



Cultura, Ciencia y Deporte

ISSN: 1696-5043

ccd@ucam.edu

Universidad Católica San Antonio de  
Murcia  
España

Ferreira Celestino, Tadeu; Gomes Leitão, José Carlos; Borges Sarmento, Hugo; Routen, Ash; Almeida Pereira, Antonino

Elite Coaches Views on Factors Contributing to Excellence in Orienteering

Cultura, Ciencia y Deporte, vol. 10, núm. 28, enero-abril, 2015, pp. 77-86

Universidad Católica San Antonio de Murcia

Murcia, España

Available in: <http://www.redalyc.org/articulo.oa?id=163036903004>

- How to cite
- Complete issue
- More information about this article
- Journal's homepage in redalyc.org

redalyc.org

Scientific Information System

Network of Scientific Journals from Latin America, the Caribbean, Spain and Portugal

Non-profit academic project, developed under the open access initiative

## Elite coaches views on factors contributing to excellence in orienteering

Representaciones de entrenadores de elite de los factores que contribuyen para la excelencia en orientación

**Tadeu Ferreira Celestino<sup>1</sup>, José Carlos Gomes Leitão<sup>2</sup>, Hugo Borges Sarmento<sup>3</sup>, Ash Routen<sup>4</sup>, Antonino Almeida Pereira<sup>3</sup>**

1 University of Trás-os-Montes e Alto Douro. Portugal.

2 Research Center in Sports, Health Sciences and Human Development (CIDESD). University of Trás-os-Montes e Alto Douro. Portugal.

3 Centre for the Study of Education, Technologies and Health (CI&DETS). Polytechnic Institute of Viseu - School of Education. Portugal.

4 School of Education. Durham University. Reino Unido.

### CORRESPONDENCIA:

**Tadeu Ferreira Celestino**

titta2323@hotmail.com

Recepción: abril 2014 • Aceptación: enero 2015

### Abstract

In the sport of orienteering, the studies in the context of sporting excellence are still scarce. Investigations carried out to date have been focused on the isolated analysis of specific factors contributing to excellence. The aim of this study therefore was to identify factors that coaches consider most prevalent in the development and maintenance of excellence in this sport. Ten elite level Portuguese and Spanish orienteering coaches completed semi-structured interviews and data were analysed using content analysis. Results showed coaches placed great emphasis on a set of personal factors, designated as primary influencing factors, including psychological attributes, sports preparation and genetic factors. Coaches also identified environmental factors that exert a secondary influence, with particular emphasis on the family, the sociocultural aspects and peer and friendship groups. Finally, elite coaches recognised the need of interaction and interconnection between these primary and secondary influencing factors for the development and maintenance of excellence in orienteering.

**Key words:** expertise, influencing factors, athlete development, coaching.

### Resumen

En el deporte de orientación, los estudios en el contexto de la excelencia deportiva son aún escasos. Las investigaciones realizadas hasta la fecha se han centrado en el análisis aislado de los factores específicos que contribuyen a la excelencia. El objetivo de este estudio, por tanto, fue identificar los factores que los entrenadores consideran de mayor prevalencia en el desarrollo y mantenimiento de la excelencia en este deporte. Diez entrenadores portugueses e españoles de orientación de nivel elite completaron entrevistas semi-estructuradas y los datos fueron analizados mediante el análisis de contenido. Los resultados mostraron que los entrenadores pusieron gran énfasis en un conjunto de factores personales, designados por factores de influencia primaria, donde se incluyen los atributos psicológicos, la preparación deportiva y los factores genéticos. Los entrenadores también identificaron los factores ambientales que ejercen una influencia secundaria, con especial énfasis en la familia, los aspectos socioculturales y los grupos de pares y de amistad. Por último, los entrenadores de elite reconocieron la necesidad de la interacción e interconexión entre estos factores de influencia primaria y secundaria para el desarrollo y mantenimiento de la excelencia en la orientación.

**Palabras clave:** factores de influencia, desarrollo de atletas, entrenamiento.

## Introduction

As a consequence of improvements in scientific knowledge and technology, intervention methodologies applied to sports training have enabled athletes to achieve previously unimagined levels of performance (Serpa, 2007).

Despite these improved training methods, there remain only a few athletes that can achieve and maintain levels of excellent performance (Gagné, 2007), which gives them a uniqueness and a unique status. This singularity, which is widely recognized, has always been an object of scientific curiosity, and has become a central topic of study in different fields of achievement in which sport is not an exception (Matos, Cruz, & Almeida, 2011).

Despite strong research interest, defining and characterizing *a priori* what excellence is has proved to be a difficult and controversial task (Ruiz, Sanchez, Durán, & Jiménez, 2006). Therefore, many questions remain concerning the conceptualisation and operationalisation of the term excellence. According to Matos et al. (2011) excellence is constantly faced with the coexistence of terms such as expertise, eminence, expert performance, high performance, elite, talent, among others. However, in all of them there is a common denominator, which is the quality of being superior, compared to most individuals and particularly in relation to their peers. Thus emerges the idea of a high and consistent performance over time in a specific domain (Matos et al., 2011).

In parallel with these terms, there is a set of theoretical models that seek to understand this phenomenon further, which can be applied in the field of sport, such as: i) giftedness in which excellence is associated with concepts such as innate abilities or talents of high intellectual powers, ii) expertise which is considered as superior performance, exceptional performance or performance expert; and iii) wisdom where excellence is linked to previous experiences in one's personal and social life (Matos et al., 2011).

