How structured and unstructured sport activities aid the development of expertise in volleyball players

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Published version

COUTINHO, Patricia, MESQUITA, Isabel, DAVIDS, Keith, FONSECA, Antonio M. and CÔTÉ, Jean (2016). How structured and unstructured sport activities aid the development of expertise in volleyball players. Psychology of Sport and Exercise, 25, 51-59.

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To appear in: Psychology of Sport and Exercise 2016

Abstract

This study sought to analyse self-reported perceptions of how the nature of sport activities undertaken by volleyball players aided their development. Thirty highly skilled and thirty less skilled players participated in retrospective interviews to identify the nature of activities undertaken in their developmental pathways. All players reported having an early-diversified sport involvement with participation in both structured and unstructured activities. Highly skilled players differed from less skilled players by having accumulated more hours experience in structured sport activities, some of which were undertaken with older peers. Furthermore, highly skilled players specifically highlighted the value of their involvement in particular unstructured activities with older peers and recognized their importance for expertise achievement. These findings illustrate the importance of considering the role of unstructured (in addition to structured) sport activities in the development of expertise in volleyball. Further work is needed to verify the generality of the findings to other sports.

Keywords: practice, play, expertise, athlete development, talent

Introduction

In the past decades, researchers have sought to examine which particular attributes contribute most to excellence in sport, acknowledging the important role played by early developmental activities for the acquisition of skill and expertise (Côté, Baker, & Abernethy, 2007; Côté & Erickson, 2015; Côté, Erickson, & Abernethy, 2013; Ericsson, Krampe, & Tesch-Romër, 1993). In a comprehensive paper, outlining an approach to the study of expert performance, Ericsson, Krampe and Tesch-Romër (1993) concluded that expertise is predicated on investment in intense, highly structured, specific and effortful activities, which are not particularly enjoyable and designed to improve performance, defined as deliberate practice. In their paper, the authors were particularly emphatic in declaring that "…high levels of deliberate practice are necessary to attain expert level performance" (Ericsson, Krampe, & Tesch-Romër, 1993, p392) (our italics). They also alluded to Simon and Chase's '10-year rule' (p.366) as a basis for establishing expertise in various domains including sports, and distinguished the relevance of deliberate practice from 'playful interactions' (p.368). These ideas have gained prominence in the sport sciences, and a body of work has attempted to show, that 10,000 hours (on average) of accumulated deliberate practice is a definitive requirement for achieving an expert level of performance (e.g. Baker, Côté, & Abernethy, 2003b; Baker, Côté, & Deakin, 2005; Berry, Abernethy, & Côté, 2008).

Despite the prominence of the deliberate practice approach to expert performance, in recent years a significant lack of clarity has emerged in key findings. For example, the notion of a 10,000-hour 'rule' (Gladwell, 2008) has been heavily criticised for lacking substantial support (e.g., MacNamara, Hambrick, & Oswald, 2014). A major problem is that measures of variability in estimates of time spent in deliberate practice show great inter-individual differences in response. Tucker and Collins (2012) pointed out that reported practice time values ranged between approximately 3,200-23,000 hours in chess masters. Due to the large

variation in the number of hours needed in practice it has been suggested that the nature of the practice activities undertaken by developing athletes is a far more important stimulus for the acquisition of expertise, rather than the time spent practising (Davids, 2000; Hambrick et al., 2014).

In a systematic review, Coutinho et al. (in press) have also indicated that there may be potential negative consequences from early engagement in deliberate practice stimulated by undertaking such a vast number of hours of intense training during early development, a possibility acknowledged by Ericsson et al. (1993, see p.371). These consequences include burnout, dropout, overuse injuries and lower levels of attainment (see also Baker, Cobley, & Fraser-Thomas, 2009; Forsman, Blompvist, Davids, Konttinen, & Liukkonen, 2016; Fraser-Thomas, Côté, & Deakin, 2008a, 2008b; Law, Côté, & Ericsson, 2007; Wiersma, 2000). Consequently, some researchers have indicated that time spent in deliberate play during the early stages of athlete development may be more important as a formative experience in expertise achievement (for a review, see Côté et al., 2007; Côté & Erickson, 2015; Côté et al., 2013). In contrast to deliberate practice tenets, deliberate play emphasises fun and enjoyment, involving early developmental activities that are intrinsically motivating, and providing immediate gratification (Côté, Baker, & Abernethy, 2003; Côté et al., 2007; Côté & Erickson, 2015; Côté et al., 2013).

