deemed to be those important for mechanism of injury (Passing, jumping, landing, balance, pressure, game phase, court area, player position). Players were grouped according to their position (mid court or end court) and team standard (3 levels).

Analysis is still in progress, each of the game behaviours will be calculated for position and normalised for quarter game time. Intraclass correlation coefficients will be used to determine reliability (Hopkins, 2007). Correlation coefficients will be calculated for combinations of game behaviour data and the magnitude of the effect. The combinations will be specifically selected for plausible association with game behaviours within selected positional groups. Uncertainty in the correlations will be expressed as 90% confidence limits, estimated for the worst-case scenario of a zero correlation (Hopkins, 2007).



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Visual search strategy of soccer players according to different age groups

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Abstract

Visual search has been considered one of the most important aspects within the process of decision-making in soccer (Williams and Davids, 1998). Literature shows that there are differences on visual search between different competitive levels but in relation to different age groups further investigation is still necessary. The sample comprised 51 youth soccer players. The instrument used to collect and analyse data was the Mobile Eye Tracking – XG (Applied Science Laboratories, Bedford, MA, EUA). This system is used to verify gaze behaviour through visual focus. Players were grouped according to their age group : U-13 (17), U-15 (17), U-17 (17). Video stimuli were the same as that employed by Mangas (1999). Visual search stimuli were grouped in five categories: “player in possession of the ball”; “ball”; “teammates”; “opponent”; “space”. The number of fixations made by players, in each stimuli category was analysed. Data distribution was verified through Shapiro-Wilk's test. One-way ANOVA was performed to compare mean values between the three groups. Results displayed significant differences in one of the categories. The “space” category displayed significant differences between U-13 (74.35 ± 12.41), U-15 (58.78 ± 14.22) and U-17 (61.88 ± 16.44). No other significant differences were found in other categories. These findings are related to the specific sports development phase of each age group. The U-13 was the category that employed most of the visual search related with “space” unlike the U-15 and U-17 age groups. These differences might be related to the specific knowledge of soccer, which is usually lower in younger players. These findings are important for coaches and researchers to understand how visual search strategy change according to the age group.

Keywords: Soccer; Visual Search Strategy; Age Group.

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This study was funded by the State Department of Sport and Youth of Minas Gerais (SEEJMG) through the State Act of Incentive to Sports, by FAPEMIG, CAPES, CNPQ, FUNARBE, the Dean's Office for Graduate and Research Studies and the Centre of Life and Health Sciences from Universidade Federal de Viçosa, Brazil.

Reliability of an In-footage Event-Position Logging System

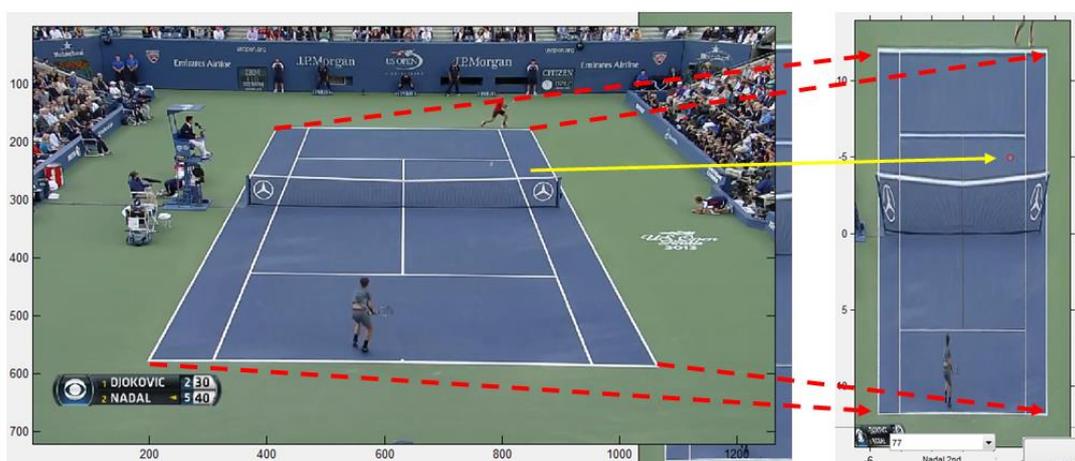
David Thomas

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Abstract

Positional performance variables can be instructive in competition preparation and academic research. The reliability of this data is critical, particularly when being used to inform tactical decisions and training plans (O'Donoghue, 2007). While plotting event locations on scale diagrams of playing areas has been proposed as a means of data collection (Hughes and Franks, 2008), these procedures rely on the operator's ability to infer positions based on visual clues from footage, and perceptual difficulties surrounding this can lead to inaccuracy and disagreement (Bradley, et al., 2007).

The current study proposes a method which allows the operator to directly select positions within footage, and automatically convert them into XY space using information obtained from playing area markings. Inter-operator reliability is compared against a conventional scale-map approach, testing agreement in logged serve bounce positions in the 2013 US Open Men's Tennis final. Finally, the in-footage approach is used to collect serve bounces in the 2013 US and Australian Open finals, in an attempt to determine whether Novak Djokovic varied tactics based on opposition handedness, comparing his serve selection when playing Rafael Nadal (left-handed) and Andy Murray (right-handed).





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Discriminant analysis that determine the final outcome of world league senior male volleyball

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Abstract

Game analysis has assumed a key role in the coaching process (Joao, et al., 2010; Zetou et al., 2007). Attacks, blocks, and serves, due to the possibility of scoring a direct point, are considered Scoring Skills. On the other hand, the defense, setting, and reception procedures are termed Non Scoring Skills (Marcelino et al., 2010). The aim of this study is to determine which of these scoring skills and non scoring skills – has higher impact on the final outcome of high-level volleyball matches.

Twenty four games from two groups (i.e. Group C: Portugal, Finland, Argentina and Serbia and Group B, Russia, Bulgaria, Germany and Japan) of men's 2011 World League were selected for game analysis. The data recording and analysis were performed using the Data Volley software. The discriminating function analysis was used to identify the factors that contribute the most to establish the maximum difference between wins and losses. Values of linear composites $|SC| \geq .30$ were considered as relevant (Tabachnick & Fidell, 1996). The significance level was set at 5%. The statistical procedures were performed in the SPSS software version 17.0.

The variables that contributed the most to the discrimination between defeat and victory were: attack error (SC=-.66) and service error (SC=-.45); and excellent service (SC=.42), opponent error (SC=-.38) and excellent reception (SC=.36), respectively.

As attack and service errors indicate the defeat of a given team, it may be suggested that high level volleyball teams should minimize the error rate during the matches to increase the probability of victories.

KEY WORDS: volleyball, matches analysis, outcome, scoring skills and non scoring skills



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The development on measurement methods for PiP (perturbation in performances) in football

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Abstract

The purpose of this study was to develop a method for measurement of perturbation in performance, particularly for football match (K-league game). The literature reviews and interviews to experts in footballs field have found relevant factors to the perturbation in performance, and a technique of notational analysis in sport has used to record details of perturbation in performance. The similarity and differences between the data collected and tracking data of individual players by x, y coordination were compared. The movement distance of each player, displacement of the movement distance of each player, movement distance of teams, and displacement of the movement distance of both teams were particularly concerned using a centroid calculation (Equation 1). As results, the distance of each player and teams were not suitable method to measure the perturbation in performances, but the displacement of movement distance of players and teams could be used to measure the perturbation in performances objectively after the comparison to a result of experts' group interview.

$$Cent A_t, Cent B_t = \frac{\sum_{i=1}^n (X_i, Y_i)_t}{n}$$

Equation 1. Centroid formula of team X and Y where $Cent A_t, Cent B_t$ are centroids of team A and B, $(X_i, Y_i)_t$ is a location of i^{th} player at time t , and n is number of all players in each team.

Keywords: perturbation in performances, football perturbation, centroid displacement, football analysis



Validation of a multiple context-dependent social networks method for applied soccer performance analysis

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Abstract

Recent studies have been adopting social networks analysis to uncover the structure and organization of the web of interactions underlying individual and team performance. However, the social networks approaches employed in these studies were not designed to provide practical performance analysis insights for soccer practitioners. Thus, the aim of this study was to develop and validate a social networks method for applied performance analysis in professional soccer.

The original methodology was designed considering the complementarities of information that multiple context-dependent networks would provide to analysts and coaches. We used OPTA passing distribution raw data from 32 teams obtained from 16 Premier League matches. Beyond the team global network for the entire match we developed a set of specific social networks capturing different game contexts: goalkeeper's distribution, defenders' distribution, midfielders' distribution, forwards' distribution, shooting opportunities path analysis, 1st phase area distribution, 2nd phase area distribution and creation & finishing area distribution. Topological graph visualizations were developed using NODE XL software. Moreover, we calculated three individual players' metrics (*betweenness*, *closeness* and *eigenvector*) from each specific network to objectively quantify the individual influences in team performance. This methodology was developed under the advice of a panel of 5 experts which assured its face validity. Feedbacks from the experts were integrated during this process. In a second step we assessed the quantitative content validity procedures using the Content Validity Ratio (CVR) (Lawshe, 1975), where a panel of 8 subject-matter experts was asked to indicate whether each context-dependent network is "essential" to capture the essence of each specific game context. The CVR data of every context-dependent network was superior to 0.5, which ensured the content validity of the methodology. In a third step, we tested the sensibility of the methodology comparing the mean and variance of players' metrics in each match between the different context-dependent networks, using repeated measures ANOVA.

Significant differences were found in the mean and variance of all the players' metrics between the multiple context-dependent networks ($p \leq .001$), with large effect sizes attributed to *eigenvector* ($\eta^2=.570$) and *betweenness* ($\eta^2=.590$) measures. Bonferroni's post hoc tests revealed also significant differences between almost all the networks ($p \leq$



.05). These results suggest that the multiple context-dependent networks are sensitive enough to capture differences in the way players interact with each other in different game contexts.

In sum, our analyses suggest that the complementary use of multiple context-dependent networks may provide objective information about individual and team performance. *Eigenvector* and *betweenness* centralities seemed also the more suitable measures to quantify the individual performances within the team activity.

Keywords: complex social systems, context-dependence, centrality, performance analysis, passing distribution, soccer.



Cricket batting placement distribution analysed by bowling line and length at the 2013 ICC Champions Trophy

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Abstract

Fielder positioning is a key task undertaken by cricket captains, and contributes greatly to a team's success, as bowling maiden overs has been shown to be more important in the later stages of an international tournament (Petersen et al., 2008).

We analysed the performance analysis data of hit ball distribution on the cricket playing field at the 2013 ICC Champions Trophy Tournament to determine the particular distribution resulting from specific bowling delivery classifications. Each bowling delivery was assigned one pitch position from a matrix of 18 possible width (line) and length combinations, based on the first bounce location. Hit deliveries were allocated into one of ten regions on the field, based on the directional angle the ball travelled after being hit. Each of these regions corresponds to a specific cricket fielding position. Furthermore, each delivery was further classified by several variables that influence its resultant position, including the handedness of both the bowler and batsmen, the bowlers type classification (fast, medium, off spin, leg spin), and the side of the wicket the bowler delivered from (over or around-the-wicket).

Of the 7157 coded deliveries analysed from the 12 matches, 3690 (52%) were hit and had field co-ordinates (used in the creation of the wagon wheel graphic) to show the direction and distance the ball travelled. The most numerous delivery was a good length ball (pitching in line with the stumps) from a right handed fast bowler bowling over-the-wicket to a right handed batsman. The corresponding fielding position hit distribution showed this is most likely to be hit to the cover position (25%), and least likely hit to the fine leg position (1%). Interestingly, approximately two thirds (61%) of these deliveries are hit in front of the wicket in the field segment from cover to the long-on position, which is same proportion for full balls (60%) of the same line. In comparison, only one in ten (12%) bouncer deliveries (very short length balls rising sharply at the batters upper chest or head) on the stump line are hit in this region. Interestingly, three-quarters (76%) of these bouncer deliveries are hit on the batsman's leg-side in the region from mid-wicket to long leg.



The main contribution of this paper is quantifying the hit fielding position distribution by classified delivery type, information that to date has not been published in the scientific literature. A captain's field placement should exploit these known hit distributions for each delivery type. As a captain is reliant on bowlers to execute their delivery of the ball to the appropriate pitch position, bowlers who are the most capable and consistent in delivering these instructions should be selected.

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ROOM 2



Physical and physiological demands of beach volleyball game: an analysis based on GPS

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Abstract

The aim of this study was to measure physical and physiological demands in beach volleyball (BV) during a game. Four professional BV players (aged: 31.0 ± 3.7 ; height: 188.00 ± 0.04 cm; weight: 81.3 ± 4.2 kg; playing experience: 11.5 ± 6.4 years) participated in this study. The data were gathered during a friendly game performed (3 sets) in an official-size sand court (length: 16 m, width: 8 m), with official BV rules (game result 2-1) and under 28°C. The external workload (distance covered per minute) was collected using a 5Hz non-differential GPS. Also, players were wearing 1Hz heart rate (HR) belts during the game, used to calculate the time spent in HR zones (zone1: < 75% of HR_{max}, zone 2: 75-85% of HR_{max}, zone3: 85-90% of HR_{max} and zone 4: $\geq 90\%$ of HR_{max}). The jumping height (m) was obtained with an Ergo jump (Bosco System, Globus, Italy). Results showed that players spent ~ 8 sec.min⁻¹ in zone 1, ~ 13 sec.min⁻¹ in zone 2, ~ 25 sec.min⁻¹ in zone 3 and ~ 14 sec.min⁻¹ in zone 4. According to the distance covered per game, players performed an average distance of 1800 m, corresponding to 40.4 m.min⁻¹. Concerning the vertical jump tests, countermovement jump in block, countermovement jump in attack and vertical squat jump, the results obtained were: 52.2 ± 9.1 cm, 62.2 ± 9.9 cm and 45.2 ± 5.1 cm, respectively. The HR values recorded revealed that BV is characterized by intermittent efforts, where very intense action (above 90% of HR_{max}) takes places during ~ 14 sec.min⁻¹. These actions may be related with jumps and spikes, common in the attack, block and service. Intense actions (between 85-90% of HR_{max}) occurred during ~ 25 sec.min⁻¹, probably associated with the difficulty of displacement on sand and with the short duration of each rally. According to the distance performed, our results revealed that players accomplished 1800 m, which makes an average of 850 m per set. This study suggests an analysis of the frequency of actions during games associated with GPS and HR records, which may allow a better understanding of physiological demands during BV games.



Influence of different small-sided games on physical and physiological demands in rugby union players

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Abstract

Given the demands upon the rugby professional athlete, the specificity of the physical preparation should reflect the degree to which each component of fitness is relied upon in competition. Due to a lack of knowledge in rugby union and because no study has compared the effectiveness of different rugby SSGs for improving physical fitness and skills in rugby players there is a need to understand the between-player differences and within-player changes over different rugby SSGs sessions. An understanding of this area, may assist coaches to deliver appropriate training methods on an individual basis. This study aimed to describe the influence of four different small sided games (SSGs) training sessions with 15 minutes duration on physical and physiological demands in rugby union players

Fourteen rugby union players (22.4 ± 3.2 years) participated in the study that was conducted during the competitive period of final-four Division I 2012-2013 qualifying competition. Time-motion and body impact data were collected using GPS technology with heart rate monitored continuously across training sessions

The results of this study demonstrate that SSGs with evasion skills showed different levels of physical performance, and skill qualities of rugby union players. Although HR responses being similar between all SSG formats, the high levels of individual variability in HR responses may explain the obtained results. There was a significant effect of speed zones ($F=598.3$, $p<.001$, $\eta^2=.96$), with pairwise differences between all zones with exception in z2-z3 and z5-z6. In addition, the interaction between speed zones and SSG formats was significant ($F=94.7$, $p<.001$, $\eta^2=.78$).

Future use of this technology may help practitioners in design and implementation of individual position-specific training programs with appropriate management of player exercise load. Given the importance of each SSG rugby training session is relied upon in competition and the need to know if they differentiate the player performance. These findings lend support to the development a well-known SSG training assessment for rugby union players.



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Evaluation of first-person (head-camera) vs. third-person perspective video feedback for decision making training in rugby sport

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Abstract

The use of augmented video feedback in sport can be categorised into two perspectives; third-person perspective (3PP), where footage is taken from a high side or end of field position and 1st person perspective (1PP), from close to where the eyes of the observer would be. Traditionally 3PP video has been used as it can be captured on any camera device and is non-intrusive. However, with the advances of technology and miniaturisation of camera hardware cameras can be placed on an athlete's head or body, allowing real-time decision making to be explored in natural settings from the athletes' viewpoint. Whilst research has explored the impact of 1PP video on experts decision-making and post event reflection in sports such as orienteering (Omodei & McLennan, 1994; Dickson, McLennan, & Omodei, 2000) and river-surfing (Houge-Mackenzie & Kerr, 2012), limited work (Croft & Ribeiro, 2013) has been conducted in combative team sports, such as rugby. Furthermore to date, no studies have examined the difference between the two video perspectives in an applied setting.

