6

An Uneven Playing Field: Talent Identification Systems and the Perpetuation of Participation Biases in High Performance Sport

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Introduction

The two predominant discourses on elite athlete development have described athletic talent as primarily the result of innate abilities (i.e., nature) *or* extensive practice and experience (i.e., nurture). Either discourse can be used to justify identifying precocious athletic abilities (i.e., talent identification) or beginning structured training/practice (i.e., talent development) at very young ages. However, greater emphases on talent identification and development early in childhood increase the possibility of suboptimal outcomes from both participation in sport generally, and talent identification and development in particular. In addition to the well-known consequences of over-pressurized environments for youth, such as lack of enjoyment, burnout and eventual dropout from sport (Fraser-Thomas et al. 2008; Goodger et al. 2007), biases within sports systems with respect to how talent is identified and developed can

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exert substantial influence on athlete development at early stages of skill development. First, athletes can be spuriously identified as talented or untalented; an example of type I (false positive) and type II errors (false negative). Second, if certain groups have an advantage over other groups at an early stage in life, the practices inherent to early talent identification and development (i.e., early training) can widen the gap between these groups in terms of skill development. Both of these limitations intrinsic to talent identification and development systems increase the risk of bias in high performance sport.

In this chapter, we describe a framework for understanding how biases in athlete development emerge between advantaged and disadvantaged youth. Specifically, we propose conceptualizing biases using the theory of Life Cycle Skill Formation (LCSF; Cunha and Heckman 2008; Cunha et al. 2006) and review three significant biases on athlete development: relative age, birthplace effects and socioeconomic status, all of which are specific to the developmental environment of high performance sport. We conclude with a discussion on the processes that perpetuate bias in high performance sport and suggest several directions for future research in this area.

Life Cycle Skill Formation: A Framework for the Uneven Playing Field

The framework of LCSF proposed by Nobel Laureate James Heckman and colleagues has been particularly useful for understanding differences in educational and health outcomes between advantaged and disadvantaged youth (Cunha and Heckman 2008; Cunha et al. 2006). In particular, this body of research has observed that differences between advantaged and disadvantaged youth, in terms of cognitive (i.e., intelligence) and non-cognitive skills (e.g., motivation), can occur very early in childhood. Then, initial gaps in skills/abilities at young ages widen over time, partly because a person's current skill level makes it possible/easier to acquire later skills in an additive manner. For example, there is evidence that the inability to secure a loan for higher education restricts very few (approx. 8%) families from sending their adolescents to the

university (see Carneiro and Heckman 2003). Instead, individuals are primarily disadvantaged by their early developmental environments, which did not promote or invest in cognitive and non-cognitive skills, creating a deficit in their abilities at the end of secondary school education. Consequently, the research by Heckman and colleagues suggests that early interventions can improve cognitive, psychosocial and health outcomes (i.e., promote school attendance, reduce crime and teenage pregnancy and increase workforce productivity), and ultimately reduce the gap between advantaged and disadvantaged groups. In addition, because skills (cognitive and non-cognitive) acquired at one period of development are necessary building blocks for skills learned later in development, the framework of LCSF proposes that investments in disadvantaged populations have the highest impact when they are made early in the lifespan (see Heckman 2006).

As a result of this research, Heckman and colleagues have identified a number of features important to life cycle skill formation (Cunha et al. 2006):

1. *Sensitive periods*: Some stages during the life cycle are more productive to skill formation.
2. *Self-productivity*: Skills produced at one stage of development facilitate attaining skills at later stages of development.
3. *Complementarity*: Skills produced at one stage of development increase the productivity of investments made at later stages of development. In addition, investments made early during development increase the productivity of (or 'complementarity' of) investments made at later stages of development.
4. *Multiplier effects*: Together, self-productivity and complementarity produce multiplier effects whereby current abilities beget later abilities. In addition, this suggests that equity-efficient trade-offs exist: investments made later in life produce lower returns without investments made early in life.

Emphases on talent identification and development practices in sport at young ages may create contexts where differences between advantaged and disadvantaged groups appear early in life. We propose that the gaps

between advantages and disadvantaged groups are created and reinforced as a result of the LCSF features of *sensitive periods, self-productivity*, *complementarity*, and *multiplier effects* (Cunha et al. 2006). The following sections review three biases in athlete development between advantaged and disadvantaged youth: relative age, birthplace effects and socioeconomic status.