These criticisms have led to the emergence of ideas about a number of developmental pathways that athletes might benefit from engagement in during early years toward expert performance (Côté, Murphy-Mills, & Abernethy, 2012; Ford, Hodges, & Williams, 2013). For example, the Developmental Model of Sport Participation (Côté, 1999; Côté et al., 2003, 2007) suggests three different developmental trajectories, including: (1) recreational participation through early diversification and deliberate play, (2) elite performance through early diversification and deliberate play, and (3) elite performance through early

specialization and deliberate practice. Early diversification is based on the notion that children "sample" a wide range of sporting activities that involve higher levels of deliberate play and lower levels of deliberate practice before specialization (Côté, 1999; Côté & Abernethy, 2012; Côté et al., 2003, 2007). In contrast, early specialization includes an early start age in one sport and an early investment in deliberate practice (Baker, 2003; Baker et al., 2009; Wiersma, 2000). Early-diversified sport involvement allows children to experience a number of different physical, cognitive, affective, and psychosocial environments, which may enhance the intrinsic motivation that stems from the fun, enjoyment, and competence children experience in sport (Côté & Erickson, 2015; Côté & Fraser-Thomas, 2008; Côté, Horton, MacDonald, & Wilkes, 2009; Côté et al., 2012).

Although the theoretical background developed around early specialization-deliberate practice and early diversification-deliberate play has guided athlete development research in the past few years, some empirical evidence has also demonstrated that sport participation includes involvement in a number of other types of activities that differ from the original definition of deliberate practice and deliberate play (Berry et al., 2008; Côté et al., 2013; Ford, Ward, Hodges, & Williams, 2009; Ford, Yates, & Williams, 2010; Hopwood, MacMahon, Farrow, & Baker, 2015). Accordingly, the concepts of structured and unstructured activities have been used in literature (Berry et al., 2008; Fraser-Thomas et al., 2008b) in order to consider the composition of sport activities and support the inclusion of other important activities that are not considered in the original definitions of deliberate practice and deliberate play. Structured activities involve formal adult-led sport activities that include all kinds of organized training. In contrast to the original definition of deliberate practice (Ericsson et al., 1993), structured activities may also include specific pedagogical games designed to improve performance (Griffin & Butler, 2005; Launder, 2001; Light, 2006) (i.e. practice activities not performed alone), practice activities that are enjoyable,

organized competition, observing others perform or engaging in activities that may lead to implicit learning (Maxwell, Masters, & Eves, 2000). Contrary to structured activities, unstructured activities include informal youth-led activities, developed in play environments like backyard or street games of basketball, football or hockey with siblings and friends. An important element of unstructured activities is that they provide an opportunity for children to hang out together and have fun playing games, which are often spontaneously created and adapted to specific locations and contexts in mind (like quiet streets, public parks or school yards, outside school times). In contrast to the original definition of deliberate play (Côté, 1999; Côté et al., 2003, 2007), unstructured activities may also include spontaneous fun activities that are monitored by youth in their free time with the goal of improving skills or performance (e.g. basketball player practising shooting on her own in the backyard) (Côté et al., 2013). These activities are not systematically or pedagogically planned and are characterized by their extrinsic value of skill development (Côté et al., 2013). Unstructured activities may also include other informal play or physical activities like riding a bike or playing tag. This is an important distinction since unstructured activities comprise a high degree of novelty and variability exposing children to new physical, social and emotional situations, also allowing them to explore their independence and enhance their organisation and leadership skills (Côté et al., 2003, 2007; Côté & Erickson, 2015; Côté et al., 2013). Furthermore, flexibility in the structure and form of games provide children with the freedom to invent, adapt, and negotiate rules (and other characteristics), which promote the development of important characteristics of expertise in sport, such as innovation, creativity, adaptability, and flexibility (Côté & Erickson, 2015; Côté et al., 2013; Davids, Araújo, Seifert, & Orth, 2015; Ford et al., 2013; Memmert, Baker, & Bertsch, 2010). Bernstein (1967) proposed that such features form a hallmark of skilled behaviour, which he termed dexterity. Despite the obvious functional relevance of this type of activity, little attention has

been given to the potential significance of the role of unstructured activities (i.e. youth-led activities) in athlete development.

Some researchers who have attempted to record the training activities and developmental pathways of expert athletes have typically used a diversity of research approaches that vary from retrospective quantitative interviews to questionnaires and qualitative interviews (for a review, see Côté et al., 2007). The majority of studies have relied on quantitative methodologies, providing useful insights into patterns of sport involvement and pathways to reach sport expertise. However, a quantitative approach is somewhat limited to fully understand the dynamic and complex nature of athlete development. Accordingly, combining quantitative with qualitative methodologies in a mixed methods approach could be a valuable strategy to examine the underlying activities and issues related to athlete and talent development in sport.

The purpose of this study was to characterize the developmental pathways of highly skilled and less skilled volleyball players, specifically considering the nature of formative sport experiences (i.e. structured and unstructured activities) undertaken throughout their development while taking into account potential interactions between expertise level and gender. Based on the theoretical rationale provided, it was expected that expert performers in volleyball would demonstrate a significant balance in previous experience of structured and unstructured physical activity, sport experience and training, compared to the non-expert sample.