Whilst the benefits of 3PP video have been well-documented, research into 1PP is limited. Williams, Cumming & Edwards (2011) suggested that during the observation process (e.g. when an athlete watches their performance on video), the athlete would be better prepared for the movement and perceptual components of the task, if the observed action and executed action were highly congruent. It could be argued that using 1PP would achieve greater congruency than 3PP due to the stimulus of the extrastriate body area (EBA) in a way that is similar to that needed during the executed action. This area of the visual cortex has been shown to respond to perceptions of other people's body parts as well as goal directed movements of body parts (Astafiev, Stanley, Shulman & Corbetta, 2004). This study will utilise a game based scenario in which the opponents body positions and movements are crucial to the decision making process.

Participants will be divided into one of 2 condition groups; head mounted camera (figure 1.) feedback (1PP) and side of field camera feedback (3PP). Each of the groups will participate on a weekly basis in a decision making training drill, previously piloted (Croft & Ribeiro, 2013) with trending results. The drill involves attacking and defending players, with the ball carrier being required to pass the ball to a player "in space", attempting to breach the defence players line. This drill will be repeated 10 times per session with 3 interruptions for video feedback and observation of the opponent's body movements and cues. Improvements in decision making success will be recorded and reported between 1PP and 3PP groups.



Figure 1. Head camera device encapsulated inside conventional rugby headgear.

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Additional time in soccer – a comparison between different leagues

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Abstract

Taking the financial consequences for winning a championship, a title or for qualifying for the Champions-League into account, the importance of additional time in soccer appears to be really huge. But so far, there is only one single pilot-study which analysed all 31 matches of the 2012 European Championship (Siegle & Prüßner, 2013). Results showed that in 51% of all matches, the additional time was too short. A possible influence of score on the additional time was not identified. For the first time additional time has been analysed in detail. Nevertheless, there are still some open questions left, which this study tries to answer.

Accordingly, the aims of the present study were to analyse a possible influence of the referee, and a possible influence of playing country on the additional time added up at the end of a soccer match. Results show big differences between Bundesliga, Premier League, Primera Division and Serie A. The highest duration of relevant game stoppages were reached in Serie A and Premier League (4:01 min). Accordingly, indicated (3:50 min) and actual additional time (4:14 min) had its highest values in Premier League. Bundesliga displays the lowest times in all three categories: duration of relevant game stoppages (3:11 min), actual additional time (2:23 min) and indicated additional time (2:10 min). Additionally, the performances of the referees are very diverging. From every country (England, Germany, Italy and Spain) the top referees were analysed in detail (Table 1).

FIFA has to improve the coaching skills for referees. Differences in adding up time at the end of a match will simple be reduced if all countries have standard guidelines. One method to prevent referees adding up too little time could involve a fourth official records all relevant interruptions and adds the stoppage time. However; for this method all types of interruptions have to be clearly defined. FIFA's law of the game, where Rule 7 includes facts about the additional time, is too general. Referees can make the decision whether additional time is added or not (FIFA, 2013).

Table 1: Overview of the analysed referees

Referee	Indicated additional time [mm:ss]	Actual additional time [mm:ss]	Relevant game stoppages [mm:ss]
Nicola Rizzoli (Italy)	03:00	03:00	03:29
Howard Webb (England)	04:03	04:31	04:23
Felix Brych (Germany)	01:20	01:22	03:04
Carlos Velasco Carballo (Spain)	03:06	03:22	03:23

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How long does it take to win a handball match in different competitive contexts?

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Abstract

The present study aimed to analyse the effect of contextual variables (match location, quality of opposition and current points difference), as well as performance indicators (shot efficiency, goalkeeper efficiency and personal punishments) on the time that home teams take to win/lose a handball match.

The sample consisted of 221 matches of the ASOBAL League played in the 2009/2010 season. Data was collected from <http://www.asobal.es> site. Each game was analysed from the perspective of home team. The quality of opposition was determined by the difference between the latest rankings (RD) of the home team and the opponent. A k-means cluster analysis was performed to classify the quality of opposition into three groups.. The same method was used to classify the points difference into four groups; as well as shot efficiency, goalkeeper efficiency and personal punishments into two groups.

The Kaplan-Meier Survival Analysis has been used to estimate the cumulative survival probability of match result (it means that match outcome has not been achieved) to win or lose the match at each point of time according to the different contextual variables and performance indicators. The log-rank test has been applied to compare the curves functions of survival probability of winning/losing according to different contexts.

The results of long-rank test revealed the significant effect of shot efficiency ($p < 0,05$) and points difference equilibrium during the match ($p < 0,001$) on the time of match outcome, when home teams have lost. At the same time the goalkeeper efficiency ($p < 0,001$) and points difference equilibrium ($p < 0,001$), as well as quality of opposition ($p < 0,05$) showed the significant impact on the time of winning outcome of home teams.

The results suggest that goalkeeper efficiency, which also reflects the general quality of team's defense, is more important for earlier success of home teams in handball that the team's shot efficiency. The results of unbalanced matches are decided in the first part of the game. Playing against lower and equal-ranked opposition the home teams reached the final outcome close to 30 minutes; while in the games against higher-ranked teams the final score difference was reached during the last 15 minutes of match.



Complex performance diagnostics in Basketball - the influence of specific performance components on individual performance indicators

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Abstract

Specific performance monitoring and training observation is the foundation of lasting and sustainable success in competitive sports. In order to improve the conditions for this requirements in German youth basketball (Stadtman et al., 2011), a sophisticated project ("Basketball - Talente") was created in 2006. The developed diagnostic tools enable an accurate assessment of each individual's performance potential and support the purposeful training scheduling. Therefore this study is designed to identify causal correlations between central performance components regarding the performance indicator: *individual game effectiveness* as an essential condition for the complex offensive and defensive game performance in youth basketball (male and female). In addition, another aim in this context is the identification of gender and age related performance differences.

The study is created as a combined longitudinal and cross sectional study in pre-/post-test design. A total of 42 youth basketball player (22 male, 20 female) are taking part in the project. Each individual's tactical behaviour (central game indicators) during the game play in at least 70 matches is observed by using a grid marking system. A numerical rating scale: *game effectiveness index* (Hohmann, 1994), and also an expert rating is used for the quantification of the game effectiveness and general game performance. Concurrently the physical (e.g. strength, quickness) and tactical/cognitive performance data (e.g. decision making) are being gathered two times over the entire evaluation period (December 2013 – May 2014) by using complex motor tests and so called *game test situations* (Memmert, D.,2004) as well.

As estimated, first results displays significant performance differences ($p < .05$) between the male - female and under-15 – under-17 teams regarding to their individual game performance level and their motor and tactical performance level as well. The tactical/cognitive components seem to have greater influence concerning performance indicators than the mainly physical oriented skills. The study will be helpful to improve our understanding of causal relationships between specific physical and tactical/ cognitive performance indicators (complex performance structure) in youth basketball in particular consideration of the performance outcome (game effectiveness) in game play.



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Patterns of Ball Recovery of the Spanish National Soccer Team in the 2010 FIFA® World Cup

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Abstract

In soccer, keeping the ball far from the team's defensive third is regarded as being a secure approach, since allowing the opposition to have the ball within this sector provides great risks to the team's goal (Gréhaigne, 1992). Therefore, considering the defensive success of the Spanish National Soccer Team in recent UEFA® and FIFA® tournaments, this study aimed to verify Spain's patterns of ball recovery during the 2010 FIFA® World Cup, with respect to the zones of the field of play where the Spanish Team regained possession of the ball. The sample comprised 608 offensive sequences performed by the Spanish Team during their seven matches in the 2010 FIFA® World Cup. The location of the field where ball recovery took place was categorized in 12 zones, following the model proposed by Gréhaigne, Mahut, and Fernandez (2001) and . Chi-squared (χ^2) test was performed to compare the frequency of actions of ball recovery between each field zone ($p < 0.05$). Standardized residuals (R) were used to examine the significance ($R > 2.0$ and $R < -2.0$) of each zone to the model . Results displayed that the Spanish Team recover a significantly higher number of balls ($p < 0.001$; $R = 10.71$) within the right defensive midfield zone, whereas the central offensive zone provided significantly less recovered balls ($p < 0.001$; $R = -6.97$) than any other zone of the field. Such findings indicate that besides being regarded as a team who employ very offensive playing methods, Spain displayed a pattern of ball recovery that suggests they prefer to regain possession in their defensive half of the field, probably intending to perform fast counter-attacks immediately after recovering the ball.

Keywords: Soccer; Ball Recovery; World Cup.

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Handedness and stroke type distribution in top-level table tennis matches

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Abstract

The overrepresentation of left-handers in interactive sports lead to suppose that they have some kind of advantage in those sports (Hagemann, 2009). Grootuis et al. (2013) suggested that left-handed athletes have a fighting superiority, higher level of aggressiveness, and tactical advantages over their right-handed counterparts. This study aimed to compare the patterns of offensive play between left- and right-handed top-level table tennis players, even considering the opponent's handedness.

Methods. 15 table tennis matches played by top-ranked players were analysed. Five matches were played by a right-handed (RH) vs. a left-handed (LH) player, while the other matches were played by both LH (n=5) or RH (n=5) opponents. Handedness was established according to which hand was used to hold the racket. Video recordings of the matches were analysed at slow motion using the software Kinovea. The type of stroke used by the players (service, push, top spin, block, top counter top, smash, lob, drive and flick) was collected for each shot. The stroke type distributions of matches with all the combinations of opposition categories (RH vs. RH, LH vs. LH, RH vs. LH, and LH vs. RH) were compared.

Results. In all match categories, the stroke used more often by the players was the top spin (RH vs. RH: 31.3%, RH vs. LH: 31.0%, LH vs. LH: 34.3%, LH vs. RH: 38.9%). After the first attack performed using a top spin, the players counterattacked by using themselves a top spin (RH vs. RH: 17.5%, RH vs. LH: 21.8%, LH vs. LH: 12.5%, LH vs. RH: 18.6%) or countered the shot passively using a block (RH vs. RH: 18.6%, RH vs. LH: 18.5%, LH vs. LH: 20.5%, LH vs. RH: 16.2%).

Conclusions. The top spin was the most used stroke in the first attacking shot. In the matches between two RH opponents, counterattacking with a top spin was more common than in matches with other combinations of opponents' handedness. Conversely, when a LH played against another LH, passive countershots were more frequent than in other match categories. Finally, when the opponents had different handedness, LH players attacked more often with a top spin, showing a particularly offensive playing style and forcing their opponents to counterattack themselves with a top counter top.



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The application of self-organising maps to performance analysis data in rugby union sport

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Abstract

With the advent of professionalism in rugby union greater resources are now being invested into “scientific preparation” (Escot, R, 2003) with many teams believing it necessary to find new methods for analyzing and identifying meaningful information prior to match day. Commercial entities including Verusco™ and Opta™ provide services where notational information is collected about various occurrences in a match. These can be imported and linked with video footage using various software (Sports Code™, Trymaker™, Dartfish™). This can occur within twenty four hours of the game’s completion enabling the analyst and coach the ability to look at specific aspects of an opponent’s game.

The major issue that faces most coaches and analysts is the volume of information received. A typical Opta™, Sports Code™ timeline, for a single rugby match, can have in excess of 2000 instances and labels of information. Unless there is a prior understanding of an opponent much time can be spent identifying irrelevant trends and information which may not fairly represent the performance of the match.

Kohonen Self-organising Maps (SOMs) are a form of Artificial Neural Network (ANN) originally developed by Kohonen, (1982). They are an unsupervised learning tool reducing high dimensional data to a visualizable, low-dimensional topographical map. These visualizations may help the analyst quickly identify important patterns – representative of relationships between input variables -- in a match.

Within sport SOMs have been applied to time-continuous data sets in, for example, javelin throwing (Bauer & Schöllhorn, 1997), from which the authors showed the importance of day to day coordination variability, even among elite athletes. Lamb (2012) used SOMs to look at discrete data sets describing golf shot launch characteristics to visualize many linear but also non-linear relationships between launch parameters supporting the theory that the golf swing is a degenerative discrete sports action similar to those identified by Chow et al. (2005).

This paper will report the application of a SOM script to discrete data summarizing matches in New Zealand’s ITM Cup rugby competition. The input variables were



descriptions of match events organised as frequencies. The SOM approach was used to narrow down the input variables to ones that discriminate between successful and unsuccessful outcomes. The paper will then make recommendations on future applications of SOM for match analysis in a professional rugby environment.

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Analysis of influencing factors behind offensive rebounding performance in elite basketball

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Abstract

The aim of the research was to analyse the influencing factors of rebounding efficiency through observing position, activity and number of players struggling for rebounds.

Rebounding situations were notated from all the games played by the best eight teams in Euroleague 2011/12. Kruskal-Wallis and Mann-Whitney tests were used to demonstrate differences between variables and Logistic regression was employed to find the most influential factor which particularly determined whether a rebound was grabbed by an offensive or a defensive player.

The efficiency of offensive performance from actions started with offensive rebounds was higher than from offenses after possession change. This appeared mostly in the higher shooting efficiency and the higher number of forced free throws. The number of offensive players participated in rebounding was identified as the most important factor that influenced the efficiency of offensive rebounding. However the most ideal offensive rebounding was found for the active participation of three players. The lack of boxing out in defense was often notated for the observed teams which contributed the effective offensive rebounding of guards and forwards. The results of the current research support the better understanding of effective offensive rebounding and allow working out a theoretically established offensive rebounding team strategy.

Keywords: basketball, rebounding efficiency, offensive rebounding tactics

Quantifying the structure of coaches' verbal behaviour during the team timeout in handball

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Abstract

Team timeout (TTO) is used to influence the team performance, allowing coaches guide the players' activity during the match. The aim of this study was to analyse the quantity and structure of the instructional verbal behaviour of handball coaches during the TTO in two different contexts: i) when the coach calls the TTO and ii) when the TTO is called by the coach of the opponent team. All the coaches were Portuguese native speakers, with an age of 46.0 ± 5.7 years and 19.5 ± 9.0 years of coaching experience. The sample consisted of 670 units of meaning registered during 33 coaches' speeches in a total of 19 TTOs. Coaches' verbal behaviours during the TTO have been coded by units of meaning according to the CCIT instrument developed by Hastie (1999). The one-way ANOVA was used to compare the content of coaches' verbal behaviour (frequency of units of meaning) in the two TTO conditions. Recurrence Quantification Analysis (RQA) was used to assess the dynamical structure of the coaches' verbal behaviour. RQA consists in extracting quantification measures from the so-called recurrence plots (Leonardi, 2012). Here, we quantified the MAXLINE as a measure of speech stability. The one-way ANOVA revealed no significant differences in the number of coaches' statements in the two TTO conditions. In both groups of TTO the coaches used more tactical instructions compared to other categories of statements. The RQA analyses showed significant differences in the MAXLINEs of coaches' instructions between the two groups, revealing a greater stability in the structure of the coaches' speeches when they were responsible for the TTO calling. The findings of this study revealed that coaches' speech during TTO typically include tactical information, linked to psychological issues to reinforce the strategic intentions of the coach near the players. However, the communication of the coaches, who called the TTO, was more stable and better structured, which may enhance the probability of its efficacy. Our findings suggest that the handball coach should be prepared to anticipate the TTO calling by the opponent team to optimize the structuring of his verbal behaviour.



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Influence of different rules on physiological and technical demands of ball-drills in young basketball players

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Abstract

Ball-drills (BDs) have been shown to be an effective way of improving skill and physical fitness levels of basketball players (Klusemann et al., 2012). Recently, it has been demonstrated that BDs physiological and technical demands were influenced by several variables such as court size and number of players involved (Klusemann et al., 2012). However, no study investigated the effect of different rules on BDs training load (TL) and technical demands. Thus, the aim of this study was to compare the physiological and technical demands of BDs played with different rules in young basketball players.

