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Editorial

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Welcome to issue 84 of the ITF Coaching and Sport Science Review. This issue is the second one of 2021 and, apart from in the ITF Academy, it is also available in the new page that includes the articles in individual files as well as a new digital submission system that will improve the quality and visibility of our publication. The new page can be accessed here.

This issue includes contributions from all over the world and cover a wide range of topics such as physical testing, digital marketing, notational analysis, high-performance female players, mental training, biomechanics of the serve, tactical training, and others.

The ITF World Tennis Number continues its successful implementation. Over 130 nations have signed to participate in the project, representing 81% of global players. 1.5 million Player Records and 10 million match records have been validated and loaded. The first 100 Junior Player ITF World Tennis Numbers went public on 19th July in the player profiles of itftennis.com, and 1000 ITF World Tennis Tour Junior players will have their ITF World Tennis Numbers displayed. Work continues with the ITF nations on how to successfully activate the ITF WTN using an extensive promotional and branding toolkit of launch resources. ITF are also using advanced processes to identify duplicate players in different databases around the world. ITF Academy offers three educational courses on ITF WTN. ITF WTN is used as a supportive entry criterion to 2021 ITF World Junior Tennis Finals (14U) and JDC & BJKC Junior (16U) Finals, and to 2021 ITF Seniors World Championships.

Following the postponement of the 2020 ITF World Participation Conference due to the COVID-19 pandemic, this year's third edition was hosted virtually on 12-14 July. Under the topic of 'innovating to drive participation in sport', 466 delegates from 142 different nations were in attendance to hear from 33 expert speakers during the three-day event. As with the 2018 and 2019 events, the Conference continued to provide an interactive forum centred around shared practices and discussions across the specific Conference topics. The content from this year's conference, as well as the previous two ITF World Participation Conferences, are already available through registration on the ITF Academy platform.

The 2021 ITF Global Tennis Report, which was presented during the above Conference, revealed that tennis participation has increased globally, despite the impact of the pandemic. In fact, it appears that tennis has benefitted more than most sports over the last 18 months since it can be played

socially distanced. The new report is an important and timely update to the 2019 Global Tennis Report, which was the first time a worldwide picture of performance and participation had been established in tennis. The data provides crucial insight that informs the ITF's Global Development strategy, which sees more than $10 million invested each year to ensure the sustainability and long-term health of tennis. The report is available in the ITF eBook app as well as here.

At the time of writing, the ITF Academy has more than 37,690 registered users and 153,400 anonymous users (coaches, players, parents, administrators and fans) who have access to more than 160 English courses, 135 French and Spanish courses, 95 courses in Portuguese and 110 courses in Russian. Three additional languages have been activated since the last report. Indonesian and Turkish were requested by the NAs which provide the translations to be uploaded.

Arabic is the other new language added with more than 40 courses already translated and published. For the period 1 March 2021 to 25 July 2021 since the last report, more than 1,018,250 page-views were recorded, with users spending an average of 13 minutes per session, browsing an average of 12 pages. As per publications, currently there are more than 175 publications available on the ITF eBooks app in up to 15 languages.

This year's edition of the ITF World Coaches Conference by BNP Paribas will take place virtually from 5 to 7 November via the ITF Academy. Planning is underway with further information to be provided on registration, format, and speakers shortly.

As per courses, since 1 March 2021, eighteen ITF-supported courses have been delivered, six of which were in person and twelve virtually. Topics for virtual delivery included national tutor development courses at Play Tennis and CBI levels and courses for tennis parents. The in-person courses followed the standard ITF syllabi – Play Tennis, CBI, and CAP. The theoretical delivery of the OS Scholarship programme for the ITF Coaching High-Performance Players courses in Valencia was successfully delivered through the ITF Academy. The 25 selected candidates completed the six-week theoretical part of the course by completing the assigned online subjects as well as attending daily webinars, all facilitated through the ITF Academy. The practical aspects of the certification course will be completed in the autumn of 2021, depending upon the candidates' ability to travel. Furthermore, the ITF International Tutor Certification was launched over the summer, inviting the core group of identified tutors to apply as part of the initial phase of the programme. To date, more than ten tutors have received their recognition at the various certification levels.

The ITF continues to support 141 active National Associations that are involved in the ITF Junior Tennis Initiative (JTI). Brunei Darussalam and Somalia have become active JTI nations during 2021, with Somalia joining for the first time. The ITF Development Officers continue to meet regularly with their regions' National JTI Coordinators, coordinating virtual conference calls each quarter. All National Coordinators were invited to attend the ITF Participation Webinar and the ITF World Participation Conference, as a means to ensure that they are up-to-date with the ITF activities in participation and to receive educational opportunities. All National Coordinators must now complete the 'Understanding the JTI' and 'Safeguarding in Tennis' courses within the ITF Academy prior to any subsidy is processed by the ITF to their National Associations and will be invited to attend the 2nd Global National Coordinator Workshop to be hosted virtually later in the year.

The level of tennis activity is being monitored by the ITF Development Officers due to the impact of the pandemic, particularly within the components of the grassroots tennis and junior performance under the JTI. In correspondence with the nations and the National JTI Coordinators, recreational activity nationally is being tracked regularly, as well as levels of inactivity. Primary School tennis activity is still being impacted in many countries, both in terms of development and competition. Furthermore, the ITF have created an online digital Toolkit for National Associations to create pre-defined print and digital promotional assets. These assets are for promoting their JTI activities and their organised Tennis Festivals to increase tennis participation for all. All active JTI nations have been provided access to the ITF Toolkit and their Users must be nominated by official personnel within the National Association through an online nomination form. Once permitted, the Toolkit Users may create and then download their customised assets for their promotional means.

Conducted under the participation pillar, a Rules of Tennis trial has begun to receive feedback from National Associations related to a proposed amendment under Appendix VII "10-and-under competition". The amendment was submitted to the Rules of Tennis Committee in December 2020 following an in-depth research study conducted for the ITF by Tennis Australia and Victoria University, Melbourne. The aim of the rule change amendment is to allow more young players to experience greater success when playing on the designated "red", "orange" and "green" courts. The ITF have administered guidance for all National Associations to trial the amended net heights and receive feedback from their tennis coaches, competition administrators and from competition players' parents. Tennis equipment manufacturers will also be consulted during the trial period. All coaches interested in cooperating with the trial should contact their National Association.

We would also like to encourage new submissions to the ITF CSSR through the new platform. Finally, we would like to thank all the authors for their contributions, as well as all of those who sent in proposals. We hope that you enjoy reading the 84th edition of the ITF Coaching and Sport Science Review.

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From "sigma test" to customized training

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ABSTRACT

This article illustrates how you can assign a metabolic exercise to a tennis player, after having performed the "Sigma Test" and having acquired the subjective parameters.

Key words: sigma test, tennis, assessment test, tennis training, metabolic training, physical form, attention energy cost.

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INTRODUCTION

As can be seen from all the studies performed on the tennis performance model, the tennis player must have a good degree of organic and local muscular resistance, bearing in mind not to exacerbate the methods and training times as if we were facing a marathon runner.

In fact, much of the tennis player's stamina derives from his strong ability to mentally resist effort. From this point of view, working with the "SensoBuzz" app becomes decisive, as the aspect of central fatigue, therefore nervous, is very stressed (Buzzelli, 2007; Smith, 2016).

In the "Coordinabolic Method" (Buzzelli, 2008), we start from the evaluation of the organic abilities under attentive aegis, through the "Sigma Test" (Buzzelli, 2008), which will indicate the parameters on which the subsequent specific training will be based.

In fact, when the "Sigma Test" is completed, we will have three fundamental parameters that will help us manage the individualized dosage: the meters traveled by moving back and forth from the base to the target, with technical running (considering that the base-target distance is set at 5.50m), the emission time of the signals that the student has performed in the last phase of the test (TC or Critical Time) and the number of signals performed (Cycles).

Based on these three parameters, the best choice can be made in relation to what you want the athlete to achieve, in terms of "Capacity" and "Power" of the individual energy systems (Weinieck, 2009).

To better understand these concepts, we use a synoptic framework, summarized in the following table.

Tables 1 and 2: General indications for dosing the load according to the metabolic goals and critical time (Tc) obtained by the athlete in the Sigma Test, and the relative recommended spaces between the base and the target.

Table 1

CAPACITY (percentage ± of time compared to TC)										
Meters (base-target)	**5,50**	**5,00**	**4,50**	**4,00**	**3,50**	**3,00**	**2,50**	**2,00**	**1,50**	**1,00**
Capacity	-5%	-10%	-15%	-22%	-25%	-33%	-35%	-50%	-55%	-70%
Anaerobic Alactacid					X	X	X	X	X	X
Anaerobic Lactacid			X	X	X	X				
Aerobic	+8%	+3%								

Table 2

POWER (percentage ± of time compared to TC)										
Metri (base-target)	**5,50**	**5,00**	**4,50**	**4,00**	**3,50**	**3,00**	**2,50**	**2,00**	**1,50**	**1,00**
Power	-15%	-20%	-32%	-34%	-36%	-42%	-47%	-56%	-60%	-75%
Anaerobic Alactacid							X	X		
Anaerobic Lactacid					X	X				
Aerobic	TC	- 8%								

The recommended training load will be that indicated in the following table.

Table 3

Example of load dosage according to the metabolic quality to be stimulated.

Trained Metabolic Quality	Sets, Series and Repetitions	Break between series and between sets
Quickness	5 x 10 x 8-10	15" – 1'30"
Alactacid Anerobic Capacity	3 x 12 x 10-12	30" – 2'30"
Alactacid Anaerobic Power	2 x 10 x 7-9	45" – 3'
Lactacid Anaerobic Capacity	2 x 18 x 15	1'30" – 5'
Lactacid Anaerobic Power	12 x 12	2'00"
Aerobic Capacity	6 x (Cicli / 2)	2'30" Active Pause
Aerobic Power	2 x 8 x (Cicli / 4)	1'30" Passive Pause – 3' Active Pause

TOOLS AND METHODS

To carry out this exercise, starting from 2007 (S. Buzzelli, 2007), a special tool called initially "SensoTouch" and then definitively "SensoBuzz", was used but currently it is possible to use a smartphone application, also called "SensoBuzz" (S. Buzzelli, 2019), which emits visual and acoustic signals in a random mode with a pre-established time scan. The exercise is performed in a space as illustrated in Figure 1.

EXECUTIVE PROTOCOL

The following figure illustrates the recommended arrangement of the targets for the execution of the metabolic work described above.

You can use three visual and two sound signals or even more than 5 signals or other types of signal or variants to increase the degree of difficulty.

Issue times, travel distances, purposes and workloads are described in the previous tables (Tab. 1,2,3).

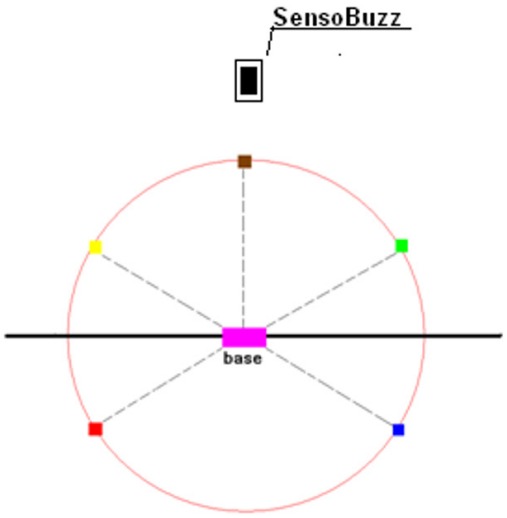

Figure 1.

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Teaching tactics in tennis. A constraint-based approach proposal

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ABSTRACT

The aim of this article is to provide a structure framed in constraint-based approach, which will help coaches to classify tactical exercises, and in turn, serve as a reference for the creation of new exercises depending on the objectives and the game situation they wish to develop. By way of example, a proposal is made for exercises for the serve situation, with the intention that these can serve as inspiration for coaches to create their own.

Key words: methodology, dynamical systems, learning, exercises.

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INTRODUCTION

A sport such as tennis is characterised by taking place in an environment of constant uncertainty, where players are forced to adapt continuously, reacting to the many different stimuli that occur in a multitude of dynamic and unpredictable situations (Sanz et al., 2012). During matches and training sessions, there are many aspects that make every action different:

- Different strokes and movements
- The opponents
- Partners (doubles discipline)
- Types of surfaces
- Types of balls
- Climatic conditions
- Other...

Having framed tennis as an open skill sport, it is important to define the concept of tactics, as this will be closely related to the open nature of the sport. Tactics is associated with the players' decision making during the game based on the options available and the risks and opportunities associated with each option (Fuller and Alderson, 1990). Therefore, tactics will be related to the decisions players make regarding the use of their technical, physical and psychological resources to solve the changing situations that occur during the game.

Traditional tennis teaching methodologies are based on the principle of learning by reproducing ideal models, through constant repetitions of different patterns of play. However, if we understand that tennis is an open sport, with the characteristics mentioned above, coaches must create practice situations with conditions similar to those of matches (Sanz and Hernández., 2013). Therefore, it is very important to avoid training sessions and drills always focusing on repeating patterns under the same conditions. The tactical training process should be based on learning produced in an environment that provides all possible stimuli to cope with the multiple game situations that tennis demands (Sahan et al., 2018). In doing so, players should develop their ability to adapt to the environment and make decisions that are best suited to each specific situation.

The proposal made in this article is based on an alternative model to cognitive learning proposals, mainly from the dynamic systems theory or the constraints led-approach. Constraints are pressures that limit or prevent certain movements, facilitating or allowing others (Davids et al., 2008). All categories of constraints from the environment (physical and social characteristics), the individual (personal characteristics) and the task (e.g. goals, rules and equipment) directly or indirectly influence decision-making and action in play. Therefore, a coach can manage player constraints, task constraints or environmental constraints to promote the emergence and development of successful performance.

Task constraints are based on:

- Amplify the sources of information present in the context (e.g., place a rope over the net so that players focus their attention on the height of the ball).
- Gestures and a whole range of non-verbal actions that a coach can use (e.g., combined signals with players that can indicate which side to scan on the opponent, how high or how deep the ball should go, or whether to go further into or out of the court).
- Using verbal language, corresponding to the so-called augmented feedback and the interrogative method (e.g. two players play a point and the coach asks them if the pattern used during the point was the most appropriate one).

Individual constraints are based on:

- Structural constraints, which refer to morphology, body composition or skill level in a particular task, i.e. aspects of the individual that remain relatively constant over time.
- Functional constraints, which refer, among others, to thoughts or emotions (Araújo and Volossovitch, 2005).

Environmental constraints are based on:

- The effect of factors such as the presence and behaviour of the public or the presence of family members ("social constraints"), the conditions of the venue (e.g. temperature or brightness), or even the type of competition from an organisational point of view (e.g. regional tournament, national championship), on the performance of the players must also be considered. Although the manipulation of these factors is more difficult, it is important to consider their effect on performance and training.
- It is important to consider the influence of the coaching environment on players' performance and decision-making. The coach through his intervention can create two types of environments: player ego-oriented environment and player task-oriented environment (Roberts, et al., 2007).

