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COMPARING MULTI-LINE DEFENCE SYSTEMS IN HANDBALL PLAY BASED ON THE SIGNIFICANCE OF PLAYERS' DUAL PARTNERSHIPS

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I. Abstract

Introduction –

The appearance of multi-line defence systems opened new ways in the development of playing modern handball. This kind of defence system, being different from the conventionally structured and accepted 6:0 zone defence system, focusing on activity and anticipation, has resulted a spectacular development of defence tactics.

Methods -

To answer the questions I studied matches, played by the World's best multi-line defending teams picked from national teams and European elite club teams. These matches are most suitable for demonstrating the responses to our suppositions.

Results and discussion -

Multi-line defence systems require a high standard of defence activity in the 1:1 (one against one) game. It forms the base of the team tactics in each of the systems studied, supporting the successful defending game. It also reflects the defence philosophy, represented by the team. It carries on the style marks, characterizing them during the games.

II. Keywords

Handball, playing, multi-line, defence, systems, group tactics, dual partnership

III. Introduction

Accommodating to the changing circumstances, multi-line defence opened new doors for physical, technical and tactical development of the game. The playing philosophy has been re-evaluated; the judgement of defence has changed. The offensive game is a result of a serious, constructive procedure, because **scoring has** remained an essence of the game... According to widely held views, defence is a destructive activity that does not need any significant technical-tactical skills, as it is mainly a "question of will-power". Professional leaders usually stint on spending time on it, so they preferably focus on training the offensive playing...

The above mentioned opinion has fundamentally changed when working-out of defence strategies started. New directions and trends have appeared, having a main purpose of *"attacking the offense"* and regaining the ball as soon as possible. The new "goal philosophies" require a new quality of defenders, which requirement has already been considered during the selection process. Handball players with outstanding skills became defence specialists who – deserving the energy invested in them – have essentially contributed to the success of their teams. Their role in the teams has been appraised, their respect has also increased.

Defence still banks upon the strong 1:1 (one against one) tactics.Height, body mass, physical factors are determinative elements in defence skills. Players must have good conditional and co-ordination abilities, besides these – good defenders are determined by their standard of technical and tactical skills. Up to nowadays defence became as important as offence (attack) is.... The "goal" is to entirely enforce the tactical aim by means of the applied game elements like: checking, blocking, stepping out, supporting, helping ... which can be seen by outsiders as a combat of emotionally overheated players "sailing close to brutality".

Usefulness of trained motion programs can be measurable in the quality of their application against attackers, as well as in its efficiency. It is a very important factor, that the body-to-body game – within the rules – is allowed. The role of the players in the team performance of defence has a determinative importance, but it is not equivalent with the man-to-man play.

Defence is based on the individual abilities of handball players, playing on different positions, and on the propriety of their responses to different game situations. Defence systems give us a correct view of the given team's defence strategy, the quality of which is determined by the individual, dual and joint partnerships of handball players, playing a role in the defence. My present thesis cannot take the responsibility of an overall analysis of multi-line defence systems, neither in extent, nor in time. However, I will try to highlight partnerships, being crucial elements of this subject, founding my thesis on proved experiences and professional literature sources.

I will use and show the experiences of the 20 years that I got in the National Championship No I, and that I still get every day as a leading coach.

The question of defence has been keeping professionals' mind occupied since handball playing handball itself has emerged. We cannot deal with the development of defence until we clear up the definition of defence. Many professionals have drafted descriptions in many ways, but for me Ferenc Kolozs has defined it in the most likeable way.

"Defence is the negative art of playing handball."

(Ferenc Kolozs: "Playing Handball", 1988)

Bethinking ourselves of the above quoted sentence, we must decide in favour of it, as we have to arrest the opponent's constructed and pre-planned tactics and – if possible – use it for our own vantage. "Easy scoring" can determine the final results of matches in the modern geared handball games. It is also undoubted that an open defence is the best situation to start from.

After playing a secondary role, defence got to a new development period where new defence strategies and tactics appeared. In this "chapter" the role of well defending players has been appraised. The coaches had to train players to be qualified to the new roles.

"Those players can be considered as qualified people, who are able to solve the compatibility of relevant stimulations, game situations, and memorized action programs by their decisions, with a considerable efficiency." (Istvánfi, 2006)

Players, applicable in multiple positions, and defence specialists came into the limelight.