Twenty-one young basketball players belonging to under 17 and under 15 teams performed 2 BD typologies: regular drill (RD) and no-dribble drill (NDD). All basketball rules were allowed for RD, while dribbling was not allowed for NDD. TL was assessed through the percentage of maximal heart rate (%HRmax), the rate of perceived exertion (RPE), and Edwards' TL (Edwards, 1993). Technical actions (TAs) were classified in: passes (total, correct, wrong, and % of correct passes), shots (total, scored, missed and % of made shots), interceptions, steals, turnovers and rebounds. Wilcoxon signed ranks tests were applied to assess differences between NDD and RD conditions for %HRmax, RPE, Edwards' TL and TAs, and the level of statistical significance was set at $p < 0.05$.

Results showed higher values ($p < 0.05$) for %HRmax, RPE, Edwards TL in NDD ($92.0 \pm 3.1\%$; 8.5 ± 1.0 ; 56.0 ± 3.8 , respectively) than in RD ($90.0 \pm 2.5\%$; 7.9 ± 1.1 ; 54.5 ± 2.8 , respectively). TA analysis reported higher values ($p < 0.05$) in NDD than RD for total passes (30.1 ± 9.5 and 14.9 ± 6.1 , respectively), correct passes (27.0 ± 8.9 and 13.3 ± 5.8 , respectively), wrong passes (3.0 ± 1.6 and 1.6 ± 1.0) and interceptions (2.7 ± 1.8 and 1.1 ± 1.2 , respectively).

The main finding of this study was that NDD elicited a greater physiological demand and a higher number of passes and interceptions than RD. In conclusion, basketball coaches should consider NDDs as a viable method to increase the physiological load of their training sessions, and to teach pass skills in a game-based situation.



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The importance of gender in the coaching practice in Norwegian elite football

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Abstract

Introduction: Despite that football is the largest female sport in Norway, The Norwegian Football Association (NFF) reports that only 25 % of the participants on coach programs are women. International research confirms that there is an under-representation of women in the coaching profession, especially in the context of men's sport (Norman, 2012). Previous studies that have investigated women's under-representation in sport have provided a variety of reasons to explain the absence of women, however there are still no clear answers to account for this under-representation.

Purpose: In our research we investigate the importance of gender in the coaching practice in Norwegian elite football. The study also aims to assess the factors that can make conditions in the coaching profession more women-friendly.

Methods: The data included in the survey is based on semi-structured interviews with 5 Norwegian female coaches at elite level. These were selected from a quantitative survey in an ongoing research project on the coaching practice and gender, led by Professor Kari Fasting at Norwegian School of Sport Sciences.

Results: The participants in our study confirmed the importance of how the masculine hegemony of sport idealizes male values and characteristics. The participants coaching competencies were unfavourably judged and underappreciated. The female coaches were not included in coach-networks, and there were fewer opportunities for women to coach because of the secondary status women's sport has compared to men's. The participants confirmed that they constantly need to prove competence to be respected.

Conclusion: An increased focus on coach programs, coaching teams and mentor programs, will make conditions in the coaching practice more women-friendly. For this to occur, it must be a change of attitude in the masculine culture of sport. This change of attitude will lead to an identically rating of the coaching competencies, independent of gender.

Keywords: coaches, football, women, gender, elite level



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Influence of graded physiological exertion on shooting ability in soccer

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Abstract

Although many studies examined impact of fatigue on shooting success in soccer, precise relation between progressive exertion and shooting ability was still not revealed. Therefore, purpose of this study was to identify a specific phase of progressive exertion that may initiate severe deterioration in shooting performance. A sample of 28 semi professional soccer players performed pretesting procedure, experimental (EP) and control (CP) protocol on 3 separated days. Pretesting included all-out treadmill testing, estimating their lactate thresholds and establishing 5 individual intensity zones (IZs). The EP conditions required players to perform shooting test following each speed-level of progressive, shuttle run intervention beginning at running speed 8 km/h and increasing for 1 km/h until exhaustion. The CP conditions incorporated only 8 repeated shooting trials every 3 minutes. Each shooting trial consisted of 10 shooting attempts used to measure 3 variables: shooting accuracy (SA; a mean distance of the places where the ball enters into the goal and the goal center), shooting velocity (SV; recorded using professional sports radar) and shooting quality (SQ; SA divided by the time elapsed from the kick to the point of entry). Shooting scores were analyzed in each of 5 individually established IZs. Two-way ANOVA for repeated measures revealed interaction between factors condition and shooting sequence (IZ in EP) in all measured variables: SA ($F [5, 135] = 5.283; p = 0.000$), SV ($F [5, 135] = 9.325; p = 0.000$) and SQ ($F [5, 135] = 5.606; p = 0.000$). One-way repeated measures ANOVA showed differences between 5 shooting trials performed within experimental condition for SA ($F [5, 23] = 4.854; p = 0.004$), SV ($F [5, 23] = 3.845; p = 0.011$), and SQ ($F [5, 23] = 6.852; p = 0.000$). The Bonferroni post hoc test showed reduction of the SA when baseline (BL) score was compared to IZ 5 ($p = 0.031$), and when 1st and 2nd IZs were compared with 4th ($p = 0.018; p = 0.014$) and 5th IZs ($p = 0.031; p = 0.004$), respectively. Decrease in SV was observed when shooting trials corresponding to IZ 4 ($p = 0.005$) and IZ 5 ($p = 0.003$) were compared to the BL measure and when the IZ 2 and IZ 3 were compared to IZ 5 ($p = 0.038; p = 0.006$). Likewise, harmful effect in SQ was found when the BL score was compared to score of IZ 5 ($p = 0.002$) as well as when scores from IZ 1 and IZ 2 were equated to scores from IZs 4 ($p = 0.014; p = 0.018$) and 5 ($p = 0.013; p = 0.001$). No differences between any of subsequent trials within control protocol regarding tested variables were observed. This study confirmed several previous findings that testified about detrimental effect of exertion on shooting ability. In addition, it revealed for the first time that SA, SV and SQ were severely impaired following an individual exercise intensity corresponding to the anaerobic threshold and



above the threshold. These outcomes may be practically applied in form of conducting training protocols within the level of exhaustion that has proved to deteriorate shooting ability.

Keywords— Accuracy, fatigue, kicking test, precision, soccer



POSTER PRESENTATIONS



Optimization of a Jump Shot Rhythm at the Junior Level of Basketball Performance

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Abstract

Jump shot is one of the most frequently used methods of shooting in the modern basketball. For example in the Spanish league, it accounts for 41% of all points (Rojas et al, 2000). Several studies have examined shooting technique at different distances from the basket (Bartlett and Miller, 1996; Okazaki and Rodacki, 2012). Rojas et.al, (2000) were analyzed the adjustments in technique made by a basketball player when shooting against an opponent. It was suggested that training would benefit from practice with an opponent for at least some of the time to condition players to the demands which they were more likely to meet in the game situation. Based on the results of our previous research which enabled to determine the phase structure and create rhythm models of shooting in elite male basketball (Bazanov, 2001) the purpose of this study was to improve the shooting rhythm of jump shot performances of male under 20 years old basketball players. Methods: Five under 20 years old basketball players performed before and after the feedback session 300 (150+150) middle range jump shots. The whole action of shooting was divided into 5 phases and examined quantitatively and qualitatively. The data obtained were analyzed using descriptive statistics. The reliability of the differences was examined by F-test and T-test. Results: The main results are shown in the following table. We can see, that duration of the whole jump shot activity reduced from 1,27 s (+/-SD 0,11) to 1,1 s (+/-SD 0,09) ($p < 0,01$). The main changes occurred in preparation („catching“ and „sitting down“) phases. Conclusion: Execution of technical requirements allows to change significantly the jump shot rhythm performance and reduce the duration of the preparation phases.

Table 1. Comparison of jump shot rhythm before and after the feedback session

Phases	Catching		Sitting down		Jumping up		Shooting		Follow throw		1-4 phases		The whole action	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
MAX	0,66	0,46	0,35	0,3	0,33	0,36	0,26	0,28	0,36	0,35	1,27	1,11	1,6	1,32
MIN	0,16	0,11	0,13	0,06	0,15	0,15	0,13	0,13	0,18	0,15	0,75	0,57	1,07	0,87
AVERAGE	0,33	0,25	0,22	0,13	0,22	0,25	0,21	0,2	0,29	0,27	0,98	0,83	1,27	1,1
SD	0,1	0,07	0,04	0,03	0,04	0,06	0,03	0,03	0,04	0,04	0,12	0,09	0,11	0,09
F-TEST	5,77E-06		0,025840419		0,00204205		0,0872107		0,387576		0,000859278		0,00390857	
T-TEST	8,07E-15		4,79E-61		8,62E-07		4,95E-01		0,000256		5,25E-25		5,85E-33	

N=300; Duration is shown in seconds (s)



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Technique assessment of the javelin release performed by young Serbian athletes

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Abstract

The official throwing distance has been found to be highly correlated with release velocity in elite and young javelin throwers (Panoutsakopoulos & Kollias, 2013; Saratlija et al., 2013). The achievement of high release velocity is depended on specific technique aspects of the throw. Thus, it is of importance to analyze the technique elements adopted by young javelin throwers. The purpose of the present study was to indicate the biomechanical parameters of the delivery phase associated with performance in young javelin throwers.

Seven right-handed young Serbian club level javelin throwers (19.0yrs \pm 1.0; 1.84m \pm 0.08; 81.0kg \pm 5.2) were examined during competition. The attempts were recorded from the right side with a stationary digital video-camera operating at 100fps. The APAS-XP software (Ariel Dynamics Inc.) was used for the execution of a 2D-DLT kinematical analysis. Spatial parameters (i.e. delivery stride length, distance to foul line, BCM height, javelin's grip height) and the body configuration (i.e. joint angles and inclination of body segments) were calculated. A commonly adopted Model Technique Analysis Charts (Tidow, 1996) was used for the qualitative assessment of the throwing technique of the examined athletes. The relationship between the extracted biomechanical parameters and the official distance of the throw was examined with correlation analysis using the SPSS 10.0.1 software (SPSS Inc.).

Results revealed that the official throwing distance (46.43m \pm 4.89) was significantly ($p < .05$) correlated ($r > .78$) with release velocity (16.0m/sec \pm 1.4), release angle (36.4 $^{\circ}$ \pm 1.4), javelin grip height (1.21m \pm 0.07) and the braking leg knee angle at its final touchdown (153.0 $^{\circ}$ \pm 11.4). The most common technique errors observed during the delivery phase were the flexed elbow of the throwing arm, the large knee flexion of the braking leg and the lack of the braking leg's knee extension at the instant of the release.



The quantitative assessment revealed less favorable values in key biomechanical parameters compared to the results of other studies investigating elite young athletes (Saratlija et al., 2013). It is suggested that young javelin throwers' training should emphasize in performing the release of the javelin with a proximal to distal joint sequencing that optimizes the transfer of the kinetic energy along the body, starting from the support leg and ending to the throwing hand and the javelin.

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Kinematic analysis as a mean for diagnostics of dynamic balance abilities

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Abstract

Many sports and physical activities require different levels of abilities and skills. Development of dynamic balance abilities plays a key role in most of them. Balancing on fitball is very interesting and useful exercise which is already established in sport preparation. Regarding diagnostic process, in many cases time for holding dynamic balance is the main criterion. But with help of 3 D biomechanical analysis is possible to achieve much more accuracy and different points of views.



Incidence of different ball styles in elite level goalball

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Abstract

Introduction: Goalball is a paralympic team sport, exclusively designed for athletes with visual impairments. This non-invasion game is based on a continuous exchange of attack-throw and defense-block actions. Throughout the course of a goalball match offensive players attempt to overcome defensive players, with a variety of throwing ball styles: rolling (ROL), bouncing (BOU) and curve (CUR) (Morato, Gomes & Almeida, 2012). The purpose of this study is to present the frequency of different kinds of thrown balls in elite level goalball.

Methods: Observational assessment was standardized by the comprehensive training of two evaluators; these two evaluators had at least 4 years of extensive goalball experience (Anguera, 1999). The protocol consisted of recording the ball style (ROL, BOU and CUR) of each attack, from 20 randomly selected matches, 10 per gender, from the Beijing 2008 Paralympic Games. A total of 1491 women (FEM) and 1560 men (MAL) throws was investigated. Penalty shots were not recorded. The intra and inter-observer Kappa index ranged from 0,83 to 0,89. Chi-square tests were used to compare intra and inter-gender ball style incidence.

Results: Inter-gender significant differences were found between ROL and BOU ball styles (Table 1). Within both groups, ROL and BOU balls were more common than CUR balls. In the FEM group ROL balls had a higher incidence than BOU which in turn were more common than CUR balls.

Discussion: The higher occurrence of BOU style among men may be attributed to their greater muscular strength, similarly to Chu et al. (2009) findings regarding baseball pitchers. Muscular strength is proposed to be fundamental to the BOU style execution (Morato, Gomes & Almeida, 2012). This hypothesis may also explain the FEM intra-group differences, where a higher amount of ROL balls were recorded. Morato, Gomes & Almeida (2012) suggested that CUR balls are the most technically demanding and difficulty ball style to teach for blind athletes, possibly accounting for its low incidence. Future studies could investigate the efficacy of these different ball styles in goalball performance, enhancing the knowledge about this sport.

Table 1 - Incidence of ball style in elite level goalball

	Male	Female	p value
	n=1560	n=1491	
Rolling	45% ^a	66.7% ^{a,b}	<0,01
Bouncing	48.7% ^a	28.4% ^a	<0,01
Curve	6.3%	5.9%	0,6092

Legend: ^a significantly different than curve balls,
^b significantly different than bouncing balls.

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The swimming activities as a tool for integration

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Abstract

Educational activities that satisfy the needs of particular subjects, i.e. the disabled and reentry dropouts, play a significant role in the field of initiatives regarding the prevention and the recuperation of scholastic dispersion (G. Duclos- D. Laporte -J.Ross -2006). Our research regarded eighteen students and was carried out in a secondary school in Naples, situated in a peripheral part of the city where only private sports facilities are available.

The difficulty in finding easily accessible sports facilities increases the need among the disabled to practice sports activities.

The students carried out two hours of physical water activities from January to May in the public pool of Monterusciello (NA). They were followed by a special needs teacher, expert in the sport of swimming, and by the qualified personnel granted us by the facility. The activities were primarily recreational. During the activities the pool was attended by other subjects who did not have any disabilities and by athletes in training.

The analysis of the data collected, and the surveys given to the students, teachers, and family members, showed that the activities had a positive influence on the personal autonomy of the subjects, on a social level and showed improvements in scholastics as well. Furthermore, an increase in attendance was seen, from an average of 63% for the months of September- December, to about 85% in the months of January-May.

Such an activity can therefore be considered a valid educative tool, on hand for teachers of schools found in areas of social decay, favoring the inclusion of disabled and/ or destitute subjects.

Keywords: *aquatic motor activities, disabled in the school, inclusion*



The influence of contextual variables on the team's performance in attack-defence transitions in futsal. A case study

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Abstract

The aim of the present study was to analyse the influence of contextual variables (quality of opposition, match location, match status and game period) on the team performance in attack-defence transitions in futsal. The sample consisted of 574 attack-defence transitions, registered in 20 matches played by the team in the regular phase of the Futsal Portuguese Championship of the First National Division in 2011/12 season.

An observational system was developed for the recording, quantification and analysis of players actions during the attack-defence transitions. Each episode of attack-defence transition started when the team lost the ball and terminated when one of the next three actions occurred: *ball recovery by defence, use of organized defensive system or an opponent shoot*. The *SportsCode V8 Pro* software was used for the data collection. Pearson chi-square analysis was carried out to analyse the association between the different performance indicators and the outcome of attack-defence transitions, as well as a Multinomial Logistic Regression was used to identify the influence of contextual variables on the outcome of attack-defence transitions.

The results revealed a positive association between three performance indicators (*zone of the lost of possession, number of passes allowed during the attack-defence transition and numerical relationship at the end of attack-defence transition*) and the *outcome of the attack-defence transition*. The findings also suggest an interactive effect of the *quality of opposition*game period* and *match location*quality of opposition* on the attack-defence transition success. The quality of opposition showed a significant predictive power on the probability to use an *organized defensive system* at the end of attack-defence transition, when play against strong opposition.

Further research should focus on the spatial-temporal analysis of players' behaviour in different game situations.

Does an inside floater change the place of action of soccer players?