Therefore, given the open-ended nature of tennis, and given the importance of creating training situations that provide the maximum possible stimuli to cope with the demands of the situations encountered during competition, constraint-based approach provides a theoretical framework and structure that can be very useful for the creation and classification of exercises for tactical training.

PRACTICAL PROPOSAL

In this section, based on the three categories of constraints and the five game situations, we propose a structure for classifying tactical training exercises and, as an example, we propose some exercises for training tactics in the serve situation.

Table 1 shows the proposed classification of tactical training exercises. It is proposed to classify the exercises into a total of 15 categories depending on the constraint being manipulated and the game situation.

Table 1

Structure for the classification of tactical training exercises

	Serve	Return	Baseline	Net	Passing
TASK	Cat. 1	Cat. 4	Cat. 7	Cat. 10	Cat. 13
INDIVIDUAL	Cat. 2	Cat. 5	Cat. 8	Cat. 11	Cat. 14
ENVIRONMENT	Cat. 3	Cat. 6	Cat. 9	Cat. 12	Cat. 15

Proposed exercises

Exercise Category 1 (Task constraint for serve situation)

- Objective: Pattern selection.
- Description: The receiver shall change his position before the serve. Accordingly, the server should use a pattern in the serve that is appropriate to the position of the receiver.
- Premises and/or variations: The receiver shall change his position just as the server throws the ball.

Category 2 exercise (Individual constraint for serve situation)

- Objective: Consistency.
- Description: The server does a series of explosive drills for 15 sg (e.g. two 360 degree jump turns, several kangaroo jumps, quick skipping in place 5 sg and a push-up) and then starts the point with a single serve.
- Premises and/or variants: vary the exercises and duration according to the level of play and the degree of fatigue of the player.

Exercise Category 3 (Environmental constraint for serve situation)

- Objective: Stabilisation of patterns.
- Description: The player will listen to different types of noises/sounds for 15 sg in the service position. He then has to perform the pattern of play previously indicated by the coach.
- Premises and/or variants: at the end of the point, the coach will ask for information about the song (author, title, etc...).

CONCLUSIONS

The aim of this article is to provide a framework with which to plan and develop tennis drills and tasks through a classification based on constraint-based approach and game situations.

As previously indicated, the classification is based on dynamic learning theories, which argue that the constraints of a training task should be representative of the context for which this experience is intended to provide. Thus, we must ensure that

the requirements of the proposed tasks correspond to the characteristics and requirements of the performance context for which the results are intended to be applied. Therefore, it is essential that the coach's intervention seeks to ensure training exercises that allow the perception-action coupling to be established based on the information that is available in the game context. (Carvalho et al., 2011).

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Tennis: a promising approach to family-centered physical activity and health promotion

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ABSTRACT

Despite global goals to reverse the prevalence of obesity and inactivity, little to no progress has been made. This article presents the details of a tennis-based, family-centered program that can serve as a model for future wellness interventions. The program succeeded in providing a source of physical activity for the children and adults involved. Participant feedback confirmed that the program was well received and that an expanded program would be feasible. Tennis appears to be a viable platform for health promotion, and tennis professionals looking to build partnerships for the purpose of growing the game should keep in mind potential public health stakeholders.

Key words: racket sports, nutrition, wellness, family, physical activity.

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INTRODUCTION

Childhood obesity has become a public health epidemic. The average body mass index (BMI) of both boys and girls has increased and is continuing to trend upward (NCD Risk Factor Collaboration, 2017). Individuals who are obese in childhood are more likely to be obese as adults. They are also more likely to suffer from chronic diseases such as hypertension and type 2 diabetes, as well as from social problems (Lanigan & Singhal, 2009). Despite having nationwide goals to reverse the prevalence of obesity, little to no progress has been made (Skinner et al., 2018). Current research suggests that multi-component physical activity programs for youth are successful in reducing weight and that parental involvement can enhance these effects (Bluford et al., 2007). Additionally, sound dietary habits can lead to a reduced risk of chronic disease, lower risk of obesity, and improved educational performance (Boeing et al., 2012; Burns et al.,2018; Faught et al., 2017; Shi et al., 2013). Unfortunately, many children are confused as to what 'healthy eating' is, and not all children receive education in school regarding the topic (Edwards & Hartwell, 2012). The literature suggests a relationship between the dietary habits of children and those of their parents, and positive dietary changes in parents could lead to positive dietary habits in children (Cullen et al., 2000). As such, the purpose of this pilot study was to develop and assess the feasibility of a family-centered tennis program that incorporated health and nutrition education for both the children and adults participating. This approach has the advantage of involving parents, being multicomponent, and providing both parents and children the skills necessary to enjoy a multi-generational lifetime sport.

METHODS

Participants

Twenty-three families with a total of 31 children and 20 adults enrolled in the program. The children were between five and ten years of age, and prior tennis experience was not a requirement for enrollment. Participants provided written consent/assent and completed a health screening prior to engaging in on-court activities. The study protocol was approved by the Institutional Review Board at Kansas State University.

Program

The curriculum for the tennis program was adapted directly from the United States Tennis Association (USTA) Red Ball Team Challenge curriculum. This curriculum falls under the umbrella of Net Generation, the youth brand created by the USTA to "spread the love of tennis to a new generation by empowering those that will teach them" (Morris & Davies, 2018). Through Net Generation, coaches are trained and provided with curricula designed to target specific skill ranges. The Red Ball Team Challenge is a set of activities that introduce the participant to the sport of tennis. These lessons are ideal for beginning players of all ages and aim to increase physical activity time while reducing wait time in lines. To better adapt to beginning players, the program utilizes red

balls that are larger and easier to hit than traditional tennis balls. Smaller, mobile nets are used to section off traditional full-sized tennis courts thereby creating a playing area better sized for beginners. All coaches in the current family-based program were provided on-court training by a USTA representative on how to best implement the curriculum.

Complementing the tennis activities were a set of nutrition and health lessons adapted from information provided by the United States Department of Agriculture (USDA) and the Office of Disease Prevention and Health Promotion (ODPHP). Lessons revolving around eating more vegetables, being an active family, and being a healthy role model were used. Lessons about building healthy eating habits and consuming less sugars were adapted from ODPHP materials.

Program structure

The program consisted of five one-hour lessons offered over the span of five weeks. The lessons were offered at two locations within Kansas during the spring of 2018. Parents were given the option to participate on-court with their child/children or to remain off the court. All participants were loaned a tennis racquet and ball to be used during the lessons and at home to practice in between lessons. Each lesson began with a group warm-up and stretching activities. During this warm-up period, one of the nutrition education topics selected for the program was introduced as the topic of the day. Following the warm-up, participants were led through five or six activities from the Net Generation, Red Ball Challenge curriculum. During this time, children under eight years of age were grouped together and children eight years old and older were grouped together to minimize the skill difference between groups. During the first lesson, activities focused on getting participants accustomed to holding a tennis racquet and performing hand-eye coordination activities with the ball. During the next lesson, previous activities were reviewed, and newer, more advanced activities were introduced. By the final lesson, activities were centered around multiple tennis shots and volley play.

In between activities were allotted water breaks. During each water break, coaches further provided education on the nutrition topic of the day. After all activities had been completed, all participants were gathered for a discussion about the topic. Parents were given informational handouts from the USDA and ODPHP, and children were given interactive handouts that they could color and keep. All participants were reminded of activities performed that day that could be practiced at home between practices.

Table 1
Family-centered tennis program health topics.

Week 1
Children: MyPlate-Fueling for activity
Adults: The Dietary Guidelines & MyPlate- Eating for health and performance
Week 2
Children: Eating more fruits and vegetables
Adults: Promoting increased fruit and vegetable consumption
Week 3
Children: Pick a healthy drink
Adults: Limiting sugar sweetened beverages
Week 4
Children: Being physically active
Adults: Being physically active & limiting screen time
Week 5
Children: Building a healthy snack
Adults: Promoting adequate sleep

Program evaluation

Following the final lesson, families were invited to fill out an online survey regarding their participation and experience within the program.

RESULTS

Sixty-five percent (n = 15) of the families enrolled in the program completed the survey. Of the families who completed the survey, twelve (80%) attended at least four of the five sessions, eleven (73%) had at least one adult participate on the court with their child/children, and eleven (73%) families reported practicing tennis weekly outside of the program. When asked about continuing to play tennis in the future, eleven (73%) families reported interest in attending another program of similar intensity, fourteen (93%) families reported that they would be interested in attending a program that targeted a higher skill set, and nine (60%) families reported that they had already signed up or planned to sign up for tennis lessons outside of the program.

Feedback responses such as, "It was a nice activity for children and parents to do together," and "It was fun because it provided my daughter and I with a fun activity to do together," exemplify the value families placed on the program as a result of it being an activity that they could participate in together.

DISCUSSION

Results confirm the program was well accepted and that an expanded program would be feasible and has the potential to support sustainable behavior change. The program succeeded

in providing a source of physical activity for the children and adults involved. It also equipped parents with the knowledge and skills needed to incorporate sound nutrition and physical activity into everyday family life. In addition, most children enjoyed learning about tennis and expressed interest in continuing to play the sport after the completion of the lessons.

Today's youth engage in an array of behaviors that threaten their overall health and wellbeing (Kann et al., 2018). Yet, sports-based programs may be an effective approach to promoting wholesome values and improving wellness. Tennis professionals looking to build partnerships for the purpose of growing the game should keep in mind potential public health stakeholders. From a health promotion perspective, tennis appears to have numerous benefits, including improved aerobic fitness, improved bone health, and a reduced risk of cardiovascular morbidity and mortality (Pluim et al., 2007). Tennis is a lifetime sport and while modifications may be necessary, it is a great option for increasing physical activity among all age groups. Because many locations offer public courts that can be accessed for free or for a minimal fee, tennis-based wellness programs can be developed with relatively low facility costs.

Although additional future research is needed to examine the effectiveness of the education provided to determine its role in future programs, based on the findings of this pilot program, tennis appears to be a great platform for health promotion.

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Cost of an unforced error in tennis - A statistical approach

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India.

ABSTRACT

The objective of this paper is to (1) introduce a scientific way of measuring the cost of an unforced error in tennis during various match situations and (2) to provide a basis for players and coaches to choose the right strategy among extremely cautious and adventurous playing styles based on a statistical approach. To do this, we analyzed a total of 2,490 different match situations. The results of this study show that the cost of an unforced error varies greatly depending on the match situation. Players are better served by playing a high percentage, low-risk game in situations when the cost of an unforced error is higher than the median cost and adapt a high-risk approach when it is lower than the median cost.

Key words: unforced errors, performance analysis, professional tennis, statistics.

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INTRODUCTION

Tennis has sometimes been called "a game of errors" (Ferreira, 2020) because unlike in most other sports like basketball or football, errors — your own as well as your opponent's — reflect in the score. When you make an error, your opponent gets a point and vice versa. A point won by hitting a winner counts as much as a point won due to an error of the opponent. On the other hand, your errors also add to your opponent's score. Even the world's best players make "Unforced Errors" in their attempt to hit an adventurous shot that gives them a chance to win a point (Mencinger, 2011).

(Merriam-Webster, n.d.) Unforced Error: a lost point that is entirely a result of the player's own blunder and not because of the opponent's skill or effort

In professional matches, coaches keep a close track of the number of unforced errors that a player is making and use it to finetune their training strategies (Brody, 2006). Players and their coaches work extensively to cut down on unforced errors by emphasizing that unforced errors could "cost you" because tennis matches are always lost on errors and never won on placements (Tilden, 1950) .

That raises some interesting questions:

- How can we scientifically measure the cost of an unforced error?
- Is the cost of an unforced error the same in all match situations or are some unforced errors more costly than others?
- In which match situation should a player attempt a low percentage shot and risk the possibility of an unforced error? And the corollary, when should a player play a high percentage game to absolutely avoid an unforced error?

- Can we model the cost of unforced errors across all match situations and derive some interesting statistical insights?

METHOD

Definitions

The score of a tennis match changes with every point and the score cannot return to the same scenario again . As the objective of the player is to win the game, set, or match (and not individual points) the Cost of Unforced Error (CUE, for short) is measured by the number of additional points that one needs to play due to the unforced error.

Cost of Unforced Error (CUE): the number of additional points that one needs to play due to an unforced error.

Sometimes an unforced error from a player may completely change the complexion of the game. Therefore, we cannot be sure of the actual number of additional points that one needs to play, making it impossible to accurately measure the CUE.

What we can instead measure is the minimum cost of unforced error (MUE, for short), which we define as the minimum number of additional points that one needs to play due to the unforced error.

Minimum Cost of Unforced Error (MUE): the minimum number of additional points that one needs to play due to an unforced error.

Examples

At the beginning of a match, when the score is 0 - 0, the player needs a minimum of 4 points to win the game. If at this stage, the player makes an unforced error, the score becomes 0 - 15 and the player has to play a minimum of 4 more points to win the game. That is, the player has to play a total minimum of 5 points in the game instead of 4 when the score was 0 - 0. So, the MUE in this case is 5 - 4 = 1.

The MUE value changes for an unforced error depending on the match situation and the score of the match, set and game at that time. For example, when the match is still at 0 - 0 in the first set, but the game score is 0 - 30, 15 - 30 or 30 - 30, an unforced error will cause the opponent to reach 40 and at a minimum force the player to first make the score a Deuce and later win it by playing two additional points. In this scenario, the MUE value is 2.

Consider another scenario, when the match is still at 0 - 0 in the first set, but the game score is 0 - 40, 15 - 40, 30 - 40, or 40 - A. An unforced error at this stage will cost the player the game and the player now has to play one additional game or a minimum of 4 additional points, making the MUE value 4 for these scores.

In the same match, consider the scenario when the score is 6 - 5 in the first set, but the game score is 0 - 40, 15 - 40, 30 - 40, or 40 - A. An unforced error at this stage will force the set to get into a tiebreaker and the player now has to play a minimum of 7 additional points, making the MUE value 7 for these scores.

In some scenarios, an unforced error may cause the player to lose a set. The player then has to play an additional minimum of 6 games with a minimum of 4 points in each game, making the MUE value 24.

In some extreme scenarios, an unforced error may end the match and there is no comeback for the player from such loss. While the true cost of such loss is unquantifiable or infinite, we can still find out the MUE value. Let us assume that the player continues in the tournament and can compensate for the loss by winning the next match, which is a minimum of 2 sets (in a best of 3 sets match), making the MUE value 48.

As we examined, the MUE value can be 1, 2, 4, 7, 24 or 48 at different stages of a match depending on the score at the time the unforced error was made.