Material and Methods

To examine this idea a mixed method design was used in this study. This approach comprises a combination of quantitative and qualitative methods to produce a data set with complementary strengths (Creswell, 2007, 2014). A mixed method approach can provide a deeper understanding of athletes' development by considering not only a quantitative set of

data, but also by interpreting the meaning that athletes place on events, processes, and structures behind their development in sport (Poczwardowski, Diehl, O'Neil, Cote, & Haberl, 2014; Readdy, Raabe, & Harding, 2014). By providing athletes with the freedom to use their own words when explaining their perceptions of their development in sport we aimed to enhance and complement existing data in this research field (Denzin & Lincoln, 2000; Miles & Huberman, 1994; Patton, 2002; Silverman, 2000).

Participants

To achieve our aims, coaching staff members of 18 volleyball clubs in Portugal were recruited to help select participants for the study. The sample included 30 highly skilled and 30 less skilled volleyball players (15 male and 15 female for each group). Participants were selected based on two main criteria: (a) being no younger than 23 years old (peak performance in volleyball is achieved in the mid to late twenties; Balyi & Hamilton, 2004), and (b), having a minimum of 10-years of sport-specific experience in volleyball, but with no prior limitations on the number of reported hours spent in sport participation. Additional criteria that we used to characterise the sample of highly skilled participants included: playing in the premier league (Helsen, Starkes, & Hodges, 1998; Low, Williams, McRobert, & Ford, 2013), belonging to a senior national team (Baker et al., 2003b; Hayman, Polman, Taylor, Hemmings, & Borkoles, 2011; Memmert et al., 2010) and being ranked amongst the best volleyball players by national team coaches (Baker, Côté, & Abernethy, 2003a; Berry et al., 2008). The less skilled players were regularly involved in recreational volleyball and had never been part of a senior national team.

All procedures followed the guidelines stated in the Declaration of Helsinki and were approved by the ethics committee of the first author’s institution. Players were contacted personally or by telephone and were provided with an overview of the study – 100% of the players contacted agreed to participate in the study. Prior to the beginning of the study, all

players were given information sheets that informed them about the purpose of the study and signed consent forms.

Data Collection

An adapted version of the retrospective interview procedure suggested by Côté, Ericsson and Law (2005) was specifically designed to examine the sport participation histories of these Portuguese volleyball players. The interview design sought to gain an in-depth understanding of players' general patterns of activity involvement (training patterns) during their sport development. The procedure included closed- and open-ended questions to collect quantitative and qualitative data on participant training patterns throughout development, specifically considering their early developmental sport activities (i.e. the amounts of structured and unstructured activities undertaken). The interviews were conducted by the primary researcher in a quiet area, familiar to participants and free from distractions, in a face-to-face format, and took approximately 2 hours to complete. All interviews were audio recorded and transcribed verbatim.

Quantitative data. Quantitative data were collected in a series of tables and charts designed to assemble the information in an accessible and intuitive profile for both the primary researcher and the athlete. Training patterns were examined from a developmental perspective by calculating means of reported number of structured and unstructured activities experienced as well as the number of hours spent in these activities. Structured activities were defined as all sport activities undertaken in a formal, organised training setting such as a club, sport school or other organization, supervised by an adult (a coach or teacher) and had performance enhancement as their primary focus (examples: volleyball in a club, karate in a private martial arts school, swimming lessons with a personal trainer). Unstructured activities were proposed to involve voluntary play or physical activities undertaken in an informal environment, monitored and regulated by youth or someone involved in the activity, in which

the main purpose is to maximise enjoyment (examples: riding a bike, street basketball, backyard soccer, playing tag). These activities were analysed taking into account three developmental stages: 8 to 12 years, 13 to 16 years, and 17 to 20 years. These developmental stages were selected after a preliminary quantitative analysis of the data, in which some specific patterns differentiating participant development were highlighted. The developmental model of sport participation (Côté, 1999; Côté et al., 2003, 2007) was also used as the theoretical background to define each individual's developmental stages. Finally, the Portuguese volleyball federation competitive system was used to validate the age values of each stage. Accordingly, the first stage (8-12 years), second (13-16 years), and third (17-20 years) stages matched the different stages of training of the Portuguese volleyball federation.

Qualitative data. In order to facilitate participants' ability to discuss their sport development they were invited to use their own words to describe and explain in more detail their sport experiences throughout development. Main questions focused directly on their past developmental sport activities such as: “Could you elaborate on your sport involvement during childhood and adolescence by discussing experiences that you feel were significant for you?” Probing and follow-up questions were used to encourage athletes to expand their answers such as “Can you give me a specific example of how this type of activity was performed?” In sum, the qualitative part of the interview allowed athletes to focus on their previously identified sport experiences (quantitative part) and provided understanding of those experiences.