Primary conditions of successfully handle the game situations are: perception of the problem and proper reactions to it.

The development of open and multi-line defence systems has resulted an increasing demand of individual decisions in the defence actions, which also requires a high concentration in the game. Anticipation can be the adequate reaction to the tactical thinking that has appeared in offensive actions. Besides the "talented attackers" the category of "talented defenders" also has shown up. It is hard to talk about a significantly talented handball player having a low level of mental and emotional intelligence...

"In playing handball, and generally in ball games, the idea of intelligence has been crowded out by the idea of creativity, which is identifiable with the capability of creating new, associative partnerships. (H.C. Nemor – Silberman)

Thanks to these partnerships, also to the quality of exercises at trainings, and the tactical thinking – players can get experiences that help them to be successful in less-trained situations as well. They can better accommodate themselves to the circumstances, for example to their team-mates. It is also clear that even little modifications of similar game situations would require the change of applied skills and of "time-space" dynamic elements.

Keeping the defence under pressure is mainly resulted by the play of insiders, well-trained left or right backs, as they are dangerous in close and distant zones as well. They can generate most confusion in the defence by their breaking-through actions, their passing-in actions, passing out to the sides (principle of triple threat).

Multi-line defence systems have been created to inhibit back players from being successful. The main purpose of it has been to keep players, having a big shooting power from score-threatening zones, and force them to employ game elements demanding more co-ordination. Defence must focus on back players' game, as their play will determine the opportunities of their team-mates: wingers and line players.

Controlling back players' game gives a chance to the players (line players, wing players), acting "at the line", which means right in front of the goal area line. In contrast to the above mentioned attacking players, by the help of a well-trained goal-keeper the attacking

play will be concentrated to the inside zones, which can be slowed down by a multi-line defence, and its dynamic can be considerably decreased. Situations worked out this way require lots of energy and inaccuracies may slip into the organization and preparation.

Handball is a strategic branch of sport, teams fight for the success, namely for the win, based on previously defined and elaborated principles. Because of the previously appointed tactics, players set the well-trained game elements to each other. The more a team can co-operate, the more successful will be its attacking play. This kind of co-ordinated team-work must be broken by the defence, which cannot be performed by sheer force only.

Modern defence players are aggressive and have an accurate manner. Defence motion is active, its depth and width, both having an offensive character, so a larger playing area can be controlled. It properly applies defence elements, based on anticipation skills. It has an assertive defence attitude: it is fair, accurate, decided and tough as well. Applying their own body power and body mass, defenders use their arms as an extension of their body, their fast foot-work also trends to get the ball as soon as possible, they almost can "read the attackers' motion".

Quotation from the rules of the handball game:

"Norms of behaviour against the opponent, fouls and faults

8.1 Allowable

a) using arms and hands to trench or get the ball

b) "playing out" the ball from the opponent by open hands, from all directions

c) closing the opponent (owning the ball or without ball) by body

d) taking a body contact with the opponent, controlling or escorting him/her from the front side, by curved arms

8.2 Not allowable

a) cutting out or knocking out the ball owned by the opponent

b) blocking or pushing off the opponent by arms, hands, or legs

c) "outflanking", catching, pushing the opponent, butting against or springing at the opponent

d) bothering, holding up or endangering the opponent any other not allowed way

(Handball Game Rules, 2001)

It is not a part of this subject but it must be mentioned that there is no successful goal-keeping without an extraordinary performance of the goal-keeper.

"Development of defence has already been defined many ways by many people, but it is undisputable that cumulating motion experiences and the very different motion types can develop training skills and motivation."

(Beyer B.K., Allyn and Bacon: Practical strategies for the teaching of the thinking, 1987)

"Qualification (training) must prepare people to a kind of work that does not exist yet in these days, the character of which cannot even be imagined yet. Children must be trained to learn, also must be provided with intellectual disciplines that they can use apply their skills to solve new kinds of problems."

(H.C. Nemor – Silberman)

In the following I intend to present the big periods of the development of defence, by showing up the defence concepts of leading coaches.

