Chapter 28

Detecting Pupils Talented for Sport Climbing in Slovenian Schools

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Introduction

The choice of a suitable sport activity remains one of the most frequent and professionally most demanding tasks encountered in modern sport (Baur 1988; Westcott 1989). It appears in different forms: the initial choice of a sport (orientation), the choice of an individual discipline or playing position (specialisation), and the selection for club and national teams. Both specialisation and selection are usually carried out within clubs and national teams, and involve a small number of children and athletes with ambitions in competitive sport.

The initial choice of a sport, however, is a very frequent process, with most children, youths and adults participating in it during one period of their lives. This process is not important only for mere identification of talented individuals who may fulfil their own ambition and meet the expectations of their parents, clubs, national teams and countries, but is also important for those children who have no wish or ability to take up competitive sport at all. In the case of the latter group, the choice of a sport stands for the choice of an enjoyable and useful leisure activity. Here, too, it has proved extremely important that the child should choose a suitable sport, one in which he/she can be successful. If that is not the case, and if the child even experiences difficulties when trying to participate in the team, then he/she is likely to be dissatisfied with the sport and give it up altogether. A carefully chosen sport also guarantees the regularity and intensity of training, thus providing a sufficient stimulus for positive biological, psychological, and social effects (Šturm 1992).

In this paper, we present an evaluation model for sport climbing, which is part of a knowledge-based system called Talent. It is a computer tool designed for physical education (PE) teachers to help them discover sport talents in young people and, consequently, advise them to those sports in which they may, owing to their talent, prove more successful than in others. The basic aim of Talent has been to bring the expertise in sport talent identification to PE teachers and coaches, to pupils and their parents. The system does not only deal with the identification of talent that might eventually lead to world-class sport results, but also with counselling children who have no wish or ability to take up competitive sport. The system encourages PE teachers to deepen their expert work and support them in their judgements and advice to all pupils who are choosing “their own” sport. Thus, the teacher inevitably takes on a new, modern role, as he/she becomes an adviser, a co-ordinator, and a leader in the educational process.

The paper is organised as follows. We first present the background that motivated the development of Talent and the model for sport climbing in particular. A short description of architecture, functionality, and user-interface of the Talent are described in section 3. This is followed by a detailed description of the evaluation model for sport climbing. A summary and some experiences of using Talent in practice conclude the paper.

Background

Competitive sport is a field of activity that is relatively highly valued in Slovenia. Considering the size of its population (2 million), Slovenia is one of the most successful countries in the world as far as sport is concerned. This is especially true in the field of climbing and mountaineering, where Slovenian climbers are successful in wide range of climbing forms from sport (competition) climbing to big walls and in the Himalayas. With over 80,000 members of Alpine Association, Slovenia has one of the highest ratios of population membership in national climbing associations.

Great importance is attributed to competitive sport, and consequently to the field of selection and orientation of children talented for sport. With this aim in view, the Faculty of Sport in Ljubljana has for several years been carrying out a project - *Computer-Aided System of Initial Selection and Orientation of Children to Sports* (Šturm 1992; Kapus and Jošt 1995), in collaboration with the Jozef Stefan Institute and the Faculty of Organisational Sciences as well as numerous coaches and PE teachers. The aim of the project has been to develop procedures of initial selection of, and orientation to, sports and employ these in practice. The system builds on *Information System for Monitoring Motoric and Physical Development in the School Youth in Slovenia* (Strel et al. 1984), which has already gained ground throughout Slovenia.

Within the project mentioned above, a number of multi-attribute models for the evaluation of children's talents for individual sports have been developed and successfully tested in practice. A lot of knowledge and expertise in sport talent identification has been accumulated in these models (Rajkovic et al. 1992). To make this expertise more accessible to schools, pupils and their parents, it was decided to develop a knowledge-based computer program specifically designed for PE teachers. The development of this system, called Talent, has been initiated in 1995 within the project *Expert Systems in Education* at the Faculty of Organisational Sciences. The development is supported by the Ministry of Education and Sport of the Republic of Slovenia within its *Computer Literacy* programme (Batagelj, Rajkovic 1996). Now the program Talent is used at about one third of schools.

Talent Expert System

Talent is a knowledge-based system aimed at the assessment of children's talents for individual sports. It is based on the so-called *Sports Card*, an information system used for the assessment of motoric and morphological development of children and adolescents in the Republic of Slovenia (Strel et al. 1984). The Sports Card measurements are performed once a year in all elementary and secondary schools, and involve almost complete population of pupils aged 6 to 18 (300,000).

In Talent, each Sports Card measurement is evaluated by a number of *multi-attribute models*. For each sport discipline, there is a corresponding model that evaluates the tests with respect to that discipline, and aggregates them into an estimate of child's potential for that discipline.

The evaluation is carried out by all models in the system, so the overall result is an estimate of child's talent for a number of sport disciplines. Currently, there are 22 models for sports that enjoy great popularity and are extensively exercised throughout Slovenia, including athletics (5 disciplines), swimming (4 disciplines), skiing, football, volleyball, handball, basketball and tennis.