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Abstract

The number of players is a type of condition that enables coaches to include neutral players, in order to create the context of offensive numerical superiority as a means to encourage the performance of actions in the offensive and defensive halves (Martín Acero & Lago Peñas, 2005). Floaters are used to support teams within the offensive phase of the game (Hill-Haas, Dawson, Coutts, & Rowsell, 2009). This study aims to examine if an inside floater can change the place of action of soccer players. The sample comprised 18 U-11 players. The instrument used was the System of tactical assessment in Soccer - FUT-SAT (Teoldo, Garganta, Greco, & Mesquita, 2011). Two kinds of small-sided games (numerical equality - "GK+3vs.3+GK" and numerical superiority - "GK+3vs.3+GK+1") were performed in a 36mx27m area, during 4 minutes each. To examine differences between both arrangements paired *t*-test was performed ($p < 0.05$) through SPSS 22. Results did not display significant differences in the place of action in the playing field between both arrangements, in both offensive and defensive tactical actions within offensive and defensive halves. Thus, the place of action in the playing field of U-11 players did not change when an inside floater was included.

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Biomechanical analysis of the giant slalom turn in skiers of different performance levels

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Abstract

Purpose. The skiing technique and the training methodology are continuously evolving. Since 1930s, researchers have analysed kinematic and dynamic variables of skiing (Müller,1994). Three-dimensional video analysis, together with GPS devices and inertial sensor systems, is the most accurate approach to study the technical parameters in skiing and has been used in studies involving top-level athletes (Pozzo et al. 2004). However previous studies are limited to a description of biomechanical parameters of skiing in athletes of different levels, and have not attempted to provide any explanation on the development of the skiing technique and of differences between athletes of different performance levels. This study aimed to compare the technical characteristics during a giant slalom turn between elite and beginner athletes.

Methods. Seven skiers (n= 3 elite (EA); and n= 4 beginners (BA)) were filmed using 3 cameras (50 Hz) while performing a giant slalom turn (inserted in a 10-gate track) with 11 degrees of inclination. The data were processed with SIMI (Simi Reality Motion System, GMB, Germany) and subsequently with the BTS system. Time and kinematic (linear and angular) parameters of the lower limbs and the trunk, and the trajectory of center of mass (COM) were analysed.

Results. There were differences between the groups regarding the time to cover the turn (shorter in EA), the distance of COM from the gate (COM 0.22 m closer to the gate in EA), the minimum height of the COM during the turn (39% and 47% of the athletes height in EA and BA, respectively), and the knees angle, more flexed in EA, especially in the external limb (106° vs 125°). It is worth noting that the above reported parameters were those showing the biggest differences between groups and the highest correlations with the turn performance (r values ranging from 0.64 to 0.83). Also the timing of the movement, calculated with respect to the gate, was different in the two groups. In fact, almost all the examined events occurred after crossing the gate in EA, while in BA the same events occurred both before and after crossing the gate.

Conclusions. The results remark the overall better performance of the EA group with respect to the BA group: analysis of timing of movements demonstrates that the technique in EA is more effective and correct than in BA. Moreover, it seems clear that the BA group



approaches the curve more prudently and variably than the EA group; this behaviour of BA may be due to a low self-confidence, but also to poor technical skills and a lack of strength. The intersubjective comparison allowed to identify the individual mistakes and to confirm that the best ranked athlete (FIS value) was also that with the most advanced skiing technique.

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Comparison of Declarative Tactical Knowledge between U-11 and U-15 Youth Soccer Players

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Abstract

Declarative tactical knowledge is the one the player is able to verbalize or, in other words, the player's ability to know "what to do" (Mangas, 1999). Literature has evidenced that players with more time of practice in a sport display better declarative tactical knowledge. Thus, this study aimed to compare declarative tactical knowledge between U-11 and U-15 youth soccer players. The sample comprised 36 U-11 (n=18) and U-15 (n=18) soccer players, from a Serie A Brazilian club. The instrument used to assess declarative tactical knowledge was the test developed by Mangas (1999), which enables the assessment of 13 offensive video sequences. The scenes are projected onto a large screen, whereas the video is occluded and the participant has to verbalize which is the best option for the player in possession. For assessing the results, responses were categorized into the following scores: 1, 0.75, 0.50, 0.25 and 0, respectively. Descriptive analyses (means and standard deviation) were conducted. Shapiro-Wilk's test was used to examine data distribution. To verify the differences between both age groups, Mann-Whitney's test was performed through SPSS v.20 ($p < 0.05$). Significant differences were found between the groups for the scores 1 ($p < 0.001$), 0.50 ($p = 0.041$) and 0.25 ($p = 0.002$), whereas U-15 players displayed better results for the best responses (1). This result can be explained by the fact that players with more practice time within the sport present a wider knowledge base, and might be able to identify more relevant stimuli for decision-making. It is concluded that U-15 players display better soccer specific declarative tactical knowledge, when compared to U-11 players.

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Do saccadic movements influence soccer players' decision-making?

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Abstract

Saccadic movements are one of the components involved in visual tracking. It is an important way to conduct a preliminary mapping of a situation that subsequently the individual will select the best sources of information to be analyzed. However, this variable is not explored within the soccer context, but its function seems to be important in the build up of decision-making in players who perform a greater number of saccades and are also able to identify more relevant information for further analysis. The aim of this study is to examine saccadic movements of soccer players with different levels of quality of decision-making. The sample comprised 57 youth soccer players. The instrument used to collect and analyse data was the Mobile Eye Tracking – XG (Applied Science Laboratories, Bedford, MA, EUA). This system is used to examine gaze behaviour through the track of visual focus. The players were grouped according to their age group: U-13, U-15, U-17. Video stimuli were the same as the one employed by Mangas (1999). Descriptive statistics (mean and standard deviation) were performed. *T*-test was used to determine whether there were differences between groups with different levels of quality of decision-making. Results from the saccadic analysis did not display differences between groups with high and low quality of decision-making ($t_{(16)}=1,613$, $p=0,113$, $r=0,22$). These results indicate that saccadic movements do not influence players' decision-making. This may occur because this variable does not provide information at the cognitive level and therefore cannot provide any useful information for the players' decision-making. It is concluded that there are no differences in saccadic movements between players with different quality of decision-making.

Keywords: Saccadic Movements; Decision-Making; Soccer

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This study was funded by the State Department of Sport and Youth of Minas Gerais (SEEJMG) through the State Act of Incentive to Sports, by FAPEMIG, CAPES, CNPQ, FUNARBE, the Dean's Office for Graduate and Research Studies and the Centre of Life and Health Sciences from Universidade Federal de Viçosa, Brazil.



Wicket loss and risk taking during the 2011 Cricket World Cup

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Abstract

In one day cricket, teams are not awarded any additional runs for having wickets remaining at the end of their innings. Therefore, one might expect batting teams to adopt an optimal strategy risking the loss of wickets in order to maximise the number of runs made. The purpose of the current investigation was to compare the loss of wickets in the 2011 Cricket World Cup with an expected pattern assuming a probability of 1 / 30 of losing a wicket on any ball. Such a strategy would be expected to see 10 wickets lost in 300 balls (a single innings of 50 overs). There were 49 matches in the 2011 Cricket World Cup but one was excluded from the study because it was abandoned and another was excluded because the first innings was stopped after 40 overs when the team still had 3 wickets left. Table 1 summarises the performances in the remaining 47 matches and compares these with expected performances based on a simulation of 10,000 innings assuming a probability of losing a wicket of 1 / 30 in any ball. The median over where any wicket was lost was lost occurred later than expected for both the team batting in the 1st innings and the 2nd innings. This suggests that teams do not risk losing wickets as much as they could afford to in one day international cricket. Taking greater risk when batting could lead to a greater number of runs being scored. A limitation of the study is that power play overs were not distinguished from non-power play overs during the simulated overs. However, there was no significant difference in the number of wickets lost in power play and non-powerplay overs by the teams batting in the first innings ($p = 0.617$) or the second innings ($p = 0.608$).

Table 1. Overs where wickets were lost in the 2011 Cricket World Cup compared with an expected pattern assuming a probability of a wicket being lost of 1 / 30 in any ball.

Wkt	Expected		1 st Innings		2 nd Innings	
	Over of dismissal (LQ: Median :UQ)	Matches where wkt was not taken	Over of dismissal (LQ: Median :UQ)	Matches where wkt was not taken	Over of dismissal (LQ: Median :UQ)	Matches where wkt was not taken
1	2 : 4 : 7	0.0	3 : 7 : 10	0	2 : 6 : 9	4
2	5 : 9 : 14	0.0	8.5 : 12 : 21.5	0	7 : 11 : 18	6
3	9 : 14 : 20	0.1	19 : 27 : 33	0	12 : 21 : 29	6
4	13 : 18 : 25	0.4	26.5 : 33 : 42	0	20.25 : 27.5 : 37	9
5	17 : 23 : 30	1.1	34 : 41.5 : 44	1	22 : 31 : 38.75	13
6	21 : 27 : 34	2.7	38 : 45 : 48	1	25 : 33.5 : 41.75	17
7	24 : 31 : 37	5.7	39.25 : 47 : 49	9	28.75 : 37 : 42.25	19
8	28 : 34 : 40	10.1	43 : 46.5 : 49	13	33 : 40 : 44.5	20
9	30 : 36 : 41	15.6	44.25 : 48 : 49	17	35 : 42 : 46	22
10	32 : 38 : 43	21.7	46 : 48 : 49.75	21	35.25 : 42.5 : 45	25

Comparison of declarative tactical knowledge between U-11 youth soccer players from different positions

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Abstract

In sports, declarative tactical knowledge is regarded as the athlete's ability to know "what to do" in situations within a specific domain (Garganta, 1998). In soccer this knowledge is essential so that the player can make suitable tactical decisions according to his/her positional role and tasks. Therefore, this study aimed to verify differences between the declarative tactical knowledge of U-11 players with different positional roles. The sample comprised 14 U-11 players categorized as follows: forwards (n=4), midfielders (n=5) and defenders (n=5). The instrument used was the test of declarative tactical knowledge developed by Mangas (1999). Responses given during the test were scored according to test's protocol, whereas the best answer was awarded 100 points, the second best, 75, the third, 50, the fourth, 25 and other responses were awarded 0 points. Descriptive analyses were conducted, as well as the Shapiro-Wilk's normality test. For inferential statistics one-way ANOVA was performed through SPSS v.18 ($p < 0.05$). No significant differences were found between positions. Findings indicated that the level of declarative tactical knowledge of U-11 players is not a determinant aspect when positions is taken into account, suggesting that for this age group there is no need for players to be specialized in a certain position. Thus, within this age group players should experience and develop their capabilities, techniques and tactics by thinking about the game as a whole and not as position-specific fragments. It is concluded that declarative tactical knowledge does not differ across U-11 soccer players from different positions.

Keywords: Soccer; Declarative Tactical Knowledge; Positional Role.

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Influence of an inside floater on the action outcome of soccer players

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Abstract

The number of players is an important game constraint regarding offensive numerical superiority (Aguiar, Botelho, Lago, Maças, & Sampaio, 2012). However, manipulating the game through the addition of a floater in the drill might hamper players' actions (Almeida, Ferreira, & Volossovitch, 2012). This study aimed to examine the influence of an inside floater on the action outcome of soccer players. The sample comprised 18 U-11 youth players. The instrument used was the System of tactical assessment in Soccer - FUT-SAT (Teoldo, Garganta, Greco, & Mesquita, 2011). Two kinds of small-sided games (numerical equality - "GK+3vs.3+GK" and numerical superiority - "GK+3vs.3+GK+1") were performed in a 36mx27m area, during 4 minutes each. To examine differences between both arrangements Wilcoxon's test was performed ($p < 0.05$) through SPSS v.22. Results displayed an increase in goal attempts ($p = 0.013$) and decrease in loss of ball possession ($p = 0.004$) in "GK+3vs.3+GK+1". Offensive inside floater enabled favourable conditions for goal attempting besides avoiding loss of ball possession, what indicates the benefits of employing offensive numerical superiority through the floater. Offensive inside floater might be included to encourage more goal attempts and facilitate control of ball possession.

Keywords: Soccer; Inside Floaters; Action Outcome.

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The influence of an outside floater on the place of action in the playing field at U-11 youth level

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Abstract

Game actions are performed through players' movements and positioning on the playing field, that emerge from actions of opposition and cooperation with the player in possession, aiming to create scoring chances and to score (Garganta & Gréhaigne, 1991; Metzler, 1987). This study aims to examine the influence of an outside floater on the place of action in the playing field at U-11 youth level. The sample comprised 18 youth soccer players. The instrument for data collection and analysis was FUT-SAT (Teoldo, Garganta, Greco, Mesquita, & Maia, 2011). Descriptive analyses (means and standard deviation), Paired *t*-Test and Wilcoxon test were used to compare defensive and offensive tactical actions performed in the "GK+3vs.3+GK" and in the "GK+3vs.3+GK+1" in relation to the place of action in the playing field. SPSS for Windows v.18 was used for statistical procedures. There was significant difference ($p=0.035$ and $p=0.011$) in defensive and offensive tactical actions in the defensive half, whereas "GK+3vs.3+GK+1" displayed higher means of tactical actions in comparison with "GK+3vs.3+GK". Thus, it is concluded that "GK+3vs.3+GK+1" enabled players to perform higher number of tactical actions and, consequently, to have more possession to build offensive actions. In this configuration, players opted for performing more tactical actions in the defensive half than in the offensive half, prioritizing the utilization of this area to build offensive tactical actions (Teoldo, Garganta, Greco, Mesquita, & Muller, 2011).

Keywords: Tactical Actions; Tactics; Soccer.

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The influence of positional role on the offensive tactical performance index of U-13 youth soccer players

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Abstract

In soccer, the tactical component is considered the main aspect for expert performance. However, within a team, players have different tactical tasks according to their positional roles. Thus, this study aims to examine the influence of positional role on the offensive tactical performance index (OTPI) of U-13 youth soccer players. The sample comprised 1005 offensive tactical actions, performed by 25 U-13 male soccer players from a Brazilian club, classified as defenders (n=11), midfielders (n=7) and forwards (n=7). For data collection and analysis, FUT-SAT (Teoldo, Garganta, Greco, & Mesquita, 2011) was used. It enables the assessment of players' performance based on the ten core tactical principles of soccer (Teoldo, Garganta, Greco, & Mesquita, 2009). Descriptive analyses (means and standard deviation) were performed. To compare offensive tactical performance between the groups, one-way ANOVA and Kruskal-Wallis tests were performed ($p < 0.05$). Significant differences were found between all the groups for the principle of Depth Mobility ($p = 0.04$), whereas midfielders displayed higher mean values of OTPI (61.78/ $SD = 27.54$). This result is probably due to the fact that midfielders within this team displayed more offensive characteristics, thus being able to easier perform actions that are specific from other positions. It is concluded that positional role influenced the Offensive Tactical Performance Index (for the principle of Depth Mobility) of U-13 of youth soccer players.

Keywords: Soccer; Positional Role; Offensive Tactical Performance

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The performance analysis in the sport of swimming through new technology

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Abstract

The studies by new technologies applied to assessment of sport performances have been focused on the complexity of the phenomenon and analyzing the particular aspect. The performance is evaluated by quantitative data for biomechanics and bioenergetics and qualitative data by video analysis related single performance to evaluate specific indicators and descriptors. The aim is to take in relationship quantitative data and qualitative one in water sports. Method is theoretical-argument on specific experimental studies of the whole phenomenon. Water polo study evaluates the correlation between tactics scheme and outcome and correlation between swimming velocity ball handling and without ball in athlete types. Cliff diving, which means diving from 28 meters with speed 24 m/s) study evaluates correlation between biomechanics of water impact and technical model. Synchronized swimming study evaluates correlation between biomechanical aspects of technical elements and score indicators and descriptors. Swimming study evaluates correlation between morphological diseases and pain in water polo athletes Investigation of water sports utilizes ecological and integrated method that joins qualitative and quantitative aspects, thus it could be to use new technologies to address the use of technical instruments by global vision of sport performance to help the coaches in monitoring and assessment.

Keywords: video-analysis; evaluation, qualitative and quantitative aspects performances



Performance Analysis as a method for justifying International Selection in Rugby Union

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Abstract

For any international rugby match it is expected that the team is based on the strongest players available (Boon & Sierksma, 2003). Selection for international duty in any sport is always an area of contention and it is never clear whether there is justifiable evidence to support player selection (Bruce et al., 2009). The purpose of this study was to compare England International Rugby Union players selected during 2012-13 with eligible club standard players and evaluate any differences in key performance indicators.

Twelve professional Rugby Union players (27±4yrs) who competed in the Aviva Premiership during the whole 2012-2013 season were analysed on both general and position specific KPI's (James et al., 2005) across three positions and each comprised two international and two comparable club level players. The three positions were identified as key positions within their respective playing units. Scrum Half play a major role in establishing direction and pace of attacking plays; A Centre plays a pivotal role in decision making in both attacking and defensive actions and Hookers have a more critical role in developing and setting up plays than other front row players (Vivian et al., 2001; Greenwood, 1997; Hughes and White, 1996) T-tests were performed to examine the difference across international and club level players by position and a factorial ANOVA was utilised to compare for differences and interaction between playing level. Significance was accepted at $P < 0.05$.