Now I intend to quote some graphics (Diagram No. 1,2,3,4) and ideas connected to "Defence" subject, delivered by Frantisek Taborsky at an international symposium of coaches, which – I think – clearly highlight the development, classification and variations of defencence

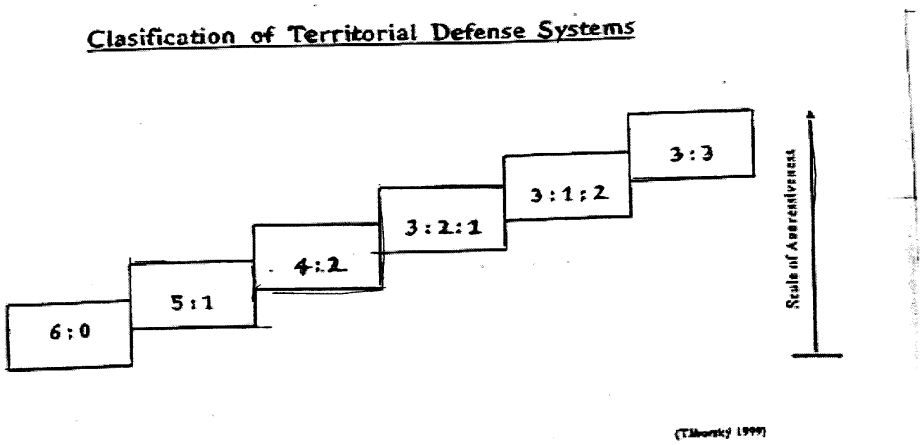


Diagram No. 1. Taborsky / EHF CC Symposium

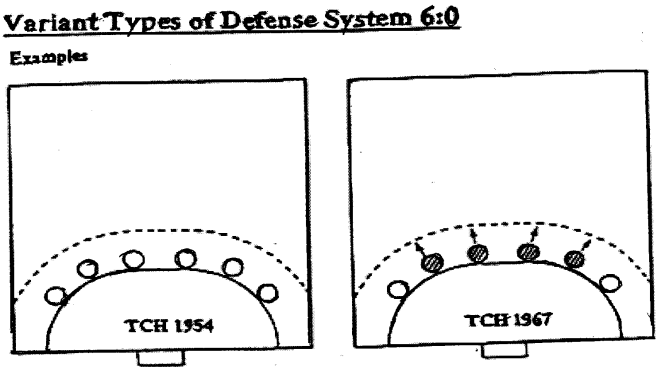


Diagram No. 2. Taborsky / EHF CC Symposium

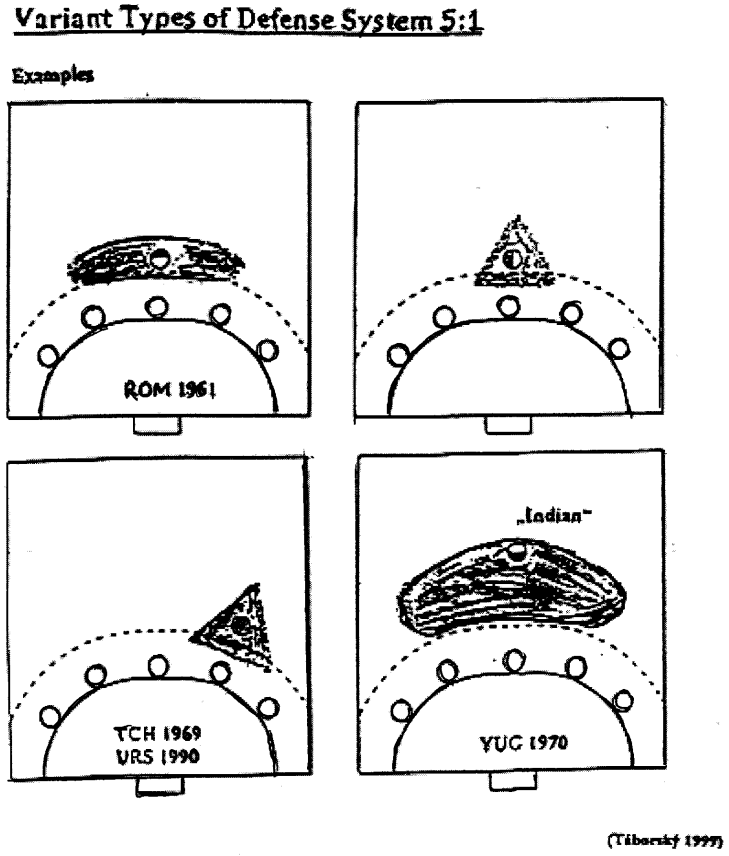


Diagram No. 3. Taborsky / EHF CC Symposium

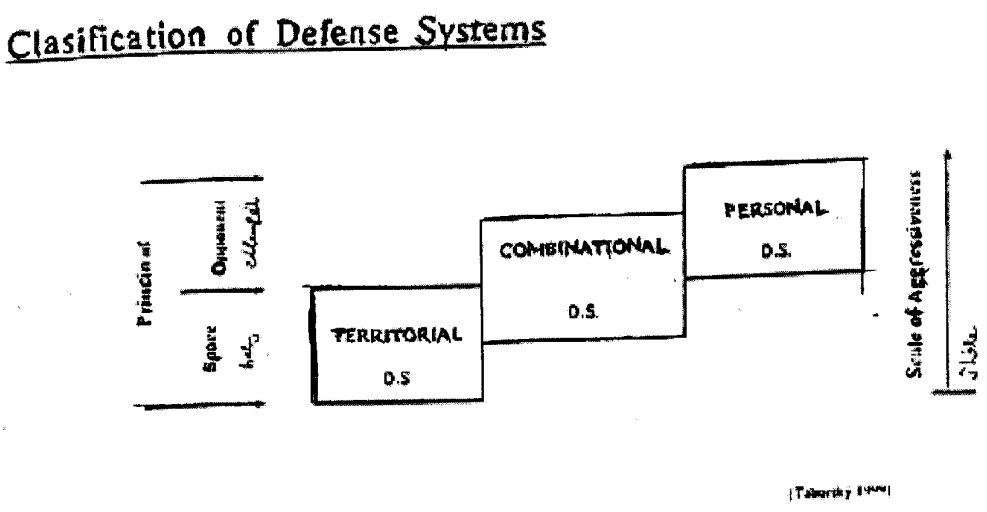


Diagram No. 4. Taborsky / EHF CC Symposium

These diagrams clearly can show the development from the starting situation of modern defence systems. You can see the development of defence systems, the increasing level of aggressiveness (Diagram No. 1.). The Zenith of the development of territorial (=zone) defence is Sweden's defence (6:0 – 1990), that was developed and improved by Sweden's picked team, lead by Bengt Johansson... That is why we call this kind of defence "Swedish Zone"...

In the development of 5:1 defence systems, sharing tasks among individual defenders has been showing a difference, focusing especially on the role of the "disrupting" players' task. Thanks to the development of this kind of "zone defence", the 3:2:1 (Yugoslavian) system has appeared which has been the most effective defence system for a long time. Formation of combined development