



Initial and Further Selection of Children Gifted for Handball on the Basis of Some Chosen Morphological and Motor Parameters

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INTRODUCTION

The search for children with talent for various sports must be founded on the knowledge of the demands that a particular sport has towards an individual. A model of a top competitor in sports or a potential top competitor in a certain age category therefore represents one of the starting points in developing criteria for the search for those talented in sports and monitoring their development.

The purpose of the procedures for the identification, involvement and monitoring of potential top competitors in a particular sport is the selection of those children and youths whose inclinations, interests and abilities are closest to the requirements of that sport.

The procedure for identifying potential top competitors, the method of their involvement in sports and monitoring the development of their abilities and characteristics can be divided into two parts:

1. Searching for Children Talented at Sports (orientation of those into their best suited sport)

Sport can be divided into different disciplines, which have some common, but also certain individual characteristics. The relationship between anthropological characteristics of a talented competitor can vary greatly between different sport disciplines. These differences can also be present within a single sport - between individual disciplines, different types of players, etc. Therefore we feel that it is difficult to construct uniform criteria for all the different sports. The assessment must be made from the specific viewpoint of the sport in question or, at most of several sports which have similar requirements. In the search procedure we therefore use a method that enables us to categorise hierarchically the individual sports in accord with the structure of the individual's anthropological characteristics.

The search for »sport talent« and the determination of talent can be carried out in several ways:

A. A spontaneous decision of the individual (for children usually their parents), based on own initiative and orientation, or as a consequence of the social milieu.

B. An intuitive decision of an expert, who assesses an individual's talent on the basis of his/her own criteria, amassed through long personal experience; these can also be supported with varying degrees of theoretical knowledge.

C. Selection on the basis of the results of tests used to assess the level of development of morphological characteristics and motor skills.



On the basis of these results and their comparison with the norms, we obtain data on the morphological and motor potential of the individual for sports. Together with the experience of experts this can be quite successful, since the talent criterion is at least partly objective. However, tests should be used that have as high a degree of prognostic validity as possible.

D. An interdisciplinary approach to talent determination. In this case talent is - assessed on the basis of measurements in the main subdimensions of the psychosomatic status. Beside the morphological and motor parameters this approach incorporates additional information on cognitive abilities, conative characteristics and social status of the potential competitors in sport.

The process of including beginners can be carried out in different ways. An approach is useful and efficient only if it is suited to the actual conditions in which the sport activity takes place. Therefore such selection models should be developed which are best suited to the surroundings and conditions in which they are to be used.

The general conditions in Slovenia and the knowledge and education of experts who deal with talent selection in handball have reached a level that enables selection using the first three methods mentioned above. Our wish is, however, to present an optimal selection model, since it incorporates most of the theoretical and practical knowledge, available in this field to experts in Slovenia and taking into consideration realistic possibilities in practice. This is described in point C.

2. Monitoring the development of the important anthropologic, training and playing characteristics (selection)

Systematic monitoring of a competitor in the motor and morphological dimension enables the coach to predict, with a greater degree of probability, the success of an individual and to identify possible weaknesses in the training process through inconsistencies between the expected and achieved results. It helps the national team coaches in the selection of competitors who will represent the country and gives them an insight into the individual's sport anamnesis.

In light of the findings of several authors (Thiess, Harre, Siris, Zaciorskij) that the determination of talent is not a single act, but a process. We can say that monitoring the development of a competitor can also serve as a possible correction to the initial assessment. In evaluating the proper development of a handball player - (assessment of potential - prognostic talent) in the morphological and motor dimensions we use the technology of expert decision making, which includes some motor and morphological measures. The database used for "the expert decision model" was gathered by using the measurements of the best Slovene handball players.

To make the initial selection procedures and the monitoring of the competitor easier to understand, we also present a model which encompasses a presentation of

- λ the process of orientating children into handball (initial selection of talented individuals),
- λ monitoring of their development (process of selection)
- λ and the characteristics of the training process.



All three components are closely interconnected. Together they represent the complete process of preparation in handball.

