

Trainings- und Bewegungslehre des Hochsprungs (2nd ed.)

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24:3; 137-139, 2009

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The high jump is a popular athletics event that is well covered in the sport-science literature. However, most of this is published in periodicals and focuses on individual aspects of the discipline, whereas overall presentations are relatively rare. There are a few older monographs that compare different techniques, but target-oriented deduction of training contents from analyses of high

jump technique is notably neglected. In most cases, high jump training is discussed as a part of general athletic training and the features typically not considered include:

- the multidimensional characteristics of the movements in the approach, take-off and flight phase;
- the curved approach run and the rising up from the inward lean at the take-off;

- the ancillary significance of the approach velocity as well as the steep take-off angle;
- the utilisation of the rotations and pseudo-rotations for optimising the jump result during the flight;

A specific training theory of the high jump or any other event should primarily deal with the physical, technical and tactical characteristics that determine the level of the sport-motor performance. Such a theory should also clarify the role these characteristics play in the complex performance and how they can be trained.

In the recently published *Trainings- und Bewegungslehre des Hochsprungs (Training and Movement Theory in the High Jump)*, Wolfgang Killing, has admirably filled a gap in the literature, at least for German readers. In this predominantly scientific work, he gives an extensive overview of the international development of high jump technique and training. Although the main focus of the book is on the absolute peak level of performance, problems related to training young jumpers are also dealt with in some chapters.

Killing is very well qualified to tackle this topic. He was a top-level German high jumper in the 1970s and later he worked as high jump coach for the German Athletics Federation (DLV). Currently, he is the head of the DLV Coaches Academy in Mainz. He has authored two practice-oriented books - *Gekonnt nach oben (How to go higher)* in 1995, and *Leistungsreserve Springen (Performance Reserve in the Jumps)* in 2008 - and numerous articles for German athletics magazines.

Trainings- und Bewegungslehre des Hochsprungs contains 12 chapters starting with an introduction. In chapter 2, the development of high jump techniques up to introduction of the flop is described. Killing shows that this development was greatly dependent on the available facilities and the

rules, which, for example, until 1932 required the jumpers to clear the bar legs first. Even in the 1950s, high jumpers were forced to land in sand pits, which explains why squat or scissors jumps were preferred. From a coaching perspective, over-estimations of the importance of bar clearance and the swing elements were typical of this era. The introduction of better landing equipment and then the flop technique had positive influences on both performance per se and performance density.

In chapter 3, early teaching methods of the high jump are discussed and a teaching sequence for the flop is developed. The effectiveness of this sequence is empirically tested with school pupils.

The fourth chapter is devoted to methodical and methodological aspects of technique analysis. In this context, the partial-heights model is identified as significant for the deduction of performance-determining influence parameters. Because of the considerable disadvantages of the partial-height model developed by Hay in 1973, a new, simplified model is presented. This chapter ends with a discussion of the possibilities and problems of relevant biomechanical analysis methods.

In the introduction to chapter 5, the current state of knowledge regarding the flop technique in high-performance sport is presented and appropriate questions and research hypotheses are derived. The focus then moves to three-dimensional analysis of several hundred jumps. Subsequently, investigations dealing with approach behaviour and the bar clearance are presented. The chapter concludes with a discussion of typical measurement errors in biomechanical investigations.

In chapters 6 and 7, which are based on the author's own empirical investigations, the flop technique is submitted to a three-fold analysis. First, the inter-individual ranges of freedom are dealt with. Although

these are mostly quantitative in character, qualitative deviations in the form of so-called technical variations can also be identified. In the discussion, the author on the one hand tries to give a motor-science based rationale for the considerable range of freedom of the flop technique while on the other hand he tries to summarise these variations in the form of a technique pattern. In the seventh chapter, the intra-individual movement constancy in the high jump is dealt with on the basis of an evaluation of a great number of jumps of a top-level athlete. Even in individual athletes, considerable deviations can be found for almost all parts of movement. This unexpectedly low rate of movement reproduction can be explained as a response to external and internal disturbing factors. This has implications not only for the technical model but also for technique training and the significance of supplemental objective information.

Based on the previous technique analysis and his own dataset, Killing tries to establish the performance-determining parameters of the high jump in chapter 8. In order to do this, a jump is divided in relevant partial performances, which are statistically related to the target performance. In the form of a deductive chain, the partial performances are attributed to further influence factors or conditions of their creation. In analogy to the considerable technical freedom range, individual significant statistical correlations are established and quantified by means of regression calculations. The graded effectiveness of the influence factors is explained by referring to their different dimensionality. At the end of the chapter, Killing draws consequences for performance diagnosis.

Chapter 9 deals with special jumping strength, the most important physical and coordinative basis of the high jump. General and specific jumping-strength exercises are empirically examined as to their specificity criteria by using dynamometric and kinematic methods. In the presentation of results, commonalities and peculiarities are identified

and rankings of jumping forms against individual movement criteria are established. Using these rankings, specificity criteria and exercise catalogues for technique training and jumping-strength training are developed. In the ends an attempt is made at structuring the jumping forms.

In the tenth chapter, training concepts and protocols of elite high jumpers are examined in light of training-science analysis criteria and specific questions. The training concepts dealt with stem from international athletes from the years 1950 to 1987 and from German top-level high jumpers from the years 1988 to 2001. In the discussion, these latter protocols are compared with one another and with the earlier concepts so that commonalities, trends and peculiarities can be identified.

In the last chapter, training-practical conclusions from the results and findings established in the previous chapters are compiled. Training guidelines are presented under the following headings: optimisation of the high-jump technique, periodisation of high-jump training, and test exercises for the high jump.

In summary, Killing's study reflects the author's long experience with specific problems of the high jump and can be regarded as a model for applying the principles and methods of training and motor science to the analysis of a specific athletics discipline. Seen from this point of view, Killing's book is not only significant for the high jump but for other athletic events, too.

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Cologne: Sportverlag Strauß, 2009, 315 pp., ISBN: 978-3-86884-504-74, € 19.80