Data and insights

We have tabulated all possible scenarios for a 3-set tennis match with a tiebreaker at the set score of 6 - 6 in all three sets. The match score during the course of the match can be any of the 4 values, 0 - 0, 0 - 1, 1 - 0 or 1 - 1 indicating the number of sets won by the player and the opponent. The set score can be any of 38 possible values between 0 - 0 to 6 - 6 during the match. During a set, the game score can be any of 18 possible values between 0 - 0 to 40 - A or A - 40. When the set score is at 6 - 6, the match enters a tiebreaker and the tiebreaker score can be any of 51 possible values between 0 - 0 to 6 - A or A - 6.

Table 1

Possible Match scores	4
Possible Set scores	38
Possible Game scores	18
Possible Tie-breakers per match. (1 for each match score)	4
Possible Tie-breaker scores	51
Total match scenarios studied = (4 x 38 x 18) + (4 x 51)	2,940

By enumerating the MUE values for these 2,940 different match situations we generated the raw data and over this data we did standard statistical analysis and derived the following learnings.

Table 2

	Implication of unforced error	MUE value	Number of match situations for this MUE value
1	Additional point	1	1356
2	Game enters Deuce	2	948
3	Game lost	4	496
4	Set enters Tiebreaker	7	16
5	Set lost	24	62
6	Match lost	48	62

We then calculated the statistical averages of MUE values.

Table 3

MUE value statistics		
1	Minimum MUE value	1
2	Highest MUE value	48
3	Median MUE value	2
4	Mean MUE value	3.34

CONCLUSION

While it appears at first glance that an unforced error is just one lost point, on closer examination we find out that the median MUE is 2, and in some match scenarios, the MUE can be as high as 24 or 48. A player can win points either by playing aggressively and trying to hit winners and at other times by playing conservatively waiting for the opponent to make a mistake (Fein, 2016). The player can afford to take more risks for low MUE values (1 or 2) and play conservatively for high MUE values (4 or above). By being aware of the MUE values for different match situations , players can adapt their game during the course of the match in a more scientific manner thereby increasing their overall effectiveness.

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RECOMMENDED ITF TENNIS ACADEMY CONTENT (CLICK BELOW)

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The effect of natural preferences on serving biomechanics: a new approach to the motor skills of tennis players

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ABSTRACT

Research has demonstrated the existence of two 'natural preference' profiles in running. The objective of this study was to determine the influence of the natural preferences of terrestrial (with a "posterior and flexion" movement) and aerial (with an "anterior and extension" movement) on the ball speed and impact position during the service of 19 professional players. The results allow to propose a new reading grid of the service technique to consider the preferential motricity of each player while respecting the biomechanical principles.

Key words: service, performance, biomechanics, natural preferences.

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INTRODUCTION

The serve is the only tennis shot that does not depend directly on the opponent. It allows the player to fully express his coordination. Service performance is often measured by ball speed. To hit a hard the serve, players must generate a significant amount of movement that can be captured through the shift in centre of mass (Elliott, 2003). Different motor strategies were highlighted by Elliott et al. (2003) in terms of centre of mass displacement and the amount of movement created in three servers of the same level. Some players will favour a more vertically oriented amount of movement and centre of mass displacement, while others will create a more forward oriented amount of movement related to the displacement of their centre of mass in that direction (Figure 1). The quality of the service also seems to be determined by mechanical principles independent of coordination. This is the case for the height of the ball at contact (Vaverka & Cernosek, 2013). As height is a non-modifiable factor in players, it is possible to discuss the combined skills of balancing and aiming high at the ball (extension) to improve service performance. To investigate this issue in depth, it is interesting to consider the theory of natural preferences® highlighted in running (Gindre et al., 2016) (Lussiana et al., 2017).

This theory links the efficiency of the runner's stride to their natural motor skills of balance (more anterior or posterior) and coordination (more flexion or extension). Research has shown that there are two "natural preference" profiles in running. The "aerial" profile would optimise stride performance by favouring rebound-extension coordination and anterior balance. Conversely, the coordination of the "terrestrial" profile is oriented towards push-flexion and posterior balance. The explanation could lie in the preferential activation of muscles that are more anterior in “terrestrial” and posterior in “aerial” athletes (Lussiana et al., 2017). These

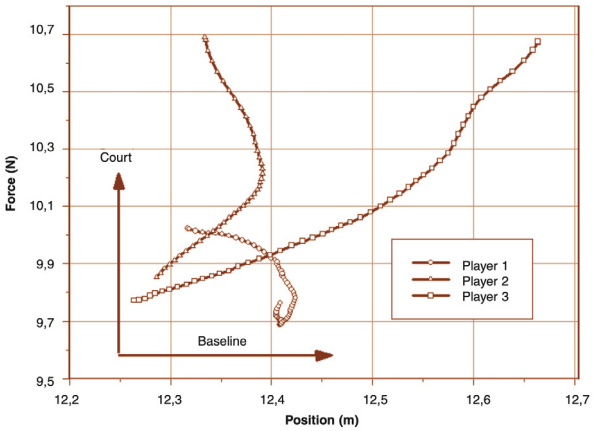

Figure 1: Centre of mass shift on serve for three different players (Elliott, 2003).

preferential muscle groups could jointly ensure balance and the dominant muscle action of athletes. “Terrestrial” athletes would primarily use the anterior muscles to maintain posterior balance (flexion) and to act primarily by pushing forward (concentric pushing). “Aerial” athletes, on the other hand, use their posterior muscle chain to maintain a more anterior balance and a more upward movement (plyometric rebound) (Figure 2).

To date, no studies have focused on exploiting these natural preference models to refine the understanding of tennis players' motor skills. Therefore, the aim of this preliminary exploratory study is to determine the influence of the terrestrial (with a "posterior and flexion" motor pattern) and aerial (with an "anterior and extension" motor pattern) profiles on ball speed and impact position during the serve.

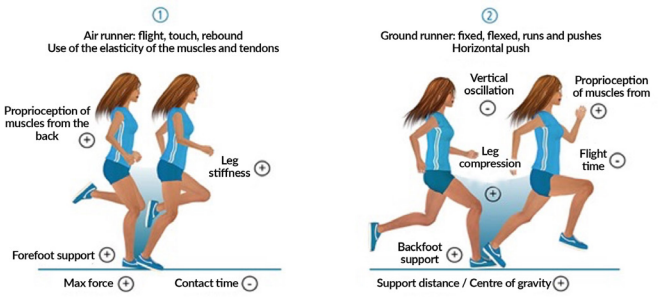

Figure 2. Schematic presentation of the characteristics of the air and ground models in running (Volodalen®).

METHODS

Nineteen professional tennis players participated in this study (age: 20.9 ± 3.0 years; height: 1.86 ± 0.08 m; body mass: 75.7 ± 6.8 kg; International Tennis Number 1). The experiments took place on a tennis court surrounded by a motion capture system comprising of 23 optoelectronic cameras (Oqus 7+, Qualisys, Sweden). The players were classified into the "terrestrial" (TER) or "aerial" (AER) group by a Volodalen® expert using the Vscore scale which is based on running observation criteria (Gindre et al., 2016) (Table 1).

Table 1

Characteristics of the aerial (AER) and terrestrial (TER) groups.

	AER (n=9)	TER (n=10)
Age (years)	20,8 ± 2,9	21,0 ± 3,1
Height (m)	1,91 ± 0,07*	1,80 ± 0,08
Weight (kg)	79,2 ± 6,9*	72,2 ± 6,7
Ranking (ATP)	507 ± 591 (n°17 à n°1571)	605 ± 436 (n°81 à n°1230)
Serve technique	Foot-up (n=9)	Foot-up (n=7) and foot-back (n=3)

*p<0,01**

Next, the players and their racquets were equipped with reflective body markers to calculate the trajectory of the joint centres and the racquet head (Figure 3). The players performed 5 flat serves (first ball) in a target area (1 m x 2 m at the T) in deuce box. The ball speed was measured with a radar (StalkerPro, USA). The impact position in height and depth, the take-off height of the centre of mass at impact and the maximum vertical velocity of the rear hip during the leg thrust were calculated. Given the differences in height and mass between our two groups, a number of variables were standardised. Student's t tests were performed to compare kinematic variables and ball speed between the terrestrial and aerial groups (Statistica 12 software). A Fisher's exact test was used to compare the distribution of serve techniques between the two groups of players (foot-up or foot-back). The significance threshold was set at $p < 0.05$.

RESULTS

Ball speed (relative to subject height and mass) was similar between the 2 groups (1.3 ± 0.1 versus 1.4 ± 0.1 km/h/m/kg; p=0.059). The height of impact relative to the height of the players was identical between AER and TER servers (1.49 ± 0.02 x height versus 1.49 ± 0.04 x height; p=0.903). The AER servers lifted their centre of mass at impact more than the TER (24 ± 6 cm vs. 18 ± 4.0 cm; p=0.02). TER servers impacted the ball more forward than AER (0.37 ± 0.04 x height versus 0.31 ± 0.08 x height, p=0.03). The maximum vertical velocity of the rear hip of the AER servers during the leg thrust was significantly higher (2.44 ± 0.24 m.s-1 versus 2.14 ± 0.26 m.s-1; p=0.01). Fisher's exact test revealed no significant difference in the distribution of support techniques between the two groups (p=0.211).

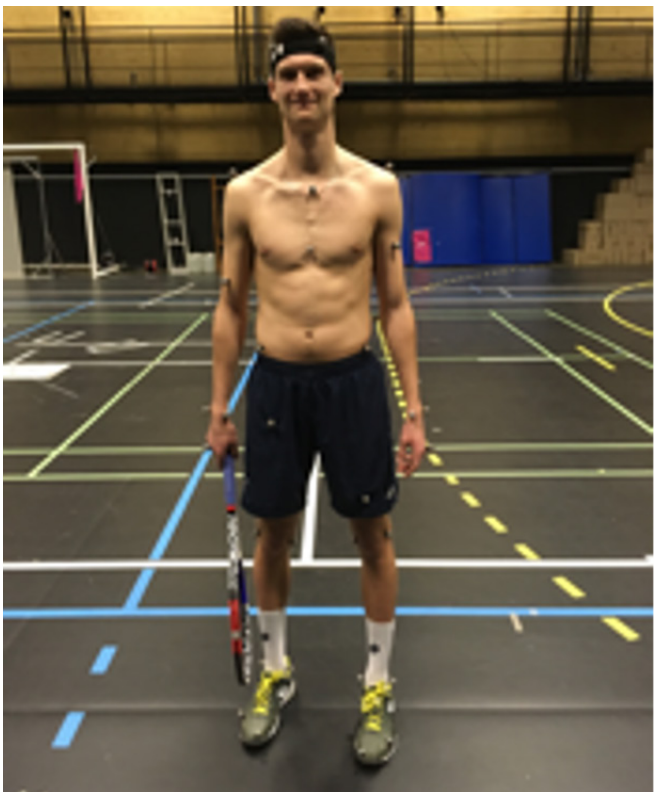

Figure 3. Player and racquet equipped with reflective body markers.

DISCUSSION

This research is the first to address the issue of natural preferences® in tennis. In this study, the normalized values of ball speed and impact height tell us that AER and TER players serve equally hard and hit the ball at the same height. However, the TER servers impact the ball further forward than the AER. Conversely, the maximum vertical velocity of the rear hip of the AER servers during the leg drive is significantly higher than that of the TER, causing them to take off more from the terrestrial. As the statistical analysis does not show any difference in the distribution of the serve foot-up or foot-back stance between the two groups, the results obtained for the AER and TER servers seem to be independent of the stance technique used.

Natural preferences may help us to explain the differences obtained between AER and TER servers. Indeed, the AER servers showed a higher take-off height and a higher maximum vertical hip velocity indicating a better ability to propel themselves upwards during the service due to their natural preference based on an extension pattern. Contrary to expectations, the impact height was not significantly higher for the AER servers but is in line with the literature which indicates an optimal impact height around 1.5 x player height. The results concerning the take-off height and the

vertical speed of the rear hip are in agreement with the work carried out on natural preferences in running. Indeed, Lussiana and Gindre (2016) have shown that AER runners possess coordination based on a preferential upward shift of the centre of mass and muscle functioning in a "rebound" mode (plyometric contraction) (Lussiana & Gindre, 2016). AER servers have also been shown to produce higher maximal vertical force than TER ones (Gindre et al., 2016) (Lussiana et al., 2017). TER servers have a coordination based on a preferential forward shift of the centre of mass and a "push" mode of operation (concentric contraction) (Lussiana & Gindre, 2016). The difference in forward impact position on the serve for our two groups tends to confirm the forward "push" mode of operation of TER servers in tennis.

PRACTICAL APPLICATIONS

In terms of practical applications, this work in connection with the Natural Preference Theory® opens up new perspectives in the field of technical and physical training. Indeed, it is possible to imagine that coaches can provide technical advice adapted to the natural preferences of their players while considering the biomechanical principles of service performance. For example, depending on the "aerial" and "terrestrial" profile, it seems relevant to individualise the advice on the amplitude, duration of the flexion and extension phases of the lower limbs or the orientation of the terrestrial reaction forces during the service, independently of the chosen technique (foot-up or foot-back). Furthermore, since it is known that the progress of each athlete at a given strength training is highly variable and specific (Radnor et al., 2017) (Damas et al., 2019), it appears possible to individualise this advice also during off-court strength training exercises (i.e., much more flexed squats for terrestrial servers).

CONCLUSION AND PERSPECTIVES

The results of this study for the serve need to be extended to other strokes with reliable data ideally obtained in a competitive ecological context so that the motor skills adopted by the players are as natural as possible. Further work is needed to analyse other parameters related to the "terrestrial" and "aerial" profiles, such as angular velocities, plantar pressures, ball trajectory and lower limb flexion and extension amplitudes. In addition, natural preferences in the way upper body rotations are coordinated have been demonstrated in golf. An associated body is characterised by a rotation in which the shoulder line and the pelvis line work in synergy (e.g., Federer). Conversely, a dissociated body is characterised by an independent rotation between the shoulder and pelvic lines (e.g., Murray) (Figure 4). The

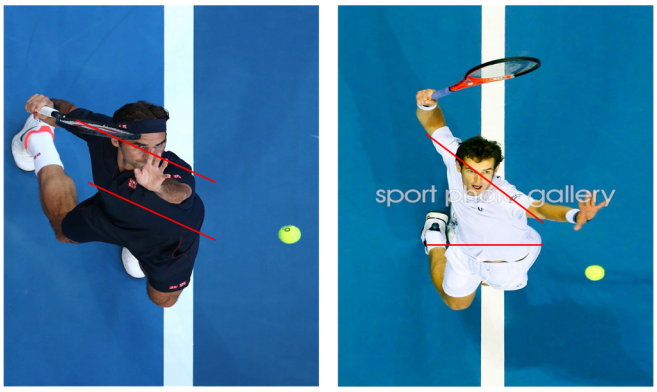

Figure 4: Example of a combined (Federer on the left) and disassociated (Murray on the right) profile.

"associated" and "dissociated" profiles and their influence on the service technique deserve to be investigated in the future. In our opinion, the Natural Preference Theory® is a tool that can help coaches to determine the key points on which to act according to the specificities of each athlete. By no means, this is a question of replacing the dogma of a technical model that would apply in the same way to all by another model, but instead the proposal of a new reading grid that allows the preferential motor skills of each athlete to be considered while respecting the biomechanical principles.