Model of Orientation and Selection in Handball

age - categories		process of universal training and specialisation	process of orientation into handball and playing roles	process of selection
over 18 years	seniors CL	functional training		for senior teams 5. stage ↑
18 years 17 years	older juniors SM	advanced special handball training	orientation into best playing role (considering others)	for older junior teams 4. stage ↑
16 years 15 years	younger juniors (cadets) MM	special handball training	orientation into two or three playing roles in each game phase	for cadet teams 3. stage ↑
14 years 13 years	older boys SD	universal- special handball training	search for playing role (several attack and defence roles)	for older boy teams 2. stage ↑
12 years 11 years	younger boys MD	universal handball training (pers. defence)		for younger boy teams 1. stage ↑
10 years	beginners (youngest 9 years boys), NMD	introductory handball training (mini handball)	search for children suitable for handball	
			orientation ↑ of motorically gifted children into handball	

The Development of Players is Implemented in Four Major Developmental Stages

developmental stage	age category	age
1) Period of multiform sports preparation		7 - 10
a) Stage - forming a wide sports foundation		7 - 8
b) Stage - learning about mini-handball	youngest boys	9 - 10
2) Period of basic sports training		11 - 14
a) Stage - change to normal handball	younger boys	11 - 12
b) Stage - universal training	older boys	13 - 14
3) Period of specialised sports training		15 - 18
a) Stage - wider specialisation	cadets	15 - 16
b) Stage - narrow specialisation	juniors	17 - 18
4) Period of best personal results		19 →
a) Stage - stabilisation of best results	younger seniors	19 - 22
b) Stage - constant achievement of best results	seniors	22 →



Motor Abilities and Morphological Characteristics

The entire psychosomatic status of a handball player is very complex and intricate. In a simplified way we can express the main abilities, characteristics and properties of the model of a handball player with the help of an expert model of the prognostic success of a handball player. The main branches of this model are:

SUCCESS IN PLAY (SUCCESS)

1. INNER FACTORS OF SUCCESS (NOTRDE)

1.1. STRUCTURE OF PERSONALITY OF THE INDIVIDUAL (STROSE)

1.1.1. POTENTIAL DIMENSIONS (POTRAZ)

1.1.1.1. morphological characteristics (MORFOR)

1.1.1.2. functional-motor abilities (VZDRŽ)

1.1.1.3. energy component of movement (ENKOMP)

1.1.1.4. informational component of movement (INFKOMP)

1.1.2. REALISATIONAL AND MOBILISATIONAL DIMENSIONS (REAMOB)

1.1.2.1. psychical abilities (PSISPO)

1.1.2.2. personality characteristics (OSEBNO)

1.1.2.3 social-psychical characteristics (SOCPSI)

1.2. PLAYING EXPERIENCE (IGRIZK)

2. EXTERNAL FACTORS OF SUCCESS (ZUNADE)

2.1. quality of opponents and team-mates (NASSOI)

2.2. behaviour of spectators and referees at matches (GLESOD)

2.3. success in leading the match (USPVOD)

From empirical experience of the handball coaches and the research data we can conclude that properly developed morphological characteristics and motor abilities (energy and information component) are highly correlated with competitive success in handball. This is one of the reasons why we are trying to enhance the quality of prediction through an assessment of the level of development of the measured characteristics and abilities. The measurement procedures for this are relatively simple and available to most sport pedagogues who are involved with searching for those talented for handball their teaching and training. We assume, however, that for success in handball the level of development of other dimensions of the psychosomatic status is also very important (specially cognitive abilities and conative characteristics). Unfortunately assessing and monitoring these is in the practical situation almost impossible. Therefore we shall limit ourselves, in this description of the initial selection of those talented for handball and for monitoring their development, to morphological characteristics and motor skills.

On the basis of research and data recording of individual measurements of top handball players and the assessment of experts in handball we can define a quite precise informational model of a handball player in morphological and motor space.