In relation to sport Ericsson & Lehmann (1996) and Janelle & Hillman (2003), consider an athlete of excellence to be one that invariably presents a good set of genetic characteristics (physiological) and dominates the technical and cognitive aspects (decision making). An athlete of excellence can also be considered to be one with "expertise" in four domains (physiological, technical, emotional and cognitive) (Janelle & Hillman, 2003) that are manifested in a consistent and systematic manner over time, which is not limited only to isolated episodes of performance excellence (Ericsson & Lehmann, 1996).

The study of athletic excellence should also be understood from a bio-psycho-physio-axiological perspective. This multidimensional approach research in the field of sporting excellence suggests consideration should be given to the athlete, the analysis of their development, maintenance of their characteristics, skills, circumstances and the identification of aspects that lead to their excellence (Starkes & Ericsson, 2003). In addition there is also an argument that one should also seek to examine the underlying factors that differentiate outstanding athletes from their peers (Matos et al., 2011).

Consequently, research into sporting excellence has focused on two different paradigms of analysis, taking into account its multidimensional and multifaceted character. Firstly there are studies developed in a positivist analysis perspective, based on quantitative methodologies, with a mono-disciplinary character, centred on the design of tools that aim to reduce to a single and easy evaluable unit-the discriminative variables of the excellent athletes (Calvo, 2003). These studies demonstrate that excellence is a consequence of genetic inheritance of the individual, and they assume the need to select and find those athletes that are genetically predisposed to a given sport (Calvo, 2003). The more favourable the genetic disposition to the sport, the greater the chances of a successful outcome from a planned and structured training load (Lorenzo & Sampaio, 2005).

However, there are also studies that take a constructivist approach, using qualitative methodologies, in order to analyse the evolution of the athlete on the path to excellence (Lorenzo & Sampaio, 2005). This perspective aims to understand the development of the individual and the conditions/environment that are present (Calvo, 2003). Indeed some qualitative work suggests that sporting excellence results from the influence of contextual and social aspects surrounding the athlete (Bloom, 1985; Côté, 1999; Matos et al., 2011; Saenz-Lopez, Ibanez, Gimenez, Sierra, & Sánchez, 2005).

The multiplicity of research carried under these two paradigms, has led to the identification of a set of factors that may play a significant role in the development and maintenance of sporting excellence. Nevertheless, it is still not clear what the relative contribution of each factor is in the development of excellence in sports performance (Lorenzo & Sampaio, 2005).

In order to further examine this issue Baker & Horton (2004), suggest the classification of factors associated with excellence in two major groups: i) the factors of primary or direct influence, where the psychological variables are included (MacNamara, Button, &

Collins, 2010; Sáenz-Lopez et al., 2005), the genetic factors (Bouchard et al., 1998) and the factors related to the sports preparation (Baker, Côté, & Abernethy, 2003; Ericsson, 1996; Ericsson, Krampe, & Tesch-Romer, 1993; Sáenz-López et al., 2005); ii) the factors that exert a secondary influence on the performance. Namely the mediators of the relationship between the primary influences and the performance, including cultural (Baker & Horton, 2004; Bloom, 1985) and contextual factors (Lorenzo & Sampaio, 2005; Sáenz-López et al., 2005), instructional (Deakin & Cobley, 2003) and available resources, familial influences (Bloom, 1985; Côté, 1999; Côté, Baker, & Abernethy, 2003) and the type of relationship with, competence, and support of coaches (Morgan & Giacobbi, 2006).

Therefore the need for a holistic perspective accounting for the interaction between multiple factors modellers of sporting excellence is required (Baker & Horton, 2004; Phillips, Davids, Renshaw, & Portus, 2010; Saiz, Ruano, Luján, & Calvo, 2007).

Lately, several authors have shown the importance of the context as a major factor in the development of sporting excellence (Stambulova, Alfermann, Statler, & Côté, 2009), and in particular the microenvironment where the athlete is developed such as family, friends or coaches (Côté, 1999). The orienteering sport involves the combination of physical and intellectual components (Ottosson, 1998; Sailer, 1994), since it requires a combination and management of the physiological demand of the sport and the involvement of cognitive processes that allowing permit a good capacity to read and interpret a map (Seiler, 1996).

In order to understand the real impact of these components on performance, Kolb, Sobotka, & Werner (1987) developed a theoretical model that estimates the relative contribution of different components to orienteering performance. Kolb et al. (1987) concluded that there are some similarities in the relevance of the components of running (54%) and orienteering (46%), with a slight advantage to the first one. These results reinforce the identification of factors underlying performance of excellence, which are divided according to Seiler (1994) and Seiler & Hartmann (1994), between the physiological demands of the sport, the psychological requirements, the interaction between psychological and physical aspects in training, coaching to optimise performance, the teaching process of orientation and finally, social influences.

Therefore, the study of performance excellence in sport orienteering has focused on a multidisciplinary analysis centred on: i) the psychological aspects associated with the understanding of the cognitive processes involved in orientation (Lunze, 1987; Ottos-

son, 1996) as well as in the development and analysis of strategies for self-regulation control such as anxiety control, positive thinking and self-confidence, imagery, map visualisation techniques, motivation, selective attention, memory (Nazário, 2001) and concentration (Walsh, 1997); ii) the physical aspects (physiological), including morphological characteristics (Chalopin, 1994), aerobic capacity, anaerobic power, muscular endurance and muscular strength (Bird, Lewis, & Bailey, 1993; Creagh & Reilly, 1997; Moser, Gjerset, Johansen, & Vadder, 1995; Peck, 1987, 1990), and iii) the interaction between psychological and physical aspects (Cheshikhina, 1993; Fach, 1985; Hancock & McNaughton, 1986; Lunze, 1987).