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Development and implementation of a mental development programme for young elite tennis players

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ABSTRACT

This study was conducted with two young Canadian elite tennis players. An eight-week practical work was conducted with the aim of acquiring new knowledge in sports psychology, and then applying these notions in several competitive situations. Specifically, we focused on the control of thoughts during the 25-second break between rallies. The players were taught a specific mental routine that they had to perform between each point. In terms of results, there was a very interesting trend after analysing the data collected. When players did not perform their pre-set routine before a rally, they had more than 50% chance of losing the next point by making an unforced error.

Key words: sports psychology, mental routine, thought control

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INTRODUCTION

In tennis, mental toughness is often the aspect that makes the difference between winning and losing (Cowden, 2016). Indeed, our sport requires an extraordinary level of concentration and mental involvement. But why in tennis more than in any other sport? In fact, on average, out of 60 minutes of play on court, a player will only really hit the ball for 12 minutes (Vaillant, 2008). Therefore, the other 48 minutes will be devoted to time between points and side changes. All these 'dead' times are then pivotal moments where the players can escape through inappropriate thoughts that have no place in a winning process. Ironically, the players may simply lose the game when they are not playing. It is then essential, that the coach mentally guides their players during these moments of waiting. That is why it was decided to provide the players with a specific mental routine to perform between each rally. Then it was tested if the mental routine had an impact on the outcome of the next point.

This technique is inspired by the work of Mamassis and Doganis (2004), Vaillant (2008) and Morais and Gomes (2019).

DETAILED DESCRIPTION OF THE MENTAL ROUTINE BETWEEN RALLIES

First of all, it is important to understand that there are only four possible situations following a rally in tennis. Here is an explanation of the desired reactions to each of the four situations.

Situation 1: The player wins the point because the opponent made a mistake.

Sometimes you win points without having earned them. This is very common in tennis. Be opportunistic, take advantage of the opportunity. As they say, tennis is too stingy and thankless a game to be picky. So, congratulate yourself, but discreetly and above all, it is important not to denigrate yourself.

Second situation: The player wins the point, because they made a good shot.

You have just won a "super" point. Let yourself be overwhelmed by the positive emotion that comes with it: pleasure, pride, a sense of achievement, etc. Afterwards, it is important to mark the point literally with a positive anchor (clenching your fist, verbal encouragement, etc).

Third situation: The player loses the point because the opponent made a good move.

You have just lost the point, but you are still playing very well. Take a deep breath to release any frustration and then look for the positive side of the situation: "No regrets, I did my best". Occasionally we can even applaud the opponent and say, for example, "Well done, good shot".

Fourth situation: The player loses the point because they make a mistake

You have just lost the point because of something you did: bad footwork, lack of concentration, bad choice, etc. Instead of sinking into a negative emotion that will be very difficult to get out of and will not help you at all, say something detached to yourself such as: "Everyone misses, even Federer", "This proves that I am human", etc. Then, in a vacuum, do the move you wish you had done, visualise the ball where you would have liked it to go, and move on. This is called a neutral anchor.

So, for these four situations, the first five to ten seconds after a rally will be spent analysing the situation and the reaction that needs to happen. Thereafter, the players should think about the next move. If the player is serving, they should decide which serve they are going to use as a first serve, as well as on the second serve. If the player is returning, they should determine their position and the return to be made according to the situation.

Finally, in the last five to ten seconds, the player must first do some visualization work as well as perform a precise physical routine. When serving, the player must visualize the serve they are about to hit. When receiving, the player must visualise the return they would like to play. Finally, after the visualization, the player should perform the physical routine (during about five to seven seconds). For example, the player could bounce the ball a few times or take a deep breath and relax the shoulders. This routine should be completely identical for each sequence.

METHODOLOGY AND PROCEDURE

This mental development programme was conducted with two young (male) elite tennis players. These players were respectively 13 and 14 years old and were ranked among the top twenty players in their age category in the province of Quebec. The programme lasted eight weeks. First, six training sessions were devoted to learning the mental routine to be performed between exchanges. Then, the players took part in three different competitive situations: a practice match, a league match and a provincially sanctioned tournament.

Each training session lasted two hours. The first sessions served, among other things, to establish a bond of trust with the subjects. A contract was signed by both parties (player and coach). We also explained very clearly, in a theoretical way, each step of the mental routine to be performed between points. The aim was really to make sure that the players understood perfectly what they had to do, but also that they adhered to the process and that they were convinced that this technique would improve their game in the end. This is an extremely important step in a process of change on a mental level. On a practical level, during the subsequent sessions, the players experimented with several on-court exercises to improve their ability to deal with the mental routine.

One of the key exercises in this process was active on-court work. This exercise takes about 40-50 minutes. It involves playing points between the two players. However, for half of the exercise (20-25 minutes), the same player will serve during all the points. The server must then alternate between the left and right diagonals. The players do not keep score during this exercise. They just play points against each other, of course, trying to perform the mental routine they have learned.

The coach's role is to follow the players on the court during this mental routine (the 25 seconds between exchanges). The players must then mention aloud everything that happens during this routine. The players must first tell the coach why they react the way they do to the point they have just played. Then they should say (out loud) what type of serve they are about to perform. Finally, they should mention their physical routine that they will perform before serving. For example, this physical routine can be, like Denis Shapovalov's, two throws between the legs followed by four bounces on the floor. After that, the players serve and play the point. Then the process is repeated when the rally ends. The coach will also have to do the same process with the returning player. It is therefore more efficient to do this exercise with two coaches at the same time (one following the server and the other following the returner). However, it is also possible to do it by changing sides after a few interventions with the same player. After 20-25 minutes, the roles are exchanged. The turner becomes the server, and the server becomes the turner.

Towards the end of the study, the players participated in three different competitive situations: a training match, a league match and a federally sanctioned tournament. For each of these situations, a very precise coding was carried out. After each exchange, it was noted whether or not the player had successfully completed the mental routine. It was then noted whether the point that followed was won or lost. In addition, it was noted when a player made a direct error. It was then possible to statistically correlate rallies lost due to unforced errors with successful and unsuccessful routines.

RESULTS

As far as the results are concerned, they are very conclusive. For the purposes of this article, the statistics of the two players under study have been combined and an overall average has been obtained. In total, 340 rallies were coded during the study. Here is an explanatory table including the different statistics under study:

Table 1

340 rallies evaluated	Direct mistakes after the routine	Percentage of points lost
259 routines judged successful	43	17%
76 routines judged non successful	44	58%

DISCUSSION

This study was very revealing in terms of the importance of the mindset between rallies. Indeed, instilling a specific mental routine in our players can have immediate effects on their performance (Cox, 2011).

A similar study to this one also looked at this factor. Morais and Gomez (2019) worked with eleven players aged between

11 and 14 years, ten boys and one girl. They focused on the serving routine and wanted to find out if including a specific serving routine (both physical and mental) would increase the players' performance in their serving games. Like in our research, the results of this study were very revealing. Indeed, the number of games won on serve increased from 25% to 55% after the introduction of the service routine.

Several other studies have looked at the importance of the mind in tennis. Many researchers have used a questionnaire in their various studies. For instance, Cowden (2016) used "The mental toughness inventory (MTI; Middleton et al., 2011)". This questionnaire measures 12 different dimensions of mental toughness such as perseverance, task focus, goal commitment and stress minimisation. 43 elite junior players from South Africa were invited to participate in the study. The average age was 13.6 years. Immediately after completing the questionnaire, the players were thoroughly coded within a tournament match. They were evaluated on more than 20 specific criteria such as percentage of break points saved, percentage of first serves in break point situations, percentage of critical points lost due to an unforced error, percentage of critical points won on return by hitting a winning shot, etc. After tallying the results, the researcher was able to come up with several interesting findings. He was able to state that there was a partially significant correlation on several dimensions. The one that stood out the most was the one that evaluated the percentage of critical points won in service. So, also based on the questionnaire filled out at the outset, it was concluded that those with high mental strength were more likely to win the critical points on serve. These players also had a high level of self-confidence and the natural advantage they had in serving gave them the additional mental weapons to win most of the crucial points.

As we can see from the scientific literature of the last few years, instilling a mental routine as well as various specific psychological strategies can only lead the player to an overall progression of his level of play. However, it is important to know your athletes well in order to apply the appropriate approach when carrying out mental interventions. Even if many techniques are fairly universal, it is important to know the personality of our players in order to establish an effective helping relationship and specially to establish a relationship of trust that will last over time.

CONCLUSION

The mental aspect is paramount to success in sport and this is even more valid for our growing youth. Living in a society of performance, anxiety is more and more present in our daily life. This is why the mental aspect must be of paramount importance in the learning and sport development of our young people.

Indeed, given the very high rates of psychological distress observed in our society (Picard & al., 2007), it would be relevant to conduct more research that verifies to what extent the mental strategies used by athletes could also be useful for young people in general. I therefore encourage the entire scientific community working in this field to get involved in order to exploit this field of activity, which is, for me, captivating, exciting, but above all extremely important.

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The junior coach tournament attendance dilemma: How willing are parents to pay coaches to attend matches?

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ABSTRACT

Many tennis coaches are paid by the hour. Unfortunately, this pay structure can contribute to poor coach attendance at tournaments. This study sought to determine whether parents would be willing to pay coaches to attend tournaments. Findings show a willingness on the behalf of parents to pay. This has implications for how coaches may reduce the financial burden of forgoing a weekend's coaching, while potentially enhancing athlete development.

Key words: willingness to pay, parents, coaches, tournament attendance.

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INTRODUCTION

A considerable number of tennis coaches are paid by the hour. As they accrue more hours on court, their income increases. A compensation model centered on hourly pay makes sense in this context. Demand for tennis coaching can fluctuate. By paying coaches an hourly wage, tennis clubs and organizations assume less risk. Consequentially, coaches under this wage structure, are incentivized to maximize their time spent on-court coaching. Although such a form of motivation can be beneficial to clubs, as well as coaches who experience a greater degree of freedom to form their work schedules under an hourly wage structure, it is not without its downsides. Coaches are most in demand outside of regular work and school weeks (i.e., on evenings and weekends). This can be problematic, as these hours often coincide with junior tournaments and competitions. Coaches are faced then, with the choice to dedicate weekends to on-court coaching or attending their athletes' tournaments for which they are seldom paid. As a result, in the sport of tennis, it is quite common for coaches to go extended periods without seeing their athletes compete, much to the disdain of junior tennis parents (Horne et al., 2020).

In some instances, coaches do charge a fee for their presence at tournaments. These coaches are able to attend without forgoing a weekends worth of income while providing a valuable service to athletes and their parents. A service that includes pre-match preparation, match analysis and de-brief, as well as providing coaches with first-hand knowledge for designing future training sessions and schedules. Unfortunately, this practice is not widespread and tends to be confined to high-performance programs and academies where coaches' tournament attendance fee is built into the program package. It is not yet known whether such practices can be replicated outside of high-performance settings. Setting where it is more likely parents, who are considered the

purchaser of youth sport programming (Green & Chalip, 1998; Vealey & Chase, 2016), will pay coaches directly. Therefore, to determine whether the opportunity exists for coaches to charge for their tournament attendance in other tennis clubs and facilities, further investigation is warranted. In seeking to address the dilemma of coach tournament attendance, the purpose of the current study was to determine parents' willingness to pay (WTP) coaches to attend their children's tournament match.

WILLINGNESS TO PAY

Willingness to pay is a popular method employed by market researchers to measure the price consumers are willing to pay for a specific product or service. It has been adopted in the sport industry to gauge interest in amateur sport and recreation programs (e.g., Johnson et al., 2007), ticket pricing at professional soccer games (Kemper & Breuer, 2015) and pricing for sport club membership fees (Wicker, 2011). The contingent valuation model (CVM) was considered most

appropriate for the study's purpose as respondents in this model are asked directly what they would pay for a specific product or service (Mitchell & Carson, 1989). The CVM has, however, received some criticism. A main point of criticism against using the CVM concerns the potential for bias. The fear being study participants respond with the WTP a hypothetical higher price than what they would actually pay. In the context of the current study then, participants may show a higher WTP for a coach to attend than they might in pay in actuality. It is important to consider this when evaluating the study's findings.

In determining parents' WTP for their children's coaches to attend a tournament match, the study set out to answer the following research questions:

- Would parents be willing to pay coaches to attend their children's matches?
- To what extent are parents willing to pay coaches to attend their children's matches?

METHOD

As a part of a larger project, surveys were distributed to parents of junior tennis players who have competed regularly in the six months prior to the study. Purposive sampling was initially used to approach parents at tournaments in the Midwest United States. Parents were also reached through popular social media pages, as well as through the researcher's network of tennis coaches and administrators. Participants were then asked to share with other tennis parents whose children had been competing regularly. A total of 130 parent surveys were completed and returned. The WTP measure was included in the survey for the larger project, with the measure adapted to fit the context of the current study (i.e., junior tennis parents' WTP coaches to attend a tournament match). Participants were asked to choose from one of seven available listed options. The options included: no coach in attendance, $0, $50, $100, $150, $200, $250. Data analysis for the WTP measure included a frequency count to determine parents' WTP for the available options.

RESULTS

Table 1 shows the frequency distribution of parents' WTP for coaches to attend a tournament. Although parents' preferences varied, their preferred option was to pay $50 for a coach to attend one match. An overwhelming 42.3% of parents were willing to pay this amount, with $100 for a coach to attend one match parents' next preferred option, with 27.7% of parents selecting this option. As the two most popular options, parents' exact WTP coaches to attend one tournament match likely falls between $50-$100. Findings also demonstrate that nearly 20% of parents would not pay for a coach to attend their children's match or would prefer the coach not to attend. As over 80% of parents were willing to pay at least $50 to a coach to attend one match, findings suggest a market exists for coaches to charge for tournament attendance.

Table 1

Frequency distribution of parents' Willingness to Pay.

Willingness	Frequency	Percent
No coach attend	7	5.4
$0	18	13.8
$50	55	42.3
$100	36	27.7
$150	5	3.8
$200	5	3.8
$250	4	3.1
Total	130	100.0

DISCUSSION

The study set out to ascertain parents' WTP for coaches to attend their children's tournament matches. Findings show parents would be willing to compensate a coach for attending a tournament match. This is an important finding, as it illustrates how athlete development could potentially be enhanced within the confines of the current youth tennis business model.

The study highlights a viable solution to coaches' lack of attendance at their athletes' tournaments within the existing compensation model. Charging parents a fee to attend athletes' tournament matches can be beneficial for several reasons. First, it will incentivize coach attendance at matches. Likely improving attendance and, therefore, enhance athletes' development. Second, it does not require coaches to forgo an entire weekends income. Further, the transaction can occur within the existing business model for junior tennis. And finally, by improving coaches' tournament attendance, it will assuage parents' existing frustrations with coaches current attendance records.