1. Morphological Structure in Handball:

For a modern model of a handball player the following features are characteristic:

λ pronounced longitudinal dimensions (body height and extremities, length and finger span);

λ pronounced transversal skeletal measures (robust joints and shoulder width);



- λ well expressed circular dimensions, defined mostly by muscular tissue, which must not, however, hinder good flexibility in the shoulder joint and negatively affect speed, coordination and kinaesthetic feeling;
- λ minimal amount of subcutaneous fat in all body segments.

2. Motor Skills, together with the Capability of the Cardio-Vascular and Respiratory System:

For successful playing of handball the following abilities are very important:

- λ explosive and elastic power of the leg and arm (shoulder) muscles;
- λ agility;
- λ velocity of locomotion (short sprint) and speed of reaction;
- λ specific kinaesthetic feeling in ball manipulation;
- λ functional capabilities on the respiratory, cardio-vascular and cell level (aerobic - anaerobic power and capacity).

MODEL OF INITIAL SELECTION AND MONITORING OF CHILDREN GIFTED FOR HANDBALL

This model used for searching for (sport) talent is based, in Slovenia, on the data from the so-called "sports chart". That is data which is gathered once a year from practically all of the pupils from primary and secondary schools - „The Information System for Monitoring and Evaluating Morphological Characteristics and Motor Skills of Female and Male Pupils in Slovenia“. The system encompasses three morphological measurements and eight basic motoric measurements. We have chosen, for our use, three morphological and three motoric measurements. On the basis of the data from the "School Sport Information System" we can, with the help of "Expert Modelling", determine at least broadly, a descriptive assessment of the talent for handball of all those pupils who could be included into training within a certain geographic area. Access to data from this information system is permitted only to certified persons (professors of physical education at a certain school) and can be used only with the explicit permission of the individual in question.

The assessment of talent obtained through "The Expert System", based on the "School Sport Information System" for monitoring some anthropometrical and motoric parameters, is therefore a relatively good guide in the search for children with a talent for handball. However we should keep in mind that errors of measurement exist. We use a modest test battery from which results are correlated with success in handball and assessment errors occur because of the approximation of the future projection of the development of anthropological dimensions. This can be corrected to a certain degree with repeated testing with a larger test battery and encompassing eight motoric and eight morphological measures for all who were identified in the first phase as more or less talented.



Expert System for Determining Potential (Prognostic) Success in Handball

With the development of computers and artificial intelligence, where the capabilities of the computer and the knowledge of experts combine, a new method of treating complex systems (models) has developed, based on logic - the so-called "expert decision making". We do not wish to enter into a long explanation of the subject, just give some basic data which will help the reader to understand the selection procedures based on an assessment obtained through "expert decision making".

In order to determine the assessment of an individual's potential success in handball and to monitor the development of this potential, a knowledge database has been constructed. It is composed of criteria and rules to assess the suitability of the candidates for handball. This database determines the transformation of the data on the candidate into an assessment - which can be taken as an assessment of his/her potential success. The knowledge database consists of weights, ideal values and normalisers, which define the relationship between the test results and the final assessment of the suitability of the candidate for handball.

Generation of an Expert Decision Model

An important characteristic of this kind of expert decision making is, from the viewpoint of usability and efficiency, that it uses the data on the candidates from the database of "The Basic Sport Information System" which has data on the great majority of the female and male primary and secondary school pupils in Slovenia. This means that this procedure can be carried out on all pupils who have all the data, without any additional measurements. As we have already mentioned, the complete procedure encompasses three morphological and eight motorical measurements. For the purpose of a simple assessment of the level of development of morphological and motoric dimensions - from the viewpoint of talent for handball - we have chosen three morphological and three motoric measurements, which have, in our view, good prognostic validity for assessing talent - (body height, body weight, upper-arm skin fold, standing broad jump, 60m run and 600m run).



