

1 Running head: DEVELOPMENTAL ACTIVITIES OF ELITE SOCCER PLAYERS

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11 The developmental activities of elite soccer players aged under-16 years from Brazil, England,

12 France, Ghana, Mexico, Portugal and Sweden

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Abstract

The developmental activities of 328 elite soccer players aged under-16 years from Brazil, England, France, Ghana, Mexico, Portugal and Sweden were examined using retrospective recall in a cross sectional research design. The activities were compared to the early diversification, early specialisation, and early engagement pathways. Players started their involvement in soccer at approximately 5 years of age. During childhood, they engaged in soccer practice for a mean value of 185.7, $s=124.0$ h/yr, in soccer play for 186.0, $s=125.3$ h/yr, and in soccer competition for 37.1, $s=28.9$ h/yr. A mean value of 2.3, $s=1.6$ sports additional to soccer were engaged in by 229 players during childhood. Players started their participation in an elite training academy at 11 to 12 years of age. During adolescence, they engaged in soccer practice for a mean value of 411.9, $s=184.3$ h/yr, in soccer play for 159.7, $s=195.0$ h/yr, and in soccer competition for 66.9, $s=48.8$ h/yr. A mean value of 2.5, $s=1.8$ sports other than soccer were engaged in by 132 players during this period. There were some relatively minor differences between countries, but generally the developmental activities of the players followed a mixture of the early engagement and specialisation pathways, rather than early diversification.

Introduction

The development of youths into expert or professional soccer players in adulthood is the goal of professional clubs, national governing bodies, private academies and many coaches and support staff. There are increasing pressures to develop these players, such as the recent Union of European Football Associations (UEFA) ruling on the quota of “home-grown” players within a team’s squad (UEFA, 2010). In light of these pressures, there is a necessity to base youth development policies and practices upon scientific evidence (Williams & Hodges, 2005; Ford, Yates, & Williams, 2010). There are many interacting factors involved in the development of expert performance by soccer players (for a review of some of these factors, see Davids & Baker, 2009; Abbott, Button, Jan Pepping, & Collins, 2005). One key factor in the development of expert soccer players are the activities and pathways in which they engage during childhood and adolescence. In this study, the activities and pathways engaged in by elite soccer players who are aged under-16 years in Brazil, England, France, Ghana, Mexico, Portugal and Sweden were examined and described.

Most researchers have examined the developmental activities of adolescent or adult athletes by having them retrospectively recall their engagement in the activities in which they engaged during their formative years via interviews and questionnaires. This method has been used to reveal three main developmental activities physically engaged in by athletes during their formative years. *Practice* is formal activity engaged in with the aim of improving performance. *Play* is usually informal and self-directed activity engaged in with the intention of fun and enjoyment (Côté & Hay, 2002). The term *deliberate* has often been used by researchers as a prefix to the terms ‘practice’ and ‘play’ (Côté & Hay, 2002; Ericsson, Krampe, & Tesch-Römer, 1993). *Competition* is formal physical activity engaged in by teams with the aim of winning (Ford & Williams, 2012). To date, researchers have revealed at least three main pathways or models

1 detailing how these activities are engaged in by elite athletes from childhood to late adolescence.

2 The pathways are characterized by the amount of time spent in practice, play and competition

3 activity in one or more sports. These pathways are termed *early specialisation*, *early diversification*

4 *and early engagement* (Côté, Baker, & Abernethy, 2007; Ford, Ward, Hodges, & Williams, 2009).

5 The early specialisation pathway is engaged in when athletes begin during childhood in

6 relatively high intensity practice and competition in their primary sport. They engage in relatively

7 little play activity in the primary sport and in relatively few or no other sports during this period. It

8 usually also involves identification and selection into a talent development programme in the

9 primary sport during childhood (Baker, Cobley, & Fraser-Thomas, 2009). The developmental

10 activities engaged in by Olympic rhythmic gymnasts in Canada have been shown to follow the

11 early specialisation pathway (Law, Côté, & Ericsson, 2007). Researchers have shown some

12 potentially negative consequences of engaging in the early specialization pathway. Law et al.

13 (2007) showed that the Olympic rhythmic gymnasts in Canada reported reduced enjoyment,

14 poorer physical health and had more injuries when compared with lesser-skilled gymnasts.

15 The concerns over early specialisation have led a number of researchers to advocate the

16 early diversification pathway (Baker, 2003; Baker et al., 2009; Côté et al., 2007). The early

17 diversification pathway is followed when athletes engage in a number of different sport activities

18 during childhood. It involves engaging mainly in play activity in those sports during childhood

19 (Côté & Hay, 2002). It usually also includes engagement in the primary sport during childhood as

20 shown in studies on tennis (Carlson, 1986; Côté, 1999; Monsaas, 1985), ice hockey (Soberlak, &

21 Côté, 2003) and Australian Rules football players (Berry, Abernethy, & Côté, 2008). Early

22 diversification also involves late or delayed specialisation with the accumulation of larger amounts

23 of practice in the primary sport starting around 13 to 15 years of age (Côté et al., 2007). Athletes in

24 countries such as Canada, Australia and the United States have been reported to follow this early

1 diversification pathway (Baker et al., 2003; Carlson, 1986; Côté, 1999; Durand-Bush & Salmela,
2 2002; Monsaas, 1985; Soberlak & Côté, 2003). The dependent measures used to test whether
3 participants diversified were the number and duration of time spent in other sports. In
4 Canada, expert ice hockey players have been reported to engage in six other sports during
5 childhood (Soberlak & Côté, 2003), whereas in Australia expert team sport athletes participate in
6 more than eight other sports (Baker et al., 2003).