As findings suggest, it is recommended coaches charge parents a fee similar to what they charge for an hour or two's worth of instruction. Additionally, it is conceivable that coaches may be able to attend a tournament where they have multiple athletes participating, thus earning additional attendance fees. Certainly, the specifics of each agreement between parents and coaches would require negotiation to determine a price, and precisely what services parents are purchasing (i.e., pre-match preparation, post-match written report/analysis).

The current business model for youth tennis is well established and unlikely to change in the near future. It is imperative that ways are sought to improve current practices within tennis's existing structure. The current study accomplishes that by showing parents are willing to pay coaches to attend within the typical hourly wage structure. More frequent tournament attendance would appease parents, while more importantly, providing coaches with a deeper understanding of how their athletes perform in competitive settings. Thus, improving parent-coach relations and enhancing athlete development. To

further establish the true viability of parents paying for coaches to attend, future research should investigate at what fee coaches would be willing to attend. Failure for parents and coaches to align on an appropriate fee would act as a barrier to developing such an arrangement.

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"Slippage" in the talent development environment of elite junior tennis players

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ABSTRACT

"Slippage" occurs when there is a mismatch between the intended message communicated (by coach, parent, or talent development environment) and the received message by junior tennis players. The concept of slippage has received attention in educational settings, but research has yet to investigate the possible effects on junior tennis players. The purpose of this study was to examine the experiences of 8 UK, elite junior tennis players and describe what it is like to perform in the elite junior context. An Interpretative Phenomenological Analysis (IPA) of 8 elite junior tennis players (playing LTA Grade 2 and upwards) shows their insights into elite junior tennis. This study found that (a) participants seek meaning behind their tennis experiences and they infer messages from their environment that are not intended, (b) "slippage" is associated with unintentional pressure, and (c) "slippage" is associated with a reduction of junior tennis players' confidence. The findings of this research contribute to an evolving, problematic epistemology of sports coaching and confirms that coaches can lose control of their intended message as players infer their own meanings from interactions within tennis. The findings present governing bodies opportunities to inform coach education literature and consider how the difference between the intended coaching message and the received coaching message can impact the emotional state of junior tennis players.

Key words: interpretative phenomenological analysis, elite junior tennis, slippage

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INTRODUCTION

The talent development environment (TDE) has a profound physical and emotional effect on the athletes' who train within such environments (Henriksen et al., 2010). Youth performance coaches create intensive preparation programmes to enable young people to train in specialised environments with desirable values for sporting achievement. TDE's contain beliefs, values, attitudes, dispositions, and subtle intuitions acted out via interactions between players, coaches, and parents in the elite junior tennis environment.

Without careful monitoring and criticality of the conscious or sub-conscious messages that children see and hear, it is possible that flawed learning outcomes are absorbed. "Slippage" occurs when there is a difference between the intended message (from coach, parent, or the talent development environment) and the received message by the player (Cassidy & Tinnings, 2004). Despite governing body's best intentions, seemingly well-structured training programmes are associated with players who experience unintentional pressure and low levels of confidence due to misinterpretation of messages in the TDE. For example, players repeatedly told about areas to improve so they can reach higher levels, can interpret this as not being good enough and reduce confidence.

A deeper understanding of 'slippage' and the real world impact on the emotional state of elite junior tennis players would help junior tennis coaching through better provision of TDE's that

are more considerate of social learning. It would be helpful to understand what it is like for junior tennis players to live, eat, and breath a sport known to; prioritise ranking / selection / representation (Lauer et al., 2010); include a prominent performance narrative (Douglas & Carless, 2012); rely on financial investment from parents (Dunn et al., 2016); contain high levels of interpersonal conflict (Wolfenden & Holt, 2005; Smoll, Cumming, & Smith, 2011, Gowling, 2019).

Elite junior tennis "a multifaceted social setting involving complex relationships between players, parents, and coaches" (Wolfenden & Holt, 2005, p. 122). The specific nature of the social context in which talent development in tennis occurs

contributes to the reality of junior tennis players. For example, tennis players commit to tennis earlier than in other sports, and early specialisation means coaches, players, and parents interact with each other intensely for many years (Knight & Holt, 2014). The intensity and frequency of coach, player, and parent interactions will inevitably affect the children involved and this deserves more attention in research.

This article looks at the experiences of 8 UK elite junior tennis players and illustrates they are sensitive to more than simple words and instructions given directly to them during training. The responses show participants searching for their own meaning relating to their tennis experiences and they infer messages from their surroundings that are not intended.

METHOD

This study was an interpretative phenomenological analysis (IPA) of 8 elite junior tennis players in the UK. The participants included 4 males and 4 females aged between 11 and 18 years old. The participants trained in the following areas: Northern England (4), Southern England (3), and Wales (1). Participants were Junior elite, and this was defined as competing at national level competition and above (Rees et al., 2016). Interviews were semi-structured, and the aim was to understand what it was like for participants to play elite junior tennis. Interviews lasted between 45 minutes and 90 minutes and were audio recorded. Interview transcripts were transcribed verbatim, printed out, and analysed following the IPA procedure.

RESULTS

The results show (a) junior tennis players seek meaning behind their tennis experiences and they infer messages from their environment that are not intended, (b) "slippage" can be associated with unintentional pressure, and (c) "slippage" can be associated with reduction in confidence.

Junior tennis players seek meaning behind their tennis experiences and they infer messages from their environment that are not intended.

Junior tennis players are not non-thinking pawns, who blindly attend training and competition, oblivious to the sacrifices, behaviours, judgements, and expectations of others. Often by the time players reach yellow ball (U12) they have experienced many years of training and competition. Years of interactions in tennis inform players interpretations about the sacrifices people make for their tennis, leading to questions about whether there is more to tennis than fun. Amy described her views on tennis culture: "Everyone says, relax and play your game. Someone should tell the adults to relax. Why are they all so frantic"? Due to the amount of training, travel, and competition involved in the elite junior context, it is natural that coaches and parents make substantial time, financial, and emotional commitments to help players and give them opportunities to succeed. However, sometimes the message received by the player can 'slip' to one of single minded dedication to tennis to the detriment of other areas of life. Sam described how tennis became a dominant source of conversation: "My dad only really talks to me about tennis these days. It's like that's all that matters". Understandably, parents want their children to know they are interested in their development. However, the support network around players is unable to fully attend to social learning and the messages players derive from daily interactions. Tomas illustrated how his parents concern for his development could be perceived as a player stressor:

When I've lost, I sit at the top of the stairs at home and listen to my mum and dad talking about my tennis. I know the next day we will have a family discussion about my programme and where I'm going in tennis. It becomes this huge issue.

Scrutinising daily interactions and attributing 'meaning' to such interactions was fundamental to the participants perceiving tennis as taking on increasing importance in the lives of people in their environment. Parent – coach interactions contributed to players feeling tennis was a priority for everybody involved in their development. James said, "I reckon my dad speaks to my coach more than my mum these days. They are on the phone for hours". It is important that parents and coaches work together to benefit junior players, but James went on to describe a detrimental effect on his tennis participation, "I feel guilty sometimes when I lose. Everyone puts so much effort into my tennis. I just know everyone is gutted when I lose". The participants consistently described situations where they searched for meaning behind the actions of people in their development, often making their own interpretations that informed their attitude towards tennis and what it means to them.

"Slippage" can be associated with players feeling unintentional pressure

A consistent theme throughout the responses highlighted that junior players were intrigued by 'why' the behaviours they witnessed around tennis occurred. For example, Oli said "I don't get why my coach reacts like he does. If I lose, it is always followed by 'you've got to work harder'. I'm like, I am working hard". Once players inferred their own meaning, there was often contradiction between the spoken words they received (e.g. relax, enjoy yourself, have fun) and the perceived behaviours they witnessed from coaches, parents, other players (anxiety, upset, anger, disappointment). Sarah said "You start to dread tournaments. You don't want to let anyone down. It would be nice to play freely but tournaments are tense. Everyone is so uptight". Junior tennis players have a preoccupation with pleasing parents and coaches through their performances because they are aware of the sacrifices made (Lauer et al., 2010). Wanting to please others associated with their development contributes to the pressure that players feel during competition.

The participants continued to describe examples of unintentional pressure. Participants seemingly interpreted much of their post tournament feedback as 'criticism' rather than constructive feedback. A mismatch between the intended coaching message (i.e. work hard to improve) and the received message (i.e. not good enough) seemed to affect players enjoyment of competition. Amy said "I hate it when my coach comes to watch. All the pressure and the criticism is hard to take". Rachel described a similar experience "I know they are there to support (parent/coach) but you see their reaction when you miss. I'm not missing on purpose". James concurred with Amy and Rachel, "When my coach is there, I'm scared to hit my backhand down the line. It's my best shot, but if I play it, I get told off". Lorimer and Jowett (2009) highlight the importance of empathetic accuracy in coach, athlete, parent relationships. The evidence suggests that some junior tennis players may be inaccurate in how they assess coach / parent expectations, resulting in players experiencing pressure.

"Slippage" can be associated with reduction in confidence

Participants consistently questioned their daily interactions, inferred their own meanings (slippage), and described unintentional pressure due to wanting to please their coaches and parents. Unsurprisingly, there was evidence that players experienced issues with self-confidence. Sam said "I'd rather play ITF's. When you play in this country, it can be embarrassing because you know everyone is talking about you when you lose". There was agreement throughout the responses that it was difficult to play freely, because the participants imagined negative judgements by those within tennis. Rachel described discomfort with competition "You feel like if you're top seed, people want you to lose. I hate being number 1 seed". A natural consequence of performing well is players carry high rankings. Unfortunately, some players interpret their high ranking as added pressure which made it difficult to play freely. Tomas added, "I'd much rather be the underdog. When you are number 1 or 2 seed you know you'll play bad". When I asked Tomas why he knew he would play bad, he said "everyone expects you to win, but wants you to lose". Junior tennis is a competitive environment which includes interpersonal conflict (Gowling, 2019) and participants were aware of this. There is evidence to suggest that players assumed the competitiveness they witnessed amongst player, coaches, and parents created an unhealthy atmosphere that impacted on their perceived ability to perform under pressure.

DISCUSSION

The data in this study highlights several ways that junior tennis players are affected by their talent development environment:

First, the findings of this study add to the work of Lorimer and Jowett (2009). Empathetic accuracy between player, coach, and parent aids the healthy development of junior tennis players. Failure to maintain an accurate understanding of the intended message behind tennis behaviours can cause the intended coaching message to 'slip' and potentially damage the players experience in tennis (Cassidy & Tinnings, 2004)

Second, the findings confirm our understanding that unintentional pressure exists in elite junior tennis (Lauer et al., 2010). Players understand the sacrifices their parents make to provide opportunities in tennis. Without regular communication and criticality of the talent development environment it is possible the intended message of care, provision of opportunity, and self-improvement can slip to a received message of pressure to justify sacrifice.

Finally, the findings confirm that elite junior tennis is a competitive environment that places a high cognitive load on young people (Wolfenden & Holt, 2005; Gowling, 2019). Junior tennis players require a cohesive support network to help them keep perspective on their tennis experiences in light of contradictory messages they infer from the talent development environment (e.g. competition, and criticism)

CONCLUSION

The findings of this research contribute to an evolving, problematic epistemology of sports coaching and confirms that coaches can lose control of desirable coaching messages as players infer their own meanings from interactions within tennis. The findings present governing bodies opportunities to inform coach education literature, and player support systems due to differences between the intended message (from coach, parent, or environment) and the received message that impacts on the emotional state of junior tennis players.

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Comparing the traditional and constraints-led approaches to skill acquisition in tennis

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ABSTRACT

The following article aims to highlight the differences between a traditional or 'information processing' approach to skill acquisition and the 'constraints-led approach'. The terms are defined then various aspects of each method are considered in the context of tennis coaching. Practical examples of using the constraints-led approach are then given.

Key words: skill acquisition, constraints, self-organisation

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INTRODUCTION

While many schools of thought exist on the most effective methods by which one can teach motor skills, they can be broadly divided into two categories: 'information processing' (IP) approaches and 'ecological' approaches, the foremost of which is the constraints-led approach (CLA). IP refers to what could be termed the 'traditional' method of direct, explicit instruction based on expert knowledge of 'correct' technique or tactics, honed through a high volume of repetition, for instance as recommended by Fitts & Posner's (1979) cognitive-associative-autonomous stages model of skill acquisition. The CLA is an approach to skill acquisition that views skill as evolving adaptation to a dynamic environment, harnessing constraints around which the athlete is encouraged to self-organise. The ensuing technical and tactical solutions arrived at then constitute a unique fit between the current environment and the individual qualities or 'intrinsic dynamics' of the athlete.

DISCUSSION

Self-Organisation

The IP model of learning is based on a dualist assumption of mind and body (Woods, McKeown, Rothwell, Araújo, Robertson and Davids, 2020). It can be likened to a computational model of behaviour whereby motor programmes are created and stored in the brain, then later called upon and executed as necessary e.g. learning the ideal technique for a forehand (through interpretation of demonstrations, verbal instructions and corrections accompanied by repetition), then later performing it in competition as required. This approach has been criticised for its "organismic asymmetry" in neglecting the performer-environment relationship (Dunwoody, 2007) and the unique importance of the ever-changing and dynamic nature of an athlete's surroundings in shaping their motor abilities.

In contrast, rather than assuming the control of a central executive in the brain issuing orders and delegating movement instructions to the limbs and musculature according to a pre-established programme, the CLA consists of treating the performer as a complex adaptive system and allowing her to self-organise around the environment in the pursuit of a task goal and a functional solution. Employing the CLA involves the manipulation of the environment and the assumption that, as each interaction between the athlete-system and the environment is unique, there is no 'optimal' technique, just individual, de-centralised regulation of system components in order to satisfy the demands of each task (Chow, Davids, Button, Renshaw, Shuttleworth, & Uehara, 2009).

Individual	Environment	Task
Intentions: • Competitive/Co-operative • Gain advantage • Apply Pressure • Make it harder/easier for yourself/opponent • Cause/avoid/get out of trouble Fatigue Emotion Confidence Motivation Personality Physical including coaching aids: • Handcuffs • Resistance bands • Occlusion/Sunglasses • Weights Speed/agility Ability Experience Genetics incl. handedness Sociocultural Injury	Weather: • Temperature • Humidity • Wind • Precipitation Visibility: • Sunlight (or lack of) • Floodlights Other players: • Stronger/weaker • Older/younger • Same/opp. gender Spectators • Hostile/friendly • Camera/video Court surface: • Indoor/outdoor • Clay • Grass • Hard • Fast/Slow • Wet/dry • Altitude Sound: • Crowd noise, cheering/jeering • Music: headphones/speaker	Court dimensions: • Length, Width; Areas in/out: for balls & players; Areas for 2nd bounce Net/barriers: • Min & max heights; 'Low ceilings'; Rope/tape above net; Height ratio (e.g. lower at middle); Draped/opaque net; 2nd net for height/depth Ball type: • Compression; Size; Other e.g. taped, stripped Racquet type: • Length; Weight; Balance; Head-size; Strings Instructions/feedback: • Educate ATTENTION & INTENTION Time-limits: • Racing (e.g. rally-race); Win in a certain # of shots; Objective measures i.e. mins/secs Starting court position Ball feed position Ball feed type: • Spin • Speed • Distance • Direction • Height Sound: • Noisy vs. quiet footwork/shots • Listen to sound of contact

Figure 1. Example table of potential constraints available to a tennis coach.