The International players attained higher total positive KPI's ($P = 0.015$), however, although differences were observed for each player position these did not reach statistical significance ($P > 0.05$). Scrum-Half and Hooker showed a trend for higher attainment for International players and Centre for club level players. Factorial ANOVA revealed that there were interactions within each position, highlighting that pass, kicks and carry are the most important towards International selection for Scrum-Half; line-out, tackle and carry for Hookers and finally carry, tackles and pass for Centre.

The main finding of this study was the England International player selection for 2012-13 season shows quantifiable evidence in support of player selection for Scrum-Half and Hooker, but not Centre. The analysis demonstrates that passes and kicks are most important for Scrum-Half selection and tackles and carry offer greater importance for selection as a Hooker. The KPI's for Centre are much less clear. In conclusion, club level



players should focus on the aforementioned specific positive indicators to enhance their opportunities to represent England in Rugby Union.

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What performance indicators influence the time of the first goal in the match?

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Abstract

Scoring the first goal playing at home in soccer could be crucial for winning the game (Tenga, 2012; Leite, 2013). The aim of this study was to identify the performance indicators that influence the time of scoring the first goal in a high-level soccer match. A total of 240 matches of the Portuguese Premier League played in 2009/10 season have been analysed. Time of the first goal scored, time of ball possession, shots on goal, set plays, disciplinary sanctions and substitutions were selected as predictor variables and entered into the Weibull hazard model to analyze the first goal scored by teams playing at home. All statistical analyses were carried out using Software R, version 3.0.2. The results showed significant effect of the time of ball possession ($p < 0.001$) on the time of the first goal scoring. Home teams, as well as their opponents with greater ball possession have a higher probability to score the first goal of the game. At the same time a larger number of shots on a goal ($p < 0.001$) and set plays ($p < 0.05$) performed by opponents' teams delay the time of the first goal scored by the home teams. Our findings suggest that the survival modeling is a useful tool for the performance analysis in soccer. Further research should analyze the influence of performance indicators on probability of scoring in soccer, considering the dynamics of teams' performance during the match.

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New possibilities watching of playing achievement in volleyball

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Abstract

In this paper we deal with watching and evaluation playing processes in frame of transition and their influence on a result of the set by extra league junior team VK Brno in the season 2006/2007 with help of program Volley context. Results are based on eighteen matches during this season, playing at home and on the opponent court. In all matches we were watching, recording and evaluating quantity of repeating playing processes in a winning and lost sets of the junior team VK Brno.



Fitness profiles of elite Portuguese rugby union players

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Abstract

The physical demands of rugby competition have been investigated through the use of time motion analysis (Cupples and O'Connor, 2011; Vaz et al., 2010), global positioning systems (McLellan et al., 2011; Suarez-Arrones et al., 2012) and the measurement of various physiological variables (Johnston et al., 2012). The development of notational analysis and the identification of key performance indicators have also provided further information into specific playing profiles of successful teams and individuals (Hughes and Bartlett, 2002). The aim of this study was to describe the fitness profiles of senior elite Portuguese rugby players. Forty-six senior Portuguese rugby players, classified as backs (n=22; age 26.2±2.8) and forwards (n=24; age 26.7±2.9) were assessed during physical testing sessions for the Portuguese National rugby team. The body composition, maximum strength and anaerobic capacity of players are hypothesized to be important physical characteristics as successful performance in rugby is predicated on the ability to undertake skilled behaviours both quickly and whilst withstanding large forces when in contact situations. No absolute differences were found between the backs and forwards for the speed performance variables although positional differences were found across all speeds when assessed relative to body mass since the forwards were significantly heavier. The backs body mass (kg) was significantly lower ($t = -3.2$, $p < .001$, $ES = -1.04$) than the forwards. When speed variable were adjusted for players' weight differences were found across all indicators between positions (10metres: $t = 4.2$, $p < .001$, $ES = 0.80$; 20 m: $t = 3.2$, $p < .01$, $ES = 0.79$; 30 m: $t = 3.1$, $p < .01$, $ES = 0.75$; 40 m: $t = 4.3$, $p < .01$, $ES = 0.81$; and 50 m: $t = 3.3$, $p < .01$, $ES = 0.82$). Coaches and the management team can use this information for monitoring progressive improvements in the physiological capacities of rugby players. These physical characteristics of elite rugby players provide normative profiles for specific positions and should form the basis of developmental programmes for junior players.

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Players' displacements in elite female volleyball matches: comparison between playing positions

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Abstract

This study aimed to analyse the characteristics of selected typical displacements occurring during match play in elite female volleyball players. One quarterfinal of the Serie A female Italy's Cup was examined. One set for each of the two teams was analysed. The SIMI Motion Software was used to evaluate the movement of players on the playing surface area (2D). 14 players were tracked using the C7 vertebra as a reference point for the player's body. A total of 27169 players' positions were digitised. The examined displacements were those performed when doing the following actions: blocking, defensively exiting from blocking, moving to defend, preparing the spike run-up, doing the spike run-up with and without spiking, covering, receiving. The intra- and inter-operator reliability were assessed using 5% of all digitised points. The mean \pm SD intra- and inter-operator errors were, respectively, 0.029 ± 0.017 and $.024 \pm 0.016$ m, then consistent with the previous literature (Jäger et al., 2007). The statistical analysis revealed the following significant ($p < 0.05$) differences between playing positions in the mean distance of displacement:

- for blocking, between outside hitters/opposite attacker ($0.95 \pm .58$ m) and middle blockers (1.56 ± 1.03 m); and between middle blockers and setters (0.88 ± 1.05 m)
- for defensively exiting from the block, between setters ($1.14 \pm .9$ m) and outside hitters ($2.04 \pm .98$ m)
- for defend, between middle blockers ($1.01 \pm .56$ m) and libero ($1.37 \pm .87$)
- for preparing the spike run-up, between middle blockers (2.01 ± 1.12 m) and outside hitters (2.46 ± 1.33 m)
- in the majority of displacements for covering the attack, between many players positions

In conclusion, the specialization of players leads to a variable displacements distance, that is linked to each position's characteristics. Indeed, rather large distance is shown in defensive displacements by libero, in blocking actions by middle blockers, and by outside



hitters for preparing the spike run-up. The present findings are useful to coaches to design training drills guided by the specific characteristics of each playing position.

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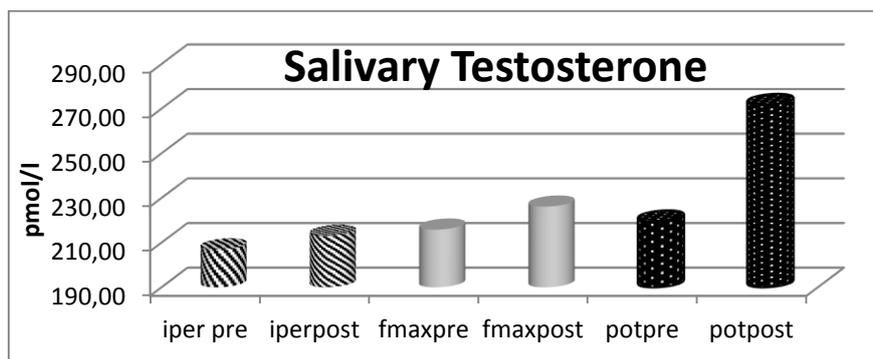
Acute Testosterone and Cortisol responses to different strength training workouts in strength athletes

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Abstract

The aim was to monitor the acute hormonal responses to different strength training sessions on strength and power athletes. Eighteen experienced strength trained males (age= 24.8 ± 4.3 years, body weight= 78.7 ± 11.8 kg, height= 178.5 ± 4.9 cm) performed an hypertrophy (5 set of 10 reps, 70% 1RM, 2 min. rest period), a maximal strength (5 set of 3 reps, 90% 1RM, 3 min. rest period) and a power workout (5 sets of 5 reps 50% 1RM, explosive intent, 3 min. rest period). Each training session was conducted at the same time of day and was composed by the same strength exercises while load volume was not equated. Testosterone and cortisol levels were detected prior and post each training workouts using salivary samples. Repeated measures ANOVA were used to examine hormone concentrations across each different training session. Salivary cortisol didn't change significantly with any training scheme. Testosterone levels increased significantly (+ 24.2 %, $p < 0.05$) after power training (table 1). Increases in testosterone levels were not significant with hypertrophy and maximal strength schemes. These results indicate that high power resistance exercise protocols produce greater increase of testosterone than maximal strength and hypertrophy schemes. Results of this study suggested the importance of power training sessions inserted into a resistance training program to activate the endocrine system in trained athletes.



Differences in attacking phase between winner and loser women handball team in relation to the beginning of action

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Abstract

Handball is complex sports which consist of numeral structural elements in the phase of attack and defense. The aim of this study was to determine differences in attacking phase between winner and loser women team in relation to the beginning of action. Many studies confirmed positive correlation between start of action and final score (Vuleta, Milanović i sur.2009 Foretić i sur. 2011, Ohnjec,Vuleta, Bojić-Ćaćić, 2013). We assume that beginning of the action could produce differences between winner and loser teams in women handball.

Table 1. Frequency of different action start in women handball teams

Start of action	Frequency			%		%		
	POB	POR	Ukupno	POB	POR	POB	POR	
PB	443	525	968	32,67%	38,77%	45,76%	54,24%	100%
UL	55	61	116	4,06%	4,51%	47,41%	52,59%	100%
IZ-LILI	208	212	420	15,34%	15,66%	49,52%	50,48%	100%
IZ-LNNVP	153	117	270	11,28%	8,64%	56,67%	43,33%	100%
SB-SPI	117	121	238	8,63%	8,94%	49,16%	50,84%	100%
SB-PPI	70	65	135	5,16%	4,80%	51,85%	48,15%	100%
OL-SPI	277	221	498	20,43%	16,32%	55,62%	44,38%	100%
OL-PPI	33	32	65	2,43%	2,36%	50,77%	49,23%	100%
Total	1356	1354	2710	100%	100%			

PB-throw; UL-throw balls; IZ-LILI- Kicking the ball away after he came off the field of play; out-LNNVP- Kicking ball after he came out of the goal area; SB-SPI - throw as a result of errors opponent's mostly in their half of the pitch; SB-PPI - throw as a result of progressive punishment most often in the opponent's half of the field; OL-SPI - League ball in their half of the pitch; OL-PPI - League ball in the opponent's half of the field; POB-winning team; POR-defeated teams

$$\chi^2 = 18,65, df = 7, p = 0,01;$$

The Highest frequency variables beginning of the attack (Table 1) has the start throw that in more frequent with the defeated (PB = 525, ie 38.77%) than the winning team (PB = 443, ie 32.67%) while the lowest frequency has a beginning attack steals the opponent's half of the field with 33 attacks and winning 32 attacks losers.



The calculated value of χ^2 - test = 18.65 refers to the winning and defeated teams differ significantly with respect to the variable start attacking. Factors resulting differences are a higher level of quality games at the stage of defense and a number of defense porters and a higher level of co-players in the implementation of tactical variations defense allows winning balls and starting attacks.

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Using Invasion Profiles as Performance Indicators in Soccer

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Abstract

Quantification of success is an important issue in performance analysis. Match outcome and indicators like goals scored, shots at goal or ball possession are not valid to performance and are unsuited to analyse e.g. the success of tactical patterns, substitutions or interventions in training. Rather it is necessary to use an objective indicator, which bases on tactical sub-goals and not depends on chance (Lames & McGarry, 2007). Therefore, this presentation proposes the concept of invasion profiles.

An invasion profile (IP) consists the quantity and position of invasions to the opponents pitch side. It is calculated by dividing the pitch into n zones. The counter of zone x gets incremented, when a team plays the ball from zone $x-1$ into zone x . Every zone gets a weight that is empirically determined by the transition probability between two zones. Based on this weights and the IP we calculate an invasion index (II), which can be used as an indicator for attacking and defending performance.

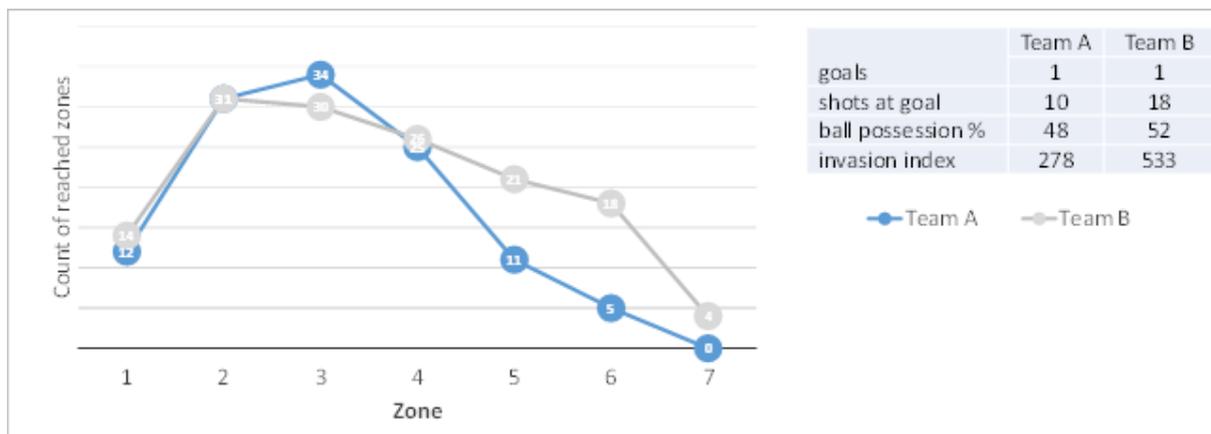


Fig.1: Invasion profiles calculated for a Bundesliga match during season 2013/14 using 7 zones (which decreased distance to opponent's goal).

Figure 1 shows an example of two team IPs in a match of the first German professional soccer league (Bundesliga). Although the game ends in draw, team B was able to come much closer to opponent's goal than Team A (Zones 5, 6, 7), which can be interpreted as more successful attacking play. In this example the dominance of Team B is reflected by the higher II and the number of shots at goal, but not in ball possession. In other analysed



games, there is no correlation between II and shots at goal. It seems to be, that invasion profiles and invasion indexes are mostly independent of standard success variables and are better suited to describe performance output.

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Goalball – Performance Analysis in Paralympic Sports

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Abstract

Background: Goalball is one of the paralympic disciplines designed for visually impaired athletes. Two teams, each consisting of three players try to score points by rolling the ball into the oppositions' net. All players wear additional blindfolds to guarantee that players are equally impaired. The ball contains bells allowing players to echolocate its movement. Goalball-specific software was developed for performance analysis ("Goalscout", "Goalview" and "Goalanalyzer") (e.g. Link & Ahmann, 2013). For practical and intuitive scouting purposes the software runs on tablet PCs. Additionally, positional data extracted from video sequences provides precise information. "Goalanalyzer" accurately measures the speed of the ball. The purposes of this project were to: a) design a software prototype that efficiently analyzes performance and, b) analyzes key aspects of Goalball (e.g. Hansen & Lames, 2001).

Materials and Methods: Male and female games (n=60) from the London Paralympics 2012 were collected and analyzed with the new software.

Results: Bowling patterns were characterized for all teams and players. For example, male teams avoided bowling from outside sector 9 (only 4%). Although, they use long line bowls more often than diagonal bowls (71% bowls with an angle between 75 and 90 degree). The significant scoring sector was 7 (Bonferroni $p = 0,006$). 60% of goals scored by male teams resulted when the ball bounced over the floor, instead of 40% of goals when the ball did not bounce. 46% of goals were scored in female games, when the ball bounced. The analysis of bowl distribution in regular game situations based on factors of bowl outcomes, provided performance indicators for teams and players (e.g. table 1). 25% of goals resulted from penalties.

Discussion and Conclusion: Performance analysis of bowling patterns for individual teams could be used to form strategies. Further research should investigate the underlying causes of observed bowling patterns; i.e. the significance of penalties or ball movement (i.e. bouncing ball). The developed software allows these questions to be addressed. Overall this tool will help experts to adjust their subjective opinion on current strategies.