7 The early engagement pathway differs from the early diversification pathway in that
8 childhood engagement in sport is mainly through participation in relatively high amounts of play
9 activity in the primary sport, rather than through relatively high amounts of play activity in
10 multiple sports. In the early engagement pathway, the amount of engagement in other sports
11 during childhood is relatively low compared to the diversification pathway, but not non-existent.
12 The early engagement pathway differs from the early specialisation pathway in that the amount of
13 childhood engagement in practice and competition in the primary sport would ideally be relatively
14 low during this period. During early adolescence, the amount of engagement in practice and
15 competition in the primary sport increases and becomes relatively high in mid-adolescence,
16 whereas the amount of play decreases. Soccer players in Brazil have been reported to follow this
17 specific developmental pathway (Salmela, Marques, & Machado, 2004; Salmela & Moraes, 2003).
18 Greater amounts of engagement in soccer-specific play activity during childhood has been shown
19 to be correlated to superior decision making ability in elite soccer players (Williams, Bell-Walker,
20 Ward, & Ford, 2011) and to differentiate players in England who progress to professional status in
21 late adolescence from those who do not (Ford et al., 2009; Ford & Williams, 2012).

22 The early engagement pathway was developed because the other pathways did not
23 adequately describe the relatively high amounts of play activity in the primary sport shown in
24 studies on soccer players in England (Ford et al., 2009; Ford & Williams, 2012) and Brazil

1 (Salmela et al., 2004; Salmela & Moraes, 2003). The existence of three different developmental
2 pathways that detail the sport activities engaged in by children may be due to them
3 oversimplifying a complex process, or to between-country or -sport differences. Ford, Hodges, and
4 Williams (in press) have detailed the complexity inherent in these pathways by identifying several
5 variables within them that are free to vary independently of one another. These include the start age
6 and amount of engagement in activity in the primary sport, in practice in the primary sport, in
7 competition in the primary sport, and in sports other than the primary sport. Other factors are the
8 amount of formal, coach-led versus informal, non-coach-led activity and whether the intention of
9 the coach, athlete and significant others during the activity is to win, implicitly or explicitly
10 improve performance, or to have fun and enjoyment. Each of these factors is free to vary
11 independently of one another, which may indicate that the three generic pathways may present too
12 simplistic a description of the process.

13 An example of the complexity inherent in the pathways can be seen in Ward, Hodges,
14 Starkes, and Williams(2007). They collected retrospective participation history data from 203 elite
15 and sub-elite male soccer players in England aged between eight and 18 years of age. The players
16 started in the sport at five years of age. The accumulated hours of team practice in soccer was the
17 only activity that consistently discriminated between the elite and recreational players from the
18 under-nine year age group onwards. Team practice is formal activity engaged in with the aim of
19 improving performance and is led by a coach or adult. The elite training academy programme in
20 England begins at under-nineyears and the elite players were engaging in significantly more team
21 practice from that point onwards compared to the recreational players, which supports the early
22 specialisation model. The hours accumulated in play activities and competition in soccer did not
23 discriminate between the skill groups. However, during childhood, both groups spent around seven
24 hours per week in soccer-specific play activities, which supports the early engagement model. The

1 number of other sports in which they engaged did not discriminate between groups. Participants
2 engaged in two other sports, which is lower than the number reported in earlier observations of
3 elite athletes in Canada and Australia (Baker et al., 2003; Durand-Bush & Salmela, 2003) that are
4 used as support of the early diversification model.

5 The majority of researchers have revealed the developmental activities engaged in by
6 expert athletes in a single sport in a single country as per Ward et al. (2007). In contrast, others
7 have shown the activities that expert athletes engaged in during their development in a single
8 country across a range of sports (Baker, Côté & Abernethy, 2003; Durand-Bush & Salmela, 2002;
9 Moesch, Elbe, Hauge, & Wikman, 2011). Researchers who examined the developmental activities
10 engaged in by athletes in a single country across a range of sports or in a single sport have only
11 described the youth development system in that country or more narrowly the development system
12 of a sport in a country. The possibility exists that the developmental pathways and activities are
13 either sport and/or country specific. A stronger test of the various pathways necessitates that data
14 are gathered from a single sport across a range of countries to be able to make generalisations as to
15 the pattern of developmental activities engaged in by athletes in that sport.