Constraints

The CLA stems significantly from the work of Newell (1986) and his definition of "constraints". The term refers to the boundaries for action that arise from the interactions between the athlete's own physical and mental state (individual constraints e.g. height, mood, level of fatigue); environmental constraints (e.g. humidity, gravity, court surface); and task constraints (e.g. the equipment being used, the rules of the game, the dimensions of the court).

The focus of the CLA is to manipulate these boundaries (most commonly those in the category of 'task' constraints), in order to guide the intention and attention of the athlete in attuning to useful information in the environment, as they search for a functional movement solution.

Repetition without repetition

Central to this process is the knowledge that in the dynamic environment of competitive sport no two movements are ever exactly the same, no shot or footwork pattern is ever precisely replicated. This knowledge necessitates the constant presence of variability in the practice environment, so that the athlete can develop versatile and adaptive movements, robust and flexible enough to satisfy a wide variety of movement problems. This is in contrast the IP aspiration of a 'champion' model for a skill, where the goal is to achieve a movement with as little deviation from the optimal technique as possible. Hence the practice mantra of the constraints-based coach or practitioner; "repetition without repetition".

Instructions and feedback

In the CLA therefore, rather than prioritising explicit information on idealised movements, verbal feedback from the coach supports the search for movement solutions by guiding intention and attention such that the athlete can more readily attune to the relevant information in the environment.

EXAMPLE EXERCISES

In this section, three examples are provided outlining possible CLA strategies to address some common issues encountered in tennis coaching. The examples below are to be juxtaposed with the typical major elements found in a traditional skill acquisition approach where the coach would look to identify technical errors then correct them with a verbal description of the desired technique followed by a demonstration from the coach, or an elite-level exemplar like a video of a professional player. This could be followed by a progression of hand-feeding, basket-feeding and rally-feeding accompanied by a high volume of instructions, corrections and feedback on performance.

Groundstroke racket-speed

Goal: To increase the separation angle on a forehand groundstroke

Player level: Novice. Constraints used (and category):

- Cord or ribbon to bind player's hands (individual)
- Instruction (for a basket-feed) to keep toes pointed forward at all times; "imagine you're buried up to your hips in concrete" (task)

With a player who struggles to generate groundstroke racket-speed, a coach may decide to try and facilitate concentric rotation and a greater separation angle between hips and shoulders. Without resorting to explicit instruction, a constraints-led approach may employ constraints to prevent the player's arms from moving independently of each other and the upper body, thereby encouraging shoulder rotation. Simultaneously the instruction to keep the toes pointing forwards or play open-stance locks out

the hips and invites the solution of turning the shoulders past the hips in order to move the racket. Instructions and feedback would be used to maintain the intention of creating racket-speed ("hit hard!") and draw the player's attention to prominent kinaesthetic or auditory information in the environment, for instance the feeling of the upper and lower body moving independently, or the sound of the ball coming off the strings.

Serving and volleying

Goal: To improve a player's ability to serve and volley in singles.

Player level: Intermediate. Constraints used:

- A fast court, e.g. grass/artificial grass (environmental)
- No bounces allowed on the server's side (task)
- Court shortened and narrowed as necessary to create the optimal level of challenge for the server (task)

Used in a competitive game situation, these constraints exemplify how an environment might be designed in which a player could explore solutions to the problem of winning from the serve without letting the ball bounce on their side of the court. Although the coach would not volunteer explicit technical solutions, she would make herself available to offer help when requested and to pose questions that direct the attention of the player to relevant sources of information in the environment.

Second serve

Goal: To reduce the number of double-faults in the final set of matches

Player level: Advanced. Constraints used:

- Deliberately fatiguing the player with shuttle runs or a bleep test (individual)
- Second serves only rule for the server in a practice set (task)

A tendency to double-fault in the final set of a match could of course be due to a number of reasons. Part of a constraints-based solution might be to create a representative environment that allows the player to explore solutions to serving when fatigued. As a player's individual constraints can change during the course of a match (dehydration, increase of lactic acid, loss of concentration) she is effectively playing with a different body to that with which the match was started, therefore a different second-serve solution is required. Such a solution

can be arrived at without direct prescription from a coach, just through giving the player a high volume of chances to adapt their serve by self-organising in a constrained environment.

CONCLUSION

Manipulating constraints is not new to coaching per se, coaches have always utilised tasks and environments in ostensibly similar ways. But in order to maximise their effectiveness, the CLA and its theoretical foundations provide a basis for using constraints in a way that assumes a model of behaviour profoundly different from the traditional, cognitive approach of transforming 'one size fits all' technical information into procedural knowledge. The use of constraints to impact behaviour change will not be optimal if deployed as part of a prescriptive coaching style. The CLA is the use of interacting constraints to facilitate the emergence of functional behaviour through self-organisation, not to simply provide opportunities for a player to execute a pre-established technique dictated by a coach.

Ongoing developments in psychological theory are continuously informing best practice in skill acquisition and, far from being locked into the assumption that skills can only be coached through the prescriptive transmission of expert information, coaches are encouraged to explore more ecological and implicit approaches to developing skill in tennis players.

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Relationships between body size and physical abilities in elite female tennis players

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ABSTRACT

This paper studied the relationships between anthropometry and physical fitness indicators that affect elite female tennis players' training process planning. Bodyweight and height were measured as well as aerobic and anaerobic lactic capabilities, and the physiological indicators determined. Results showed reliable relationships between the anthropometric and functional fitness indicators and the players' competitive performance. It was concluded that monitoring the average weight relative to the height of female tennis players can assist in the improvement of the players' performance through changes in the training process, specifically by relating the weight and height indicators with the strengths and weaknesses of the players' tactical patterns.

Key words: physical and functional fitness, total body sizes, elite female tennis players, the competitive performance results

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INTRODUCTION

To improve the training process, it is necessary to precisely understand the requirements that a high-level athlete must meet in a particular sport. Specifically, research in tennis have identified the parameters of the external indicators of the energy system demands during high-performance female players competitive matches (Skorodumova et al., 2019) and the requirements for their physical and functional fitness (Skorodumova et al., 2019).

For an optimal implementation of the training process, it is necessary to determine the relationships between physical and functional fitness indicators and the result of the performance in competitions (CP) and to clarify and prioritise the physical abilities that contribute to maximise the results. In this context, researchers and coaches should pay considerable attention to aspects such as the total body sizes, the determination of height, weight, and their corresponding ratios in female tennis players.

The external indicators that define the energy system demands during competitive tennis matches are well known (Ivanova, 2010; Naumko, 1996). However, there was a common view that the best tennis players were characterised by being taller and slimmer, i.e., anthropometric indicators, of which the mass and height index is important (Naumko, 1996) than the non-so successful players. Therefore, the lack of research that contributes to clarify the relationships between the total body sizes and the CP, as well as the indicators of the functional and physical fitness, justifies the need for this study.

The objective of the study is to determine the relationships between some indicators that evaluate the total body sizes, functional and physical abilities of high-performance female tennis players and the results of their competitive performance. The specific research questions of the study are the following: 1. Determine the total body sizes of Russian high-performance female tennis players; 2. Determine the functional and physical fitness of Russian high-performance female tennis players; 3. Determine if there are statistical correlations between total body size indicators and the result of Russian high-performance female tennis players' competitive performance; 4. Determine if there are statistical correlations between the total body size indicators of Russian high-performance female tennis players and the physical and functional fitness indicators; and 5. Compare the total body sizes indicators of leading female tennis players in Russia with similar indicators of leading female tennis players in the world.

METHODS

The total body sizes, functionality, and physical fitness were determined as part of a stage-by-stage comprehensive testing. Body weight measurement conducted using medical scales, the accuracy of which was up to 10 g. Athletes stood on the middle of the scale platform, having previously removed shoes and extra clothes, and were on it in a standing position, without moving, until the moment of weight measurement. Body height was measured by an easel height meter in a standing position from the apex point to the support. The athletes' initial position was the main stand - the back is straight, the heels together, the knees are straightened, the hands along the body. Based on these measurements, two indicators were calculated: the mass-height index (MHI Kettle 1; MHI = m/H) and the body mass index (BMI Kettle 2; BMI = m/H2, where m is the weight of the athlete, and H is the body height).

The functionality measures were conducted as follows: the aerobic capabilities were determined during a treadmill

running, with a stepwise increasing load every 2 minutes to overflowing. During the test, the heart rate was taken and the exhaled air was analysed using an automatic gas analyser 'Metalyzer- 2,' to determine the different physiological indicators. The anaerobic lactic free capabilities were measured using a 6 seconds of maximum intensity work on a cycle ergometer. The determination of the players' physical fitness was carried out using specific developed tests widely used in Russia in studies with tennis players (Skorodumova et al., 2013; Skorodumova et al., 2018).

The statistical analysis used included the determination of averages and quadratic deviations, the calculation of Pearson correlation coefficients and the linear rationing of obtained values.

Sample

Data from 41 top female tennis players (age average 17 y.o. ±3,41) who played for the national teams of the Russian Tennis Federation were used in this study.

RESULTS AND DISCUSSION

Table 1 includes the total body sizes of the players in the sample and the indicators of the functional capabilities of the energy supply systems and the physical fitness obtained.

Table 1

Indicators of the total body sizes of the top female tennis players in Russia (n = 41).

Indicators	Body height (cm)	Body weight (kg)	MHI (g/cm)	BMI (kg/m2)
Mean value ± Standard deviation	174.6 ± 5,54	64.27 ± 6,21	367.92 ± 29,99	21.06 ± 1,62

MHI: mass-height index (Kettle index 1); BMI: body mass index (Kettle index 2).

The calculations showed that the correlation of the total body size indicators with the competitive performance results was 11.1 %. Table 2 includes the statistical correlations of the indicators and their impact on the relation between the total body sizes and the competitive performance.

Table 2

Statistical correlations between the indicators that characterise the total body sizes of female tennis players and their competitive performance (CP) (n = 41).

Anthropometric indicators	Body height (cm)	Body weight (kg)	MHI (g/cm)	BMI (kg/m2)
Statistical correlation with CP, %, p-value < 0.05	14,9	31,3	29,7	24,1
Priority	4	1	2	3

MHI: mass-height index (Kettle index 1); BMI: body mass index (Kettle index 2).

The results indicated that the greatest correlation with the total body sizes values were obtained with the players' weight, not their height, as previously suggested (Naumko, 1996). Apparently, the conclusion made by the author is related to the height of male tennis players. In our study, the women's body height indicator showed the smallest correlation. In fact, the height of the female tennis players ranked one and two in the world is 166 and 168 cm respectively, and the average height of world's 10 top female tennis players is 174.6 cm (min 166 - max 182).

The second correlation was shown by the mass-height index and its significance to the total body sizes takes 2nd place. In this context, it has been considered that according to this mass-height index, it is logical to calculate the energy expenditures of the body (Naumko, 1996). The third correlation was shown by the body mass index (BMI or Kettle index 2), which allows to calculate the ratio of a person's mass and height. According to the World Health Organization's (WHO) interpretation of the BMI indicators, which includes rating scales, the indicators of female tennis players (mean - 21.06 kg/m2) are on the average values of the 'Norm' scale (18.5-24.99 kg/m2).

The following indicators showed statistically significant correlation coefficients that were considered at the significance value $p < 0.05$. The bodyweight index correlated with the body height at $r = 0.599$, with the mass-height index at $r = 0.953$ and with the body mass index at $r = 0.748$. The body height correlated with the mass-height index at $r = 0.331$, and the mass-height index correlated with the body mass index at $r = 0.913$ (Figure 1).

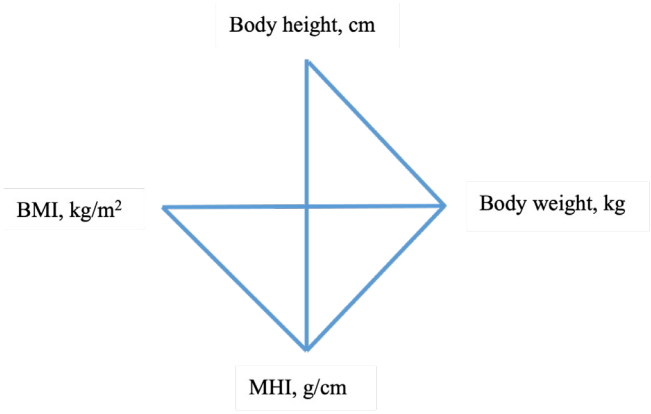

Figure 1. Correlation of anthropometric indicators. MHI: mass-height index (Kettle index 1); BMI: body mass index (Kettle index 2).

Thus, the two indexes, the bodyweight and the mass-height index, correlated with all the analysed indexes.

The body height index and the body mass index did not correlate and had the least contribution to the significance of the total body sizes. Thus, regardless of the height, players should monitor very carefully their weight and mass-height index. None of these indicators had a statistically significant correlation with the outcome of the competitive performance. However, body height, body weight, and mass height index had a statistically significant correlation with power indicators (VO2max, O2Pulse, MVV), and with aerobic performance indicators (VO2AT), which have a reliable correlation with the outcome of the competitive performance. Bodyweight showed a significant correlation with another indicator of the CP efficiency, the oxygen consumption at the aerobic threshold level. The body mass index showed a significant correlation with VO2AT, VO2max, and O2Pulse (Table 3).

Table 3

Statistical correlations of the total body sizes and the functional capabilities indicators. (n = 41, p value < 0.05)

Indicators	VO²AET (ml/min)	VO²AT (ml/min)	VO²max (ml/min)	O²Pulse (ml/b)	MVV (l/min)	T peak power (s)
Body height	-	0.427	0.525	0.530	0.428	0.558
Body weight	0.461	0.586	0.687	0.635	0.445	0.510
Mass-height index	-	0.529	0.615	0.553	0.367	-
Body mass index	-	0.370	0.412	0.346	-	-

VO2AET: oxygen volume consumption at the anaerobic threshold; VO2AT: oxygen volume consumption at the aerobic threshold; VO2max: maximum oxygen volume consumption; O2Pulse: the volume of oxygen consumed by the body per heartbeat; MVV: maximal voluntary ventilation; T peak power: time to reach the peak power.

Table 3 shows only those functional performance indicators that showed a statistically significant correlation with the competitive performance. Of all 13 indicators of the anaerobic productivity, the indicator of time to maximum power showed a reliable correlation with the competitive performance. Body height and weight showed a reliable correlation with this indicator. Bodyweight and mass-height index showed a positive correlation with the maximum power, although it did not show a correlation with the competitive performance, but surely had, albeit insignificant, some influence.