has started at the end of 1990s, that can be followed up in the handball play of these days as well. It generated a new format and thanks to this, the philosophy of a flexible defending game has become an accepted concept of our age...

According to Juan de Dios Roman Seco, the history of handball defence does not show any positive development, systems can show up just a "poor image". This is one part of the truth...

He also highly underlines that the 6:0 defence developed from defensive to offensive character... From the 5:1 defence system has been developed the so called Yugoslavian 3:2:1 defence system, which became one of the most efficient defence systems... The author says: "The 1:5 system was an ambitious trying from Denmark in 1982-84." He describes the 3:3 system as an individual defence, applied mostly by Arabian countries like Algeria for example.

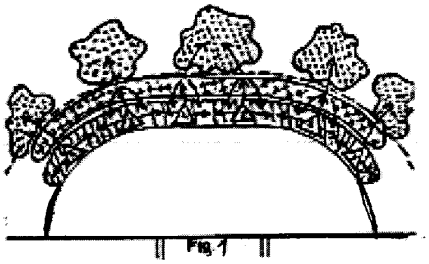
Soviet teams took their 5:1 system from the Romanian handball players and developed it in a special way. The author considers the development of the offense as a continuous process, while in the defence he can see development mainly in countries which have been going on the way of 6:0 territorial (zone) defence, and did not forget about traditional concepts and developed tactical and technical changes that have created a way for a much more open defence system, by increasing the quality of co-operation among the players.