Relative Age

One of the most consistent and pervasive biases identified in sport is the 'relative age effect' (see Cobley et al. 2009), which refers to differences in chronological age (and as a result physical and cognitive maturation) between members of the same age cohort. In many youth sport systems worldwide, young athletes are grouped into age divisions using a selection, or cut-off date, to determine eligibility for participation. For example, with a selection date of December 31st, athletes must turn a particular age (e.g., 6 years old) by December 31st of the current season of play in order to be eligible to play in a specific division. Naturally, a child born immediately prior to the selection date deadline (i.e., the end of December) will be almost 12 months younger than a peer born earlier in that selection year (i.e., January). This difference in age between members of a cohort has been termed relative age and the consequences of those differences are known as relative age effects (RAEs: Cobley et al. 2009).

Ultimately, relatively older children have advantages over their relatively younger peers. For example, a 12-month relative age difference among 6-year-olds represents a 17% difference in accumulated lived experience, which may include informal experience playing games and sports (comparatively, a 12-month relative age difference among 16-year-olds only represents a 6% in total lived experience). Importantly, by virtue of the chronological differences in age between relatively older and younger youth, there are also probabilistic differences in growth and maturation.[1] Research suggests that youth selected to competitive sports teams are physically larger and more mature for their age. For example, a sample of 9–10-year-old competitive ice hockey players was found to

have mean values of height and weight at approximately the 75th percentile, compared to standard growth charts of children the same age (Baker et al. 2010).

Samples of youth athletes almost exclusively demonstrate RAEs (see Cobley et al. 2009 for a review), strongly suggesting that these effects emerge because of advantages to relatively older youth who are more likely to be larger by virtue of their older chronological age. There is no evidence that relatively older youth are naturally better athletes; they are merely advantaged by favourable circumstance. In the case of RAEs, the favourable circumstance is the alignment between a *sensitive period* and early talent identification. The fact that RAEs emerge very early during childhood suggests that the *sensitive periods* for when these (dis)advantages influence athlete development are early in the lifespan. Evidence suggests that coaches preferentially select athletes who have a size and maturation advantage over their peers and/or that larger athletes have performance advantages over less physically developed peers (i.e., maturation-selection: Cobley et al. 2009). Furthermore, RAEs continue to exist beyond the point where relative age is itself meaningful, which suggests that those selected early to competitive/high performance youth sport subsequently receive better coaching and more opportunities (Musch and Grondin 2001); these are all essentially investments that reinforce the process of self-productivity and complementarity, and help to perpetuate RAEs. Although athletes not selected to the highest performance streams might eventually 'catch-up' in terms of physical growth and maturation, the process of their skill formation has not benefited from the same rate of self-productivity and complementarity as those selected to youth sport because of early-life advantages. Furthermore, according to the theory of LCSF and the feature of complementarity, the investment/resources needed to address the problem may not be cost effective or realistic once athletes reach adolescence.

However, like many things, RAEs cannot be solely explained by a single variable (i.e., physical maturation), or decontextualized from important environmental constraints. Wattie and colleagues (Wattie et al. 2015) have suggested that in order to understand RAEs, the characteristics of the socio-cultural/physical environment, individual athletes' characteristics and the demands of specific sports all need to be considered.

One of the examples described in Wattie and colleagues' review highlights this point nicely. In female gymnastics and artistic sports, reverse-RAEs have been observed, with over-representation of relatively *younger* athletes (Wattie et al. 2014; Hancock et al. 2015). This may be the result of a number of factors, including performance advantages to those with greater strength to weight ratios, dropout among relatively older (early maturing) participants and social norms. This example highlights that characteristics of the performer (i.e., sex), the characteristics of the sport (i.e., advantage to higher strength to size ratio), and environmental factors (i.e., social norms) are all important to understanding specific RAEs and the process of LCSF.