Given the above, we note that in past decades the study and understanding of performance excellence in this sport modality has focused its attention on the isolated analysis of a small number of determinants of excellent performance. However, this analysis is limited (Lorenzo & Sampaio, 2005) as adequate attention has not been given to the study of the underlying environmental and socio-cultural factors in which the athletes are situated (Seiler, 1994).

Consequently, combining the multidimensional nature of excellence and the strong interest for its study (Mann, Williams, Ward, & Janelle, 2007; Williams & Ericsson, 2005), it is important and necessary to carry out further investigation under the interpretive paradigm (Denzin & Lincoln, 2008) on excellence in sport orienteering.

Due to the exponential growth of orienteers that currently exceeds one million practitioners in over 58 countries (Eccles, Walsh, & Ingledew, 2006) (and in Portugal is about 2655 (Pordata - Contemporary Data Bases Portugal, 2012) there is a clear need to identify and understand the aspects that coaches consider crucial to obtain and maintain high performance levels. The objective of this study therefore was to identify factors that elite level orienteering coaches consider most important in the development and maintenance of excellence in orienteering.

## Methods

Semi-structured interviews (Ghiglione & Matalon, 2001) were used to elicit coaches views on performance. The sample consisted of 10 Iberian coaches of orienteering (Portuguese and Spanish), all male, with an average age of 42 years. Seven are licensed in Physical Education and Sport and 8 were national team coaches. All trained athletes who were national champions in their respective countries and participated in

several world championships and in European championships.

The development of the interview guide was supported by relevant excellence literature (Araújo, Cruz, & Almeida, 2011; Côté, Ericsson, & Law, 2005), following the methodological requirements for the formation of an interview guide (Quivy & Campenhoudt, 1998). That is the interview script was devised and reviewed by a panel of experts (named authors-three PhD Sport Scientists, and three experts in Sport orientation graduate coaches in Sport and Physical Education). After receiving the suggestions for adjustments, the script was further reviewed by two expert coaches, re-submitted to the original panel and a final version agreed upon.

Each interview took between 1 and 1<sup>1/2</sup> hours and was transcribed verbatim. The data were then analysed using content analysis (Bardin, 2008). The software QSR NVivo 9 was used in coding the transcripts of the interviews. Given the objectives of the study and the dimensions of the analysis, the construction of a categorical coding system was done *a priori* and *a posteriori* (Bardin, 2008; Ghliglione & Matalon, 2001).

The resulting categories were submitted to the aforementioned expert panel in order to comply with the standards of fidelity and validity of the entire process (Ghliglione & Matalon, 2001).

## Results and discussion

### Primary influencing factors

From the analysis of the interviews a set of personal and individual factors designated as primary influence factors emerged (Baker & Horton, 2004). These were psychological and genetic factors and also those factors related to the preparation and sports training formation (Table 1).

The coaches stated that psychological factors are the most important for the development and achievement of sport excellence performance.

*"... The most important quality of the athlete who aspires to be an athlete of excellence is psychological aspect... this is the key factor..." Coach 8*

*"An individual who is well in physical, technical and tactical terms, it is obvious that the variation in their performance gonna owe more, in my understanding, due the psychological factor. Is this that will show positively or negatively each other together or separately from each other." Coach 1*

*"I believe that for the same technical and physical level, what stands out is the one that presents a better psychological capacity" Coach 4*

This perception is in line with the conclusions of previous orienteering literature that highlighted the importance of psychological characteristics as a key determinant for the development and maintenance of excellent performance (Lowry & Sidney, 1987; Seiler, 1993; Walsh, 1997). Moreover, this finding is in line with the findings of other studies that highlight the importance of the psychological aspects as key factors in the process of development and maintenance of sporting excellence (MacNamara et al., 2010; Ruiz et al., 2006).

Within the area of psychological factors, the coaches specifically suggest that the skills of self-regulation work as catalysts of enormous relevance to the process of developing and maintaining excellence.

*"... The sport orienteering has own special features in technical terms, psychologically I think it is probably necessary to have a very large control of ourselves." Coach 2*

*"The most important factor in high performance sport, I believe it is the psychological, the capacity for suffering, motivation, the ability to want to continue training to remain on the top ... finish all the training sessions motivated... The motivation to withstand high loads of technical training. In these situations it is difficult to stay focused. The concentration, self-control and self-confidence in the time of the competitions..." Coach 4*

The importance attributed to these self-regulatory psychological skills by the coaches, is justified as they are believed to enable athletes to regulate and adjusted their emotional state, facilitating and aiding decision making when faced with the many different navigational situations, therefore reducing potential navigation errors (Seiler, 1991).

These results regarding psychological skills are further supported by orienteering literature that suggest factors essential to achieving and maintaining sport excellence levels, are the need to develop self-control (McNeill, 1986; Seiler, 1993), positive thinking, self-confidence (Seiler, 1985), imagery, motivation (Strangel, 1996; Ottosson, 1997), selective attention, concentration (Almeida, 1997; Fach, 1985; McNeill, 1986; Seiler & Wetzel, 1997) and pain tolerance (Lowry & Sydney, 1987; Seiler, 1991, 1993; Walsh, 1997).

Interestingly the coaches also emphasised the need for well developed cognitive processes, which is con-



Table 1. Primary influence factors.