16 In the current study, we describe the developmental activities and pathways engaged in
17 by elite soccer players from various countries around the world. We present the first
18 comprehensive evaluation of the various development pathways in a single sport across multiple
19 countries and continents. It was expected that the players who were from Brazil, England, France,
20 Ghana, Mexico, Portugal and Sweden would start in the sport during early childhood at around
21 five years of age (Ward et al., 2007). Their developmental activities were predicted to follow the
22 early engagement pathway, rather than the early diversification and early specialisation pathways
23 (Ford et al., 2009). Early engagement pathway involves players engaging in the sport largely
24 through soccer-specific play activity during childhood, which is defined as under-6 to under-12

1 years of age. It also involves participation in a limited number of other sports during that period. It
2 was expected that the nature of the formal soccer activities of practice and competition engaged in
3 during childhood would be dependent on the country and its youth development system. Those
4 countries with elite developmental academies that recruited players at a young age, such as England
5 (Ward et al., 2007), were likely to have players who engaged in more practice and competition in
6 soccer during their childhood when compared to those who had less formal recruitment systems,
7 such as in Brazil (Salmela et al., 2004; Salmela & Moraes, 2003). Players in countries with early
8 recruiting elite developmental academies were expected to start the sport and begin in formal
9 activities earlier compared to those who recruited later. It was envisaged that players would begin
10 their engagement in an elite training academy in late childhood or early adolescence. During early
11 adolescence, they were expected to engage in relatively large amounts of practice in soccer and
12 reduce their time in soccer-specific play activity.

13 Methods

14 *Participants*

15 Participants were 328 elite youth soccer players aged under-16 years from Brazil, England,
16 France, Ghana, Mexico, Portugal and Sweden ($n=50$ for each country, except for Ghana where
17 $n=28$). All countries were ranked in the top 20 of the Fédération Internationale de Football
18 Association (FIFA)/Coca-Cola World Ranking at the time of the study, apart from Ghana who
19 were ranked number 36 (FIFA, 2011). Players were contracted to the academies of three Brazilian,
20 four English, one Mexican, one Portuguese and three Swedish clubs in the top professional
21 leagues in their country. Players from France were contracted to a French Football Federation
22 academy and came from multiple clubs. Players from Ghana were contracted to two private youth
23 academies, which are two of a number of these organisations that train its top youth players. The

1 guardian of the participants provided informed consent and the research was conducted according
2 to the ethical guidelines of the lead institution.

3 *Questionnaire*

4 The Participation History Questionnaire (PHQ) was used to elicit information relating to
5 the activities which players had engaged in during their development. The test-retest reliability and
6 the concurrent validity of the PHQ were shown in Ford, Low, McRobert, & Williams (2010). The
7 PHQ contained three sections. The first section was designed to elicit information on soccer-
8 specific milestones. These milestones included the age at which participants first took part in
9 soccer, their start ages in supervised soccer practice, soccer competition, and participation in an
10 elite training academy. The second section of the questionnaire was designed to elicit information
11 on participants' engagement in soccer activities. Altogether, four soccer activities were listed:
12 competition; team practice; individual practice; and play. Individual practice was defined as
13 activity engaged in alone with the aim of improving performance. It was mainly included because
14 other researchers examining this area (Helsen, Starkes, & Hodges, 1998) have included it during
15 their test of Ericsson et al.'s (1993) theory of deliberate practice. The other activities were chosen
16 based upon previous research in which retrospective questionnaires were used, as well as to match
17 the recommendations proposed by Côté, Ericsson, and Law (2005). The hours per week and
18 months per year in each of the soccer activities, as well as the weeks when players were injured
19 per year, were recorded with the PHQ for each year from the current season back to the age group
20 at which participants began playing soccer. The data starts from the under-six year's age group
21 category, which players begin to engage in when they are five years of age. The data ends when
22 they are at the end of the under-15 age group, which means they are 15 years of age and are
23 moving into the under-16 age group. Data for the under-16 age group was not included because
24 the players had not completed that season.

1 The third section of the PHQ was designed to elicit information on engagement in other
2 sport activities. It contained a list of sports from which participants were required to indicate those
3 in which they had participated in regularly for at least a total minimum period of three
4 months. Participants were not required to include other sport activities engaged in during physical
5 education classes at school, although those engaged in after school were included.

6 *Procedures*

7 To complete the questionnaire, 10-15 participants from each academy sat together in small
8 groups in a quiet room. Verbal instructions were provided regarding the purpose of the
9 questionnaire. Participants were instructed on how to complete the first section of the
10 questionnaire before commencing. At the start of the second section, to aid memory recall of the
11 hours in the soccer activities, players were required to specify the team and coach that they played
12 for in each year of their participation. The participants completed the questionnaire in about one
13 hour.

14 *Data Analyses*

15 For the milestone data, total hours in soccer activity and number of other sports, descriptive
16 statistics were calculated and reported as 'combined' data for all 328 participants and separately
17 for each country. One way between-country ANOVA was used to separately examine milestone
18 data, number of other sports and total hours in soccer activity. The average hours per year during
19 childhood (under-six to under-12 years of age) and early adolescence (under-13 to under-15 years
20 of age) in each of three soccer activities of practice, play and competition were calculated for each
21 country. The soccer-specific practice hours were calculated by the sum of individual and team
22 practice, although the number of individual soccer practice hours was relatively small. The average
23 hours per year in the three soccer activities were analysed using factorial ANOVAs for the two age

1 stages (childhood and adolescence) separately with country as the between-participants factor and
2 activity (soccer-specific practice, play, competition) as the within-participants factor.