While the causes of RAEs may be context-specific, the breadth of this phenomenon is nevertheless impressive. RAEs have been identified in many sports (e.g., ice hockey, soccer, rugby, tennis, basketball) and in many countries around the world (for reviews of RAEs in sport see Cobley et al. 2009; Musch and Grondin 2001; Wattie et al. 2015). Ultimately, however, what RAEs exemplify is that early maturational advantages (predominantly experienced by relatively older youth), coupled with emphases on talent identification and development at early life stages, create sensitive periods during which early gaps in skill development appear, and can become reinforced across the lifespan.

Birthplace

Over the past decade, the size of an athlete's birthplace has emerged as a predictor of becoming an elite athlete. This effect has been strongly supported in North American and Australian samples and highlights the inadequacies of athlete identification and development systems that assume all geographic areas are similar. In one of the first studies to explicitly explore this effect in elite sport (although see Carlson 1988; Curtis and Birch 1987; Rooney 1969), Côté et al. (2006) examined geographical distributions of professional athletes compared to the general population. They noted that athletes coming from large urban areas (> 500,000 inhabitants) or small rural communities (< 1000 inhabitants) were significantly under-represented at the professional level. For

instance, approximately 1% of the US population live in towns with between 50,000 and 99,999 residents, but 10–17% of professional hockey, basketball, baseball and football athletes come from towns of this size (Côté et al. 2006; MacDonald et al. 2009). This general effect, that very large and very small centres may disadvantage some athletes, has since been replicated in samples ranging from players drafted to play in the National Hockey League to participants at the Olympic Games (see MacDonald and Baker 2013 for a full review). However, there is some evidence that the effect may not be generalizable to all contexts, as evidenced by variable trends among European athletes (Baker et al. 2009). As such there is a need to study the generalizability of this effect and its possible mechanisms.

Similar to RAEs, it is highly unlikely that children from very large and very small centres are naturally poorer athletes than those from medium-sized regions. And while the mechanisms underpinning these effects are largely unknown, it is likely that during sensitive periods (early childhood) the socio-cultural and physical environmental characteristics of medium-sized regions represent a form of early life investment in athlete development. MacDonald and Baker (2013), in their review of birthplace effects, reviewed possible mechanisms such as the 'big-fish-little-pond effect' proposed by Marsh and his colleagues to explain the development of self-concept (see Marsh et al. 2008)—a variable that may be significant in understanding long-term skill acquisition and athlete development. Marsh's work suggests that the environments of athletes from small to medium size centres may be optimal for the development of positive self-concept, which is associated with skill development and performance (see Marsh and Perry 2005). In addition, Bale (2003) has suggested that the cultural identity of smaller cities can be very explicitly tied to sport, which may socialize youth towards participation and enjoyment of participation. Both of these hypothesized mechanisms are congruent with the general notion that early investments in non-cognitive skills (i.e., self-concept, motivation, enjoyment, and beliefs resulting from socialization) are important to the overall process of skill formation.

It is also possible that environmental characteristics provide an early life advantage to those that live in medium-sized regions. Curtis and

Birch (1987) suggested that medium-sized cities might be large enough to have physical resources (i.e., sport facilities), but not so many people that the demand for those physical resources outweighs the availability. As such, youth in medium-sized regions may have more opportunity (and encouragement) to practise, compete and develop their abilities. On the other hand, athletes from geographic regions outside this optimal range may have more limited competition to play against, in the case of athletes from small rural areas, or too much competition, in the case of athletes from large urban centres.

As a result of *complementarity*, these early life investments in a variety of different skills important for athlete development may ultimately increase the impact of investments in athlete development at later stages of development—even once athletes are no longer physically located in their 'birthplace'. Hence why the birthplace place effect can be observed at elite adult levels sport (e.g., professional hockey: Côté et al. 2006), well after players have left their favourable developmental environments.

While these explanations are reasonable, they alone cannot explain the different findings between North American and European nations, especially given the international stability of the 'big fish little pond' effect (Marsh and Hau 2003). Therefore, other cultural and/or social variables undoubtedly contribute to the effect. In their study of birthplace effects in Olympic samples from Germany, Canada, the United States and the United Kingdom, Baker and colleagues (Baker et al. 2009) considered whether population density, which differs considerably between North American and European nations, might help to explain differences between countries. Their results, while inconclusive, emphasize the need to consider specific constraints related to the geographic regions under examination. While work in this area continues, existing evidence suggests opportunities for athlete development differ considerably between regions.