Well defending team players have been tactically well trained, highly qualified, regardless of the basic line-up, they have been receptive for technical and tactical solutions...

unaltered and correspond with traditional norms.

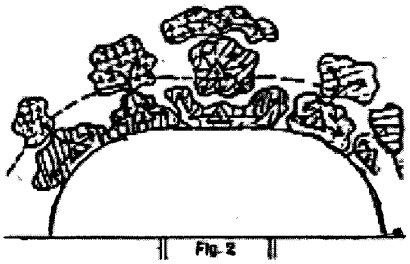
EVOLUTION OF DEFENCE IDEA 6:0 ,

Fig.1. ,
Lined field - space responsibility, traditional 6:0,
Crossed field - space responsibility, developed system 6:0,
Dotted field - space responsibility, maximum depth of 6:0 system



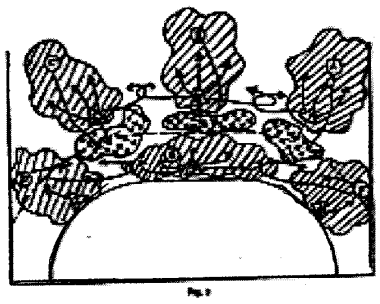
EVOLUTION OF DEFENCE IDEA 5:1 ,

Fig. 2. ,
Lined field - traditional 5:1 idea, ,
Crossed field -space responsibility, extended 5:1 idea ,
Changes of 5:1 system ,



ANALYSIS OF SPACE VARIETIES OF IDEA 3:3 ,

Fig. 3. ,
Lined field - individual space responsibility of each defensive player at initial position, ,
Crossed field - zones of eventual aid during unfolding a system and in tactical execution. .



(**Diagram No. 5.** Juan Dios Seco lecture records)

"If you add some speed, fitness and intensity to a specific defence plan – than we can start developing and we can be sure that we go on the right way, and we can work out our future defence plans. (Juan de Dios Roman Seco)

Offense and defence – must be handled with as different strategies…

In the 1980's Daniel Constantini has changed his team's defence strategy towards offensive defence… Instead of "destroying concept" they have used a kind of "getting the ball defence" which has been holding attackers under a permanent pressure …

This is the so called "5:1 French Type of Defence" which is very attractive, besides being very successful. This new concept is based on the defence variations well known up to now….

"Be the reason, not the result of owning control …"

(Daniel Constantini: Den Angriff angreifen – Prinzipen der Abwehr. From: Handball Training Magazine, September 1994)

His coaching philosophy can be summarized in 4 points:

- discouraging attacking game
- disordering the conformation, the timing of the game
- crunching/restricting the tactics of the attacking game
- getting the ball (fishing, netting)
    - pushing players to passive gaming
    - provocation of attacking fault
    - provocation of errors (faults)

This kind of concept is being accomplished by the 5:1 defence

- against starting
- in absence of players
- inset play

This kind of system is the base of the French national team's defence, which requires excellent fitness as well as outstanding individual defence abilities.

In the multi-line defence systems, the co-operation of the back centre, and the disrupting defender is essential for a successful defence play. During the selection of players

to these two determining posts, particular antropo-metrical requirements must be considered, like body weight, height, wing span of arms, etc. Conditional, co-ordinational, and mental abilities, as well as optimum psychical attributes, are very important selection factors, that we can build the technical-tactical qualification upon... Starting from the "general" advancing to the "special" we develop, and perfectionize players' skills, driving to owning the special post...

Regarding the basic line-up, 1:1 efficiency of players in different defence zones, and their co-operation level can guarantee the balance of their defence, and keeping that balance, so we can say that their defence matches are the requirements of "compatibility".

Central back players control the defence, they are the fix points, conducting the activity of the disrupting players, helping in side aside directions, if necessary stepping out of the defence wall and striking, or – if the game satiation requires it – trenching, creating shooting zones, blocking like that a part of the goal, supporting the defence this way as well.