Table 1 - Decision-graph

				Normalisers		
Mark				>=4.0	>=3.0	>=2.0
Decision tree	ponder	OU	CP	excellent	good	accepted
Antropometry	44.0					
1. height	26.0	N	76	>=68	>=60	>=53
2.mass	18.0					
2.1. weight	12.0	K	68	67-72	63-74	58-76
2.2. skinfold	6.0	P	56	>=56	>=50	>=44
Motorics	56					
1. bjump	20	N	84	>=68	>=62	>=58
2. run60m	20	P	71	>=68	>=61	>=55
3. run600m	16	P	77	>=64	>=59	>=54
SUCCESS	100.0					

Explanation of the Decision Graph: On the left side we show the structure of the graph: tests are written in capital letters, abilities that they measure in small letters. The highest knot represents the assessment of the candidate's chances for success in handball. Then the weights are given.

In table 2, we show the output of the results for two young successful players. Boštjan FICKO, born in 1974, who was the captain and the best CB player of the national junior team which achieved the tenth place at the Junior World Championship in Argentina in 1995. He is also a permanent member and the best CB player of the senior national team. Bojan JAKAC, born in 1976, is one of the motors and best LB player of the junior national team (players born 1976 and later), which took part in the qualifications for the European Championship in 1996.

Table 2 - Results

player	Ficko Boštjan		Jakac Bojan		age 9 years
	result	EM	result	EM	
Antropometry		2.3		2.2	Antropometric characteristics
1. height	144.5	2.3	143.0	2.2	Body height
2. mass		2.1		2.3	Body mass
2.1. weight	33.5	2.0	34.5	2.2	Body weight
2.2. skinfold	6	3.4	7	3.1	Skinfold of upper arm
Motorics		4.6		3.2	Motorics
1. bjump	196	5.0	170	3.0	Standing broad jump
2. run 60m	10.1	4.2	10.6	3.2	Sprint 60 m
3. run 600m	146	4.1	152	3.6	Running 600 m
SUCCESS		3.6		2.8	Prognostic successfulness



Forming a Model for Expert Decision Making to Determine the Potential Success of Handball Players

In order to determine the potential success in handball and to monitor the development of this potential, the shell of “The Expert System ND” was used. A knowledge data-base was also developed consisting of criteria and rules for the determination of the suitability of the candidates for handball. The normalisers were determined for three age groups (11 and 12 years, 13 and 14 years, 15 and 16 years) and both sexes. In this way we were able to make an expert evaluation of the potential success of an individual in light of his/her morphological characteristics and motor skills from the beginning of their “handball career” (10 or 11 years) to the end of the turbulent development years of the adolescence (17 years).

				NORMALISERS		
			mark	>=4.0	>=3.0	>=2.0
	ponder	relation with success	champion	excellent	good	accept able
1. motorics	55.0					
1.1.basic-motorics						
1.1.1. energy	35.2					
1.1.1.1. ex+el.pwr.l	21.1					
1.1.1.1.1. SDM	6.3	N	71	>=68	>=58	>=52
1.1.1.1.2. S20	7.3	P	68	>=60	>=48	>=40
1.1.1.1.3.3SM	7.3	N	71	>=68	>=48	>=55
1.1.1.2. ex.pwr.arm	14.1					
1.1.1.2.1. RMM	14.1	N	66	>=62	>=52	>=47
1.1.2. information	8.8					
1.1.2.1. agility	7.0					
1.1.2.1.1. KVS	7.0	P	65	>=60	>=45	>=38
1.1.2.2. flexibility	1.8					
1.1.2.3. ZARO	1.8	N	64	>=64	>=59	>=50
1.2. special-motoric	11.0					
1.2.1. RMMZ	11.0	N	62	>=59	>=52	>=46
2. morphology	45.0					
2.1. long. - transv.	31.5					
2.1.1. longitudinal	22.0					
2.1.1.1. AV	22.0	N	70	>=68	>=60	>=54
2.1.2. transversal	9.4					
2.1.2.1. ASR	5.2	N	67	>=64	>=54	>=49
2.1.2.2. ARRL	4.2	N	67	>=59	>=55	>=51
2.2. mass - skin.fold	13.5					
2.2.1. circumfer.	10.8					
2.2.1.1. AT	3.2	K	65	51-70	57- 67	61-63
2.2.1.2. AOSL	3.2	N	68	>=63	>=57	>=50
2.2.1.3. AONL	4.3	N	64	>=62	>=55	>=48
2.2.2. skinfold	2.7					
2.2.2.1. AKGT	1.3	P	68	>=60	>=52	>=46
2.2.2.2. AKGS	1.3	P	70	>=63	>=55	>=50
SUCCESS	100.0					



An Example of a Decision-graph for Two Young Successful Players

Below we show the results of an expert assessment of partial potential success of two successful young players. Their marks were also shown in the expert decision making on the basis of the data from the "School Sport Information System". At the same time we also give - for one of the players (Bojan JAKAC) - the assessment of playing success obtained on the basis of marks of five independent handball experts. In this way we can see the difference between the actual (competitive) success and the assessment of partial potential success.

Player	Ficko Boštjan	Jakac Bojan	age 17 years
Playing position	middle outer	left outer	
	mark	mark	
1. motorics	4.1	2.9	motor abilities
1.1. basic motorics	4.0	3.1	basic motor abilities
1.1.1. energy	4.0	3.0	energy component - movement
1.1.1.1. ekselm	3.9	2.9	explosive & elastic power - legs
1.1.1.1.1. SDM	4.0	2.8	standing broad jump
1.1.1.1.2. S20	3.8	3.3	sprint 20 m
1.1.1.1.3. 3SM	4.0	2.4	standing triple jump
1.1.1.2. eksmr	4.1	3.2	explosive power - hands
1.1.1.2.1. RMM	4.1	3.2	medicine ball throw - 1 kg
1.1.2. information	4.3	3.7	information comp. - movement
1.1.2.1. agility	4.5	4.1	agility
1.1.2.1.1. KVS	4.5	4.1	side-stepping
1.1.2.2. flexibility	3.5	2.2	flexibility
1.1.2.2.1. ZARO	3.5	2.2	shoulders flexibility
1.2. special motorics	4.1	1.8	special motorics
1.2.1. RMMZ	4.1	1.8	running medicine ball throw
2. morphology	2.8	3.1	morphologic characteristics
2.1. longpreè	2.6	3.2	longitud.-transversal measures
2.1.1. longitudinal	2.5	4.0	longitudinal measures
2.1.1.1. AV	2.5	4.0	body height
2.1.2. transversal	2.7	1.2	transversal measures
2.1.2.1. ASR	1.6	0.4	width of shoulders
2.1.2.2. ARRL	4.0	2.3	hand-span
2.2. mass_skinfold	3.2	2.9	body mass and skin fold
2.2.1. circumference	3.5	2.5	circumferences
2.2.1.1. AT	2.7	2.7	body weight
2.2.1.2. AOSL	4.2	1.9	thigh circumference
2.2.1.3. AONL	3.7	2.8	circ. - relaxed upped arm
2.1.3. skin fold	1.9	4.6	skin folds
2.1.3.1. AKGT	0.8	4.9	skin fold - stomach
2.1.3.2. AKGS	3.0	4.4	skin fold - thigh
SUCCESS		4.1	Playing success - qualifications
	3.5	3.0	Potential successfulness



The assessment of the playing success of Bojan JAKAC was given by five independent judges - handball coaches. They assessed his game at the qualification tournament for the European Championship. The assessment for Boštjan FICKO has not been made, but in view of his playing success, we can safely assume that he is very successful.

CONCLUSION

Here we would like to describe the entire process of initial selection and monitoring of the partial success of handball players:

▷ The clubs (their coaches) state that they wish to obtain an expert assessment of player's' talent on the basis of their morphological measures and motor results from the "School Sport Information System" for children in a certain area (schools). In this the Law for Preservation of Personal Data must of course be observed;

▷ At the Institute of Kinesiology at the Faculty of Sport of the University of Ljubljana the data from the information data-base of the "Information System for Monitoring and Evaluating Morphological Characteristics and Motor Skills of Schooling Youth" are analysed and the relevant expert evaluations are sent to all concerned (primary selection - orientation);

▷ Additional testing is performed at the clubs with a larger test battery, for those who have achieved the best results in the reduced expert model (primary selection - orientation); the data is sent to the Institute of Kinesiology at the Faculty of Sport in Ljubljana. There the data is analysed and the more detailed expert assessment of the suitability of their morphological structure and motor skills for handball is again sent to the clubs;

▷ Each following year the clubs carry out tests using the identical test battery. The results are written on prepared forms and sent to the institute, where they are processed. On the basis of such consecutive feedback the club coaches can reaffirm or modify their prior decisions.

In addition to the research and theoretical activities which helped to form a foundation for the initial and further selection of talented children on the basis of some morphological characteristics and motor skills (the relation ship between competitive success of handball players and their morphological characteristics and motor skills; generation of a knowledge data-base for the reduced and full expert model of potential success; finding the correlation between the assessment of potential success and the actual competitive success). Some practical experiments were also performed in Slovenia, using the described decision making system for assessing talent and monitoring further development. The results are encouraging and show a high correlation between the evaluation of the morphological structure and motor skills with the expert assessment of talent and later actual success in handball.

We feel that such expert assessment is helpful in the initial selection of children for training in handball, especially where the club chooses from several schools in order to include as many children as possible into the beginners' groups. It is very important that this selection is made on the basis of as much data on the abilities and characteristics of the children as possible. The expert assessment alone cannot, of course, be the sole criterion of selection, others must also be taken into consideration - ex.: social criterion - friendship between the children, conative characteristics and cognitive abilities, emotional ties with handball, interest of the parents for their children to be involved in handball, etc.



LITERATURE

- Baur J.:** Talentesuche und Talentfoerderung im Sport. Leistungssport 2, 1988.
- Bratko I.:** Intelligent informational systems. Ljubljana, Fakulteta za elektrotehniko, 1985.
- Dezman B., Jošt B.:** Observation of sportsman successfulness on the base of expert system. Športna zveza Slovenije, Ljubljana, 1991.
- Dezman B. B. Laskošek B.:** An expert system assesment of talented children for playing basketball. Zbornik referatov, II. mednarodni simpozij Šport mladih, Ljubljana - Bled, 1993: 40 - 46.
- Gabler H., B. Ruoff:** Problems of talent identification in sport. Savremeni trening, 2, 1980.33-41.
- Jošt B., B. Dezman, J. Pustovrh:** Evaluation of successfulness model in different sports on the base of expert modelling. Inštitut za kineziologijo Fakultete za šport, Ljubljana 1992.
- Pavcic C.:** Some latent and manifestation dimensions of handball motorics and their conection with playing quality. Magistrsko delo. Ljubljana.1973.
- Primozic M.:** Defining connection between reduced and more detailed expert evaluation for handball at 11 and 12 years old boys. Diplomsko delo. Fakulteta za Šport, 1994.
- Šibila M.:** Vpliv antropometricnih znacilnosti, osnovno in specialno motoricnih ter funkcionalnih sposobnosti na uspeh v rokometni igri. Magistrska naloga, Fakulteta za šport, Ljubljana, 1990.
- Šibila M.:** Construction and evaluation of an information system for recognising talented handball players and monitoring their development. Doktorska disertacija, Fakulteta za šport, Ljubljana, 1995.
- Šibila M., M. Bravnicar, S.Tancig:** Vpliv nekaterih razse'nosti psihosomati~nega statusa na uspešnost v rokometni igri. Inštitut za kineziologijo FTK, Ljubljana, 1990
- Šibila M., C. Pavcic, B. Leskošek:** Oblikovanje in ovrednotenje racunalniško podprtega informacijskega sistema v rokometu- 1. faza. Inštitut za kineziologijo FTK, Letno porocilo o raziskovalni dejavnosti FTK - od strani 159 - 166. Ljubljana, 1990.
- Šturm J. in sodelavci:** Selection and orientation of children in different sports on the base of expert modelling. Fakulteta za šport. Inštitut za šport, Ljubljana, 1992.
- Šturm J. in sodelavci:** Racunalniško podprt sistem usmerjanja (II. faza). Fakulteta za telesno kulturo, Ljubljana, 1988.