Data Analysis

Statistical analysis. All variables examined from a developmental perspective used a 4 x 3 (Groups x Stages) analysis of variance with repeated measures (RM ANOVA). In this study, we considered four groups (i.e. highly skilled male, highly skilled female, less skilled

male and less skilled female) and three different stages of development (i.e. 8-12 years, 13-16 years, and 17-20 years). Specifically, RM ANOVA was used to analyse training patterns (i.e. number of structured and unstructured activities practised, number of hours of structured and unstructured activities practised per year). Post hoc analyses were conducted using Bonferroni tests and effect sizes were determined using eta-squared values (η^2). Greenhouse-Geisser adjustments were applied to violations of the sphericity assumption. To assess the reliability of the information provided by players in this study, follow-up interviews were conducted with 25% of the sample (15 players – three highly skilled male, four highly skilled female, four less skilled male, and four less skilled female). Pearson product-moment correlations were calculated between the information collected in time one and time two, and showed high correlations that varied between .702 and .995. Specifically, number of structured activities (r = .971), hours of structured activities (r = .995), number of unstructured activities (r = .813), and hours of unstructured activities (r = .804) showed high level of consistency between the information reported in the two interviews.

Content analysis. All interviews were digitally recorded, transcribed verbatim and checked for accuracy by a second member of the investigation team. Content analysis was used to analyse the data. The procedure of content analysis followed the previously established guidelines (Côté, Salmela, Baria, & Russel, 1993) within the academic literature on athletic development. First, the interview transcripts were divided into units of meaning (i.e. manageable pieces of text containing one unique point or theme; Côté et al., 1993). Second, the units of information with similar meanings were grouped into more comprehensive categories (Côté et al., 1993; Côté & Sedgwick, 2003), which allowed organization and interpretation of the unstructured data. Third, the content of these categories was re-examined carefully in order to search for commonalities and uniqueness according to the meanings by which they were categorized. Raw data themes were then identified and

built upon into themes and categories. After the completion of this process, we analysed the content using deductive techniques (Patton, 2002). The trustworthiness of the data was enhanced through two main strategies. First, participants were asked to review their transcripts for verification, which allow them the opportunity to add, delete, or rework any data that they felt did not accurately reflect their intended communications (Miles & Huberman, 1994). All informants agreed with the accuracy of their original communications. Second, two members of the research team were involved in a collaborative approach within the interpretational analysis, with regularly meetings to discuss the emerging categorical organization system. This important process contributed to the trustworthiness of the data, ensuring the interpretative validity while minimizing the risk of individual research bias (Silverman & Marvasti, 2008).

Results

Training Patterns Throughout Development

Structured activities. Descriptive statistics for amount of structured activities experienced and number of hours spent in these activities throughout development are presented in Table 1 and Table 2. A significant effect for stage was found on participants' reported number of structured activities ($F(2,112) = 22.938$, $p < .001$, $\eta^2 = .291$). Pairwise comparisons of means across stages (Bonferroni adjusted alpha of $p < .001$) revealed that players participated in significantly more structured activities during stage 1 ($M = 3.0$ activities/year, $SD = 1.8$) and stage 2 ($M = 2.3$ activities/year, $SD = 1.4$) than in stage 3 ($M = 1.6$ activities/year, $SD = 0.9$). There were no other significant main effects for the interaction between expertise level and gender in this variable. Concerning participants' reported number of hours spent in structured activities, a significant effect for stage ($F(2,112) = 14.903$, $p < .001$, $\eta^2 = .210$) and interaction between expertise level and gender ($F(6,112) = 5.289$, $p < .001$, $\eta^2 = .221$) was found. Pairwise comparisons of means across stages (Bonferroni

adjusted alpha of p = .001) revealed that players accumulated more hours of structured activities in stage 2 (M = 1419.0 hours/year, SD = 602.0) and stage 3 (M = 1750.0 hours/year, SD = 897.1) than in stage 1 (M = 1079.0 hours/year, SD = 1113.0). Moreover, highly skilled male and highly skilled female players accumulated more hours of structured activities than less skilled male players (p = .011 and p = .030, respectively).

(please insert table 1 and table 2 around here)

Unstructured activities. Descriptive statistics for amount of unstructured activities experienced and number of hours spent in these activities throughout development are also presented in Table 1 and Table 2. There were no significant main effects for stage and interaction between expertise level and gender on players' reported number of unstructured activities. Analyses of the players' number of hours spent in unstructured activities revealed a significant effect for stage ($F(2,112) = 21.214$, $p < .001$, $\eta^2 = .275$). Pairwise comparisons of means across stages (Bonferroni adjusted alpha of p = .010) revealed that players accumulated more hours of unstructured activities in stage 1 (M = 1773.0 hours/year, SD = 766.2) and stage 2 (M = 1062.0 hours/year, SD = 588.1) than in stage 3 (M = 547.8 hours/year, SD = 109.0).

Understanding the Role of Structured and Unstructured Activities Throughout Player Development

Structured activities

Early diversified sport participation. Both highly skilled (male and female) and less skilled (male and female) volleyball players mentioned having participated in significant amounts of structured activities during their early sport development:

> Since I started practicing sports, it was a mixture of everything (sports) but nothing too *seriously or certain…then I definitely chose volleyball (HS female 1).*

> When I was young, I did swimming, football, and volleyball everything at the same time. But then, when volleyball started to be more demanding and training loads was higher I have to choose volleyball (HS male 5).