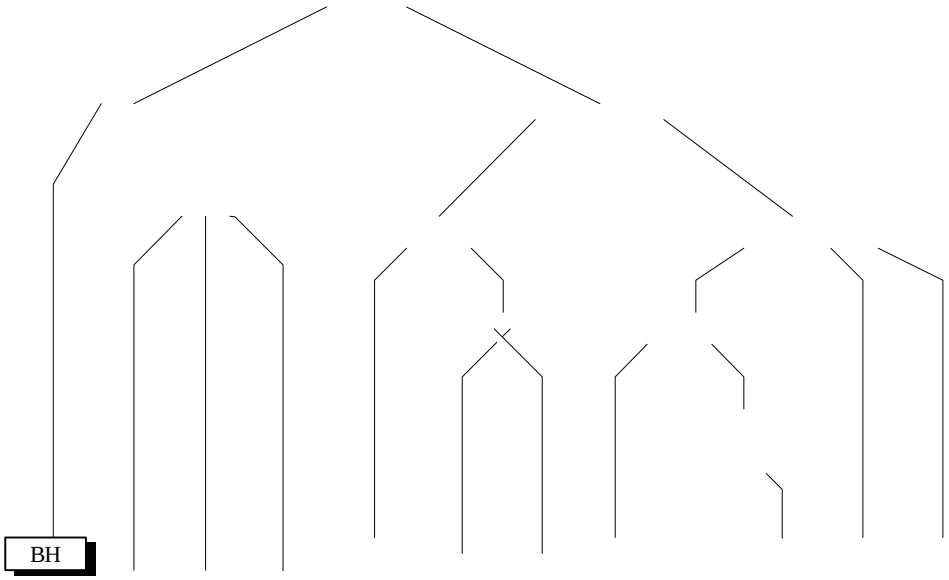
The Talent system consists of three main components: (1) a database of measurements, (2) multi-attribute evaluation models, and (3) a computer program implementing a graphical user interface for PE teachers.

The database of measurements is aimed at keeping the results of Sports Card measurement of pupils in each school. Typically, every child is measured once a year; these measurements therefore constitute a *time series* that shows morphological and motoric development of the child during his/her education period. Each *measurement* in the series consists of three morphological and eight

Haimes 1983) that map *T* values into scores. Scores are expressed either numerically in the range 0–100, or qualitatively by symbols: *unacceptable*, *acceptable*, *good*, *excellent*.

Aggregation of criteria for each sport discipline: scores are aggregated in order to yield an overall evaluation of all the tests with respect to a particular discipline. The aggregation is based on a hierarchical structure of criteria shown in Figure 28.1 with two kinds of models: numeric (ND; Leskošek 1995) and symbolic (DEX; Bohanec and Rajkovic 1990). For numeric aggregation, the score of an aggregate criterion is obtained by a normalised weighted sum. The symbolic aggregation is carried out according to *decision rules*, e.g. if *Body_height* is *excellent* and *Body_mass* is *at least good*, then *anthropometry* is *excellent*. Both weights and decision rules were defined by experts for specific sport disciplines.

Harmonisation among disciplines: the scores obtained by the aggregation for each sport discipline are normalised so that they can be compared among disciplines.



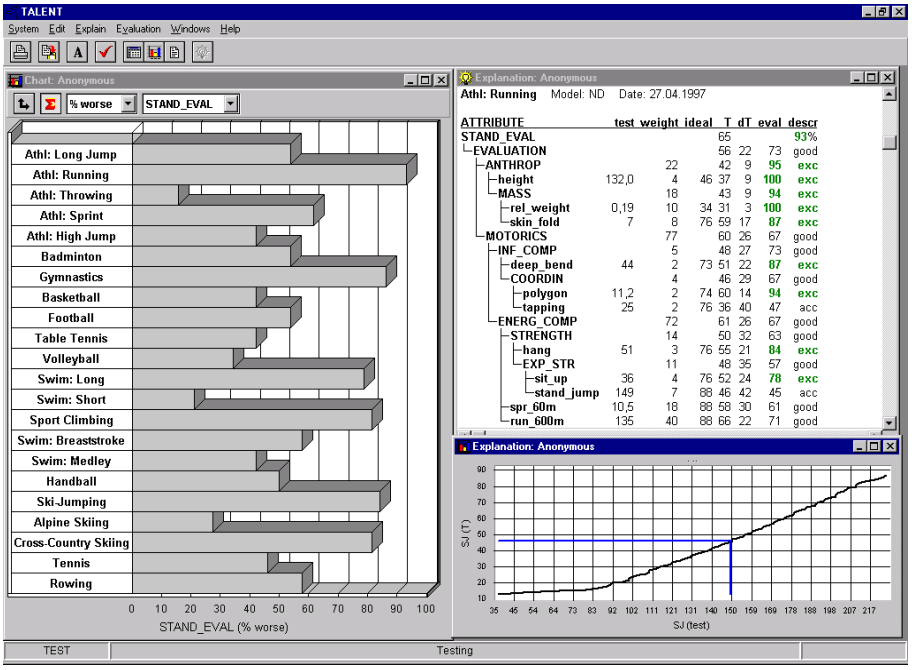


Figure 28.2: Evaluation results as displayed by Talent: A chart representing overall scores for various disciplines represented as the percentage of worse achievements in the population (left), explanation of the evaluation procedure for athletic running (right top), and explanation of the mapping of raw Standing Jump result into *T* value (right bottom).