Categories	Subcategories	Frequency	
Primary influence factors	Psychological factors	56	42
	Self-regulation Competencies		10
	Cognitive processes	21	14
	Quality of practice		6
	Ten years of practice		8
	Genetic		

sidered by Seiler (1991) as a distinctive and preponderant element for excellence in sport performance.

*"... Psychologically if I am not all my thoughts lined up, I never get going to be working on the technical and tactical part of the game." Coach 8*

*"Because our sport is a modality of thinking, is a modality in which to be able to perform a route I have to be systematically developing mental processes." Coach 8*

*"...the part of the cognitive domain, which has to do with the tactical factor of the training, which presupposes an action of the cognitive domain and encompasses everything that are the technical actions in this sport." Coach 8*

Effectively the success of actions in orienteering are closely related to the strong cognitive load that involves the strategic component and the specific techniques of orienteering (Baena-Extremera, Granero-Gallegos, Gómez-López, & Rebollo, 2013; Seiler, 1991; Walsh, 1997). This includes, reading the information from a map, building a mental picture of the terrain from the map, comparing it with the real terrain, checking the characteristics of the terrain and relocating oneself. These are highly demanding cognitive processes that characterise the specificity of the modality (Murakoshi, 1988; Seiler, 1991) and are distinctive aspects of excellence in sport orienteering (Otosson, 1996).

Other subcategories identified within the framework of primary influence factors, were preparation and sport-specific training. In this sense, respondents highlighted the need for practice of quality, as well as a minimum of ten years of training as a requirement for the development of excellence in sport orienteering.

*"We need to teach them with quality. Can not only teach running with a map, that's another thing." Coach 9*

*"In Finland there are courses for children. Parents can easily take their children to one of these summer courses..." Coach 9*

From prior work, it appears that more than the amount of practice and years of training, the most important factor is that this practice is developed with quality and performed with specificity (Davids, 2000). These opinions are perhaps supported on by deliberate practice theory (Ericsson, Krampe, & Tesch-Romer, 1993) in which the developed practice should be understood as a highly structured process with the express desire to progress and improve. This can include tasks that have an intrinsically motivating and that require high levels of effort and attention (Ericsson et al., 1993). This coach perception of practice quality supports theory described in the literature which highlights that in order to achieve excellence a long-term commitment and investment in formal and informal practice is required (Baker et al., 2003; Bloom, 1985; Ericsson et al., 1993).

In an attempt to quantify this practice, the coaches suggested it is necessary for training to consist of a long period of effective and oriented practice not less than ten years for the correct development, acquisition and consolidation of the sport specific skills, competencies and automatisms.

*"Tommi that comes from a country in which the sport orienteering is very practiced, started practicing since childhood at the school," Coach 10*

*"There is a lot of variety, but I think that 10 years of continuously experience.... are fundamental..." Coach 4*

*"Once you have this solid sport formation, obviously, starts the training to compete, the training to win, and obviously if we need to quantify the time we never talk to less than 10 years." Coach 1*

There are several authors that stipulate the need for a commitment of at least ten years of practice to achieve high levels of performance (Baker et al., 2003; Sáez-Lopez et al., 2005), beginning in early childhood (Barreiros et al., 2013). Some prior research has also found a strong positive relationship between the accumulated years of practice and the development of sporting excellence (Baker et

al., 2003; Ericsson, 1996), as well as a strong link between the quantity and quality of this prolonged practice and the subsequently obtained performance level (Ericsson, 1996). This duration of sustained practice in orienteering is perhaps justified by the complexity of the detection and use of information both from the map and from the terrain, which not depends only on the situation itself, but also from previous experience that the athlete generates over time (Oliveira & Duarte, 2005).

Also in the context of primary influencing factors, the coaches considered that genetic factor are an important aspect that have a direct impact on performance. In this perspective, this factor determines the personal characteristics associated with the competitive ability, the emotional control, the anthropometric characteristics and the motor skills.

*"I believe that there is a genetic factor that you can train a lot. You can train every day, but you must have the genetic component that help you in order to evolve."*  
Coach 10

*"... Obviously at the highest level we need to have some genetic part, not only related to the physical aspects but especially related with the mental and psychological aspects."* Coach 8

*"... I may even have all this environmental support, but if I do not have the genetically features, it is unthinkable... not worth anything I have all the environmental conditions if at the genetic level I do not have the minimum requirements for obtain high levels of performance..."* Coach 7

The coaches believed that certain observed capacities in the athletes may be the result of genetic attributes. Consequently, the fact that an athlete possesses these qualities and characteristics allows one to have greater development and adaptation to training, which differentiate an athlete from their peers.

Extant genetic research has found positive influencing relationships of genotype on the phenotype of individuals with a direct impact on sporting performance (Eynon, Morán, Birk, & Lucias, 2011; Ostrander, Huson, & Ostrander, 2009). These findings provide evidence that some of the resulting responses from the development of sports training are determined by hereditary factors (Bouchard et al., 1999), and even some genetic markers may be responsible for some performance variables, such as aerobic capacity (Berman & North, 2010; MacArthur & North, 2005).

## Secondary influence factors

Despite the important role that coaches attribute to personal character factors identified above, it appears that these alone are not a guarantee of excellence levels of performance in orienteering. Thus, on a hierarchical perspective, these coaches also emphasized a set of environmental variables, identified as secondary factors (Baker & Horton, 2004), which also exert a preponderant influence on the development and maintenance of excellence in orienteering (Table 2).