The disrupting player, in the second line of defence stops the attackers by checking, moving inwards, compared to the fore-axis of the field (course), crumbling the continuity and rhythm of the crossing game. By disordering the continuity of the offensive play the disrupter forces the attackers to directions that drive them to untrained game situations, so the efficiency of attacks will definitely decrease. The activity of really "outstanding" players can also motivate opponents to give up the initial concept of the offence. Being "mobile" in side-directions, they can help co-defenders stepping out, and – if needed – step back into the first defence line, support, and if required by the game situation, deny goal-shooting by retrenchment.

He/she controls the defence of the central part, having an excellent sense of time, and ability of "anticipation".

The activity of these two players is marked by mutual help and a beneficial level of co-operation, that requires good psychical and mental shape.

Alternatives of dual partnerships

- partnership of defenders No. 1 and 2 (on both sides)
- partnership of the No. 2 defender and the back centre defender (on both sides)
- partnership of the No. 2 defender and the disrupter (on both sides)
- partnership of the disrupter and the back centre defender

Gaming, efficiency, co-operation level and power will be analysed in the multi-line defence systems

- Statistical criteria of dual systems…?
- Dominant dual systems like
    - Sliding
    - Approach
    - Switch

Raising the most important question of this present thesis:

Which is the strongest determining factor of multi-line defence system characters?

My answer/supposition:

The number of basic defence techniques in dual partnerships...

IV. Methods

To answer the questions, I chose matches that were played by the World's best multi-line defending national teams and European elite club teams. These matches are most suitable for demonstrating the response to our supposition.

Following picked teams have been studied:

- 5:1 zone defence of the French National Team
- 3:2:1 zone defence of the Croatian National Team
- 3:3 zone defence of the Algerian National Team

Club teams, studied in the following:

- 5:1 zone (special) defence of Atletico Madrid (former Ciudad Real)
- 3:2:1 zone defence of Croatia Osiguranje Zagreb, THW Kiel

Selected matches were played by the teams chosen during the latest World & European Championship games...

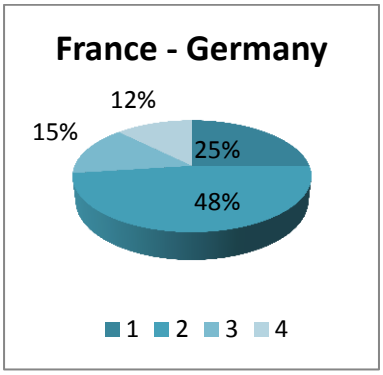
Regarding club teams, matches played in the 2011-2012 season of Champions League have been analyzed. It means I have been studying 13 matches, recorded on DVD, according to the international principles and standards.

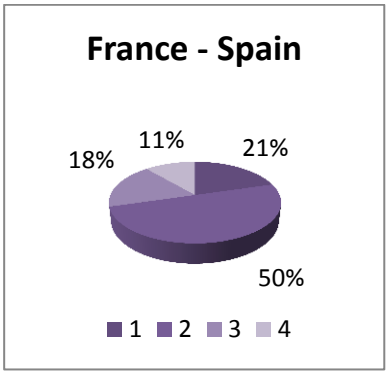
The reason why I chose the above mentioned teams is that they do a pioneer work in multi-line defence, and defence activity itself is "seeded" in their tactical "repertoire". It is clearly visible that during their trainings they focus on accordance and team-defence. By their strong and individual concepts and experiences they can contribute to the development of the open defence. Following the way they can show – other teams also can get help for preparing themselves, as well as for enlarging their "repertoire". This kind of defence "concept" can help developing the dynamics of the game, as well as making the game more spectacular.

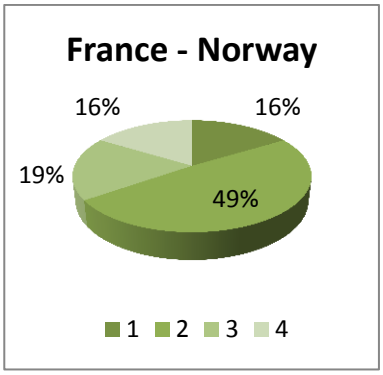
Study of France's partnerships – used in defence situations