Early diversification with older peers. Only highly skilled players (male and female) mentioned having participated in structured activities with older peers/teammates:

> *In all sports I have practiced I always had older teammates… I used to be the* youngest! (HS male 9).

> Sometimes was difficult to adapt myself to that specific sport, because they [teammates] were all older than me and they already know much more than what I knew (HS female 13).

Volleyball participation with older teammates. Only highly skilled players (male and female) mentioned practicing volleyball with older teammates:

> Throughout my development in volleyball, I played and practiced all the time with older teams (HS male 10).

> When I was 16 I started to play in the adult team. I always played with older athletes and this was very important for my development (HS male 1).

> *I played during all my development in older teams…when I was 15 I was already* practicing with the adult team and at that age I took part in my first official competition in that team! (HS female 6).

> *All the girls were older than me…they were very important to me because not only I* learnt a lot with them, but also I learnt too quickly (HS female 4).

Unstructured activities

Involvement in unstructured activities. Both highly skilled (male and female) and less skilled (male and female) volleyball players mentioned having participated in unstructured activities during their early development:

> I never was a quiet child. I played a lot with my friends during my childhood. My parents were very poor and I never had the opportunity to have a PlayStation or something like that. I had nothing to do. So, I just played, played, and played in the street (HS male 5).

> I think I started doing sports naturally. I lived in a small village and I could play a lot in the street with my friends and neighbours (HS male 12).

> *I never was a quiet child. I loved play in the street! I couldn't stay too much time in* th*e computer… I needed to go outside and play, even if it was alone!* (LS male 10).

The potential of unstructured activities for expertise enhancement. Highly skilled players (male and female) referred specifically to how unstructured activities provided an important formative experience that helped them develop physically, technically, tactically, cognitively and motivationally. They also directly implicated these experiences in their expertise development and achievement:

> I reached expertise [in volleyball] because I played a lot in the street. I was not a gifted athlete and I had my own difficulties in sport. But just because I played it a lot in the street, I could develop my physical, technical, and tactical skills (HS male 1).

> There are three major factors that helped me to reach expertise: first, because I loved and still love volleyball; second, because I work really hard on it; and third, because I play a lot in the street (HS male 2).

Involvement in specific unstructured activities. Highly skilled players (male and female) particularly indicated playing a lot of street volleyball and they emphasized the specific

contribution of this practice for their development. On the contrary, less skilled players reported playing other activities rather than volleyball:

> Sometimes after the training session we went outside and play volleyball again. We *didn't even need anything. We held a thread somewhere or we use my grandmother's* gate as a net and play during all afternoon (HS male 4).

> It is funny because the youth in my neighbourhood typically played football in their free-*times, in the break times at the school, in the street…but me and my friends were* never like this! We spent our free times playing volleyball! (HS male 8).

> During my childho*od, when I was at home I was always playing volleyball…even* alone! (HS female 7).

> Apart from physical education in kindergarten and primary school, I played a lot with my friends. I played football, I rode a bike, skateboarding, everything! But never volleyball! (LS female 2).

Involvement in specific unstructured activities with older peers. Only highly skilled players (male and female) mentioned having played specific unstructured activities with older peers:

> I always played volleyball in the street with older peers. We used to play altogether *and I loved playing with them…* (HS male 2).

> When I played volleyball in the street there was a mixture of younger and older *youths. But I know that I learned a lot with the older ones…* (HS male 9).

> In that activities (street-volleyball) we played altogether, so there were younger and older peers. But all I wanted was to play with the older ones because they played *better than me…* (HS female 3).

Discussion

In this study, we examined the developmental pathways of highly skilled and less skilled volleyball players by exploring the formative nature of their sport experiences

(specifically the nature of structured and unstructured activities experienced) embedded within a simultaneous analysis of expertise level and gender.

Analysis of participant training patterns revealed that volleyball players had an early-diversified type of sport involvement with a greater involvement in structured and unstructured activities during stage 1 and 2 (sampling and specializing years), and an increase in the number of hours spent in structured sport activities during stage 2 and 3 (specializing and investment years). These findings are consistent with the tenets of the developmental model of sport participation (Côté, 1999; Côté et al., 2003, 2007) that suggests two sport participation trajectories related to talent development: (1) elite performance through early diversification and deliberate play, and (2), elite performance through early specialization and deliberate practice. Furthermore, these findings are in line with results of empirical studies in team sports showing early diversification as a possible pathway to both expert performance and recreational participation (Baker et al., 2003a; Berry et al., 2008; Coutinho, Mesquita, Fonseca, & Côté, 2015; Coutinho, Mesquita, Fonseca, & De Martin-Silva, 2014; Leite, Baker, & Sampaio, 2009; Leite & Sampaio, 2012). The data suggested that sampling different sports during the early years of athletic development provides a good foundation for both highly skilled and less skilled sport engagement. The early diversification pathway has been associated with several benefits, including a prolonged engagement in sport, more enjoyable and positive early sport experiences, and a healthy physical, psychological and social development (Baker, 2003; Baker et al., 2009; Côté et al., 2007; Côté et al., 2012; Fraser-Thomas et al., 2008a, 2008b). An early-diversified sport involvement may also protect athletes against the potentially negative consequences of early specialization such as physical injuries, a decrease of enjoyment in sport, and dropout (Fraser-Thomas, Côté, & Deakin, 2005; Fraser-Thomas et al., 2008a, 2008b; Law et al., 2007). Beyond that, research has also acknowledged the importance of engagement in unstructured activities during childhood for

an athlete's development (Côté et al., 2007; Côté & Erickson, 2015; Côté et al., 2013; Wood, 2013). These activities are personally directed, chosen freely and regulated by children, providing them the opportunity to decide and to invent what to do and how to do it. This experience leads to a complete, active, and intense involvement in the activity providing good conditions for learning (Côté et al., 2013). Furthermore, the flexibility in the structure and form of early sport experiences, as well as their high degree of novelty and unpredictability, expose children to many new physical, social, and emotional situations, which provide a platform for the development of metacognitive capabilities, learning and overall development in sport (Côté et al., 2013; Wood, 2013).

While highly skilled and less skilled volleyball players reported participating in essentially the same type of structured and unstructured activities, highly skilled players accumulated more hours of structured practice throughout development. This finding is consistent with results reported in previous literature suggesting a relationship between investment in hours of practice and expertise achievement (Baker et al., 2003b; Baker et al., 2005; Berry et al., 2008; Hopwood et al., 2015; Schorer et al., 2015). However, the total number of hours of structured activities accumulated by highly skilled players (between 2,000 and 5,300 hours) is far less than the 10,000 hours suggested by Ericsson and colleagues' original study (Ericsson et al., 1993) and popular books (e.g. Gladwell, 2008) as a benchmark for attaining expertise. In fact, studies carried out in team sports have shown that players have achieved expert performance after accumulating between 4,000 to 6,000 hours of sport-specific practice (Baker et al., 2005; Berry et al., 2008; Soberlack & Côté, 2003), supporting the recent clarification of Ericsson (2013) on highlighting that "there is nothing magical about exactly 10,000 hours" (p. 534).

In addition to these findings, in-depth analysis of how structured and unstructured activities were specifically experienced throughout development revealed key important

differences between the groups. The current study extends previous findings by demonstrating that, not only do highly skilled players spend more time in structured activities, but they also were involved in these activities (in which the primary sport, volleyball, is included) with older peers or teammates. Previous work has highlighted the benefits of playing and practicing with older peers for athlete and expertise development (Balish & Côté, 2013; Côté, MacDonald, Baker, & Abernethy, 2006; MacDonald, Cheung, Côté, & Abernethy, 2009; MacDonald, King, Côté, & Abernethy, 2009). It could be argued that the training environment and psychosocial climate induced by older peers improve players' motivation to practice, promoting a deeper immersion in a sport activity, and consequently leading players to a more active engagement in learning (Wood, 2013). Furthermore, older peers and teammates can act as important role models affording players the opportunity to form attitudes and behaviours through the process of observational learning (Bandura, 1977), what Rietveld and Kiverstein (2014) have called the 'form of life' in a domain of expertise. Notwithstanding, this finding could also possibly be viewed as a result of the athletes' already superior talent at that age. In structured sporting programmes, younger athletes who are highly skilled could be moved up to play with and compete against older players because they are considered to be talented and their performance could be profitable to the older team. Such a phenomenon could be considered an athletic career transition (Alfermann & Stambulova, 2007), which is defined as a turning phase in career development that manifests itself by sets of demands athletes have to meet in order continue successfully in sport. Successfully coping with transitions improves the athlete's odds of having a long and successful life in sport (Stambulova, 2010). Although little is known about the potential of such a transition in sport (i.e. starting to play and competing with older athletes), possibly due to the disconnection of talent development and career transitions research (for a review, see Coutinho et al, in press), coaches and sport systems should

analyse carefully each particular case in order to understand and decide what is the best for each individual athlete's personal and talent development.

Additionally, highly skilled players explained how unstructured activities might have helped them developing physically, technically, tactically, cognitively and motivationally, which could have been an important contribution to their expertise development and achievement. From a skill acquisition perspective, involvement in this type of child-led activities allow children to experience sports in various contexts with freedom to invent, adapt, create, and negotiate activities and rules to suit to their own wishes and needs (Côté et al., 2007; Côté et al., 2013). These factors promote a stimulating environment in which athletes develop their physical, technical, and tactical attributes, but also learn the "game smartness" that can be challenging to acquire within a more formalised, structured sport training environment. Indeed, the development of dexterity (Bernstein, 1967) (i.e. adaptability and creativity) promoted by the involvement in unstructured activities has been posited as the mechanism supporting the empirically highlighted benefits of these informal activities on skill acquisition and sport expertise (Berry et al., 2008; Côté et al., 2007; Côté et al., 2013; Ford et al., 2009; Memmert et al., 2010). Interestingly, while the quantitative results of this study did not show significant differences in the number and hours of unstructured activities between groups, highly skilled players reported their engagement in specific unstructured activities with older peers (i.e. volleyball play activities away from supervising adults). Thus, it could be argued that skilled and less skilled players had a similar quantity of unstructured activities, but the distinction could be in the type and quality of such experiences. It has been suggested that these types of informal experiences in the primary sport foster the development of decision-making (Roca, Williams, & Ford, 2012), attainment (Ford et al., 2009) and creativity (Memmert et al., 2010). Thus, involvement in specific unstructured activities with older peers may have enhanced all these benefits during the

development of highly skilled volleyball players. The flexibility and negotiability in structure and form of unstructured activities enable children of different abilities and ages to play in the same game without losing the fun and enjoyment of competition, promoting therefore a productive learning environment (Côté et al., 2003). Considering the potential contribution of unstructured activities for athlete and talent development, administrators in governing bodies and sport systems should reflect on encouraging and creating more opportunities for such experiences. Possible strategic actions that may promote opportunities for involvement in unstructured activities could be facilitated at the organizational and social support levels. At the organizational level, it could be beneficial to increase the construction of outdoor spaces where children can play safely and enhance the availability of sport clubs and schools facilities during free time for children to play with specific materials (e.g. balls, volleyball net, trampolines, etc). At the social support level, it could be important to increase the awareness of parents, coaches, teachers, and administrators about the importance of children's involvement in unstructured sport activities that are not always directed and monitored by adults.

Despite the important findings of this study, there are some limitations that should be addressed. Portuguese volleyball is not considered to be at a world-class -level, which should motivate other researchers to examine the developmental pathways of high-level volleyball players. Furthermore, although retrospective methodologies have been considered an incomplete tool to collect accurate data in this research field (Côté, et al., 2005; Coutinho et al, in press), they reflect the players' perceptions of their previous sport experiences, which need to be triangulated with more objective data regarding developmental patterns (Sosniak, 2006). Notwithstanding, our study afforded important insights into this research field attesting the usefulness of mixed methodologies and qualitative methodologies as a valuable approach to analyse and explain skill and talent development in a deeper and contextualized

way. Future studies should consider the potential of prospective longitudinal designs to specifically examine the athletes' developmental sport experiences so as to better understand the contributions to developing and attaining expertise in volleyball and other sports. Here, a detailed examination of the microstructure of practice and play could provide important insights into what really differentiates learning activities performed in different stages of development by skilled and less skilled players. Furthermore, qualitative methodologies should also be considered in further studies as a valuable procedure for an in-depth analysis and interpretation of the processes of athlete talent development.

General Conclusions and Practical Implications

The findings of this study support previous research suggesting early sampling as a suitable pathway for both adult expert and non-expert performance development. Highly skilled and less skilled players were involved in several sport activities during the early years of their sport participation, with a gradual increase in the number of hours spent in structured activities throughout development. The novel contribution of this study emerged from highly skilled players highlighting participation in structured and unstructured activities with older peers as well as the involvement in specific unstructured activities (i.e. volleyball child-led play activities) as key factors for their expertise development and achievement. These findings suggest the need for deeper examinations of practice histories since athlete development characterizations based on a general portrait of early specialization or early diversification seem insufficient to understand how expertise in sport is acquired. Additional research is needed to examine in greater detail the type of practice undertaken by athletes throughout development considering the possible coexistence of what are currently deemed as opposing and contrasting learning activities (for instance, the presence of specific practice and play activities within a diversified sport involvement as shown in this study).Following the propositions that talent development is a nonlinear, inherently noisy and dynamic process,

emphasising the acquisition of increasingly functional relationship with a performance environment (Davids, Shuttleworth, Araújo & Gullich, in press) , there is a need to move beyond mechanistic and prescriptive models of talent development (which tend to model the process according to stratified and fixed stages, while outlining putative practice characteristics based on these categorisations). The data reported here suggest that there is a need for future research to test the validity of an additional talent development pathway to elite performance through a sophisticated mix of structured (adult-led) and unstructured (peer-led) play and practice, which can allow talented athletes to exploit the value of play and organised training in acquiring expertise in sport (Davids, Shuttleworth, Araújo & Gullich, in press). This type of research would provide a consideration of features of best practice and process markers of talent development, leading to the emergence of robust guidelines for the implementation of this pathway applied in practice. Further research should also consider the influence of other contextual factors in determining the quality of practice, since practising and playing with older peers was a key factor for expertise achievement in this study. Accordingly, broadening our attention to encompass larger systems in which athletes develop will create new insights into athlete and talent development. Here, exploring the use of qualitative research in a more consistent and deeper way may provide better understandings of the complex interaction of different factors (e.g. type and quantity of practice and play; peers, coach and family influence) and their influence in determining expertise achievement.

A number of important practical implications for sport practitioners can also be drawn from the data. What is clear from this study is that highly skilled players' development pathway is characterized by a greater quantity of practice and more enriched learning contexts throughout development (resulting from their involvement in early specific unstructured activities, as well as regular practice and play with older peers/teammates). Coaches should, therefore, consider not only the amount of practice but also the overall

environment in which practice activities are experienced (e.g. peers age, the degree of formality and specificity of practice), since these factors could determine the quality of practice. Coaches and sport systems should also consider the role of unstructured activities in the early years of athlete development as this type of learning context may provide additional stimuli in developing important attributes (e.g. technical, tactical, physical, cognitive, motivational) for expertise development and achievement. Sport administrators are encouraged to provide more specific and accurate long-term athlete development guidelines particularly regarding the early years of development due to the importance of this developmental stage for athlete development and commitment to sport. A comprehensive outline of all these issues would further our understanding of the factors underpinning the achievement of expert performance in sport.

Acknowledgments

This research was supported by a grant from the Foundation for Science and Technology (FCT) (SFRH/BD/64680/2009)/POPH/QREN/European Social Fund awarded to the first author.

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Table 1

Descriptive statistics (mean and standard deviation) for number and hours of structured and unstructured activities examined from a developmental perspective

	8-12	13-16	17-20	Total
Nº of structured activities	3.0 (1.8)	2.3 (1.4)	1.6 (0.9)	6.8 (3.1)
Hours of structured activities *	1079.0 (1113.0)	1419.0 (602.0)	1750.0 (897.1)	4247.0 (1975.1)
Nº of unstructured activities	1.6 (1.0)	1.6 (1.1)	1.3 (1.1)	4.4 (2.1)
Hours of unstructured activities *	1773.0 (766.2)	1062.0 (588.1)	548.0 (109.0)	3382.0 (1300.0)

* Time in hours per year

Table 2

Descriptive statistics (mean and standard deviation) for number and hours of structured and unstructured activities examined from a developmental perspective according to expertise level and gender

	Highly Skilled Male				Highly Skilled Female				Less Skilled Male				Less Skilled Female			
	8-12	13-16	17-20	Total	8-12	13-16	17-20	Total	8-12	13-16	17-20	Total	8-12	13-16	17-20	Total
Nº of structured activities	3.7 (2.1)	3.1 (1.1)	1.9 (1.0)	2.9 (0.3)	2.6 (1.6)	1.9 (1.2)	1.7 (0.9)	2.1 (0.3)	2.5 (1.1)	2.2 (1.4)	1.3 (0.7)	2.0 (0.3)	3.1 (2.1)	1.8 (1.6)	1.4 (0.8)	2.1 (0.3)
Hours of structured activities *	1060.0 (615.0)	1501.0 (564.1)	2671.0 (1051.0)	5231.2 (1478.0)	1197.3 (1887.0)	1721.0 (751.4)	2060.0 (565.1)	4978.0 (2715.0)	798.4 (386.2)	1155.3 (285.0)	1142.0 (158.0)	3096.0 (457.0)	1258.4 (999.4)	1298.0 (606.0)	1127.2 (347.4)	3683.2 (1819.3)
Nº of unstructured activities	1.9 (0.5)	2.2 (1.4)	1.6 (1.2)	1.9 (0.9)	2.3 (1.1)	2.0 (1.4)	1.3 (1.1)	1.9 (1.1)	1.6 (0.6)	2.1 (1.3)	1.8 (1.2)	1.7 (0.8)	2.3 (1.3)	1.9 (0.7)	1.8 (0.7)	2.0 (0.8)
Hours of unstructured activities *	2522.0 (1048.3)	1540.0 (901.0)	684.0 (380.1)	4745.0 (1146.3)	1560.0 (977.0)	676.0 (351.3)	327.1 (183.1)	2562.0 (1264.0)	1361.2 (699.4)	1083.2 (675.2)	642.0 (362.3)	3086.0 (2242.0)	1648.1 (726.1)	947.0 (358.4)	539.2 (161.2)	3134.2 (1352.2)

* Time in hours per year

Table B.1 Overview of the semi-structured interview conducted with successful athletes and significant others . 254. x.Â It is concluded that TI models need to place a greater emphasis on the development of potentially talented performers rather than early identification. In this thesis, the concept of talent is revised as a complex, dynamical system in which future behaviours emerge from an interaction of key determinants such as psycho-behavioural characteristics, motor abilities, and physical characteristics.Â There are two predominant methods that broadly capture how talented athletes are currently identified within sport: (a) natural selection, and (b) scientific selection (Bompa, 1999). Explain in detail how exercise programs and sports activities can differ in number of participants, structure, competition level, and skill level Exercise programs and sports activities may consist of one individual or a group of people. They can either be structured and consist of a specific pattern or a set of rules, or be unstructured and flexible. They might be competitive and focus on winning the game or might be performed "just for fun." Some exercise programs and sports activities require participants to have a certain skill or training while others require few technical sk