**Table 2. Factors of secondary influence.**

Categories	Subcategories	Frequency
Factors of secondary influence	Family	43
	Sociocultural aspects	25
	Peers group and friends	12
	The Club	4
	The sport at the School	6
	The coach	3

Indeed, the coaches were able to identify the contributions promoted and developed by the family, cultural influences, peer group and friends, orienteering clubs, coaches and the sport at the school as preponderant modelers in the process of development of excellence. Unanimously the coaches considered the support provided by the family as a crucial factor to achieve excellence in the sport since it is often the first contact with the sport modality.

*"...Is very important the family support in sport orienteering. It is important to start participating in competitions from an early age, and parents to bring their children to these competitions."* Coach 7

*"If you have no family support is very difficult that you can develop your skills..."* Coach 4

*"If we analyze the excellence athletes in sport orienteering, we found that they all have a family background connected to this sport."* Coach 3

*"Just to give you an example, in Sweden from the all the athletes who formed the nation team, only one did not have a family with a past in sport orienteering, ie, only one did not start the practice due their parents. This proves the power that the family has."* Coach 8

Previous research suggests that is very common that parents exercise the primary role to introduce, encourage and keep their children in sports practice (Bloom, 1985; Ericsson et al., 1993) providing them with

social, emotional/instrumental, economic and logistic support (Baker & Horton, 2004; Bloom, 1985; Côté, 1999) and giving them the best conditions for teaching and training (Côté, 1999; Côté et al., 2003). On the other hand, one of the stated reasons for the practice of orienteering is the fact that it is accessible to all (Celestino & Pereira, 2012; McNeill, Cory-Wright, & Renfrew, 2006), making it possible for several generations of the same family to compete in the same event.

Still in the context of secondary factors, it appears that the existing cultural diversification in the different regions of the world, not only in the aspects related to the development of the modality but also in the socio-cultural specificities, are important modelers variables of the sport orienteering excellence.

*"While I was in a Nordic country, first I have an involvement that allows me to develop my training process. I can in a much more easily way move to another city that has a good club and also maps of orientation around this location. In Portugal is very limited. You have 4 or 5 poles where you can be born and practice this sport. We can have kids 100% genetically suited to be world champions in sport orienteering but if they were born in the Algarve, will never practice this sport in their lives. In Sweden it is much more resolved, because you have much more clubs, have much more high level coaches..." Coach 8*

Despite interviewed coaches having highlighted this aspect as relevant to the development and maintenance of excellence, it is still referenced in the literature in a reduced way (Baker & Horton, 2004). However, if we analyse the model of human development of Bronfenbrenner (1979) the social, cultural and macro-social factors (laws, traditions, social policies) in interaction with other contexts become crucial for the development of the individual.

Thus, the importance that a country, society or culture assigns to a particular sport has a preponderant influence in their development and success (Baker & Horton, 2004) and, consequently, in the development of its practitioners. In this case for orienteering we can also see that evidence in the Scandinavian region, where this sport is well developed and highly participated in across the population (Johansson, 1986), compared to other regions of the globe. In this sense, the availability of appropriate infrastructure and the access to the sports equipment and accredited coaches are aspects to take into account (Lorenzo & Sampaio, 2005).

One of the most evidenced aspects by the coaches in the context of the secondary factors, was the influence

of peers and friends. The fact that the sport involves a great social and emotional interaction, makes the socializing experience and the experiences of sharing and the cooperation with the others valid reasons for practice (Celestino & Pereira, 2012; Koukoris, 2005).

*"The ideal conditions are within the group. If in addition to performing the training sessions they can maintain a friendship relationship... this is stupendous." Coach 5*

*"Switzerland is the best example. From one moment to the other, the men's began to be encouraged one for the other and it is work like a spiral, one can also progress and the other progress a little more. This is essential in order to achieve a good performance in sport orienteering." Coach 8*

*"It is unthinkable for an athlete of excellence... at the level of requirement of their routine of his life be able to do all this if he did not have the agreement, support and encouragement from their peers and others." Coach 7*

As shown above, from the moment these links of friendship and camaraderie are developed, the practice and dedication to the sporting commitments and goals can become strengthened (Côté et al., 2003) and, improvements in performance levels may be observed.

The evolution of sport careers is arguably under a strong influence from the strong links of friendship and good relationships between peers and friends (Baker & Horton, 2004; Côté et al., 2003).

### Interaction between the factors

Despite the importance that the interviewed coaches place on the primary and secondary factors in the development and maintenance of excellence in orienteering, it is clear that there is an awareness that it is the interaction between factors that may produce the most favorable effects in the development of excellence.

*"The two perspectives of factors are connected together. The genetic the athlete must have to possess and then the involvement in which the athlete are developed is very important. Therefore the things have to be... necessarily interconnected." Coach 3*

*"All the factors have influence, but to become an elite athlete, you need to have what I told you before, a specific genetic for... in addition, to being a good athlete in sport orienteering, you must have the ability to interpret the maps." Coach 5*



*"This interconnection is already done from the formation. Since the beginning of sports formation, will be instilling all these factors to the athlete... And when it comes to adult, already has all of them interconnected, he already knows what he has to do." Coach 3*

These findings are according with the results evidenced by several authors (Barreiros et al., 2013; Bloom, 1985; Ruiz et al., 2006) who reported that excellence can be effectively following the outcome of successful interaction of a multiplicity of factors and constraints of internal and external order (Baker & Horton, 2004).