Table 1. *Bowl-Distribution-Outcome for regular game situations (male)*

<i>Bowl Outcome:</i>	<i>Goal</i>	<i>Danger</i>	<i>Rebound</i>	<i>Controll</i>	<i>Out</i>	<i>Violation</i>
<i>No. Of bowls:</i>	202	153	2168	2745	658	126

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Winning Big – United States of America in the 2012 London Olympics

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Abstract

During the 2012 London Olympics the USA won all 8 games with a mean score difference of 34.1 ± 24.6 (range 5-83). This indicates a slight increase from their triumph in the 2008 Beijing Olympics where the mean point difference was 27.9 ± 11.8 (range 11–49) (Sampaio et al., 2010). The aim of this single case study was to interpret how the USA won and to understand what led them to being so successful, in terms of play-by-play action variables and scoring zones (Figure 1). The 2012 London Olympic basketball games (n=8) were captured from TV via a Blackmagic video converter in order to code and analyse each game and quarter for the USA using SportsCode Elite v8.6. By calculating the score difference of each quarter (n=32), 'big win' (15 and above difference, n=7), 'balanced win' (less than 6 difference, n=8), 'win' (between 7 and 14 difference, n=10) and 'not win' (n=7), margins could be distinguished and then categorised using the 25th and 75th percentiles. These quarters were coded and analysed by using play-by-play action variables with field goal attempts being split into five zones (Tsamourtzis and Athanasiou, 2004), each of these play-by-play action variables were normalised per actual ball possession. Results from a one-way ANOVA revealed that the number of assist passes ($F=20.4$, $p<0.001$), successful 3 point shots ($F=7.1$, $p<0.01$), two point shots missed from 'Zone 2' ($F=3.4$, $p<0.05$), 3 point shots missed from 'Zone 1' ($F=6.2$, $p<0.05$), 3 point shots made from 'Zone 4' ($F=3.3$, $p<0.05$) and 3 point shots made from 'Zone 5' ($F=4.2$, $p<0.05$) all had a significant influence on quarter outcome. The Bonferroni adjusted post hoc tests revealed that 'big win' quarters had significantly more assist passes than the other types of quarters ($p<0.01$). In addition, there were significantly more successful 3 point shots (overall) and from 'Zone 5' in 'big win' quarters than 'not win' and 'balanced win' quarters. The 3 point shots missed from 'Zone 1' ($p<0.05$) were significantly lower in 'big win' quarters than 'not win' quarters, whereas, 3 point shots made from 'Zone 4' ($p<0.05$) were significantly higher in 'big win' quarters than 'not win' quarters. Csataljay et al. (2013) states, 3 point shots are a distinguishing indicator for success. Therefore, to reduce their success rate of 3 point shots opponents must increase the level of defensive pressure on the shot by forcing the USA to perform their shots earlier, with less time to set up the shot. Assist passes can be reduced by implementing a strategy of full court press with effective communication; this will put pressure on the attack and ultimately, force bad passes or passes that are easy to steal (Sampaio et al., 2010).

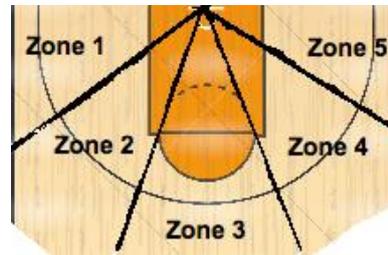


Figure 1.

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Developing team performance indicators in professional rugby league

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Abstract

Performance indicators are an important aspect of performance analysis as they allow for the objective quantification of performance (Vogelbein, Nopp & Hokelmann, 2014). However, analysing data in isolation can give misleading accounts of performance, rather it is suggested that the use of ratios can provide more context and allow for comparisons to be made (Hughes and Bartlett, 2002). Little research has been carried out using ratios in performance analysis, and there is a paucity of research on performance indicators in professional rugby league. Therefore this study will analyse team performance in professional rugby league using ratios and regression analysis to determine successful performance thereby allowing the identification of performance indicators (Hughes and Bartlett, 2002, p.739). Opta rugby league data collected from all 27 rounds of the 2013 Super League season, amounting to 189 matches, were processed in Microsoft Excel (v2013, Microsoft, 2013) and analysed using crosstabs in the IBM SPSS statistics package (v21, SPSS Inc., 2012). Games that resulted in draws (n=9) were excluded leaving 180 matches. Reliability was conducted inter-operator and analysed through a percentage error test, which indicated high levels of reliability (exact figure cannot be reported due to a commercial confidentiality agreement). Action variables included for analysis included carries, line breaks, quick play the balls, successful and unsuccessful offloads, kicks, goal kicks, passes, tackles, missed tackles, errors, penalties, metres gained and completed and incomplete sets. A comprehensive list of ratios were used for this analysis including break per carry, tries per successful passes, completed tackles per missed tackle, metres gained per completed sets, quick play the ball per metres gained, and offloads per pass.

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Comparison of energetic capacities between basketball players and runners

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Abstract

All studies have shown that in last 20 years basketball has evolved especially in terms of conditional demands such as higher tempo of the game and distances that players run through the game. All those changes may also influence physiological adaptations of trained individuals altering many aspects of exercise metabolism. According to that, primary purpose of this study was to compare basketball players (20 playmakers, 26 guards/forwards and 24 power forwards/centers) between runners competing in running events with different aerobic and anaerobic metabolic demands (10 sprinters, 15 400-metre runners, 10 middle-distance runners and 14 long-distance runners) to examine energetic capacities such as peak value of oxygen uptake (VO_{2max}), heart rate (HR_{max}) or running speed (v_{max}) and values at anaerobic threshold like heart rate (HR_{AnT}) and running speed (v_{AnT}) measured in ramp treadmill protocol.

The peak relative oxygen uptake (RVO_{2max}) value as one of the most important parameters that determines the aerobic capacity, differentiate statistically in the group of aero-runners (long and middle distance runners) and anaero-runners (sprint 100 and 400m), yet the basketball players do not differ among their groups. Relating to runners, basketball players on all positions are situated (including the other two important parameters v_{max} and v_{AnT}) in the space of anaero-runners (sprint 100 and 400 m). Knowing these characteristics have significant role in planning and implementing training systems that will enable the increase and optimal usage of energy capacities of basketball players.

Keywords: basketball, energetic capacities, VO_{2max}

Effects of relaxation time properties on system perturbations in attacking patterns of play in Football

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Abstract

In complex, dynamical systems, relaxation is defined as the system capacity to return to a stable attractor state after a perturbation (Hristovski et al., 2014). Local relaxation time is an index of time to destabilise or create a transition in states of a sports team as a complex system (Chow et al., 2009). For example, in football, the time interval between successive perturbations could provide insights on the temporal characteristics of successful attacking patterns. In this study we examined whether major system perturbations could be induced through accumulation of minor perturbations over time. A major system perturbation in football is defined as the ability to create a shot on goal when attacking and minor perturbations were defined as any attempt by attackers that did not result in a shot due to a defensive interception, poor control of a pass, a player being offside and fouls in the attacking third of the pitch. Thirteen matches involving 18 professional clubs in the Europa League competition in season 2013-14 were analysed according to these criteria for major and minor perturbations. Two conditions defined relaxation time: (i) a *momentum* condition (short-period relaxation) was recorded if a team produced a major perturbation after successive minor perturbations without defensive interruptions to play: (ii) a *phase transition* condition (long-period relaxation) was recorded if perturbations emerged between attacks by one team and the other intermittently. Additionally, time intervals between successive minor perturbations were measured and compared between winning and losing teams. Results of a chi-square test revealed significant differences ($p < 0.05$) between observed percentages of momentum and phase transition conditions, with frequency of momentum conditions being greater than phase transitions (57% vs. 43%). Results of a K-S test revealed positive skewness ($p < 0.05$) in the distribution of time intervals between successive perturbations, with most major perturbations emerging when minor perturbations emerged regularly. Results of an independent samples t-test showed that winning teams ($1.48 \text{ min} \pm 1.01$) displayed significantly shorter time intervals between minor perturbations ($p < 0.05$) than losing teams ($2.1 \text{ min} \pm 1.31$). Current findings emphasise the impact of gradual rather than sudden perturbations on destabilisation of a defending team's organisation in football.

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Effect of anxiety and relaxation on badminton performance

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Introduction

Today, in communities that have high expectations of athletes, athletic competition has a special important. In these kinds of societies, sports competition in competitive athletes has created a large demand. Often result of sporting competitions determined by the differences in perception and skill of competitors'. This topic create high stress in participants and this is usually caused by stress competitive anxiety in athletes (Shamlou, 2000).

Physical Education and Sports have several dimensions, one of the most important and perhaps the most important aspect is sports psychology. Therefore coaches and teachers can use all levels of the sport psychology, stress management, relaxation and develop and athletes can enhance their performance improvement psychological skills (Pasha Sharifi, 2002).

One of important aspects and perhaps most important aspect of sport scientific is sports psychology. Exercise studied by scientific methods and sport psychology examine human movements. (mosaddad, A,A,2002). Then sport psychology interprets human movements and predicts them for next movements and events. In other word sport psychology try by observing the general principles, developed theories and understand causes and results of movements (A. W. Garwin, 2007). One of most subjects in sport psychology is anxiety. Anxiety disorders many life functions and effect on Individual and social human performance. High have negative effective on human performance specific in sport (Jones, G, 2007). There are different methods to reduction anxiety in sport. One of these methods is relaxation that researcher done it in this study (McGowan, 2000).

Undoubted today success in athletics, almost need to higher expectations. So to resolve of these expectations and specific needs, then sport profe forced to pay more attention to although aspects of athletes and tries to enhance their abilities (Laura A Pawlow, 2002).

Although psychological pressure is a common problem among athletes, but results show when increase this pressure, too, has an impact on the quality of exercise and skills (Daniel S, 2002). This psychological pressure in sport competitions can provide the athlete's anxiety and excessive anxiety can be effective on their skills and reduce the quality of their skills. Therefore, in this study researcher wants to study the effects of anxiety on performance.

Methodology

This study was done semi-experimental and using questionnaires to assess personality characteristics. Statistics society was all male physical education students who have chosen badminton with age between 18-24. Sample consisted of two groups (control group, experimental group) which are selected randomly (n=15). tool was Sports Personality Questionnaire (SPQ20). One of the factors that measured by the questionnaire of 24 questions is anxiety.

Methods of research

Subjects divided two groups experimental (teaching with relaxation) and control (teaching without relaxation). experimental group done pre-designed and regular activities 8 weeks, 2 sessions per week and 40 minute per session. After 8 weeks subjects completed questionnaire again as a post-test was used.

Results

Table 1 shows results pre-test and post - test of effect of anxiety on badminton skills performance in male students. As it is clear, there are significant different in post-test of badminton skills performance between experimental group (with relaxation) and control group (without relaxation) in $p < 0.05$.

Table1: pre and post-test results of badminton skills performance in experimental and control groups.

<i>results</i> <i>group</i>	<i>test</i>	<i>anxiety mean</i>	<i>SD</i>	<i>Skills</i> <i>performance</i>	<i>P</i>
<i>Experimental</i>	<i>Pre</i>	<i>104.1</i>	<i>6.3</i>	<i>18</i>	<i>0.031</i>
	<i>Post</i>	<i>78.3</i>	<i>3.2</i>		
<i>control</i>	<i>Pre</i>	<i>106</i>	<i>5.1</i>	<i>11.2</i>	
	<i>post</i>	<i>99.6</i>	<i>2.8</i>		

Table 2 shows results pre-test and post - test effect of anxiety on badminton skills speed in male students. As it is clear, there are no significant different in badminton skills speed in post-test between experimental group (with relaxation) and control group (without relaxation) in $p < 0.05$.

Table2: pre and post-test results of effect anxiety on badminton skills speed in male students.

<i>results</i> <i>group</i>	<i>test</i>	<i>anxiety mean</i>	<i>SD</i>	<i>badminton</i> <i>skills speed</i>	<i>P</i>
<i>Experimental</i>	<i>Pre</i>	<i>104.1</i>	<i>6.3</i>	<i>14</i>	<i>0.072</i>
	<i>Post</i>	<i>78.3</i>	<i>3.2</i>		
<i>control</i>	<i>Pre</i>	<i>106</i>	<i>5.1</i>	<i>10.5</i>	
	<i>post</i>	<i>99.6</i>	<i>2.8</i>		

Table 3 shows results of pre-test and post - test effect of anxiety on badminton skills power in male students. As it is clear, there are significant different in badminton skills power in post-test between experimental group (with relaxation) and control group (without relaxation) in $p < 0.05$.

Table3: pre and post-test results of effect anxiety on badminton skills power in male students.

<i>results</i> <i>group</i>	<i>test</i>	<i>anxiety mean</i>	<i>SD</i>	<i>badminton</i> <i>skills power</i>	<i>P</i>
<i>Experimental</i>	<i>Pre</i>	104.1	6.3	18.4	0.028
	<i>Post</i>	78.3	3.2		
<i>control</i>	<i>Pre</i>	106	5.1	8.1	
	<i>post</i>	99.6	2.8		

Table 4 shows results of pre-test and post - test effect of anxiety on badminton skills accuracy in male students. As it is clear, there are significant different in badminton skills accuracy in post-test between experimental group (with relaxation) and control group (without relaxation) in $p < 0.05$.

Table4: pre and post-test results of badminton skills accuracy in experimental and control groups.

<i>results</i> <i>group</i>	<i>test</i>	<i>anxiety mean</i>	<i>SD</i>	<i>badminton</i> <i>skills accuracy</i>	<i>P</i>
<i>Experimental</i>	<i>Pre</i>	104.1	6.3	16.1	0.041
	<i>Post</i>	78.3	3.2		
<i>control</i>	<i>Pre</i>	106	5.1	10.3	
	<i>post</i>	99.6	2.8		

Discussion

The aim of this study was examination effect of anxiety and relaxation on skills. According the results relaxation reduction anxiety and increase performance. Relaxation can effect on skills. In many sports have many skills. Some of these skills take effect of anxiety and some do not take effect. Results showed anxiety is significant effect on performance, accuracy and power of skills. Results showed anxiety is not significant effect on speed of skills. Then teachers and coach when feel athlete have anxiety can change the strategy and use the skills in teams program that anxiety not effect in skills.



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Applied performance analysis: insights from professional football

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Abstract

The focus of sports performance analysis research has now begun to diversify, aiming to critically examine not only the technical, tactical and time-motion variables associated with performance, but also the perceptions of performance analysis (PA) and the resources and intricacies relating to the collection and provision of performance feedback within applied practice (e.g. Wright et al., 2013). However, despite the importance of feedback processes to instigate a change in behaviour and promote learning, there is a distinct lack of research pertaining to this specific line of scientific enquiry. Therefore, the aim of this study was to explore the applied practice of performance analysts working in professional football.

A sample of 65 performance analysts working within professional football completed an on-line survey. The sample comprised of analysts working within the English Premiership (n = 27), Championship (n = 22), League One (n = 11) and League Two (n = 5). Of the 65 respondents, 77% and 23% worked with the 1st team and Academy respectively. The on-line survey was created using Bristol Online Surveys (University of Bristol, Bristol, UK), comprised of 59 questions, and was subdivided into five dominant themes; (1) demographic information, (2) departmental resources and analysis undertaken, (3) perceptions and efficacy of PA, (4) provision of augmented feedback, and, (5) PA and the coaching process. All questions were mandatory and formatted as multiple choice, multiple answer, or, short answer questions.

The key findings from this study were; (1) 45% of respondents felt their organisation viewed PA to be essential. (2) 54% felt that parity in the PA process throughout the organisation was either very important or essential. (3) 26% stated that it had been challenging to implement PA within the organisation, whereas 45% confirmed it would be a challenge to implement change to the current PA provision. (4) 82% and 86% of respondents used PA to highlight strengths and weaknesses respectively in individual/team performance. (5) the dominant types of analysis included; pre-match (86%), live (78%), trend (74%), and post-match (91%). Interestingly, 19% also analysed coach behaviour. (6) 49% stated that their coaches were very involved in the PA process, yet only 28% offered coach education re: the processes associated with PA, (7) the predominant approach for pre-match and post-match feedback was video (88%), with statistical reports having lesser prevalence (55%). (8) 74% and 55% specified that pre-match and post-match presentations respectively lasted less than 20 minutes. In addition, 25% stated that post-match presentations were delivered immediately, whereas 51%



delivered post-match debriefs 1-day post event. (9) 43% considered player reflection to be essential, whereas only 71% specified that they implemented processes to encourage player reflection. However, 67% of those who implemented reflection processes confirmed that the dominant strategy for player reflection was solely access to either match/individual clips and/or statistics. Collectively, these findings provide an acute insight into the provision of objective and subjective information within professional football. Moreover, they can be critically reviewed in light of the contemporary skill acquisition research to ensure that optimal feedback strategies are employed.