3 Any violations to sphericity were corrected using Huynh-Feldt procedures when the
4 Greenhouse-Geisser value was greater than 0.75. When the Greenhouse-Geisser value was less
5 than 0.75, any violations to sphericity were corrected using the Greenhouse-Geisser procedure
6 (Girden, 1992). All data were analysed using version 9 of the STATISTICA statistical software
7 (StatSoft UK). Post-hoc tests involving between-group effects and interactions were analysed
8 using Tukey HSD. Post hoc tests involving repeated measures were analysed using Bonferroni
9 contrasts. Effect size measures involving two means were calculated using Cohen's d (Cohen,
10 1988) with pooled standard deviations, whereas effect size measures involving three or more
11 means were calculated using Cohen's f (Cohen, 1988). The alpha level set for significance
12 throughout was $P < 0.05$.

13 *Results*

14 *Milestones*

15 Table 1 contains the age at which participants reached the soccer-specific milestones in
16 each country and the countries combined. The 328 participants started in soccer at mean age of
17 4.9, $s = 1.4$ years of age. They began supervised training with an adult at mean age of 6.9, $s = 1.8$
18 years and in a league at mean age of 8.7, $s = 2.0$ years. The 328 players first engaged at an elite
19 training academy at mean age of 12.0, $s = 2.6$ years. One-way ANOVA revealed that start age in
20 soccer differed across countries, $F_{6,325} = 8.29$, $P < 0.05$, $f = 0.39$. *Post hoc* tests showed that start age
21 was earlier in each of England, Portugal and Sweden compared to each of France, Ghana, and
22 Mexico (all P 's < 0.05), whereas there were no differences in start age between the other countries
23 (all P 's > 0.05). One-way ANOVA also revealed that start age for participation in elite academies
24 differentiated countries, $F_{6,326} = 68.28$, $P < 0.05$, $f = 1.13$. *Post hoc* tests showed that the start age for

1 participation in elite academies was earlier in England compared to all other countries (all
 2 P 's<0.05). It was also earlier in Portugal compared to Brazil, France, Mexico, Portugal, and
 3 Sweden (all P 's<0.05).

4 *Soccer Activity Data*

5 *Total hours accumulated in soccer activity.* Table 1 contains the total hours accumulated in
 6 soccer activity between the under-6 and under-15 year age groups for each country and for the
 7 countries combined. The total number of hours accumulated in soccer activity during that period
 8 for the 328 players combined was a mean of 4553.0, $s=1748.8$ h. One-way ANOVA revealed
 9 that total hours accumulated in soccer activity differed across countries, $F_{6, 327}=5.29$, $P<0.05$,
 10 $f=0.30$. *Post hoc* tests showed that players in Mexico accumulated more total hours in soccer
 11 activity compared to all other countries (all P 's<0.05), except for players in Ghana and Sweden
 12 (both P 's>0.05). Players in France accumulated fewer hours in soccer activity compared to those
 13 in Mexico and Sweden (both P 's<0.05).

14 *Childhood soccer activity.* Figure 1 contains the average hours per year spent by all
 15 participants in the three soccer activities across both age stages. Figures 2a to 2g show the average
 16 hours per year spent in the three soccer activities across both age stages by players in Brazil (2a),
 17 England (2b), France (2c), Ghana (2d), Mexico (2e), Portugal (2f) and Sweden (2g).

18 There was a main effect for activity, $F_{1,92, 615.87}=272.91$, $P<0.05$, $f=0.92$. *Post hoc* tests
 19 showed that the average hours per year during childhood in soccer-specific competition (mean
 20 value 37.1, $s=28.9$ h/yr) was lower compared with soccer-specific practice (mean value 185.7,
 21 $s=124.0$ h/yr) and soccer-specific play (mean value 186.0, $s=125.3$ h/yr) (both P 's<0.05). There
 22 was a main effect for group, $F_{6, 321}=3.72$, $P<0.05$, $f=0.27$, and a significant Group x Activity
 23 interaction, $F_{11,51, 615.87}=4.67$, $P<0.05$, $f=0.24$. *Post hoc* tests showed that the amount of soccer-

1 specific practice activity engaged in during childhood was greater in both Mexico and Sweden
2 compared to both Brazil and France (all P 's<0.05).