More recently this evidence has gained importance with the adoption of a holistic perspective, that advocate the need for interaction among multiple factors (Davids & Baker, 2007; Phillips et al, 2010) as a valid justification for excellence. According to this perspective, the successful interaction of individual characteristics (psychological, genetic and sports preparation aspects) with external factors related to the micro and macro context (opportunities/resources, family, cultural aspects), designated as primary and secondary factors (Baker & Horton, 2004) may, eventually, result in excellent."

## Conclusion

In the field of orienteering studies to understand the excellence of its athletes are scarce and have been focused on the analysis of isolated variables. This contrasts with a more holistic style of analysis that has

recently been adopted in the study of sport excellence. Therefore, the present study we believe presents an innovative approach for the study of sport orienteering excellence. Using a group of accredited elite level coaches we aimed to identify the determining performance factors for orienteering excellence.

The most referenced by the coaches interviewed were the factors of primary influence. In these, not only the psychological aspects were highlighted, but also the specific athlete preparation, (namely the importance of the commitment to quality, specific, and well-structured practice, over a period of no less than 10 years) and the importance of genetics. The secondary influencing factors elicited were the family, sociocultural aspects, the peer group and friendship, the orienteering club, school sport status and the coaches themselves.

Coaches emphasized the necessity of interaction and interconnection between these primary and secondary factors for the effective development and maintenance of excellence in orienteering.

One of the limitations of this study is related to the limited number of Iberian coaches that fulfill the inclusion criteria in the study. Thereby the realization of a similar study with coaches belonging from different nationalities could prove to be fruitful.

We suggest that the findings presented in this paper are taken into account by institutions responsible for the promotion and development of orienteering in order to inform (in accordance to the interests and aspirations of current and future athletes) training and intervention for orienteering athletes based on evidence elicited from elite level coaches.

## BIBLIOGRAFÍA

- Almeida, K. (1997). Decision making in orienteering. *Scientific Journal of Orienteering*, 13, 54-64.
- Araújo, L. S., Cruz, J. F., & Almeida, L. S. (2011). A entrevista no estudo da excelência: Uma proposta. *Psychologica*, 52, 253-279.
- Baena-Extremuera, A., Granero-Gallegos, A., Gómez-López, M., & Rico R. (2013). Influencia del nivel técnico en deporte de orientación en el éxito en raids de aventura. *Cultura Ciência e Deporte*, 23, 129-136.
- Bardin, L. (2008). *Análise de conteúdo*. Lisboa: Edições 70.
- Baker, J., Côté, J., & Abernethy, B. (2003). Sport specific practice and the development of expert decision-making in team ball sports. *Journal of Applied Sport Psychology*, 15, 12-25.
- Baker, J., & Horton, S. (2004). A review of primary and secondary influences on sport expertise. *High Ability Studies*, 15(2), 211-228.
- Barreiros, A., Côté, J., & Fonseca, A. M. (2013). Sobre o desenvolvimento do talento no desporto: Um contributo dos modelos teóricos do desenvolvimento desportivo. *Revista de Psicologia do Deporte*, 22, 489-494.
- Berman, Y., & North, K. (2010). A gene for speed: An emerging role of alpha-actinin-3 in muscle metabolism. *Physiology*, 25(4), 250-259.
- Bird, S., Bailey, R., & Lewis, J. (1993). Heart rates during competitive orienteering. *British Journal of Sports Medicine*, 1, 53-57.
- Bloom, B. S. (1985). *Developing talent in young people*. New York: Ballantine.
- Bouchard, C., An, P., Rice, T., Skinner, J. S., Wilmore, J. H., Gagnon, J., ... Rao, D. C. (1999). Familial aggregation of Vo2 max response to exercise training: Results from the heritage family study. *Journal of Applied Physiology*, 87(3), 1003-1008.
- Bouchard, C., Daw, E. W., Rice, T., Pérusse, L., Gagnon, J., Province, M. A., ... Wilmore, J. H. (1998). Familial resemblance for VO2max in the sedentary state: The heritage family study. *Medicine and Science in Sports and Exercise*, 30(2), 252-258. doi:10.1097/00005768-199802000-00013
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge: Harvard University Press.
- Calvo, A. (2003). Detección o desarrollo del talento? Factores que motivan una nueva orientación del proceso de detección de talentos. *Apuntes Educación Física y Deportes*, 71, 23-28.
- Celestino, T., & Pereira, A. (2012). The sport of orienteering: Performance of physically active people who partake in leisure activities but have no experience in this modality. *Cultura Ciência e Deporte*, 7(19), 45-52.
- Chalopin, C. (1994). Physical and physiological characteristics of french orienteers. *Scientific Journal of Orienteering*, 10, 58-62.