Reference

Wright, C., Atkins, S., Jones, B. & Todd, J. (2013). The role of performance analysts within the coaching process: performance analysts survey 'the role of performance analysts in elite football club settings,' International Journal of Performance Analysis in Sport, 13: 240-261.



Performance analysis within professional football: insights for student employability and academia-industry relations

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Abstract

Graduate employability is a core value held by universities, and academic institutions often advocate the vocational relevance of their courses. In addition, a key consideration determining the success of a UK university's Research Excellence Framework submission is the impact of the research upon society. Sports performance analysis could, arguably, act as an important vehicle by which to explore and satisfy both agendas. For instance, understanding the background and role of applied performance analysts would better inform learning and teaching, and effective collaboration between academia and industry would enable scientifically rigorous, yet practically relevant research. These sentiments align to past research that examines the role of the performance analyst within professional sport (Wright et al., 2013), and, responds to previous commentary by Cardinale (2011) who stated that: "...the disconnect between academia and sport is getting bigger and bigger every day." Therefore, the aim of this study was to investigate the demographics of performance analysts within professional football and identify whether academic research informs their practice.

A sample of 65 performance analysts working within professional football completed an on-line survey. The sample comprised of analysts working within the English Premiership (n = 27), Championship (n = 22), League One (n = 11) and League Two (n = 5). Of the 65 respondents, 77% and 23% worked with the 1st team and Academy respectively. The on-line survey was created using Bristol Online Surveys (University of Bristol, Bristol, UK), comprised of 59 questions, and was subdivided into five dominant themes; (1) demographic information, (2) departmental resources and analysis undertaken, (3) perceptions and efficacy of PA, (4) provision of augmented feedback, and, (5) PA and the coaching process.

The findings of the study revealed that; (1) 77% of the respondents were aged 29 years or less. 92% were qualified to at least undergraduate level. Sport Science was the most common exit route (49%). 34% had a postgraduate qualification in performance analysis. (2) 29% had no football coaching badge, and only 19% had a qualification equivalent to or exceeding UEFA B. Communication skills and game understanding were viewed to be the most crucial factors impacting feedback to players/coaches (>60%). (3) 62% of analysts were not professionally accredited. ISPAS accreditation accounted for 73% of



accredited analysts. (4) For CPD, 80% and 62% of analysts respectively visited other analysts or attended sport-specific conferences. Only 17% attended an academic conference. (5) The primary source of work experience offered at the analysts' organisation was as an academy analyst (69%). (6) 74% of respondents stated that the club's philosophy informed the selection of key performance indicators, and is in contrast to 3% who used the academic literature. Yet, 68% of analysts undertake in-house research projects. Collectively, this study highlights key demographic information relating to practising performance analysts, and identifies the current disparity between academia and sport.

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Functional movement screen of youth male Slovenian Team Handball players

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Introduction: The proper execution of fundamental movement patterns is very important for motor development of young handball players. These movements represent the foundations for more complex movements and skills (Pori, Pori, Janežič, Štirn, Bon, & Šibila, 2013). For the efficient functioning of the human body it is very important that the movements (muscles) are coordinated into appropriate movement patterns. They have to be a logical part of a kinetic chain, where the energy, as well as force, can be optimally transferred from proximal to distal parts of the body. Poor strength of certain muscle groups in the kinetic chain as well as inadequate amplitude of joint movements, can lead to compensatory or dysfunctional movement patterns (Becham, & Harper, 2010), which can deteriorate the athletes performance. Compensatory movements in extreme circumstances, such as handball trainings and matches, can exacerbate the condition and cause bigger issues due to poor execution of movements (Boyle, 2004). In recent years the Functional movement screen (FMS) (Cook, 2010) has been deemed an efficient and reliable system to evaluate basic movement patterns. The objective of the research was to evaluate the fundamental movement patterns of youth male handball players and to analyze possible asymmetries and dysfunctional movement patterns.

Methods: The participants consisted of 64 youth male handball players (age: $14,7 \pm 0,7$ years, height: $176 \pm 5,3$ cm, body weight: $67,4 \pm 8,9$ kg) and 15 non-athletes male who represented a control group (age: $14,1 \pm 0,8$ years, height: $168,6 \pm 7,7$ cm, body weight: $63,2 \pm 5,2$ kg). To carry out the measurements we used the Functional Movement Screen (Cook, 2010). The measurements of experimental and control group were carried out on two separate occasions. The statistical analysis included descriptive statistics procedures. To determine the statistical differences in estimates between the different groups, we used one-way analysis of variance. Statistically significant differences between the left and right sides of the body of participants were determined by a T-test of pairs. Statistical significance was tested with a 5% alpha error.

Results and Discussion: The obtained data demonstrates poor general sports education as well as non-systematic training process of young handball players in terms of diagnostics and training of basic movement patterns. We have also found statistical significance differences in asymmetries between left and right sides in some tests. Those results are very concerning regardless on the age of our subjects.



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Analysis of effort and prediction of energy expenditure during exercises with Freestyler™ elastic tubes of different resistance

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Abstract

Workouts on Freestyler™ board are performed with stretching elastic tubes which are attached to arms and legs. The aim of the study was to investigate the effects of exercises with Freestyler™ elastic tubes of different resistance on heart rate frequency and prediction of energy expenditure. Eleven males (Age 23.4 ± 1.1 years; Height 181.6 ± 3.1 cm; Weight 81.4 ± 4.9 kg) participated in the study. Effort was assessed with measuring heart rate (HR) frequency. To calculate maximum HR frequency (HRmax) an intermittent Fitness test 30-15 (Buchheit, Haddad, Millet, Lepretre, Newton, and Ahmaidi, 2009) was used. Predicted energy expenditure was evaluated with Keytel et al. (2005) formula. One-way analysis of variance - Repeated measures was used to analyse the effects of exercises with elastic tubes of different resistance. The results showed that both in relative HR frequency (% HRmax) ($F(4, 40) = 161, 906$; $p = .000$) and predicted energy expenditure ($F(4, 40) = 151, 677$; $p = .000$) there are statistically significant differences when performing exercises with elastic tubes of different resistance. It could be concluded that doing the same exercises with Freestyler™ elastic tubes of different resistance could increase the % HRmax (from 19 % to 43 %) and predicted energy exposure (from 33 % to 71 %) compared to no additional resistance.



Reactive agility performance – the reliability of a newly constructed measuring protocol: a brief report

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Abstract

Although the importance of reactive agility in sports is a known issue, there is only a limited number of reliable testing protocols for this capacity. The aim of this study was to report the reliability of a developed reactive agility testing procedure, and to present the construction of original testing equipment designed specifically for this purpose. The testing equipment is based on the ATMEL microcontroller AT89C51RE2 with a photoelectric infrared sensor as an external time triggering input, and LED illuminations as controlled outputs. A total of 63 college-level athletes (39 males; age 21.1 ± 2.4 years) participated in the investigation. The procedures consist of three unpredictable (for reactive-agility) or three predictable (for non-reactive-agility) changes in running direction. Analyses were done separately for males and females. The results suggest that both tests are highly reliable (ICC ranged from 0.88-0.88; Cronbach Alpha: 0.78-0.85; Coefficient of Variation: 5-6%). ANOVA showed stabilization of the results until the third testing trial. The reactive and non-reactive agility performance carried out on the same court shared 36% and 42% of the common variance (for males and females, respectively). The simultaneous performance of both tests can be beneficial because the calculated ratio of scores will allow the indirect determination of the reaction qualities of tested subjects.

Key words: testing design, change of direction speed, performance



Multivariate analysis of international level (CIC***) eventing competition

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Abstract

Horse Trials or Eventing has been an Olympic sport since 1912 and has military origins. It is like a triathlon with 3 main phases; dressage, cross country and show jumping. The scores in each phase are cumulative, with the lowest score at the end of the three phases winning. In the first phase, the dressage, the horse and rider combination are scored on a series pre-set movements by up to 3 judges. The cross country phase involves up to 45 jumping efforts (fixed obstacles) over a distance of between 5,700 - 6270m, at an average speed of 570m/ minute. Penalties are incurred for any faults (refusals, run outs) and exceeding the set time (0.4 penalties per second over the set time). Within the show jumping phase, penalties are acquired for any faults incurred (knocked poles, refusal, run out) and exceeding the set time (1 penalty per second or fraction over the set time). A fall and error of course in both the cross country and show jumping phases results in the elimination.

At international level the dressage score involves a weighting of 1.5 (resulting in the weaker dressage tests achieving proportionally higher dressage penalty scores to be carried into the next phase of competition), this is a cause of much debate. Deuel & Russel-Cohen (1995) in their analysis of three world championship 3 day events (1998-1992) and Whitaker & Hill (2006) in their analysis of CCI**** events in the UK (2000 – 2004), reported that the dressage phase exerted the greatest influence on penalty points but Whitaker & Hill (2006) reported that cross country time had the biggest impact on final placings.

The aims of this study were to assess (i) the impact of the scoring phases on the final finishing score and (ii) the sources of non-completion at International CIC*** level.

Data was accessed from 200 competitors competing at the Tattersalls International CIC*** Ireland from 2008 to 2013. Multivariate analysis was conducted, using final place as the dependent variable and dressage score, cross country time, cross country faults, show jumping time and show jumping faults as the independent variables.

Of those that started the competition 58 (29%) failed to return a completion score. Of the completion scores, dressage penalty points contributed 69% of the penalties in the percentage accrual of penalties, cross country time contributed 17%, cross country faults 5%, show jumping faults 7% and show jumping time 2% of the penalties. However multivariate analysis indicated that cross country time had the most influential effect on



final placing (49%) of the variation, followed by show jumping faults (11%), dressage (4%), show jumping time (1%) and cross country faults (1%). Whitaker & Hill (2006) reported a similar finding on the influence of cross country time (41%) on final placing at CCI**** competition,.

In conclusion, while the dressage phase makes the biggest contribution to accrual of penalty scores, the actual cross country time penalties that had the biggest impact on finishing position.

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The changing rules effect on game-related statistics of basketball game

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Abstract

The new FIBA basketball rules were experimented by Spanish Basketball League in the last 2009/10 season. This present study aimed to analyse the effect of the changing rules in the game-related statistics of basketball game.

A total of 1836 basketball games were separated into two sub-groups: Before the Changing Rules (BCR), 837 games from the three seasons immediately before the 2009/10 season (2006/07, 2007/08 and 2008/09); and after the changing rules (ACR), 869 games from the three seasons played with the new rules (2009/10, 2010/11 and 2011/2012). Thirteen game-related statistics of a basketball game were considered the Simple Parameters (SP). Some Collective Efficiency Parameters (CEP) were considered and calculated taking account the SP. The data were analysed according to three stages. First, it was determined the simple arithmetic average between the winner and the loser teams for each SP. Second, the SP of the whole game were according to 100 ball possessions (Oliver, 2004), and the CEP were calculated over these normalized values. Finally, two-independent discriminant analysis were carried out to analyse the effects of changing rules in both classes of game-related statistics. The analysis of the structure coefficients (SC) allowed to identify the most powerful SP and CEP in discriminating between before and after the changing rules.

The discriminant functions were statistically significant for both game-related statistics: $\chi^2= 224.43$, $p<0.001$ for SP and $\chi^2= 171.22$, $p<0.001$. The results demonstrated that field goals, free-throws and fouls were discriminated before and after the changing rules – 2-points field goal made (SC=-0.30), 2-points field goal missed (SC=-0.52), 3-points field goal made (SC=0.47), 3-points field goal missed (SC=0.34), free-throws made (SC=0.46), free-throws missed (SC=0.42), fouls (SC=0.51). The CEP analysis showed the offensive rating (SC=-0.46), and the adjust field goal percentage (SC=0.35) as the discriminators of changing rules effect.

The findings revealed that the new rules introduced lower levels of offensive rating in the basketball game. In addition, results pointed out that teams try to shot more frequently from 2-points field goal zone than on 3-points.

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Effects of number of players and technical instruction on the physical performance of elite female football players in small-sided games

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Abstract

The effect of different formats of small-sided games (SSGs) on the physical performance have not been sufficiently analysed in the context of elite female football. This study aimed to analyse the effects of changing the number of players and the number of ball touches authorized within SSG on the physical performance of elite female football players.

Six elite Portuguese female football players participated in this study (age: $25\pm 6,8$; years of practice: $3,3\pm 2$; height: $169\pm 3,2$ cm; weight: $60,6\pm 2,4$ kg; body mass: $21,4\pm 0,7$ kg). Participants and their teammates were divided in two teams. Data was collected using a 15 Hz GPS system (SPI PRO, GPSports, Canberra, Australia) in three training sessions, separated one-week from each other. In each session teams performed four SSGs – 4-a-side (3x3+GKs) and 5-a-side (4x4+GKs) – constrained by two different rules: 1) the “free play”, without additional rules or conditions; 2) the “two touches play”, in which players were allowed to perform a maximum of two consecutive ball touches per individual possession. The pitch size was adjusted to $1:150\text{m}^2$ per player in each SSG. In order to avoid an order effect, the sequences of the SSGs were randomly varied in each session. Three different groups of parameters were measured: velocity parameters, distance parameters and activity duration parameters. A two-way (2x2) repeated-measures ANOVA was used to compare the effects of SSGs constraints on three groups of external load parameters. The Friedman test was used when the normality and homogeneity assumptions were rejected.

The findings revealed a significant main effects of the interaction between the independent variables on two external load parameters: the percentage of covered distance in low intensity activity ($F_{1,5}=19,208$, $p=0,007$) and the activity duration at moderate intensity ($F_{1,5}=6,404$ $p=0,052$).

These results suggest that 4-a-side free play is the SSG format that imposed less percentages of covered distance at low intensity, but higher duration of activity at moderate intensity. As so, football coaches of elite female players should consider the 4-a-side free play as a way to increase the training intensity.



Effect of three-point field goal rule changes on shooting frequency and victory in high level basketball

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Abstract

The aim of the study was to analyze and compare the frequency of three-point shooting before and after the three-point area had been changed and this impact on the outcome of the game. We were selected 48 games in high level men's basketball tournaments - Olympic games 2008, European Championship 2009, World Championship 2010 (distance of three-point line was 6.25 meters) and European Championship 2011, Olympic games 2012, European Championship 2013 (distance of three-point line increase to 6.75 meters). Selected games were the Top 8 games of each tournament, four quarterfinal games, two semifinal games, game for 3rd place and the final game. Parametric independent sample t-test was used to monitor significant differences of shooting frequency of three-point shooting and X²-test to identify the impact of shooting frequency of three-point shooting on the outcome of the game. Based on these results we can conclude that the effects of applying new rule of the three-point area significantly did not decreased the three-point shooting and did not positively effect on the victory in game on top level men's basketball.

Key words: Basketball. Three-point field goal area rule. Three-point shooting frequency.



Performance analysis in beachvolleyball: comparison of blocker and defender

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Abstract

Experts in beach volleyball claim that generally two specialized players are needed to be successful: blocker and defender (Ahmann, 2004; Kiraly & Shewman, 1999). This study aims at analyzing the differences between the two player types referring to their success in certain game situations.

A sample of 63 matches in top level beach volleyball was analyzed. Matches of FIVB World Tour tournaments, FIVB Opens, the World Championship and the European Championship of the season 2013 were analyzed using official videos from FIVB web TV. An observational system was developed characterizing the rallies by transitions between different states (service, reception, set, attack, block, dig and free ball) and the four players, thus expressing tactical behaviour (e.g. transition service defender – reception blocker) and outcomes (e.g. success rate in attack of blocker vs. defender). In addition, a focus was set on the probability of success after the service and the likelihood of making the point after receiving the ball.

We found differences and communalities between the two roles in beach volleyball. For example, differences were found in the tactical behavior of the service. Blockers had to receive a total amount of 2066 services whereas defenders had to receive 2367 services. The success rate in attacking in the sideout situation (when your team receives the ball) shows further differences. Blockers score directly with attack strokes in 56,6% of their attacks while the success rate of the defenders is 53,9%. Communalities were observed between the probabilities of success after serving the ball. In 31,4% of the cases blockers score after serving, while the percentage of defenders amounts to 31,6%.

This study analyses for the first time the two player types in beach volleyball (defender and blocker) in relation to their tactical behavior and outcomes. Surprisingly, the observable outcome does not differentiate very much between the two roles. That means, players have found a way to compensate for the tactical exploitation of their physical properties. Further studies are required to go more into detailed behaviors (e.g. differentiation between a hard driven spike and a placed shot in attacking) and to compare the outcomes with female athletes.