3 *Adolescent soccer activity.* There was a main effect for activity, $F_{1,852, 594.39}=617.43$,
4 $P<0.05$, $f=1.39$. *Post hoc* tests showed that the average hours per year during adolescence in
5 soccer-specific practice (mean value 411.9, $s=184.3$ h/yr) was greater compared with soccer-
6 specific competition (mean value 66.9, $s=48.8$ h/yr) and soccer-specific play (mean value 159.7,
7 $s=195.0$ h/yr) (both P 's<0.05). The average hours per year in soccer play activity during
8 adolescence was greater compared to competition ($P<0.05$). There was a main effect for group, $F_{6,$
9 $321=23.15$, $P<0.05$, $f=0.66$, and a significant Group x Activity interaction, $F_{11,11, 594.39}=23.98$,
10 $P<0.05$, $f=0.60$. *Post hoc* tests showed that the amount of soccer-specific practice activity engaged
11 in by players during adolescence was greater in Mexico compared to Brazil, England, Ghana and
12 Sweden, but was also lower in England compared to Brazil, France and Portugal (all P 's<0.05).
13 Moreover, *post hoc* tests showed the amount of soccer-specific play activity engaged in during
14 adolescence was greater in Portugal compared to each of the other six countries, whereas it was
15 greater in England compared to Brazil and France (all P 's<0.05).

16 *Other sports*

17 Table 2 shows the data for the number of other sports engaged in during childhood and
18 adolescence for players in each country and for the players combined. Other sports were engaged
19 in sometime during childhood or adolescence by 239 out of the 328 participants. During childhood,
20 229 of those players engaged in a mean of 2.32, $s=1.63$ other sports. Of the 229 players who engaged
21 in other sports during childhood, 107 of them did not engage in other sports during adolescence.
22 Moreover, 10 players began engaging in other sports for the first time during adolescence. During
23 early adolescence, 132 of the players engaged in a mean of 2.52, $s=1.76$ other sports. Players engaged

1 in 27 different additional sports overall. Table 3 shows the type of sports the players participated
2 in during their development.

3 One-way ANOVA revealed the number of other sports engaged in during childhood
4 differed across countries, $F_{6,228}=27.41$, $P<0.05$, $f=0.86$. *Post hoc* tests showed that the number of
5 other sports engaged in was greater for the 43 players in England who engaged in other sports
6 during childhood compared to all other countries (all P 's <0.05). The number of other sports
7 engaged in was greater for the 41 players in Sweden who engaged in other sports during childhood
8 compared to the 45 players from Brazil ($P<0.05$). Futsal was engaged in during childhood by 44
9 out of the 50 players from Brazil. They engaged in Futsal for a mean of 181.4, $s=161.9$ h/yr across
10 an average of 3.6, $s=1.78$ years of their childhood. One-way ANOVA revealed the number of other
11 sports engaged in during adolescence also differed across countries, $F_{6,131}=16.95$, $P<0.05$,
12 $f=0.90$. *Post hoc* tests showed that the number of other sports engaged in was greater for the 43
13 players in England who engaged in other sports during adolescence compared to all other countries
14 (all P 's <0.05), except for the two players from France who engaged in other sports during this
15 period ($P>0.05$).

16 Discussion

17 As predicted, players started in soccer during early childhood at approximately 5 years of
18 age. This finding supports previous research (Ford et al., 2009; Ward et al., 2007), which showed
19 that soccer players start the sport in early childhood. As expected, the childhood activities of
20 players did not follow the early diversification pathway. During childhood, not all players engaged
21 in additional sports and those that did engaged in a low number (mean=2). The soccer activity data
22 showed that the variables which construct the three developmental pathways are free to vary
23 independently of one another. Players engaged during childhood in relatively high amounts of
24 soccer-specific play activity which is associated with the early engagement pathway, although in

1 most countries they also engaged in relatively high amounts of soccer-specific practice during
2 childhood which is associated with the early specialisation pathway. The only players to follow the
3 strict definition of the early engagement pathway through relatively high amounts of soccer-
4 specific play activity and low amounts of soccer-specific practice during childhood were those in
5 Brazil. However, generally the developmental pathway for the elite soccer players across the
6 multiple countries and continents were relatively homogenous.

7 There was no evidence that the childhood activities of elite soccer players who were aged
8 under-16 years followed the strict definition of the early diversification pathway. The players in
9 this study who engaged in additional sports during childhood were shown to engage in an average
10 of two other sports. In studies used to support the early diversification pathway (e.g., Baker et al.,
11 2003; Soberlak&Côté, 2003), athletes have been shown to engage in six or more other sports. Only
12 the players in England engaged in a greater variety of other sports (mean=4) during childhood
13 compared to the other countries. The number of other sports found for players in England was
14 greater than that found in previous research with elite players in that country (mean=2 other sports,
15 Ford et al., 2009; Ward et al., 2007), but was still lower than the number found in studies used to
16 support the early diversification pathway (e.g., six other sports engaged in by elite ice hockey
17 players in Canada, Soberlak&Côté, 2003). In countries such as Australia, Canada and the United
18 States, the climate, type of primary sport and sports culture may encourage young athletes to
19 engage during childhood not only in the primary sport but also in multiple other sports.