- Cheshikhina, V. (1993). Relationships between running speed and cognitive processes in orienteering. *Scientific Journal of Orienteering*, 9, 45-59.
- Côté, J. (1999). The influence of the family in the development of talent in sport. *The Sport Psychologist*, 13, 395-417.
- Côté, J., Baker, J., & Abernethy, B. (2003). From play to practice: A developmental framework for the acquisition of expertise in team sports. In J. L. Starkes & K. A. Ericsson (Eds.), *Expert performance in sports* (pp. 89-113). Champaign, IL: Human Kinetics.
- Côté, J., Ericsson, K. A., & Law, M. P. (2005). Tracing the development of athletes using retrospective interview methods: A proposed interview and validation procedure for reported information. *Journal of Applied Sport Psychology*, 17, 1-19.
- Côté, J., Salmela, H., Trudel, P., Baria, A., & Russell, J. (1995). The coaching model: A grounded assessment of expertise gymnastic coaches' knowledge. *The Journal of Sport and Exercise Psychology*, 17(1), 1-17.
- Creagh, U., & Reilly, T. (1997). Physiological and biomechanical aspects of orienteering. *Sports Medicine*, 24, 409-418.
- Davids, K. (2000). Skill acquisition and the theory of deliberate practice: It ain't what you do it's the way that you do it. *International Journal of Sport Psychology*, 31, 461-466.
- Davids, K., & Baker, J. (2007). Genes, environment and sport performance. Why the nature-nurture dualism is no longer relevant. *Sports Medicine*, 37, 961-980.
- Deakin, J., & Cobley, S. (2003). An examination of the practice environments in figure skating and volleyball: A search for deliberate practice. In J. Starkes & K. A. Ericsson (Eds.), *Expert performance in sports: Advances in research on sport expertise* (pp. 90-113). Champaign, IL: Human Kinetics.
- Denzin, N., & Lincoln, Y. (2008). Introduction: The discipline of qualitative research. In N. Denzin & Y. Lincoln (Eds.), *The landscape of qualitative research* (pp. 1-43). Thousand Oaks: Sage Publications, Inc.
- Eccles, D. W., Walsh, S. E., & Ingledew, D. K. (2006). Visual attention in orienteers with different levels of experience. *Journal of Sports Sciences*, 24, 77-87.
- Ericsson, K. A. (1996). *The road to excellence: The acquisition of expert performance in the arts and sciences sports and games*. Hillsdale: Lawrence Erlbaum Associates.
- Ericsson, K. A., Krampe, R., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review*, 100(3), 363-406.
- Ericsson, K. A., & Lehmann, A. C. (1996). Expert and exceptional performance: Evidence of maximal adaptation to task constraints. *Annual Review of Psychology*, 47, 273-305.
- Eynon, E., Morán, M., Birk, R., & Lucia, A. (2011). The champions' mitochondria: Is it genetically determined? A review on mitochondrial DNA and elite athletic performance. *Physiological Genomics*, 43(13), 789-798.
- Fach, H. (1985). Visual attention and concentration. *Scientific Journal of Orienteering*, 1, 14-23.
- Fraser-Thomas, J., Côté, J., & Deakin, J. (2008). Examining adolescent sport dropout and prolonged engagement from a developmental perspective. *Journal of Applied Sport Psychology*, 20, 318-333.
- Gagné, F. (2007). Ten commandments for academic talent development. *Gifted Child Quarterly*, 51, 93-118.
- Ghiglione, R., & Matalon, B. (2001). *O Inquérito: Teoria e prática*. (4ª ed). Oeiras: Celta Editora.
- Hancock, S., & McNaughton, L. (1986). Effects of fatigue on ability to process visual information by experienced orienteers. *Perceptual and Motor Skills*, 62(2), 491-498.
- Janelle, C., & Hillman, C. (2003). Expert performance in sport. In J. L. Starkes & K. A. Ericsson (Eds.), *Expert performance in sports advances in research on sport expertise* (pp. 19-48). Champaign, IL: Human Kinetics.
- Johansson, C. (1986). Injuries in elite orienteers. *American Journal Sports Medicine*, 14, 410-415.
- Kolb, H., Sobotka, R., & Werner, R. (1987). A model of performance-determining. *Scientific Journal of Orienteering*, 3(2), 71-81.
- Koukouris, K. (2005). Beginners' perspectives of getting involved in orienteering in Greece. *Scientific Journal of Orienteering*, 16, 18-33.
- Leite, N., Sara, S., & Sampaio, J. (2012). *Preparação desportiva a longo prazo: Uma abordagem multifactorial*. Vila Real: Serviços Editoriais da Universidade de Trás-os-Montes e Alto Douro.
- Lorenzo, A., & Sampaio, J. (2005). Reflexiones sobre los factores que pueden condicionar el desarrollo de los deportistas de alto nivel. *Aputs Educación Física e Deportes*, 80, 63-70.
- Lowry, R., & Sidney, K. (1987). *Orienteering training and performance*. Ontário: Orienteering Ontário.
- Lunze, J. (1987). Psychological information acceptance and information reproduction abilities of orienteers. *Scientific Journal of Orienteering*, 3, 52-61.
- MacNamara, A., Button, A., & Collins, D. (2010). The role of psychological characteristics in facilitating the pathway to elite performance part 1: Identifying mental skills and behaviors. *The Sport Psychologist*, 24, 52-73.
- McNeill, C. (1986). Psychological training concentration. *Scientific Journal of Orienteering*, 2(1), 55-58.
- McNeill, C., Cory-Wright, J., & Renfrew, T. (2006). *Carreras de orientación: Guía de aprendizaje*. Badalona: Editorial Paidotribo.
- MacArthur, D., & North, K. (2005). Genes and human elite athletic performance. *Human Genetics*, 116(5), 331-339.
- Mann, D. Y., Williams, A. M., Ward, P., & Janelle, C. M. (2007). Perceptual and cognitive expertise in sport: A meta-analysis. *Journal of Sport & Exercise Psychology*, 29(4), 457-478.
- Matos, D., Cruz, J., & Almeida, L. (2011). Excelência no desporto: Para uma compreensão da "arquitectura" dos atletas de elite. *Motricidade*, 7(4), 27-41.
- Morgan, T. K., & Giacobbi, P. (2006). Towards two grounded theories of the talent development and social support process of highly successful collegiate athletes. *The Sport Psychologist*, 20(3), 295-313.
- Moser, T., Gjerset, A., Johansen, E., & Vadder, L. (1995). Aerobic and anaerobic demands in orienteering. *Scientific Journal of Orienteering*, 11(1), 3-30.
- Murakoshi, S. (1998). Information processing in photo-orienteering: Wow do we relocate ourselves? *Scientific Journal of Orienteering*, 4(1), 14-33.
- Nazário, B. (December, 2001) *A memória do atleta de orientação: Influência no nível de performance*. In I Congresso Científico de Orientação: Livro de resumos I congresso científico de orientação, Viana do Castelo.
- Oliveira, F., & Duarte, A. (2005). A tomada de decisão na orientação. In D. F. Araújo (Ed.), *O contexto da decisão: Acção táctica no desporto* (pp. 285-310). Lisboa: Visão e Contextos.
- Ostrander, E., Huson, H., & Ostrander, G. (2009). Genetics of athletic performance. *Annual Review of Genomics and Human Genetics*, 10, 407-429.
- Ottosson, T. (1996). Cognition in orienteering: Theoretical perspectives and methods of study. *Scientific Journal of Orienteering*, 12(2), 66-72.
- Ottosson, T. (1997). Motivation for orienteering: An exploratory analysis using confirmatory factor analytic techniques. *Scandinavian Journal of Psychology*, 38, 111-120.
- Ottosson, T. (1998). Map-reading and wayfinding. *Scientific Journal of Orienteering*, 4, 47-53.
- Peck, G. (1987). The Physical demands of orienteering. *Scientific Journal of Orienteering*, 3(3), 95-96.
- Peck, G. (1990). Measuring heart rate as an indicator of physiological stress in relation to orienteering performance. *Scientific Journal of Orienteering*, 6, 26-44.
- Phillips, E., Davids, K., Renshaw, I., & Portus, M. (2010). Expert performance in sport and the dynamics of talent development. *Sports Medicine*, 40, 271-283.
- Pordata - Bases de dados Portugal contemporâneo (2012). *Praticantes desportivos federados: total e por todas as modalidades*. Retrieved on February 18, 2014, from WorldWideWeb: <http://www.pordata.pt/Portugal/Praticantes+desportivos+federados+total+e+por+todas+as+modalidades-2227>.
- Quivy, R., & Campenhoudt, L. (2008). *Manual de investigação em ciências sociais* (5ª ed). Lisboa: Gradiva.
- Ruiz, L., Sánchez, M., Durán, J., & Jiménez, C. (2006). Los expertos en el deporte: Su estudio y análisis desde una perspectiva psicológica. *Anales de Psicología*, 22(1), 132-142.

