



Category: Identification and Nurturing the Talent



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THE ROLES OF NATURE AND NURTURE IN EXPERTISE IN SPORT

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It is often common for observers of athletic events to state that a successful participant is “talented.” This declaration is almost exclusively used to describe someone who consistently performs highly difficult acts correctly, or simple tasks exceedingly quick. The development of this capability is of great interest to a number of people in many domains. However, before a discussion of exceptional athletic capabilities can be examined, the term “talent” requires investigation. Once this is accomplished we can link the required parameters for the development of expertise in sport, which is conceptualized resulting from two global factors: nurture (i.e., environment, practice, etc.) and nature (i.e., genes, neural networks, etc.).

Among researchers and scientists, the questions surrounding the definition of “talent,” and what leads to highly skilled athletic performances, have stirred an intense debate. Sport performers, coaches, spectators, sponsors, and psychologists all have an interest in athletic talent, expertise, and the development of expertise. Any discussion regarding talent and expertise requires a definition of these terms. Unfortunately, the scientific literature offers little in terms of a universally agreed upon definition. One definition of “talent” states that talent must include the following five factors:

- A. It originates genetically
- B. It may not be fully apparent at an early age
- C. Early indications of talent provide a basis for predicting eventual expertise
- D. Only a few have it ,and
- E. It is relatively domain specific.

However all do not support the notion of talent but they do espouse the perspective that athletes develop expertise as a result of environmental factors such as intense training rather than some notion of innate “talent.” When asked to respond to Howe et al., a number of researchers replied that excluding innate abilities from the equation involving expertise development is probably inaccurate Working from this definition of talent it becomes more apparent that motor and physical skills, genetic factors, cognitive capabilities, perceptual abilities, self-efficacy beliefs, affective experiences, coping strategies, and the quality and amount of practice may each play a role in an athlete’s performance level. The extent of these factors’ roles in the development of expert athletic performance is of vital interest in the nature versus nurture debate. It is also important to differentiate between those who perform expertly and those who are experts in a field. Research has shown that experienced psychotherapists do not attain higher levels of successful patient treatment than do novice therapists (Dawes, 1994), and expert stock-market analysts and bankers cannot forecast market prices more reliably than university instructors and students . Therefore, expert performers are further defined as people who can consistently demonstrate a very high performance level relative to the general population in a particular domain;

As this definition pertains to sport, an expert athlete is one who performs at the highest level over an extended period of time. Literature regarding variables that account for, or contribute to expertise in sport



include research into knowledge, perceptual ability, biological and physiological characteristics, psychological characteristics, self-efficacy beliefs, and practice. The degree to which each of these factors impact the development of expert performance has led to much discussion.

Researchers tend to support the specific line maintained by their empirical results. However, a possibility exists that their views may be complimentary, rather than conflicting. The debate about the role of nature and nurture in the context of sport expertise and its development has existed for many years. Some researchers postulate that “nature,” i.e., an athlete’s physical gifts, innate ability, or “talent” (as it will be referred to throughout this chapter), plays a prominent role in obtaining exceptional success in sport, in addition to other performance domains. Others advocate the “nurture” perspective, i.e., performers become highly successful as a result of environmental factors such as intense training or familial influences. It is reasonable to surmise that the development and attainment of athletic expertise may well rely on a favourable natural predisposition and optimal nurturance for a particular domain. To argue that expertise is due to the predominance of either of these to the exclusion of the other may be flawed because it is likely that expertise in sport involves more than possessing an exceptional amount of knowledge in a particular athletic domain. Concurrently, it is likely that a lack of understanding in a specific sport context would exclude an athlete from becoming an expert in that domain. An individual’s genetic endowment is impacted by certain entry factors (e.g., motor and physical skills, cognitions, perceptions, self-efficacy, affect, and coping strategies) that influence the quality and amount of practice an individual may facilitative engage in. This engagement level then influences the individual’s performance, or achievement level.