All indicators excluding the body mass index showed a significant correlation with the glycolytic endurance index, and the body height and the weight showed significant correlation coefficients with the vertical jump with both the left and the right foot.

The absence of correlations between the total body size indicators and the indicators of agility suggests that agility does not depend on the athlete's height and weight. Therefore, being very high, a female tennis player can also be very coordinated and vice versa.

Comparing the total body sizes of the leading Russian female tennis players with similar indicators to the world's top 10 female tennis players, it can be stated that there are no reliable differences in any of the indicators (Table 4).

Table 4

Total body sizes of leading female tennis players in Russia and the world.

Tennis player	Indicators			
	Body height (cm)	Body weight (kg)	MHI (g/ cm)	BMI (kg/ m2)
From Russia, n = 41, mean value	174, 6	64,27	367,92	21,06
Min-max	167-180,1	58-70	337,9-397,9	19,4-22,7
Top 10 tennis players in the world, mean value	174,6	64,40	368,47	21,11
Min- max	166-182	57-72	335-411	19,72-23,51

MHI: mass-height index (Kettle index 1); BMI: body mass index (Kettle index 2).

The weight, the height of the players and all indexes are very similar between the group of the top 10 female tennis players in the world and the other Russian female tennis players. The data obtained indicated that the total body sizes of the players correlated with the competitive performance around 10 %, which is not decisive in deciding the competitive potential. The important aspects related to the total indicators of female tennis players are their weight and their weight-to-height ratio (i.e., mass-height index). The weight should not be much more than 70 kg, while the mass-height index should be 340-400 g/cm. The total body indicators also showed a statistically significant correlation with the indicators of aerobic performance power and efficiency.

When in competition, female tennis players should be efficient, i.e., being fast, moving quickly in all directions, and hitting powerful shots. In some situations, female tennis players perform the movements of sprinters, in others those of the high and long jumpers. Moreover, hitting a serve in tennis has similarities with the throws. Since there are optimal values of total body indicators that characterize each sport, we compared the average values of leading Russian female tennis players with similar indicators of 10 leading female athletes in sprint, high jump, long jump, and javelin throw (Table 5).

Table 5

Indicators of total body sizes of leading Russian female tennis players and 10 strongest female athletes in sprinting, high and long jumps, and javelin throwing.

Total size, (mean value)	Sport				
	Running 100 m	High jump	Long jump	Javelin throwing	Russian female tennis players, n = 41
Body height (cm)	168.7	180.5	173.8	177.0	174.6
Body weight (kg)	58.7	61.1	62.4	75.0	64.27
MHI (g/ ²m)	347.9	338.5	359.0	423.7	367.92
BMI (kg/ m2)	20.8	18.8	20.86	24.1	21.06

Abbreviations: MHI, mass-height index (Kettle index 1); BMI, body mass index (Kettle index 2).

The body height of the female tennis players takes an average position. They were shorter than high jumpers and javelins but taller than long jumpers and sprinters. The average body weight of the female tennis players and their index values was second only to javelin throwers. The average square deviation from the average body weight was more than 6 kg. Female tennis players' bodyweight had the greatest contribution to the relation between total body sizes and CP results and ranged from 56 to 77 kg, with the athletes who had a weight less than average being close to high jumpers and short-distance runners on this indicator. Furthermore, they were lighter than spear-throwers. The same can be said about the mass-height index.

We can suppose that the total body sizes of the players may have an impact on the different tactical patterns they use during competition. Table 6 presents data on two female tennis players' total body sizes, which are among the top ranked players in the world, which clearly use different tactical patterns.

Table 6

Total body sizes of two high-performance female tennis players that use different tactical patterns.

Female tennis players	Indicators			
	Body height (cm)	Body weight (kg)	MHI (g/cm)	BMI (kg/m2)
1. S. Williams	175	72	411,4	23,51
2. S. Halep	168	60	357,1	21,26

MHI: mass-height index (Kettle index 1); BMI: body mass index (Kettle index 2).

Tennis player 1 plays powerful shots, trying to finish off the points as quickly as possible with her aggressive strategy. Her anthropometric data are closer to those of the javelin throwers. Tennis player 2 moves easily around the court and dominates the point using active movements which allow her to usually win points longer than 10 seconds. Her anthropometric data are closer to those of the best short-distance runners and jumpers in the world. These relationships provide further directions for future studies and, if the assumptions are confirmed, it will be necessary to make the necessary changes to the training process.

PRACTICAL APPLICATIONS

Previous research suggested that height was a key aspect for high-performance female and male tennis players to achieve a high performance. Our study suggests that for high-performance Russian female tennis players, the weight of the players would be more relevant than their height. Our results show that at this high level the average weight of the players was 64.27 kg, and the average height was 174.6 cm. Therefore, coaches should carefully monitor these relationships by providing the optimal combination of an appropriate diet with the adequate training loads to increase performance.

Based on the results obtained in this study, it was possible to assume that the weight and height of the players have an influence on the tactics applied during match play. In comparison with lighter and shorter players, heavier and taller players seem to use powerful attacking groundstrokes and volley with the intention to finish off the point as quickly as possible. These anthropometric features are similar to those that happen in disciplines such as javelin throw. Results have also shown that lighter and shorter players can also play attacking shots by easily moving around the court in rallies lasting more than 10 s. The features of these female tennis players are more similar to those of the 10 best short-distance runners and jumpers in the world.

CONCLUSIONS

The results of this study emphasise the importance of monitoring the average weight relative to the height of the female tennis players' and to develop tactical patterns that reflect the strengths and weaknesses of the players based on these indicators by implementing the necessary changes in the training process that will facilitate their performance.

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Digital marketing strategies for tennis coaches

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ABSTRACT

This article aims to highlight the opportunity that tennis offers coaches from an economic point of view through the application of a working methodology based on digital marketing strategies. To do so, it begins by defining those strategies regularly used by companies to maximise the profit and image of the coach as a professional. This is followed by a review of the main research on the subject carried out in tennis. A case study is presented in which different strategies are proposed that can be implemented by the coach as suggested in the article or modified and developed according to the coach's needs and the characteristics of the situation. Finally, some reflections and conclusions are put forward in relation to the practical application of these strategies.

Key words: marketing, digital marketing, business, profession

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INTRODUCTION

Marketing in tennis, as in any other area of the business world, has been so influenced by communication technologies and the internet that some authors speak of the emergence of a new era in business (Yüce et al., 2017). This is because the strategies and actions carried out by companies and individuals have undergone a radical evolution that has led them to progress from traditional marketing to digital marketing.

This evolution makes it essential to understand the mechanisms by which marketing is approached from the perspective provided by today's digital world and the possible applications that this world offers for the growth of any type of business, regardless of its field of action. This idea has been defined as postmodern marketing (Brown, 2008).

Digital marketing has been defined as the use of technologies to help implement marketing activities that enhance buyer awareness by meeting buyer needs (Chaffey & Ellis-Chadwick, 2019). Internet marketing, e-commerce, the use of social media and other analogous tools are means used to implement this strategy. Digital marketing has obvious advantages as it allows access to a larger number of potential buyers, immediately and considerably cheaper. In addition, it also offers the possibility for the buyer to interact with the seller and for the seller to learn more about the buyer's behaviours, wants and needs.

The ways in which businesses communicate and maintain relationships with their customers have been transformed over the last few decades by new information and communication technologies. Aspects such as email marketing, websites, the use of social media, user-generated content and even AI-based marketing need to be understood to make the most of new trends (Ratten & Thompson, 2021).

In the case of tennis and in the context created by Covid-19, digital marketing has been a fundamental instrument to face

the challenges posed by the pandemic. Different innovative actions that have used digital media, such as online training from home or distance learning, are allowing tennis activity to continue despite the great challenge we face (Crespo et al., 2021).

The application of different digital marketing strategies in the field of tennis helps professionals to grow tennis in the context in which they operate, as well as improves their ability to generate business. Therefore, we believe it is crucial for the coach to be able to understand the key trends in the business world in general and in the digital marketing sector that are shaping the socio-economic landscape of tennis.

In this context, it can be stated that digital marketing offers a great opportunity for tennis coaches to enhance their professional activity.

STUDIES ON DIGITAL MARKETING AND TENNIS

Studies on digital marketing and tennis have been varied as they have dealt with areas related to federations, tournaments, and coaches. The following is a summary of some of the most relevant and current studies related to the subject of this article.

Gázquez (2014) analysed the role of the media in the success or failure of an event in a tennis player's career and presented some considerations and suggestions in the framework of a corporate communication strategy that would be useful for coaches, club managers, schools/academies, and federations.

The development and maintenance of a social media strategy at the New Zealand Tennis Federation was investigated by Thompson et al. (2014). The aim was to study how a small organisation could have an online social media presence. The authors concluded that it is important to employ and evaluate creative online strategies using technologies such as Facebook to ensure that they continue to meet the needs and expectations of all stakeholders. These strategies include the use of promotions and constant engagement and communication with fans and supporters.

Van Dijk (2015) identified the need for personal branding in the tennis coach's professional career as a phenomenon that has gained importance in recent years. She considered that, by establishing a personal brand, coaches could differentiate themselves. To this end, she identified four key steps in establishing a personal brand: self-assessment, personal branding, personal brand marketing, and evaluation and adjustment, while analysing the role that digital media could play in the process.

The marketing of women's professional tennis was studied by Thompson (2919) who concluded that marketing efforts and the use of social media to promote women's professional tennis are of interest due to the globalised nature of professional tennis. The author also recognised the importance of using social media as a strategic marketing communication tool to promote women's professional tennis.

Lebel and Danylchuk (2019) investigated the relationship between tennis and social media. These authors concluded that the huge impact of social media has redefined communications. In the case of professional tennis, being immersed in an era of rapid change, social media has had a tremendous impact on the way information is shared between players, tournaments, users, and industries around the world.

Crespo (2020) presented some strategies that coaches can use to create added value to the services and products they offer and emphasised the consideration of tennis and tennis coaching as a business and shared some strategies. He presented suggestions in four main areas where coaches can create a great added value to be perceived by their clients: quality of service, variety of tools used, interaction with clients and adequacy of services to the clients.

The promotion of services or the strengthening of brands through a combination of marketing and communication strategies, with special emphasis on digital tools that can be used to support the different tennis stakeholders, was studied by Monegro (2021). The author concluded that the efficient use of these instruments will allow them to achieve their objectives more efficiently and at a lower cost.

However, according to the literature search conducted, research and studies on digital marketing strategies used by tennis coaches are scarce. Therefore, the purpose of this article is to delve into this aspect, proposing examples of good practices that coaches can use to make digital marketing a tool for business generation and development of our sport.

DIGITAL MARKETING STRATEGIES FOR TENNIS COACHES: A PRACTICAL APPROACH

A real case study will be used to provide the most practical and applicable approach possible to formulate a proposal for the application of digital marketing strategies by the tennis coach.

Let's suppose that Maria, a tennis coach working part-time for the provincial federation operating in her town, wants to extend her working hours by looking for beginners and intermediate students interested in developing their playing skills.

Maria has extensive knowledge in the use of social media and has taken some MOOC (massive open online courses) in web design and development based on WordPress. With this knowledge, Maria believes she can create a digital business platform to achieve her goal of growing her tennis-based business and asked us what she should do

The specific strategies and concrete actions based on digital marketing that we recommend to Maria are defined below.

Strategies

- Establishing a digital media presence
- Optimising the components that make up the business model
- Process automation for business development

Based on the strategies defined, specific actions for each of them are detailed below.

Strategy 1 actions: establishing a digital media presence

- Development of a website rich in educational and practical content for players, coaches, and family members (training resources) with a subscription newsletter. It is crucial that it is optimised for mobiles and tablets, as the potential target audience uses these media frequently.
- Creation of profiles on each of the social networks whose user profile matches the target audience of the coach in question and development of a content strategy that stands out for its contribution of value based on useful and practical resources.
- Inclusion of an online booking platform for private and/or group lessons on the website as well as access to it from social media profiles.

Strategy 2 actions: optimising the components that make up the business model

- Boosting the target audience's awareness of the components present in the above-mentioned actions of strategy 1 through search engine optimisation, i.e., SEO.
- Boosting the conversion of the components present in the actions of strategy 1 above by means of paid advertising in the relevant media, i.e., SEM (Search Engine Marketing), ads...

Strategy 3 actions: process automation for business development

- Supporting the content strategy through advanced email marketing actions targeted at users subscribed to the website's newsletter.
- Automation of processes, a key element of inbound marketing, through activities such as automatically answering user questions via chatbots or sending confirmation and information messages after confirming, modifying, or cancelling reservations, among others.

TIPS FOR THE IMPLEMENTATION OF DIGITAL MARKETING IN TENNIS

The different tools that make up the digital marketing strategy applied to tennis can be implemented in several ways. They can be carried out by coaches if they have knowledge of marketing, IT, social media, etc. On the other hand, there are specialised companies that can offer tennis coaches a wide variety of dynamic and customised proposals that help them to offer their services in a professional manner in a digital environment.

Many of these companies are used to provide non-binding quotes including the different actions related to the required services. In addition, some national federations (LTA, 2021), regional federations (Tennis Europe, 2016) and the ITF (ITF, 2021) offer professionally designed marketing related materials that are available free of charge or if the coach is a member of these organisations. In this way, the coach can have different alternatives to choose from.

These are innovative new tools to help tournament organisers promote events or venues. They are easy-to-use, customisable resources that can increase brand awareness and strengthen connections between events, sponsors, and stakeholders. Coaches, managers, and tournament organisers can choose images, designs, partner logos, sponsors and service, product or event details using resources such as poster templates, magazine articles and brochures, social media posts (Facebook, Twitter, Instagram), flyers and email footers.

CONCLUSIONS

Finally, and as a suggestion for the future development of digital marketing strategies applied to tennis, it would be useful for coaches to understand and apply techniques related to the exploitation of data, the optimisation of their services through data analysis and the development of reports on trends and behaviours of the tennis consumers closest to them. In this way, they will be able to be at the forefront of using digital marketing and new technologies as a tool for generating benefits both for themselves and for the world of tennis.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest in the preparation of this article.

FINANCING

The author declares that he has not received any funding for this article.

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Teaching opportunities during Covid-19

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RESUMEN

Without question, the current situation poses a challenge we have not seen before in the tennis industry. This article shares how the Hong Kong Tennis Association had been providing e-learning opportunities to its players during COVID-19 with the use of ICTs and how important it can be to implement an online curriculum in our tennis programs.

Key words: COVID-19, ICT use, online learning, innovation.

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INTRODUCTION

According to the World Health Organization, COVID-19 was first detected in late 2019 in China and has since spread throughout the world in a short period to affect more than 10 million people (28 June 2020), including nearly half a million deaths. On 30 January 2020, the WHO declared the outbreak of COVID-19 disease as a global health emergency, and on 11 March, the disease was proclaimed a global pandemic.