- Sáenz-Lopez, P., Ibáñez, S. J., Gimenez, F. J., Sierra, A., & Sánchez, M. (2005). Multifactor characteristic in the process of development of the male expert basketball player in Spain. *International Journal of Sport Psychology*, 36(2), 151-171.
- Sáenz-Lopez, P., Buñuel, A. C., Jinénez, F. J., Giménez, S. J., & Godoy, I. (2007). La autopercepción de las jugadoras de baloncesto expertas respecto a sus procesos de formación. *Cultura Ciência e Deporte*, 7, 35-41.
- Saiz, S. J., Ruano, M. A., Luján, P., & Calvo, A. (2007). Factores que favorecen el desarrollo de la pericia en entrenadores expertos en baloncesto. *Cultura Ciência e Deporte*, 6, 145-149.
- Stambulova, N., Alfermann, D., Statler, T., & Côté, J. (2009). Career development and transitions of athletes: The ISSP position stand. *International Journal of Sport and Exercise Psychology*, 7, 395-412.
- Seiler, R. (1985). The psychological structure of information-seeking and decision-making in route-choice situations in orienteering. *Scientific Journal of Orienteering*, 5, 24-34.
- Seiler, R. (1991). Psychological skills training in orienteering. *Scientific Journal of Orienteering*, 7, 74-85.
- Seiler, R. (1993). Psychological skills training in orienteering. *Scientific Journal of Orienteering*, 9, 60-64.
- Seiler, R. (1994). Recent trends and future directions of research in orienteering. *Scientific Journal of Orienteering*, 10(1/2), 3-23.
- Seiler, R. (1996). Cognitive processes in orienteering. *Scientific Journal of Orienteering*, 12, 50-65.
- Seiler, R. & Hartmann, W. (1994). Orienteering annotated bibliography. *Scientific Journal of Orienteering*, 10, 2-76.
- Seiler, R., & Wetzel, J. (1997). Concentration of Swiss elite orienteers. *Scientific Journal of Orienteering*, 13, 65-72.
- Serpa, S. (2007). Excelência desportiva: Uma expressão humana. In J. O. Bento & J. M. Constantino (Coord.), *Em defesa do desporto: Mutações e valores em conflito* (pp.371-392). Coimbra: Almedina.
- Starkes, J., & Ericsson, K. (2003). *Expert performance in sport: Advances in research on sport expertise*. Champaign, IL: Human Kinetics.
- Strangel, J. A. (1996). Who orienteers? A survey of profile and attitudes. *Scientific Journal of Orienteering*, 12, 43-49.
- Walsh, E. (1997). The development of a protocol to provide real-time information to enhance coach-performance interactions. *Scientific Journal of Orienteering*, 13, 47-53.
- Williams, A., & Ericsson, K. A. (2005). Perceptual-cognitive expertise in sport: Some considerations when applying the expert performance approach. *Human Movement Science*, 24(3), 283-307.