Performance, in turn, affects the athlete’s alterable entry behaviours, completing a feedback loop that is unique for each individual, but similar among people. The literature on expertise in sport supports this integrated view and illuminates various reasons underlying the development of expertise in sport. Expert athletic performance involves a complex interaction among entry and environmental factors, including feedback systems that enable performance interpretation, which affect entry behaviours and inputs experienced by the athlete. Just as other types of systems, human systems constantly adapt to the environment so as to preserve their niche, or to expand it. Systems theory suggests that all behavior in the case of expert performance must be understood through the adaptive mechanisms utilized before trying to change or improve that behaviour. Scientific evidence provides support for each of these factors alone and for interactions among some.

A CONCEPTUAL OVERVIEW

Few researchers offer models that illustrate the involvement of specific factors in the development of expertise in sport. This review of the expertise development in sport literature begins with the research that supports the environmental view, and then the literature supporting the talent view. This is followed by a summary of the literature addressing the essential factors of expert performance in sport. The three most prominent pieces of research in the field are Bloom’s (1985) stages of talent development, Côté’s (1999) stages of sport participation, and Ericsson et al.’s (1993) notion of deliberate practice.

NATURE VS. NURTURE VIEW ON THE DEVELOPMENT OF EXPERTISE IN SPORT THE ENVIRONMENTAL VIEW

The athlete often participated in more than one sport activity, was excited about just participating, and relied heavily on the adults (e.g., parents and coaches) in his or her life for guidance and support. In this first stage, the future elite athlete was rarely, if ever, identified as destined for expertise in his or her field. This suggests a possibility that if adults in the life of the athlete emphasize the importance of winning and performance, or other “non-playful” goals, to an athlete in this stage, they are probably limiting the child’s chances for eventual high-level performance in that particular sport domain. In the middle years it was revealed that sport became much more serious to the athlete and his or her self-identity changed. Participants felt of themselves as “swimmers” or “tennis players,” rather than as people who swam or played tennis, while



other activities either decreased in importance or were abandoned altogether. The athlete became more achievement oriented during this stage and relied on his or her parents for moral and financial support.

In the late years, the athlete became almost obsessed with the chosen sport as it dominated his or her life. Motivation to attain the highest achievement levels in his or her sport became almost solely intrinsic. Coaches were highly respected task masters, while the parents' role decreased tremendously because the athlete assumed total responsibility for his or her own improvement. In his study, Côté (1999) interviewed four athletes who were 18 years of age. All were national level athletes for their age in their sport. Côté also interviewed 11 of the athletes' family members. Of specific interest was how the family dynamic influenced the development of expertise in sport. Based on his findings, Côté proposed three distinct stages of sport participation: (a) sampling, (b) specializing, and (c) investment stages.

In the sampling years, parents encouraged their children to participate in multiple sports with the goal of enjoyment, not achievement. Coaches and parents were interested in offering the young athlete "fun" opportunities, motor skill development, motivation, constructive values, a positive self-image, and enjoyable sporting experiences. Côté called this "deliberate play." Additionally, parents of three of the four athletes felt that their child had special talents in sport. This finding supported Dweck's (1986) contention that parents' beliefs may reinforce their children's beliefs, and perhaps self-efficacy, which is a determinant of progress and success. In Côté's second stage, the specializing years, each athlete limited participation to one, or perhaps two sports while increasing his or her commitment level. Social support from significant others (e.g., coaches, siblings, parents) supported the athlete's intrinsic enjoyment, and his or her ever increasing success influenced the decision to become more dedicated to the chosen sport. Practice became more structured and focused, while fun and excitement were retained. Parents increased their involvement in their child's sport during this stage, and increased their time and financial commitments to their child's efforts. Notably, this additional commitment on the parents' part seemed to be undertaken to offset any obligations the athlete might have had over and above those to school or sport. Additionally, older siblings often were perceived as role models, particularly in exhibiting a positive work ethic. During the third stage, the investment years, elite level performance was pursued. These years were much more intense than the previous specialization stage. Deliberate practice replaced deliberate play at this point. Parents continued to show great interest in their child's efforts by providing emotional and financial support. Extraordinary efforts in the area of the athlete's career often came at a price for other family members, but it is interesting to note that even though the parents were aware of their child rearing discrepancies they justified these with the belief that the potential accomplishments of the high achieving child were worth the tradeoff. In another recent study, Durand-Bush (2000) found support for Côté's model, while offering an additional fourth stage: maintenance. This stage occurred after Côté's investment stage, and was found in athletes who had achieved Olympic and World Championship gold medals. In this most advanced stage, the athlete felt a greater amount of external pressure resulting from being the best in his or her sport. Côté's (1999) model also contains a fourth stage, however, he calls it "the recreational years." In the recreational years, children who cannot, or who decide not to, invest what is necessary to reach elite levels of sport, enter a period where they practice one to several sports in order to experience enjoyment, personal growth, stay fit, and preserve an overall healthy life.

DELIBERATE PRACTICE :

Based on extensive work, Ericsson et al. (1993) introduced the concept of deliberate practice as a means to achieve expert performance. Ericsson et al. found that high levels of performance were reached in a gradual manner following many years of domain specific activities. Deliberate practice refers to those training activities that specifically address improvement of an individual's performance, and it requires specific parameters. There must be: (a) a well defined task with appropriate difficulty level, (b) high effort, and (c) opportunities for repetition and error correction. Additionally, deliberate practice is typically designed by an

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expert coach to optimize the athlete's training regimen. In other words, deliberate practice is any highly structured goal directed activity aimed exclusively at improving performance, and it is not necessarily inherently motivating or enjoyable. Therefore, it is important to note that, according to this concept, regular activity does not typically lead to improvement beyond some initial, short-term performance improvement. Support for this contention in sport contexts is found in studies with soccer players, wrestlers, and middle-distance runners. Limitations to the amount of deliberate practice one can engage in include (a) resource constraints (e.g., adequate time, energy, coaches, and facilities), (b) motivational constraints (i.e., the fact that deliberate practice is not inherently enjoyable, and therefore the athlete must be motivated by the potential of future improved performance), and (c) effort constraints, also known as learned industriousness (Eisenberger, 1998).

Additionally, the highest level of achievement in vigorous sport was typically in athletes' mid-to late. This illustrates that continued development often extends beyond the point of physical maturity, implying that situational experience is required for athletes to improve their performance. This view is that any healthy individual who engages in a sufficient number of hours of deliberate practice in a given field will become an expert in that field, and that his or her performances can be reproduced and verified. Ericsson (1998b) noted that any scientific progress in understanding expertise depends on the ability of observers and scientists to distinguish verifiable observations of specific behaviors from inferences about the mediation of general capacities. Ericsson (1998b) tempered the stand regarding reproducibility by stating: The probability of making a major innovation is so small that it is rare that the same individual will make more than a single one during their entire life. Thus, making a major innovation is not a reproducible superior performance for even the most eminent and accomplished scientists and artist. A shortcoming of the theory of deliberate practice itself lies in the three limitations to the amount of deliberate practice. Since all human beings are different to some degree (e.g., height, gender, bone structure, and eyesight), there are inherent differences between people that may require them to engage in different amounts of deliberate practice in order to achieve expert performance. It has been shown that endurance sports lead to physiological enlargement of the heart and to an increase in the heart wall's thickness, depending on the kind of endurance sport and on the intensity and extent of training. However, the adaptation of the heart may be modified by several factors including anthropometric parameters, gender, and genetic traits. Deliberate practice alone does not permit a person shorter than two meters in height to play center on an NBA basketball team, nor will the most optimal application of deliberate practice allow a female to run the 100m faster than the male Olympic Games champion in that event. Additionally, Gualdi-Russo and Graziani (1993) showed that different somatotypes correlate with performance level in some sport domains, with an increase in the mesomorphic component for those involved in sports such as ballgames and martial arts, and with a strong endomorphic component for athletes such as swimmers. Since people are different, they possess different predispositions. It is proposed that people's environments can influence their eventual performance level to a great degree, but not dictate it as genetic predispositions may greatly influence one's potential in a particular domain.

DELIBERATE PRACTICE IN SPORT CONTEXTS :

As this theory stated earlier, the amount of deliberate practice an individual engages in mediates the development of exceptional skill levels and physiological characteristics in elite performers. Additionally, Ericsson and Lehman (1996) contended that basic physiological adaptations permit extended intense practice thereby suggesting an additional factor involved in the deliberate practice model than is currently considered. Deliberate practice requires innovative, engaging, and/or diverting activities that allow the athlete to continually refine his or her performance using knowledge of results and feedback. As such, elite performers who compete in different sport domains are extremely rare and perhaps non-existent, although Christine Witty (USA Olympian in cycling and speed skating) is an example of one such athlete. Additionally, there are no

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immediate external rewards for deliberate practice as there are in other activities such as paid work. The amount of time an individual can commit to deliberate practice is limited. Optimal performance via deliberate practice in sport contexts requires extensive physical effort and mental concentration (i.e., quantity and quality), which is offset by periods of recovery. This is due to the highly taxing nature of deliberate practice in both physical and psychological dimensions. Therefore, the athlete must achieve a balance between bouts of deliberate practice and rest or recovery, which can be passive or active. This leads to the likely conclusion that an activity (e.g., rest) that is highly relevant to expert performance may be low in effort and concentration.

GENETIC FACTORS :

The literature on genetics supports both concepts of innate talent and environmental influences on expertise in sport. The following subsections review the genetic research in the areas of twins and adoptions, behavioral, cognitive, physical, physiological, maturational, and gene-environment interactions and correlations as they relate to the development of expertise in sport.

TWIN AND ADOPTION STUDIES

Research looking into twins and adoptions can be a rich source of investigating the genetic influences on expertise in sport, as well as other domains. If a person's genetic factors affect a particular trait, then monozygotic twins, who share 100% of their genetic material, should be more similar to each other than dizygotic twins, who, like ordinary siblings with the same parents, share on average only 50% of their genetic material. Adoption studies, on the other hand, involve determining the degree to which adopted individuals resemble both their biological relatives (an indication of genetic influences) as well as their adoptive families (an indication of environmental influences). A limitation of adoption studies is that adoptive homes are likely to under represent those who are living at the extremes of poverty. Therefore, the importance of environmental influences may be underestimated.

PHYSICAL CHARACTERISTICS :

In addition to behavioural characteristics, genetic factors also determine, to a large extent, various physical characteristics, which can play a large role in an athlete's performance level. Other research shows that many human anatomical and physiological characteristics adapt to intense practice, as do perceptual, motor, and cognitive competencies and studied the impact of stressful physical practices in a number of societies. Results showed that those societies with the highest stress levels had males who averaged two inches more in height, and females who reached menarche approximately two years earlier (i.e., 11 years as compared to 13). Apparently, changes within people can occur in order to adapt to the environment. However, it has also been posited that some biological factors can facilitate, while others limit, performance in particular sports e.g., a 6 foot tall 16 year old girl would probably not be a world class gymnast, and a cyclist with 65% fast-twitch muscle fibers could have difficulty finishing the Tour de France cycling race.

NATURE AND NURTURE INTERACTION :

The interaction between "nature" factors and "nurture" factors may be a vital issue. In fastball sports, it is commonly acknowledged that a large portion of expertise develops during childhood. Therefore, expertise in some contexts may be dependent upon an interaction between the athlete's physical development and his or her environment. Maturational and experiential factors that result in expertise in childhood may be the result of early behavioral adaptations. However, early development seems to be specifically associated with natural settings, since this development only appears in the laboratory under conditions that closely match those found in sport domains. These developments lead to the possible conclusion that changes associated with perceptual, cognitive, and motor functions are related to both the structural maturation of the brain, and to the emergence of organizational patterns nurtured by the athlete's interaction with his or her environment. However, few studies have examined this possible interaction.

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MATURATION :

Late sexual maturation of gymnasts and early maturation of swimmers suggests some form of sports-specific selection in young male athletes aged 8-19. Training did not appear to affect the young athletes' growth and development, rather their continued success in sport appeared to be related to inherited traits. Additionally, some research supports an interaction between practice at certain developmental stages and biological factors. For example, studies investigating performers in baseball, hockey, soccer, and tennis found that a higher proportion of elite performers were born in the months of the year which translated into these athletes being chronologically older than their peers when they participated in age grouped competition at younger ages. This suggests that enhanced self-efficacy may be impacted by an athlete's age relative to his or her peers. Additionally, research findings suggest that what coaches perceive to be early talent may be explained by physical precocity associated with a relative age advantage thereby supporting a mediating effect of the environment (i.e., coaches' perceptions) on maturation. A person may be more inclined to participate in an activity (i.e., sport) with more intensity (physically and mentally) if he or she is receiving positive feedback and encouragement from an adult who the athlete perceives to have a significant impact on his or her life.