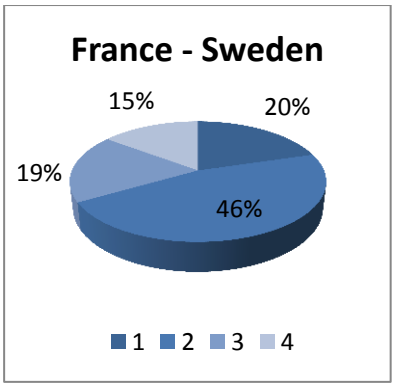
MATCH	Type of relationship in 5:1 defence									
	(1) **Defenders 1 - 2**		(2) **Def. 2 – Back Centre**		(3) **Def. 2 - Destroyer**		(4) **Destroyer – Back Centre**		**TOTAL**	
	cases	*%*	**cases**	*%*	**cases**	*%*	**cases**	*%*	**cases**	*%*
France - Germany 2008 European Championship main round	12	*25*	**23**	***48***	7	*15*	6	*13*	48	*100*
France – Spain 2008 European Championship main round	9	*20*	**22**	***50***	8	*18*	5	*11*	44	*100*
France – Norway 2011 World Cup semi-final	8	*16*	**24**	***49***	9	*18*	8	*16*	49	*100*
France – Iceland 2011 World Cup semi-final	6	*13*	**27**	***59***	7	*15*	6	*13*	46	*100*
France - Sweden 2011 World Cup quarter-final	11	*20*	**25**	***46***	10	*19*	8	*15*	54	*100*

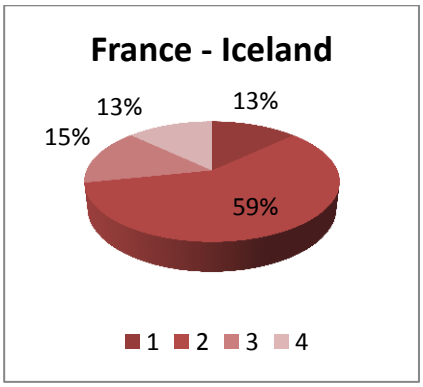
Chart 1











Study of club team partnerships – in 5:1 defence

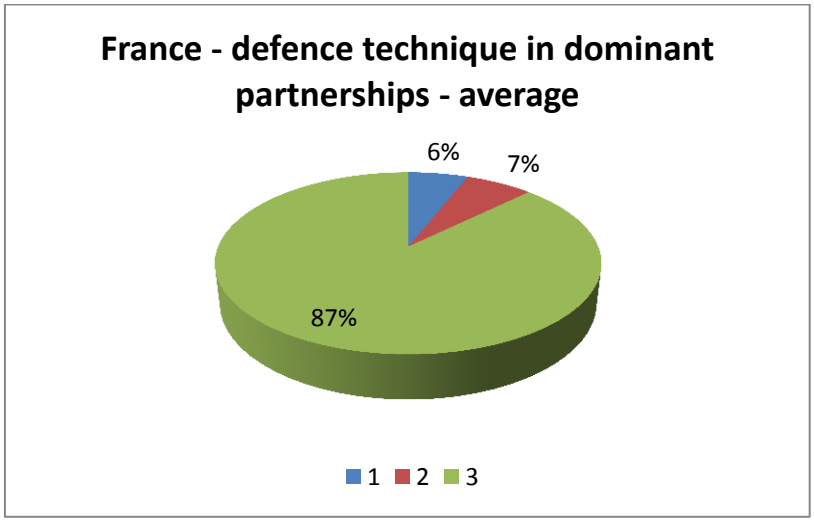
MATCH	Type of dual relationship in 5:1									
	(1) **Defenders 1- 2**		(2) **Def. 2 – Back Centre**		(3) **Def. 2 - Destroyer**		(4) **Destroyer– Back Centre**		**TOTAL**	
	cases	**%**	**cases**	**%**	**cases**	**%**	**cases**	**%**	**cases**	**%**
Atletico Madrid – Barcelona Spanish Cup (Cup of Spain)	9	*18*	**22**	***44***	11	*22*	8	*16*	50	*100*