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Performance characteristics during the giro d'italia: comparison between roles in the team

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Abstract

Several authors analyzed the performance of professional cyclists during top-level stage races (e.g., Tour de France, Giro, and Vuelta) by monitoring heart rate (HR) (Lucia 1999, 2003, Fernandez-Garcia 2000) and/or mechanical power (P) (Padilla 2001, Vogt 2006, 2007). The previous studies compared the effort required by stages with different characteristics, while little is known on the differences between cyclists according to their role in the team.

This study aimed to compare the team leader performance (L) with the domestiques helping when climbing uphill (D_{UP}), or on flat road (D_{FL}), during Giro d'Italia.

HR and P produced at the pedal were continuously monitored using the SRM system in 9 cyclists of one team (1 L, 5 D_{UP}, 3 D_{FL}) during 19 stages of the Giro d'Italia 2012. Four weeks before the race, all the cyclists performed an incremental test. Blood lactate concentration (LA), HR and P were measured. For each athlete, four HR and P intensity ranges were calculated on the basis of LA values (< 2, 2 to 3, 3 to 4, > 4 mmol/l).

The mean HR and P of the 9 cyclists in the 19 examined stages were 120 bpm/200 W for flat stages, 133 bpm/231 W for middle mountain stages, and 135 bpm/241 W for high mountain stages. The time spent at an intensity corresponding to a LA of > 2 mmol/l was 17.7%, 16.3%, and 11.5% of total time in high mountain, middle mountain and flat stages, respectively. D_{FL} and L showed a higher absolute power (respectively 243 and 230 W) than D_{UP} (208 W). However, this difference disappeared when considering the power standardized for body weight. L showed an effort higher than all his team mates in all stages, while D_{FL} and D_{UP} spent more energy respectively in flat or mountain stages, consistently with their role. HR showed a trend similar to that of P, with slightly lower times spent in the 4 intensity ranges.

In conclusion, all the cyclists tended to use as much as possible the lipid metabolism, remaining for a long time (about 85% of total) at an intensity lower than 2 mmol/l of LA. In high-mountain stages, the cyclists spent very little time at an intensity above 4 mmol/l of LA. The different performance characteristics observed in the examined roles may be explained by individual anthropometric and physical features, but also by tactical aspects forcing the cyclists to perform particular efforts according to their role in the team.



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Flow Effects on Canoe Sport

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Introduction

The latest trend of coaching is to enhance productivity as well as mental capacity. Therefore this study is based on two models, that is, the Flow theory of Csíkszentmihályi and that of Antonovsky's. During trainings the body should be strengthened so as to be able to tolerate and bear strains and stress (*Antonovsky, 1979; Csíkszentmihályi, 1991*). A special tailor made training plan will enable competitors to cope with this flow while preparing sportmen/women for competitions. It is evident that this stress and hard work bring about other personal/individual problems (*Csíkszentmihályi, 2009; Seligman & Csíkszentmihályi, 2009*).

Methods

To map up the protective factors developed by doing sports

To change trainers' attitudes on the basis of the outcomes

To work out methods supporting sportmen to be able to adapt themselves into civil life.

Results

The questions may be relevant for them.

Valid outcome can be gained only in the state of flow

Each successful professional has already experienced flow

This psychological immune system strengthened by trainings and competitions will support the individuals' life and career.

50 kayak-canoe professional competitors,

control group with 50 teachers.



To gain data in relation to psychological immune competence the Questionnaire of Psychological Immune- system PIK (*Oláh, 1996*) was used. The 16 scales attempt to identify the interviewees' stress-resistance. Each scale has 5 items and the participants can indicate to what extent they think.

Discussion

In case of educators there is a significant difference within the feeling of coherence due to the strict rules of sports. Sports do not support sportsmen/women in the third dimension of education, namely to acquire skills enabling them to act autonomously. Actually rules will control their life (*Gombócz, 2007*). Bearing this fact in our mind indicate that we should develop the educative and pedagogic strategy of trainings. It is also crucial to make a plan that focuses on enhancing the awareness of the importance of experiencing FLOW as well positive thinking.



The 'true' cost of Performance Analysis support within team sports

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Abstract

Performance analysis in its simplest form provides information about performance. More specifically analysis can elicit information in quantifiable terms, allowing any misperceptions by coaches to be avoided. When used correctly, this information can enhance the coaching process, by providing information and data to assist in the decisions made about training, player selection and player development (Hughes, 1988; Bartlett, 2001; Appleby & Dawson, 2002).

Performance analysis has become more prevalent as part of sports science support for many teams and associations, with many outside the higher echelon of competition implementing it to enable them to gain extra information about their performances. Consideration of the data collected by performance analysis methods is now included in some coaching qualifications. The FA UEFA B license now incorporates the examination of detailed player analysis and the utilisation of analysis data to prioritise player performance (The FA, 2014). Research recently conducted amongst Irish Sport indicated that 51% of coaches Level 1 and above have adopted the use of performance analysis (SINI, 2014). There is obvious significance placed upon the consideration of performance analysis within the coaching environment. The implementation of this as a support mechanism however is often inhibited by costs.

With advances in technology, modern day performance analysts have a multitude of methods available for the collection and dissemination of this information, which can be tailored to suit budgets of different proportions. This paper aims to discuss some of the different methods available and their associated 'true' costs.

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Analysis of Stroke-to-Stroke Performance on the PGA TOUR

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Introduction

The nature of golf lends itself to the idea of streakiness. Players are in control of their performance without interference from other players, and it is reasonable to think that factors such as psychological momentum can lead to streaks of exceptional performance. However, support for the idea of streakiness in golf has been weak. Furthermore, to date, studies of streakiness in golf have been limited to hole scores – a limitation of the data available. The ShotLink™ database provides data describing nearly every shot performed on the PGA TOUR since 2003 and has led to the development of a new model called the ISOPAR Method. The method allows one to assess the quality of each stroke played and thus, enables the investigation of streakiness in golf on a stroke-to-stroke basis. This study examines the stroke-to-stroke streakiness of golfers on the PGA TOUR using recurrence quantification analysis based on the performance indicator 'Shots Saved' which is derived from the ISOPAR Method.

Materials & Method

Shots Saved values were calculated for 'THE PLAYERS' tournament in 2011 on the PGA TOUR. Each player's Shots Saved values from the whole tournament constitute a stroke series. Based on each stroke series a recurrence plot (RP) was calculated and, subsequently, recurrence quantification analyses (RQA) were performed analyzing the RP structure. RPs visualize similar states between two times, in our case they highlight when two different strokes were performed similarly. A vertical line in an RP indicates that the investigated system remains in similar states during a certain time period represented by the line length – in other words, a golfer performed similarly for some strokes, independent of their quality. An RQA involves the analysis of the occurrence and length of vertical lines.

Results

The RQAs of the RPs reveal that the players show similar performances in only 7% ($SD = 0.9\%$) of all strokes on average. This overall measurement indicates that the players played quite variable during the tournament. Furthermore, on average 17% ($SD = 4.6\%$) of those similar performances form vertical lines. The mean length of the vertical lines is 2.23 strokes ($SD = 0.14$). The maximum vertical line length is on average 5.07 strokes ($SD = 1.22$). The maximum vertical line length was 9 strokes and was performed by a player



who finished on the 60th rank. On average it took 11.92 strokes ($SD = 1.34$) until a player's performance recurred, if at all.

Conclusion

The results reveal that the quality of golf shots played in THE PLAYERS varied considerably from stroke to stroke. The performances of only a few strokes were similar to each other and the number of similar performances following each other is usually rather small. Although there are phases when a golfer performs some strokes in a row similarly, those sequences are not longer than a par 5 or two short holes and occur rarely. Generally, there is, at maximum, only little evidence of the existence of a stroke-to-stroke streakiness in golf and if such a behavior is observable it seems to occur rarely and arbitrarily.



High-level international kickboxers measures: handgrip strength and hand dimensions

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Abstract

Both handgrip and hand dimensions are primordial in many sports, as in kickboxing, where 1/3 of the hits are hand-performed. Some general and hand-specific anthropometric dimensions have been positively related to handgrip strength. [1,2], Therefore, the objective of this study was the influence of general and hand anthropometric parameters in handgrip strength and sport achievement, in fact, many sports require a sustained level of hand prehensile force to maximize control and performance [2,3] as well as to reduce the possibility of injuries [4].

Forty kickboxers aged between 18-51 years participants of the International Championship of Alicante, Spain 2010 took part in this study. Body height and body mass were measured and body mass index was calculated as general anthropometric parameters. Three groups of hand specific parameters were measured: finger spans, finger lengths and hand perimeters. The maximal handgrip strength in both hands was measured with a hand dynamometer (GRIP-D TKK 5401, Takei Scientific Instruments CO). We measured of specific anthropometric parameters of the hand according to Visnapuu and Jürimäe [5] criteria. Reliability of hands anthropometrical parameters was assessed using 2 way average measures ICCs. The analyses were done using SPSS 18.0 (SPSS Inc. Chicago, IL).

General and specific (finger lengths, hand perimeters) hand dimensions were significantly different among the weight groups ($p < 0.05$) and positively correlated with handgrip strength for the whole group. However, only a few dimensions – IFL, MFL, P4, P5 – were positively correlated among weight groups. Poor correlations were found between hand-specific variables – TL, IFL, MFL, P4 – and sport achievement. Only P3 was highly correlated with sport achievement and together with FS1 explained of its variance.

The results in this study, indicate that the handgrip strength is mostly dependent on the basic (body height) and hand-specific (IFL, MFL, and P4) anthropometric parameters. Sport achievement was related to hand perimeter (P3), but its variability was weakly explained and thus, specific hand dimensions may not be good predictors for kickboxing performance.

Key Words: Hand dynamometry • Kickboxing • handgrip • hand anthropometrics • performance



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A comparison between proprietary and open source video analysis software for sport analysts

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Abstract

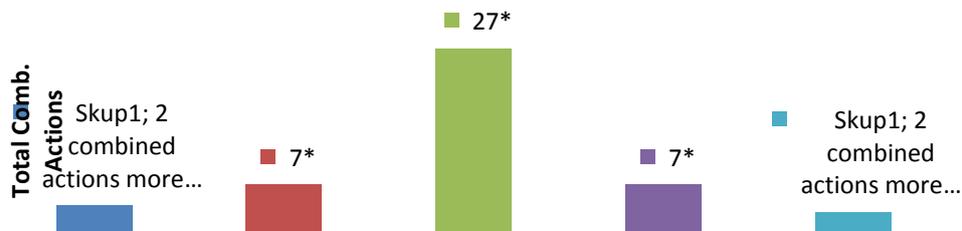
In the last years, video-based technologies have emerged as one of the most important feedback tools for sport analysts. The popularity of the use of video relies on the fact that coaches can use it to augment sensory input and precise calculation of high-order abstract information from complex situations (Hughes and Franks, 2008).

The integration of video and computer technology has allowed for the development of specialized software for two analysis areas: kinematic and notational analysis. Among others, companies such as Simi, Siliconcoach, Dartfish or Sportstec offer software packages for qualitative analysis of sport techniques (Dabnichki and Baca, 2008). Alternatively, there is the open-source software, being Kinovea and Longomatch the most popular packages.

However, there is some controversy among sport analysts regarding which kind of software to use. Some would prefer the proprietary approach since they claim it is rugged, stable and have plenty of features. Besides, this well-known software packages are commonly perceived as worthy in terms of cost and learning curve for an analyst to become professional. Some others would choose the open source alternative due to the help that the analyst community share on the internet and the fact that is free and multi-platform.

In this paper, an objective comparison between two notational analysis software is presented. A selected three-set volley beach sample match from the group stage of the 2012 London Olympic Games has been analyzed with SportsCode (SC) proprietary software and with Longomatch (LM) open software. To assure inter- and intra-operator reliability, a single trained analyst was told to perform the task in different days (Hughes et al, 2003). A zone performance indicator was selected to assess where the ball hit when the point was scored. Therefore, the court was divided into six zones for each half and two additional zones were considered: NET and OUT. The outcome of this performance indicator was either WIN, LOSE or CONTINUE. A total of 47 combined action variables were evaluated, resulting in 142 annotations for SportCode and 137 for Longomatch. Results showed that the outcome was the same for both software packages in 27 combined actions out of 47 (see Figure below). A non parametric chi square statistics was made with the values marked with one asterisk in the Figure, resulting in p-value of 0.001,

which is lower than the accepted significance level of 0.05. According to the results, both software packages provide the analystist with the same acceptable observation errors and therefore, the kind of software, free or proprietary, does not play a significant role on the quality of data retrieved.



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Psychological profile of windsurfers

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Abstract

For year, the knowledge and manipulation of psychological variables in sport can help athletes optimize their performance (Mahoney, Gabriel & Perkins, 1987; Feher, Meyers & Skelly, 1998) and continue long term competitive sport. Variables such as concentration, emotional control, competitive challenge and motivation, are critical to the quality of tactical execution (Gomà, 1991).

Eysenck makes an important contribution in the field of personality study. Initially conceptualized as an aspect of personality consists of two dimensions, the dimension of Extraversion / Introversion and Neuroticism dimension / Emotional Stability. Eysenck realizes that these two dimensions does not meet in full the temperamental personality composition, and solve this includes Psychoticism. The latter was created in response to factors not only breaks with reality, but also with aggression, conformity, toughness and integrity, among others.

This study of elite windsurfers, aims to relate the psychological characteristics associated with personality depending on the position obtained in the final classification of the competition. This investigation involved 26 male windsurfers (mean age 27.26 ± 6.27), from 19 different countries, participating in the PWA Windsurfing World Tour: Fuerteventura PWA Grand Slam, from 22 July to 1 August 2011.

Was applied Revised Eysenck Personality Questionnaire (EPQR) (Eysenck, Eysenck, & Barrett, 1985). This questionnaire consists of 83 short questions that are answered by affirmation or negation. This questionnaire assesses three basic dimensions of the subject's personality and sincerity. These dimensions are Neuroticism or Emotionality (N), Extraversion (E), Hardness or Psychoticism (P) and Sincerity or Falsity (L). Two experienced investigators were responsible for distributing the questionnaires and explain the process of completion when the championship finished. At the top of the Eysenck questionnaire athletes specify their age and the final position in the competition. All participants completed the test individually admitting their informed consent. The ethics committee of the University of Alicante approved the procedure.

Data analysis was performed with SPSS 20.0. The Student's T statistic was made for comparison of means between the top five and the other participants in the competition. Analyses revealed significant differences ($p < 0.05$) between the windsurfers in the top five and the rest in relation to Psychoticism (P). Based on the results, it seems that there a



personality profile of male windsurfers that get better results. These athletes are characterized by being outgoing, persistent in the task, creative, critical and competitive.

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Effects of timeouts in beach volleyball: Olympic Games 2012

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Abstract

The studies of the timeout in sports have demonstrated their influence on the development of the game (Gómez, 2011), having a direct effect on scores (Sampaio, 2011). In indoor volleyball, timeouts are used to manage the playing time (Zetou, Kourtesis, Giazitzi & Michalopoulou, 2008) and to prevent the opposing team continuing a run of winning points (Hughes, 2006). The aim of this study was to evaluate by which difference in score beach volleyball teams have to call a timeout if they want to reverse or maintain an advantageous end result. The sample was 64 (n=32 female, n=32 male) matches of the Olympic Games in London 2012. For each timeout called by either team, the score was noted, indicating the status of the team requesting the timeout. According to a static analysis of the status of who called the timeout in the female category, 22.9%, 75% and 2.1% were called by the team which was winning, losing and balanced, respectively. In male category, 21.3% were called by winning teams, 72.2% by loser teams and 6.7% were balanced. In both categories, there is a relationship between the difference points at the time of the timeout call and the probability of losing the set (Table 1). The study of comparison of means for independent samples T-Student, proves that differences of two points are statistically significant in female ($p = 0.040$), whereas no statistically significant differences were observed in the men for the same difference ($p = 0.055$). These results suggest that a timeout should be called with no more than a two-point difference. Therefore, an additional difference point would reduce the odds of winning considerably.

Table 1: Probability of losing the set according to the difference points

<i>Score Differences</i>	<i>Female</i>	<i>Male</i>
<i>Lose +5 points</i>	<i>80.6%*</i>	<i>85.9%</i>
<i>Lose +4 points</i>	<i>63.9%*</i>	<i>60.9%</i>
<i>Lose +3 points</i>	<i>47.2%*</i>	<i>46.9%</i>
<i>Lose +2 points</i>	<i>23.6%</i>	<i>23.4%</i>
<i>Lose +1 points</i>	<i>15.3%</i>	<i>10.9%</i>

** Result of p-value is lower than 0.05*



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