Model of Sport Climbing

For the sport climbing, i.e., free climbing on natural and artificial boulders and well-protected cliffs, the morphologic and motoric characteristics are of great importance for the decision of suggesting children to choose or not to choose this sport. Furthermore, the tests included in the Sports card (see Table 28.1) directly measure some of the basic characteristics that are important for sport climbing, particularly body weight and height, amount of body fat, strength of the arms and body, co-ordination, and flexibility.

An experiment made with 25 randomly selected males shows a great congruence between decision of a Slovenian national climbing team trainer and marks, given by Talent with rank correlation coefficients of 0.90 (DEX model) and 0.94 (ND model).

An example of a Talent 's evaluation of test results achieved by a 9 year old girl, together with some parameters of evaluation models, is shown in Table 28.2. The first column shows the criteria tree (same as on Figure 28.1). This is followed by the attribute weight and ideal *T* value for the sport climber. The remaining columns show different forms of child's results. **T** is a *T* value (deviation from population mean), **dT** deviation of child result from ideal value (i.e. **ideal - T**). **Eval** is the "score" of the result (in range 0-100) as evaluated by utility function of the corresponding ND model. The same information is shown in **descr** using the four grade scale *unacceptable*, *acceptable*, *good*, and *excellent*. The value in the first row of this column shows the percentage of all girls of the same age in the Slovenian population that have a worse final evaluation that the selected girl; the value of 96% means that only 4% are better. In the last column the descriptive values of test attribute results according to DEX model are shown.

Table 28.2: Example of evaluation of results for sport climbing.

ATTRIBUTE	weight	ideal	test	T	dT	eval	descr	DEX
STAND_EVAL				68			96%	
EVALUATION				51	11	75	**exc**	good
ANTHROP	180			38	8	87	**exc**	**exc**
height	100	43	132,0	38	5	90	**exc**	**exc**
MASS	80			39	11	83	**exc**	**exc**
weight	70	27	26,0	36	9	87	**exc**	**exc**
skin_fold	10	88	8	60	28	56	good	good
MOTORIKA	290			59	14	68	good	good
INFORM_KOM	85			52	19	56	good	good
deep_bend	30	70	35	34	36	23	unacc	unacc
COORDIN	55			61	9	74	good	**exc**
polygon	40	72	11,5	64	8	78	**exc**	**exc**
tapping	15	67	33	54	13	62	good	good
ENERG_COMP	205			63	12	73	good	good
strength	195			62	12	72	good	good
hang	150	76	60	62	14	67	good	good
DYN_STR	45			62	3	90	**exc**	**exc**
sit_up	10	66	45	67	1	100	**exc**	**exc**
stand_jump	35	65	165	61	4	87	**exc**	**exc**
run_600m	10	63	131	74	11	100	**exc**	**exc**

Conclusion

Nearly 300 P.E. teachers have used the Talent system in the past three years. In these years the authors have received many praises for the product on its usefulness, ease of use, correctness, transparency, and presentation richness of the results. Many teachers also admit they would never advise children to get involved in sport climbing simply because they don't know this sport, not in general, nor in motoric and anthropometric characteristics it requires. Many of these users also comment that the evaluation for sport climbing is in most cases very different from the evaluation for other disciplines and that many children achieve excellent marks for sport climbing while having the majority of other marks average or bad. On the other hand, P.E. teachers who are also climbers, instructors or trainers of young climbers confirm they agree in most cases with evaluations for sport climbing and in some cases even change their opinion when they see the results and the explanation as given by Talent. As shown above, there seems to be a great agreement between the evaluations of expert trainers and Talent.

Nevertheless, it should be emphasised that no decision model and thus no computer program can with certainty predict a child's talent and even less the future results, not for climbing, nor for any other sport. The complexity of sport disciplines and of a human being, his/her wishes, wills, and, naturally, the environment in which he/she lives and works, (un)fortunately cannot be entirely mirrored by formal models. That is why all results of the Talent system should be used as guidelines, as they have been designed only as an aid in advising children. To avoid giving wrong advice, one should always bear in mind the unreliability of the result, offer prudent advice, and stress the fact that the final decision rests with the child who chooses his/her sport.

In its current state the model is based on Slovenian children population norms, but we believe that it can be easily transformed and successfully implemented and used also in other countries.

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