Socioeconomic Status

There is also evidence that access to financial resources and socioeconomic status (SES) limit an individual's likelihood of becoming a high

performance athlete. Income is significantly related to sport participation in the general population. For example, the General Social Survey explored the net (before tax) household income of Canadians and found that 58% of Canadian children from households that earn less than $40,000 (before tax) participate in sport, while this rises to 85% for children from households that earn over $80,000 (before tax) (Canadian Heritage 2013). To put this in perspective, in 2012, the median income of 25,797,510 taxable Canadians was $31,320/year (Statistics Canada 2014). Overall, 54.5% of Canadians earned less than $35,000/year, and 70.6% earned less than $50,000/year. If we consider the dramatically greater likelihood of sport participation among children from households earning $80,000/year (Canadian Heritage 2013), it is striking that approximately only 14% of Canadians have an annual income greater than or equal to $75,000 (Statistics Canada 2014).

While the relationship between SES and sport participation in the general population has been well documented, these aggregate data do not provide information about biases related to high performance sport. To date, there has been little research that has considered whether the relationship between SES and Canadian high performance sport is consistent with the trends observed in the general population. The notable exception is a study by Beamish (1990), which explored Canadian national team athletes and athletes funded by the federal government in 1986 and 1987. He observed that 44% of Canadian high performance came from families with incomes in the top 20% of Canadian incomes, while only 10% of athletes came from the bottom 20% of Canadian earners. Similarly, there was a significant overrepresentation of Canadian high performance athletes whose fathers were at the highest range of scores on an index of occupational prestige/achievement (i.e., the Blishen index of the male labour force; an index comprised of occupation, income, education and a prestige score). Therefore, the available evidence suggests that the relationship between SES and athlete development in Canadian high performance sport mirrors the relationship between SES and sport participation in the general population. Indeed, SES appears to be a predictor of sport participation across life stages, beginning at the earliest stages of

participation. While informative, the stability of the SES-athlete development effect in contemporary samples of Canadian high performance athletes is unknown. However, the available evidence suggests that higher SES eliminates the financial barriers to participation and provides children with the greater opportunity to participate in activities that allow them to develop their athletic abilities. In addition, research from counties such as the United Kingdom also suggests that high performance athletes are more likely to emerge from affluent households while lower SES youth are under-represented (see Collins and Buller 2003). High SES parents have the means to make greater investments in their child's formation of athletic abilities at early ages through enrollment in activities (or multiple activities), and at later ages through access to specialized coaches and purchase of equipment.

Going forward, it may also be important to explore whether there are sensitive periods of development when financial resources are particularly influential on the overall process of athlete development. For example, White and McTeer (2012) summarized a number of different ways[2] that SES might influence sport participation. It may be that SES is a constant influence on sport participation, with no particular sensitive periods. Alternatively, financial barriers may only be particularly important during early childhood and these barriers decrease as youth progress from childhood to adolescence, or vice versa (i.e., financial barriers may not be impactful during early childhood, but do become salient during adolescence). White and McTeer's (2012) analysis suggests that the main barriers to participation imposed by SES constraints are during childhood (not adolescence). The authors suggest that opportunities to participate in sport at young ages can socialize children to value active living, and that this may partially explain the SES-sport participation trends observed subsequent to childhood among adults. However, it is important to note that this research did not distinguish between different levels of sport (i.e., recreational vs high performance sport). As such, while socialization to active living and other psychosocial outcomes (enjoyment and intrinsic motivation) may be important products of early sport participation facilitated by SES, it is possible that financial resources are important

throughout athlete development (i.e., the persistent model), as the cost of increasingly specialized training, coaching and equipment increases with the level of competition/participation.

In addition, it will also be important to consider how SES is categorized. For example, the highest SES (family income) category within the study by White and McTeer (2012) was '$40,000 or more'. The authors themselves acknowledge that this categorization may have been too broad to capture important variability between different income levels, something that may be particularly salient to high performance sport participation, which has extraordinary costs (see Campbell and Parcels 2013).