An overwhelming majority of the world's enrolled students have experienced the temporary closing of school during the COVID-19 pandemic in an attempt to encourage social distancing and therefore decelerate the transmission of the virus (Viner et al., 2020)

We already know that tennis is one of the safest sports to practice during the pandemic due to the separation distance between players while playing against each other. Hong Kong, even though it is one of the countries that are better controlling the COVID-19 situation, the government has been very prudent. For several months, tennis was not allowed, so players did not have the opportunity to keep practicing tennis and keep learning concepts.

To keep the players engaged and provide continuous education, the Hong Kong Tennis Association decided to create several educational virtual rooms using the Google Classroom platform. Within the organization, the NA has different programs organized by age groups and levels. Each head coach is responsible for creating content with his coaches' team and tailoring the content to its players' needs.

ONLINE LEARNING

Online learning can be termed a tool that can make the teaching-learning process more student-centered, innovative, and even more flexible. Online learning is defined as "learning experiences in synchronous or asynchronous environments using different devices (e.g., mobile phones, laptops...) with internet access.

In these environments, students can be anywhere (independent) to learn and interact with instructors and other students" (Singh & Thurman, 2019).

According to Liguori & Winkler (2020), innovative solutions by institutions can only help us deal with this pandemic. This is precisely what the Hong Kong Tennis Association is trying with the implementation of an online curriculum for their tennis players.

THE CLASSROOM

Each classroom targets for the different age groups and levels inside the organization. On figure 1, you can observe how it looks the classrooms in the platform.

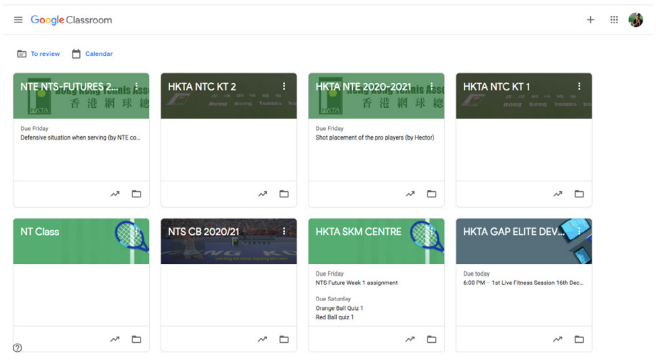

Figure 1. A general overview of the classrooms.

You can appreciate in Figure 2 how it looks like a week in the player's calendar.

A typical week of a player will mostly have at least one assignment of each topic.

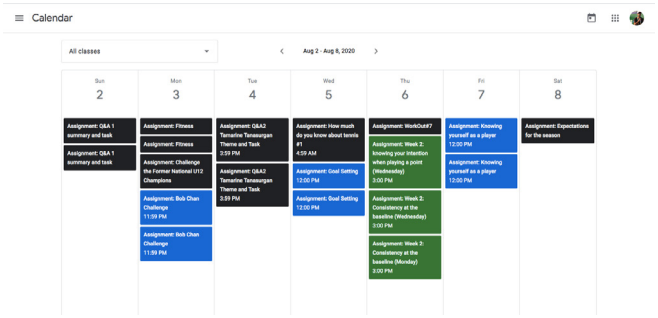

Figure 2. A general view of the weekly player's calendar.

There are different topics and content within the classroom that the Hong Kong Tennis Association Coaching team considers essential and can be taught online. That knowledge will be useful for the player once we can get back to the tennis courts again.

Tactical:

In this section, we teach the players various tactical aspects that they should take into consideration. We usually attach a theoretical material for the players to read first, followed by a visual explanation on video where the players can get the idea more efficiently. After that, we ask them to complete a quiz to test if they understood the basic concepts. To finish, we deliver an assignment more completed that evaluates all the knowledge acquired. After that, we correct the works and put them a final grade with individual feedback.

Fitness:

It is essential for the player's mental health, especially the young ones, to keep physically active; that's why we provided two fitness sessions per week for all our different age groups. Figure 3 shows an example of a fitness session done with some of our players. We worked on various aspects as injury prevention, strength, and conditioning. Sessions are run via the Zoom Platform by our fitness coaches.

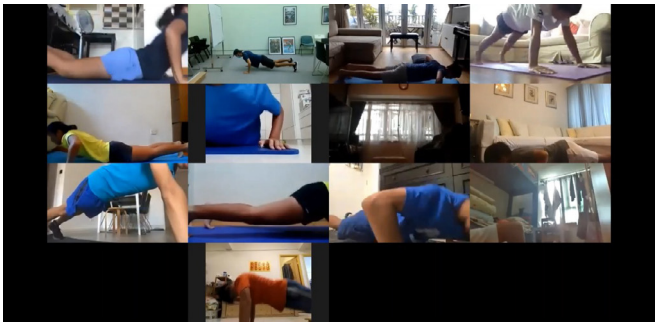

Figure 3: Players during a fitness session.

Mental training:

As we all know, tennis's mental aspect is essential and is a crucial factor while competing. Each Heach Coach updates his classroom two times per week with assignments about mental topics, as the example, you can observe in figure 4.

Assignments as: How to deal with nerves; How do you train mentally?; Improve focus, self-control.

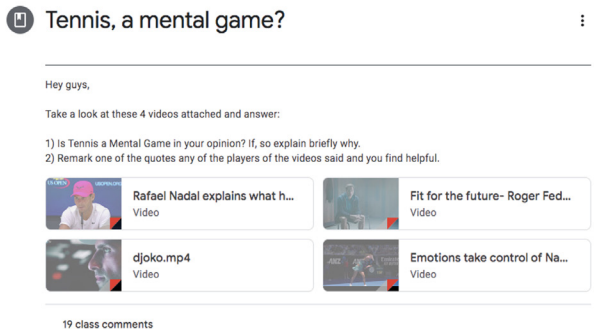

Figure 4 : An example of a mental assignment for the players.

Tennis Trivia:

In this section, we test the player's knowledge and teach them about tennis questions about tennis's history, tennis words meaning, or rules in specific tournaments from ATF or ITF.

Q & A with Professional Athletes:

Every week the Hong Kong Tennis Association brings a professional athlete who will be answering all the questions that the players from the national association have via the Zoom platform.

Some examples of professional athletes who participated in the Q & A are:

- Tamarine Tanasurgan. "How to use respect to maximize yourself as a player."
- Sofia Arvidsson. "Don't stop improving."
- Matwe Middelkoop. "Never give up".
- Nick Matthew. "Hard work pays off."

Competitions:

To keep players motivated during the lockdown, we created an online competition called "Stay Fit Battle."

Zoom platform holds the online competition, having one of the coaches responsible for acting as a referee of the match, determining who wins, and passing to the next round.

Each round has a different test for the players.

In the first round, we checked which player could do more frame touches (hand-eye coordination). Each player has three attempts to get as many frames touches as possible in a row.

In the second round, we tested how many burpees' repetitions the player could do in 3minutes, assessing at the same time their fitness level.

The Semifinal was a knowledge test about some topics and concepts we have worked on in the classroom before, observing if the players retain the new knowledge learned. And for the final, we did a competition to see who puts an overgrip faster than the other and checking their skills.

All the players enjoyed this online competition. After completing it, they asked for the second edition immediately, which tells us we are going in the right direction and showing us that online education can be fun and competitive if choosing the right way.

Challenges:

A fun way to test our players' skills and, at the same time, boost our social media channels while we give prizes from our sponsors to the three players with a higher score.

Challenges as "spot where is the ball" or "guess how many balls are there on the basket "were some examples of challenges we did to engage our tennis community.

POSITIVE EFFECTS WITH THE USE OF ICT

- They make it possible to learn in a more attractive way than traditional methods.
- The players' understanding and interest are favored by having very varied resources such as audiovisual material and multimedia tools that reinforce the players' knowledge.
- It is a great help for those introverted players to communicate with the other players, going from being a mere receiver to an active participant in the classroom dynamics.
- They help create autonomy for the players by having different channels to search for information and promote self-learning.
- It eliminates the barriers of space and time between the coach and the player, allowing the learning experience to continue outside the tennis court.

CONCLUSION

With the use of technologies nowadays, we should consider using e-learning platforms to provide and off-court education to our players. As they could be used for wet weather sessions, working with injured players, or just as a follow-up of what we train daily on the court and give a more dedicated service to our clients.

We have realized that there are not just opposing sides during this challenging time, but also positive ones. Due to the COVID-19 situation, we provide the opportunity to keep the tennis community engages, learning, and which is more important, mentally healthy and active.

In conclusion, tennis innovation should be something that is not just a consequence of the impact that COVID-19 is having on the tennis industry. Still, as an opportunity to improve our tennis programs' service by implementing an online curriculum and taking advantage of the rapid developments in technology that have made distance education easy (McBrien et al., 2009).

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Recommended e-books

ITF EBOOKS

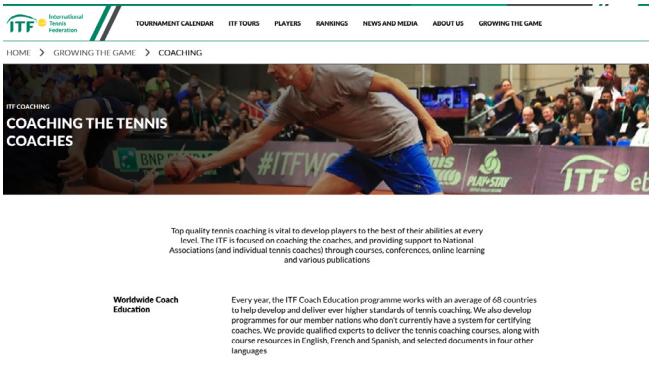
ITF ebooks offers an exclusive range of publications from the world of tennis, which are a must read for all those with an interest in the sport.

In this app users will find manuals for training and development, regularly published scientific research articles from worldwide experts and key technical and tactical information.

Users can also download and read several free publications on their mobile device or purchase ebooks at a significant discount to the printed versions. This app provides publications in Spanish, English, French, Russian, Chinese, Portuguese, Arabic and more.

Recommended web links

ITF Coaching:



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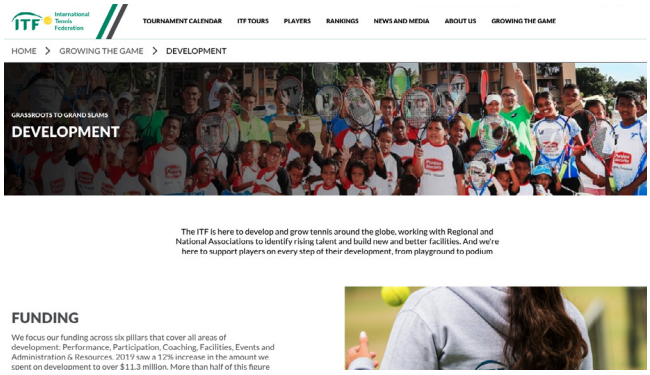

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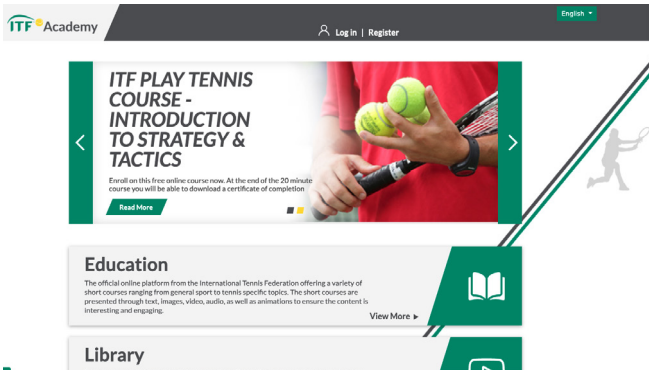

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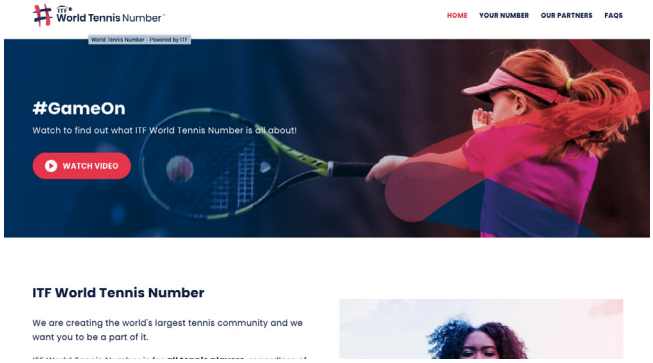
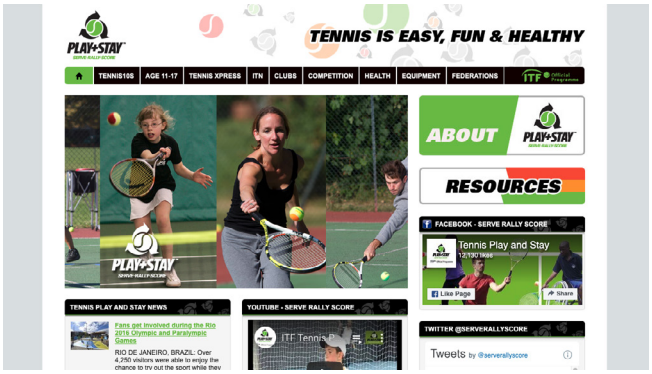


ITF Tennis Play and Stay:



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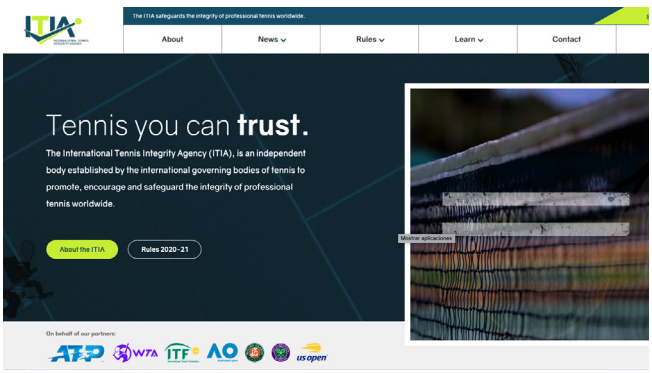

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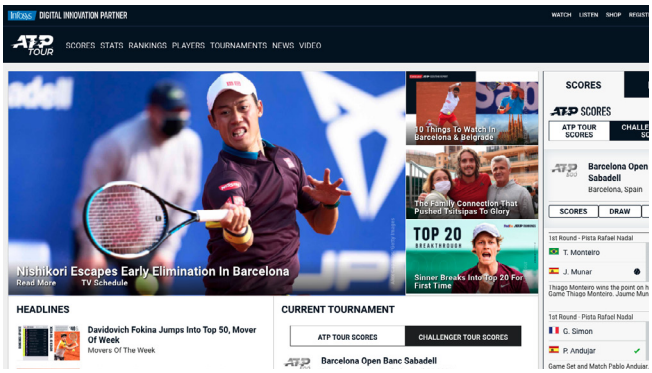

WTA: