Chapter VIII

Discussion and Conclusions
8.1 Development of a field hockey specific test battery

In chapters 2 and 3, attention is paid to how to measure the multidimensional performance characteristics important for high-performance in youth field hockey players. With a field hockey test battery the multidimensional performance characteristics can be measured practically, reliably, and with validity in talented youth field hockey players in a sports-specific way. This test battery consists of measurement of height, body mass, and percentage body fat, the Shuttle Sprint and Dribble Test (ShuttleSDT), the Slalom Sprint and Dribble Test (SlalomSDT), the Interval Shuttle Run Test (ISRT), the ‘Tactics in Sports’ questionnaire, and the Dutch Youth Version of the ‘Psychological Skills Inventory for Sports’ (PSIS-Youth). To avoid depending exclusively on the opinion of the trainer to measure tactical skills, it is recommended to apply the ‘Tactical Skills Inventory for Sports’ in stead of the ‘Tactics in Sports’ questionnaire in the future (see chapter 7).

8.2 Studies on the relation between multidimensional performance characteristics and performance level

In chapter 3, a study conducted within a group of all talented youth field hockey players is presented. The research question to be addressed was: which of the multidimensional performance characteristics; anthropometric, physiological, technical, tactical and / or psychological, makes it possible to discriminate between elite and sub-elite youth field hockey players? Results show that at the age of about fourteen years, an elite player as well as a sub-elite player has a high level of physiological characteristics, i.e. sprints fast over short distances, can perform these sprints repeatedly, is agile while sprinting and has a great interval endurance capacity. An elite player, however, distinguishes him/herself from a sub-elite player not on these physiological characteristics or on anthropometric characteristics but on excellent technical, tactical and psychological skills. Tactical skill, i.e., performing the right action at the right moment seems the most discriminating variable, followed by motivation. Although sub-elite players score high on motivation, elite players score even higher. This motivation seems essential for both their current and future performance.

In chapters 4 and 5, the talented players from the study presented in chapter 3, were followed over time by applying a longitudinal study design. The research question was: how do elite and sub-elite youth field hockey players develop their multidimensional performance characteristics across time? Results show that during the phase of talent development, players improve on all anthropometric, physiological, and technical performance characteristics. Except for the anthropometric characteristics where the development of elite and sub-elite
players is similar, elite players improve more rapidly than sub-elite players. With a longitudinal model for interval endurance capacity, scores on the Interval Shuttle Run Test can be predicted for elite and sub-elite boys and girls in field hockey in the age-band of 12-19 years. During adolescence both male and female elite youth players have a more promising development pattern of their interval endurance capacity than sub-elite youth players. A lower percentage body fat, more hours of additional training, and a greater motivation account for a more desirable development of the interval endurance capacity. Questionnaires were used as the measuring instrument for tactical and psychological skills in absence of other valid, reliable, and practicable instruments to measure these skills. To provide an external reference point, each player was to be compared to top players in their age-category. As a result of the nature of measuring instrument, however, it was difficult to draw conclusions about the development of those skills.

The studies on the relation between multidimensional performance characteristics and level of performance yield a hierarchy in the multidimensional performance characteristics important for success in field hockey. Tactics, motivation, and slalom dribble performance are the most important performance characteristics in distinguishing between elite and sub-elite youth players at the age of about 14 years. This hierarchy is in agreement with the results of a recent study on talent identification and development of talented water-polo players (Falk et al., 2004). Elite water-polo players at the age of 14-15 years were superior on most of the swim tasks, as well as on dribbling and game intelligence. This superiority was maintained throughout 2 years. The longitudinal data in chapter 4 show that at the age of 15 years and, again, at the age of 16 years, the performance characteristics from the hierarchy are still important. However, not only is the gap in test scores between elite and sub-elite players greater by that time, other performance characteristics as the interval endurance capacity additionally play a more prominent role in distinguishing between the two performance groups. Towards excellence, players have to meet increasingly high standards of achievement. In field hockey, as in most sports, there is a clear necessity for youth players to improve their performance level across a limited period of time. Different from actualizing for example musical or intellectual talents into excellence, players only have a relatively short period of time to perform at the highest level before the aging process causes a decline in their performance (Rowley, 1995).

The hierarchy in the multidimensional performance characteristics important for success in field hockey might change with time according to the evolution of the sport. Over historical time the absolute performance level of sports substantially increases. In some sports, the world records have improved by around 50% in the last century (Schulz and Curnow, 1988). The public, media, business and industry attach great importance to world-class performances
and this leads to growing sophistication of training, equipment, and facilities. In the last
decade in field hockey for example, new stick material, artificial playing surface (water-based
pitches) and the interchange rule made the game faster, increasing and changing the demands
of the players. This development of the sport may also change the relationship between
multidimensional performance characteristics and performance level.

8.3 Additional studies on talented athletes

The studies on the relation between multidimensional performance characteristics and
performance level in talented youth field hockey players show that psychological
characteristics distinguish elite from sub-elite talented youth field hockey players. One of the
most discriminating variables between both performance groups is motivation. Motivation is
not only essential for an optimal performance at a certain moment, i.e. in a match, training, or
test, but throughout the long process of developing a successful sports career. To investigate
whether this finding is specific for field hockey or can be generalized to other sports, a study
to reveal the relationship between psychological skills and performance level within talented
youth athletes in field hockey, basketball, volleyball, speed skating, and swimming was
presented in chapter 6. Results show that, in general, psychological profiles differed between
team sport athletes and individual sport athletes. Psychological characteristics seem more
related to performance level in female than in male athletes. However, for discrimination of
elite and sub-elite youth athletes, motivation and mental preparation were useful indicators
that are independent of gender and type of sport.

In chapter 7, attention was paid to measuring tactical skills. The studies described in
chapters 3 and 4 show that the most discriminating variable between elite youth field hockey
players and sub-elite youth field hockey players is tactical skill. Future elite players seem to
excel in tactical skills by the age of 14 already. However, in these studies tactical skills were
measured by the opinion of the trainers. Although these trainers are experts in the field and
their opinion is highly valued, one might argue that their judgment of a player’s tactical skills
is influenced by their knowledge of that player’s performance level. Therefore, we conducted
a study with the purpose of developing a practical, reliable, and valid self-report instrument to
measure tactical skills in sports. Results show that the Tactical Skills Inventory for Sports is
suitable for measuring tactical skills in youth field hockey players in sports practice.
8.4 Theoretical considerations

The present thesis contributes to a clearer understanding of the relation between (the development of) multidimensional performance characteristics and the performance level in talented youth field hockey players, and is a relevant step in unraveling the mechanisms of how one achieves greatness in sports. However, the definition of talent used in the present thesis is still vague: what exactly does it mean when a player is ‘better than peers during training and competition’ and how can we measure ‘the potential to become an elite performer in the future’? We used the accumulated know-how of field hockey experts to select the participants for this study. Players were considered talented in cases where they were part of a talent development program of a field hockey club of national prestige, and were playing at the highest level for their age category. The distinction between elite and sub-elite youth players was made on the basis of players additionally being part of a youth selection team of the Dutch Field Hockey Association (KNHB) or not. Consequently, the present thesis only gives insight into the process of talent development of already identified talented players; but what if not the most talented youth players were detected and identified? Field hockey, as all team sports, is characterized by a lack of objective performance measurements, making it hard to decide which player is the superior one. Although several trainers and coaches claim to be able to ‘recognize a talented player when they see one’ it would be valuable to measure more objectively what exactly it is that they ‘see’.

In the present thesis elite youth players were compared to sub-elite youth players revealing information on the performance characteristics that are important for current and future success in field hockey. Despite that, this thesis does not specify exactly the underlying processes that enable players to, for example, perform the right action at the right moment and future research on this topic is highly recommended. In addition, with the exception of the interval endurance capacity, no mechanisms underlying the development of multidimensional performance characteristics have been studied yet.

8.5 Nature-nurture controversy

Although not included in this present thesis, the environment of talented players must not be underestimated. When a talented youth player attempts to develop his or her talent to reach elite status, this has major consequences for lifestyle. The process is long, averaging at least 10 to 12 years, and during this interval, significant others, particularly parents and coaches, play an important role (Côté, 1999; Visscher et al., 2004). Bloom (1985) also stressed the role of the environment by indicating that the development of exceptional talents requires family
support, excellent teaching, and appropriate motivational reinforcement at any stage of their development. Because the present thesis focuses on individual performance characteristics and not on the environment, it is hard to draw conclusions on the real determinants of expert performance. Nevertheless, the results show that for the attainment of expert performance the undertaking of extensive amounts of practice is essential, which is in line with other research (Janelle and Hillman, 2003). Experts simply do not become experts without an enormous investment in training. The stars of tomorrow are the talented players of today and they have a long way to go to the top.

Howe et al. (1998) suggest that differences in early experiences, preferences, opportunities, habits, training, and practice are the real determinants of excellence. The deliberate practice theory of expert performance also takes the perspective that it is practice and experience rather than innate talent that is the real determinant of expert performance (Ericsson, 1998; 2003a; 2003b). This perspective is one that gains support from those advocating environmental determinants of exceptional performance (e.g., Sloboda et al., 1994a, 1994b; Howe, 2001) but it is at odds with the perspectives advanced by behavioral geneticists (e.g., Rowe, 1998).

Abernethy and colleagues (2003) critique the deliberate practice framework. They argue that genetic factors play a critical role in determining the limits to the impact of training and therefore the ultimate levels to performance in many sports (Singer and Janelle, 1999; Skinner, 2001). In support of this hypothesis, a longitudinal study on growth and development of young gymnasts, swimmers, soccer and tennis players, showed that continued success in sport of young athletes appeared to be related to inherited traits (Baxter-Jones et al., 1995). Further research with the field hockey players in the present thesis might give advancing insight in the determinants of excellence.

8.6 Recommendations for future research

Although this present thesis revealed performance characteristics that can distinguish elite youth field hockey players from sub-elite youth field hockey players, it is still unclear to what extent and how these performance characteristics can be trained. If more insight can be given into this question, sports in general and field hockey in particular can benefit enormously. Without detracting from the current results, this study will greatly increase in value when the talented field hockey players are followed until adulthood and some of them actually reach expert status. This study is a first step in bridging the gap between science and sports practice. The next important step to take is to specify the underlying processes of the multidimensional performance characteristics, to measure these in training and competition, and to evaluate
current training programs. Furthermore, when necessary, to develop, implement, and evaluate new training programs with the goal of improving the multidimensional performance characteristics of talented field hockey players. Examples are field hockey-specific programs for tactical and perceptual training.

8.7 Conclusions and implications for field hockey

The aim of the thesis was addressed by conducting research within a group of all talented field hockey players, measuring multidimensional performance characteristics in a sports-specific way, and following talented players across time by adopting a longitudinal study design. With caution because the talented players from this study have not yet reached expert performance in adulthood, and with acknowledging the limitations of this study, it is concluded that a talented field hockey player with the greatest chance of succeeding is a player with a relatively high level of performance in field hockey specific physiological characteristics, excellent technical skills, excellent tactical skills, and a very high motivation at the age of fourteen already. This, however, is not enough. A player also has to have potential to reach elite status in the future. Elite players need less time to develop better performance characteristics, meaning that a talented player has to increase his or her performance characteristics at a relatively fast pace for many years in a row. To sustain the long road to the top, investing enormous amounts of time preparing for the international sporting arena, again motivation is essential. From this thesis, relevant information for trainers, coaches, scouts, players, parents and other field hockey enthusiasts can be given:

- Acknowledge the multidimensional nature of a field hockey performance: a talented player is more than a technically gifted player.
- Motivation plays an essential role in the development of a successful career in field hockey.
- Technical and especially tactical skills have to be excellent if a player is to succeed.
- In addition, a talented player needs a relatively high level of field hockey specific physiological characteristics: sprinting fast over short distances, perform these sprints repeatedly, is agile while sprinting, and has a great interval endurance capacity.

For each talented player, it is recommended to construct a performance profile repeatedly, i.e. every year, during the entire process of talent development. In this way, the player’s level of performance characteristics can be compared to other talented peers. Even more, his or her development of the performance characteristics across time can be recorded. This
performance profile can be constructed by measuring the multidimensional performance characteristics with the field hockey test battery from this study. In Vakblad Hockey, an electronic journal of the Dutch Field Hockey Association, reference data of the multidimensional performance characteristics of talented boys and girls under 14 years, under 16 years, and under 18 years are published (Elferink-Gemser et al., 2004a; 2004b). By comparing the test results of each player with these reference data, it is possible to acknowledge strong and weaker performance characteristics, and, consequently, use this information in training.
References