20 The data for the elite soccer players in this study showed their engagement contained
21 elements associated with the early specialisation pathway. During childhood, the players began
22 supervised training with an adult, began playing in a league, began in an elite training academy,
23 engaged in very few other sports, and engaged in formal soccer activities. In certain countries,
24 some elements associated with the early specialisation pathway were greater compared to other

1 countries. For example, the amount of soccer-specific practice activity engaged in during
2 childhood was greater in Mexico and Sweden compared to Brazil and France. Between-country
3 differences in milestones and activities are likely to simply reflect differences in the youth
4 development systems of those countries. Countries with elite developmental academies that recruit
5 players at a young age generally had players who engaged in more practice and competition in
6 soccer during their childhood when compared to those who had less formal recruitment systems,
7 such as in Brazil. The relatively high amount of soccer-specific practice and competition engaged
8 in by players in most countries may lead to negative consequences later in life, such as reduced
9 health and injury (Law et al., 2007).

10 However, the activities of the players did not follow the strict definition of the early
11 specialisation pathway because they were engaging during childhood in relatively high amounts of
12 soccer-specific play activity. An engagement in relatively high amounts of soccer-specific play
13 activity during childhood is the basis of the early engagement pathway. Finding supports previous
14 research with elite soccer players in England (Ford et al., 2009; Ward et al., 2007) and Brazil
15 (Salmela et al., 2004; Salmela & Moraes, 2003) who also engaged in relatively high amounts of
16 soccer-specific play activity in childhood. An engagement in soccer-specific play activity during
17 childhood could benefit players in at least three ways. First, because such play activity is assumed
18 to be fun it may protect them against the negative consequences of engaging in practice and
19 competition in the primary sport during childhood, such as burnout (Côté et al., 2007). Second,
20 because the play activity is assumed to be fun and enjoyable it may provide players with the
21 motivation to engage further in the domain in adolescence. Third, elite players who accumulate
22 more time in soccer-specific play activity during childhood have been shown to have superior
23 decision making compared to those who accumulate less of that activity (Williams et al., 2011).

1 As predicted, players first engaged in elite training academies in late childhood at 12 years
2 of age. The present findings supported previous research (Ford et al., 2009), showing that soccer
3 players start in the elite training academy in late childhood or early adolescence. Start age for
4 participation in elite academies was earlier in England compared to all other countries, whereas it
5 was earlier in Portugal compared to Brazil, France, Mexico, Portugal and Sweden. The early
6 engagement, diversification and specialisation pathways all predict that elite adolescent athletes
7 engage in relatively large amounts of practice in the primary sport and reduce the amounts of play
8 activity in that sport during adolescence. The present data support that prediction, as players
9 engaged in significantly more average hours per year in soccer-specific practice activity (i.e.,
10 around 10 hrs/wk across a 40 wk season) compared to soccer-specific play. The amount of soccer-
11 specific practice activity engaged in by players during adolescence was greater in Mexico
12 compared to Brazil, England, Ghana and Sweden, whereas it was lower in England compared to
13 Brazil, France and Portugal. Between-country difference in the youth development systems may
14 explain these differences in activity amounts.

15 The present data only describe the activities, pathways and youth development systems for
16 soccer in Brazil, England, France, Ghana, Mexico, Portugal and Sweden. There are a number of
17 problems with merely describing the activities that elite athletes engage in during their
18 development. First, it does not follow that the described developmental activities of elite soccer
19 players are optimal or even necessary for the attainment of expert performance in adulthood.
20 Soccer clubs appear to identify and select players in early childhood into ‘talent development’
21 programmes in which the children must engage in relatively high amounts of soccer-specific
22 practice and competition. The correlation between high amounts of soccer activity and the
23 attainment of elite status does not show that the activity caused the attainment. However, the

1 description of the youth development systems and pathways that elite players engage in is at least
2 the first step in identifying what factors may be sub-optimal and may require change.

3 A number of well-respected authors have raised significant concerns that children engaging
4 in high amounts of sport-specific practice and competition as per the data in the present study will
5 experience several negative consequences, including burnout, dropout, overuse injuries and lower
6 levels of attainment (Baker et al., 2009). Of particular importance to this issue is the data collected
7 in the present study from the players in Brazil (see Figure 2a). The developmental activities of the
8 elite soccer players in Brazil did not follow the early specialisation or diversification pathway.
9 They accumulated very low amounts of soccer-specific practice and competition during childhood,
10 and did not generally engage in additional sports. Their developmental activities during childhood
11 followed the strict definition of the early engagement pathway. They accumulated a relatively high
12 amount of time in soccer-specific play activity and Futsal during childhood. Players who
13 accumulated relatively high amounts of hours in soccer-specific play activity during childhood have
14 been shown to possess superior decision making (Williams et al., 2011), higher levels of
15 attainment (Ford et al., 2009; Ford & Williams, 2012) and possibly increased positive motivation
16 (Côté et al., 2007) compared to those who do not. These players only began to accumulate
17 relatively high amounts of soccer-specific practice and competition in early adolescence.

18 The data from Brazil shows that elite soccer players may not have to engage in high
19 amounts of soccer-specific practice and competition during childhood, rather, they engaged in
20 relatively high amounts of soccer-specific play activity during this period. When coupled with the
21 significant concerns (Baker et al., 2009) over children engaging in the early specialisation pathway
22 through relatively high amounts of time in practice and competition in a single sport, we suggest
23 that a more optimal strategy may be for child soccer players to engage in the sport predominately
24 through soccer-specific play activity as per the players in Brazil. In other countries this may

1 involve not only the traditional informal play activity, but also formal play activity that is
2 scheduled and guided by coaches.