Understanding how SES impacts athlete development, particularly in contexts where talent development and identification begin early in life, will be increasingly important: Income inequality in Canada has been increasing since the 1990s (Conference Board of Canada 2011), which may have significant implications for athlete development and the perpetuation of biases within high performance sport.

Moving Forward

Biases such as relative age, birthplace and SES illustrate the inherent complexity of athlete development in high performance sport and emphasize the influence system-specific constraints can have on developmental outcomes. While factors such as genetics and extensive training are clearly necessary for athletic success, biases such as the ones outlined in this chapter can limit the extent to which primary factors can be manifested and facilitated (see Baker and Horton 2004). These biases also demonstrate that the notion of sport as a meritocracy (i.e., that progress is the sole result of ability and merit) is clearly a fallacy, since athlete development is at least partially the result of being advantaged by factors such as policy, developmental environment and/or wealth.

There are many questions about the mechanisms of participation biases on athlete development that remain unanswered. However, the LCSF framework provides a single framework with features and language

to explicitly acknowledge how biases are created and perpetuated throughout athlete development stages. In addition, it allows for the possibility of quantifying the cost effectiveness of interventions in disadvantaged groups at different life stages. For example, in future relative age interventions it could be possible to quantify the return on, or cost effectiveness of, investments made later in adolescents versus earlier in life with respect to eliminating RAEs. However, there are some important differences between previous use of the LCSF framework and its use in the context of athlete development. While there is substantial support for LCSF as it relates to the formation of cognitive (e.g., IQ) and non-cognitive skills (e.g., motivation, socio-emotional intelligence etc.), and how these skills influence a number of educational and health outcomes, there are some notable differences between those contexts and those of sport. While the cognitive and non-cognitive skills described by previous work are undoubtedly important to athlete development, going forward, it will be necessary to consider how an athlete's physical characteristics (i.e., size) should be considered within this framework of skill formation. It may also be necessary to add *physical skills* (or attributes) to the existing cognitive and non-cognitive skills described by previous research.

It may also be important to study whether advantages associated with relative age, birthplace and SES create gaps in skill formation prior to the onset of organized sport participation, or whether gaps in skill formation only begin after the onset of participation. For example, there is some evidence that relatively older youth (or their parents) are more likely to self-select informal sport participation prior to any stage of participation where coaches select participants for teams (Delorme and Raspaud 2009; Hancock et al. 2013). Future research will need to establish a comprehensive understanding of when and how biases influence skill formation. Such information will be essential for calculating what kind of investments are needed to reduce or eliminate biases, what stages of development would be best to target for interventions and whether or not some of biases (e.g., relative age vs. SES) could be addressed more easily/cost-effectively than others.

Currently, we do not have the answers to these questions. This is problematic, since at its very core, not understanding the influence of such biases is a failure to understand *who* our athletes are, *where* our

athletes come from and *how* our athletes develop. Without this information it is very difficult to design equitable and efficient athlete development initiatives and to direct resources for maximum return and cost efficiency.

The biases summarized in this chapter highlight that Sport for All is unrealized in high performance sport. At some level high performance sport cannot be 'for all'. For example, high performance sport inherently involves increasing exclusionary practices at each stage of competition and the task constraints inherent to specific sports can exclude large segments of the population based on physical characteristics (e.g., height). However, the biases discussed in this chapter reflect social inequalities (i.e., relative age and SES) and fortuitous developmental environments that constrain equal opportunities for sport for all independent of the selectivity of high performance sport. Moreover, at least two of these biases (i.e., relative age and SES) have been shown to influence both recreational and high performance sport participation suggesting that understanding may create more equal opportunities within sport at multiple levels of participation. Going forward, it will be necessary to consider whether the investments needed to promote LCSF necessary for recreational participants differ from the investments needed to promote LSCF for high performance sport. While Sport for All remains a laudable goal, systematic change and a better understanding of the skill formation process may be required to ensure participation in sport is within the grasp of those interested in its pursuit.

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Notes

1. Although not directly measured or studied, researchers have speculated about the possible importance of relative age-related differences in cognitive maturation on athlete development (see Helsen et al. 2016).
2. Originally put forward by Chen et al. (2002) to describe the relationship between SES and children's health.

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