3 Second, the present data only describe the developmental activities of players up to the
4 under-16 age group and it remains possible that none of these players will become professional
5 players in adulthood. In future researchers should seek to use expert adult athletes as participants.
6 Moreover, the sample used in this study were from a limited number of youth academies in each
7 country and the possibility exists that the development of these players is not fully representative
8 of other players in that country. Third, a range of factors other than the developmental activities
9 described in this study may have caused the players' level of attainment and skill acquisition.
10 These include an individual's relative age compared to peers in their selection year (for a review,
11 see Copley, Baker, Wattie & McKenna, 2009), where an individual is born (Baker & Logan, 2007;
12 Côté, Mac Donald, Baker & Abernethy, 2006), their genetic profile (Bray et al., 2008), the
13 microstructure of practice (Ford et al., 2010), the social environment surrounding the athlete
14 (Carlson, 1988), among many other factors. These factors were not controlled for in the present
15 study and demonstrate the complexity of the process of developing expert athletes.

16 In summary, the developmental activities of elite soccer players aged under-16 years from
17 Brazil, England, France, Ghana, Mexico, Portugal and Sweden were shown to follow both the
18 early specialisation and early engagement pathway, but not the early diversification pathway.
19 During childhood, the players engaged in relatively high amounts of soccer-specific practice and
20 play, whereas not all of them engaged in additional sports and those that did engaged in a low
21 number. During early adolescence, they engaged in relatively high amounts of soccer-specific
22 practice.

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References

- 1
2 Abbott, A., Button, C., Pepping, G. J., & Collins, D. (2007). Unnatural selection: Talent
3 identification and development in sport. *Nonlinear Dynamics, Psychology, and Life*
4 *Sciences, 9*, 61-88.
- 5 Baker, J. (2003). Early specialization in youth sport: A requirement for adult expertise? *High*
6 *Ability Studies, 14*, 85-94.
- 7 Baker, J. & Logan, A. J. (2007). Developmental contexts and sporting success: birth date and
8 birthplace effects in national hockey league draftees 2000-2005. *British Journal of Sports*
9 *Medicine, 41*, 515-517.
- 10 Baker, J, Cobley, S., & Fraser-Thomas, J. (2009). What do we know about early sport
11 specialization? Not much! *High Ability Studies, 20*, 77–89.
- 12 Baker, J., Côté, J. & Abernethy, B. (2003). Learning from the experts: Practice activities of expert
13 decision makers in sport. *Research Quarterly for Exercise and Sport, 74*, 342-347.
- 14 Berry, J., Abernethy, B. & Côté, J. (2008). The contribution of structured activity and deliberate
15 play to the development of expert perceptual and decision-making skill. *Journal of Sport &*
16 *Exercise Psychology, 30*, 685-708.
- 17 Bray, M. S., Hagberg, J. M., Pérusse, L., Rankinen, T., Roth, S. M., Wolfarth, B., et al. (2008).
18 The human gene map for performance and health-related fitness phenotypes: The 2006-2007
19 update. *Medicine and Science in Sports and Exercise, 41*, 34-72.
- 20 Carlson, R. (1988). The socialization of elite tennis players in Sweden: An analysis of the players'
21 backgrounds and development. *Sociology of Sport Journal, 5*, 241-256.
- 22 Cobley, S., Baker, J., Wattie, N., & McKenna, J. (2009). Annual age-grouping and athlete
23 development. A meta-analytical review of relative age effects in sport. *Sports Medicine, 39*,
24 235-256.

- 1 Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). New York:
2 Lawrence Erlbaum.
- 3 Côté, J. (1999). The influence of the family in the development of talent in sport. *The Sport*
4 *Psychologist, 13*, 395-417.
- 5 Côté, J., & Hay, J. (2002). Children's involvement in sport: A developmental perspective. In J. M.
6 Silva & D. Stevens (Eds.), *Psychological foundations of sport* (pp. 484–502). Boston: Allyn
7 and Bacon.
- 8 Côté, J., Baker, J. & Abernethy, B. (2007). Practice and play in the development of sport expertise.
9 In R. C. Eklund & G. Tenenbaum (Eds.), *Handbook of sport psychology* (3rd ed., pp. 184-
10 202). Hoboken, NJ: Wiley.
- 11 Côté, J., Ericsson, K. A. & Law, M. P. (2005). Tracing the development of athletes using
12 retrospective interview methods: A proposed interview and validation procedure for reported
13 information. *Journal of Applied Sport Psychology, 17*, 1-19.
- 14 Côté, J., Mac Donald, D., Baker, J., & Abernethy, B. (2006). When where is more important than
15 when: Birthplace and birthdate effects on the achievement of sporting expertise. *Journal of*
16 *Sports Sciences, 24*, 1065-1073.
- 17 Davids, K. & Baker, J. (2007). Genes, environment and sport performance: Why the nature-
18 nurture dualism is no longer relevant. *Sports Medicine, 37*, 961-980.
- 19 Durand-Bush & Salmela, J. H. (2002). The development and maintenance of expert
20 performance. *Journal of Applied Sport Psychology, 14*, 154-171.
- 21 Ericsson, K. A., Krampe, R. T. & Tesch-Römer, C. (1993). The role of deliberate practice in
22 the acquisition of expert performance. *Psychological Review, 100*, 363-406.
- 23 Fédération Internationale de Football Association, FIFA. (2011). *FIFA/Coca-Cola World*
24 *Ranking*. Retrieved on 30th August, 2011 from

- 1 [http://www.fifa.com/worldfootball/ranking/lastranking/gender=m/fullranking.html#confeder](http://www.fifa.com/worldfootball/ranking/lastranking/gender=m/fullranking.html#confederation=0&rank=207)
2 [ation=0&rank=207](http://www.fifa.com/worldfootball/ranking/lastranking/gender=m/fullranking.html#confederation=0&rank=207).
- 3 Ford, P. R. & Williams, A. M. (2012). The developmental activities engaged in by elite youth
4 soccer players who progressed to professional status compared to those who did not.
5 *Psychology of Sport and Exercise, 13*, 349–352.
- 6 Ford, P. R., Hodges, N. J., & Williams, A. M. (in press). Creating champions: The development of
7 expertise in sports. In S. Kaufmann & D. K. Simonton (Eds.), *Beyond "talent or practice?"*:
8 *The multiple determinants of greatness*. Oxford University Press: Oxford.
- 9 Ford, P. R., Low, J., McRobert, A. P., & Williams, A. M. (2010). Developmental activities that
10 contribute to high or low performance by elite cricket batters when recognizing type of
11 delivery from bowlers' advanced postural cues. *Journal of Sport & Exercise Psychology 32*,
12 638-654.
- 13 Ford, P. R., Ward, P., Hodges, N. J., & Williams, A. M. (2009). The role of deliberate practice and
14 play in career progression in sport: The early engagement hypothesis. *High Ability Studies*,
15 20, 65-75.
- 16 Ford, P. R., Yates, I., & Williams, A. M. (2010). An analysis of practice activities and instructional
17 behaviours used by youth soccer coaches during practice: Exploring the link between
18 science and application. *Journal of Sports Sciences, 28*, 483-495.
- 19 Girden, E.R. (1992) . *ANOVA: Repeated measures. Sage University Papers Series on Quantitative*
20 *Applications in the Social Sciences (84)*. Thousand Oaks, CA: Sage .
- 21 Helsen, W. F., Starkes, J. L. & Hodges, N. J. (1998). Team sports and the theory of deliberate
22 practice. *Journal of Sport & Exercise Psychology, 20*, 12-34.

- 1 Law, M. P., Côté, J. & Ericsson, K. A. (2007). Characteristics of expert development in rhythmic
2 gymnastics: A retrospective study. *International Journal of Sport and Exercise Psychology*,
3 5, 82-103.
- 4 Monsaas, J. A. (1985). Learning to be a world-class tennis player. In B. S. Bloom (Ed.),
5 *Developing talent in young people* (pp. 211-269). New York: Ballantine.
- 6 Moesch, K., Elbe, A. M., Hauge, M. L. T., & Wikman, J. M. (2011). Late specialization: the key to
7 success in centimeters, grams, or seconds (cgs) sports. *Scandinavian Journal of Medicine*
8 *and Science in Sports*.21, e282–e290.
- 9 Salmela, J. H., Marques, M. P., & Machado, M. (2004). The informal structure of football in
10 Brazil. *Insight*.7 (1) 17-19.
- 11 Salmela, J. H. & Moraes, L. C. (2003). Development of expertise: The role of coaching, families,
12 and cultural contexts. In *Expert performance in sports: Advances in research on sport*
13 *expertise* (Eds. J.L. Starkes & K.A. Ericsson), pp. 275-294, Champaign IL.: Human Kinetics.
- 14 Soberlak, P. & Côté, J. (2003). The developmental activities of elite ice hockey players. *Journal of*
15 *Applied Sport Psychology*, 15, 41-49.
- 16 UEFA (2010). *Protection of young players*. Accessed on 06 February, 2012, at
17 <http://www.uefa.com/uefa/footballfirst/protectingthegame/youngplayers/>
- 18 Ward, P., Hodges, N. J., Starkes, J. L. & Williams, A. M. (2007). The road to excellence:
19 Deliberate practice and the development of expertise. *High Ability Studies*, 18, 119 - 153.
- 20 Williams, A. M., Bell-Walker, J., Ward, P., & Ford, P. R. (2011). Perceptual-cognitive expertise,
21 practice history profiles and recall performance in soccer. *British Journal of Psychology*.
- 22 Williams, A. M. & Hodges, N. J. (2005). Practice, instruction and skill acquisition in soccer:
23 Challenging tradition. *Journal of Sports Sciences*, 23, 637 -650.