Chart 2

France's defence technique in dominant partnerships

MATCH	Defence technique in a dominant partnership							
	1. Gliding		**2. Approach**		**3. Switch**		**TOTAL**	
	cases	**%**	**cases**	**%**	**cases**	**%**	**cases**	**%**
France – Germany 2008 European Championship Group Circle	2	*10*	1	*5*	**18**	***86***	21	*100*
France – Spain 2008 European Championship Group Circle	1	*5*	2	*9*	**19**	***86***	22	*100*
France – Norway 2011 World Cup Semi-final	1	*4*	2	*8*	**21**	***88***	24	*100*
France – Iceland 2011 World Cup Semi-final	1	*4*	2	*7*	**24**	***89***	27	*100*
France – Sweden 2011 World Cup Quarter-final	2	*8*	1	*4*	**22**	***88***	25	*100*
Average	1	6	2	7	**21**	**87**	24	100

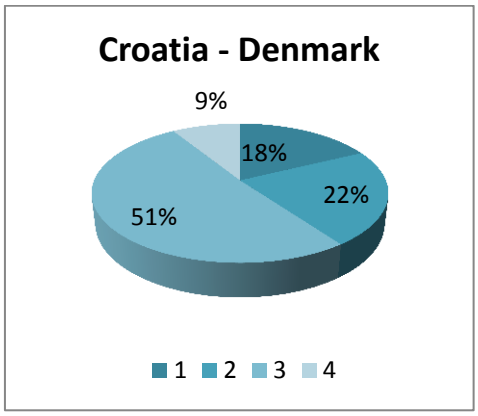
Chart 3

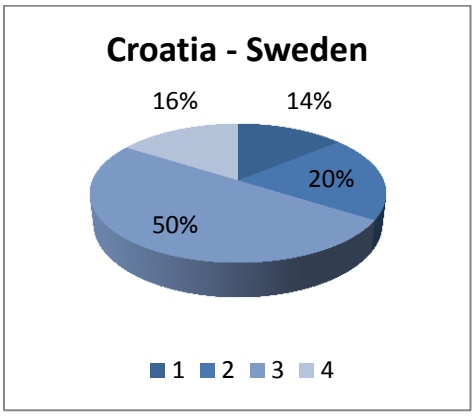


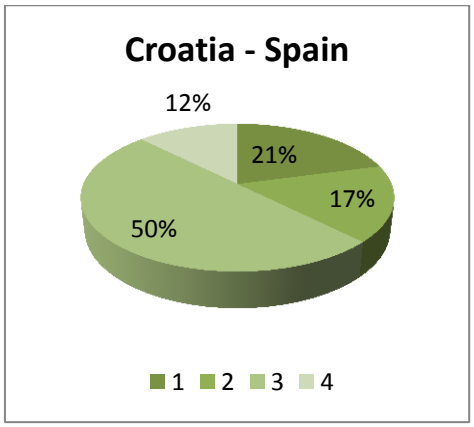
Study of Croatia's dual partnerships

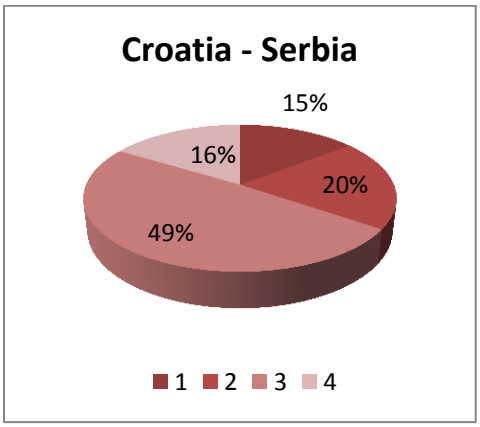
MATCH	Type of dual partnership in 3:2:1									
	(1) **Defenders 1 - 2**		(2) **Def. 2 – Back Centre**		(3) **Def. 2 - Destroyer**		(4) **Destroyer – Back Centre**		**TOTAL**	
	cases	***%***	**cases**	***%***	**cases**	***%***	**cases**	***%***	**cases**	***%***
Croatia - Denmark 2008 European Championship – Final Game	8	*18*	10	*22*	**23**	***51***	4	*9*	45	*100*
Croatia – Spain 2009 World Cup Main round	10	*21*	8	*17*	**24**	***50***	6	*13*	48	*100*
Croatia - Serbia 2011 World Cup Main round	8	*15*	11	*20*	**27**	***49***	9	*16*	55	*100*
Croatia – Sweden 2011 World Cup Semi-final	7	*14*	10	*20*	**25**	***50***	8	*16*	50	*100*

Chart 4





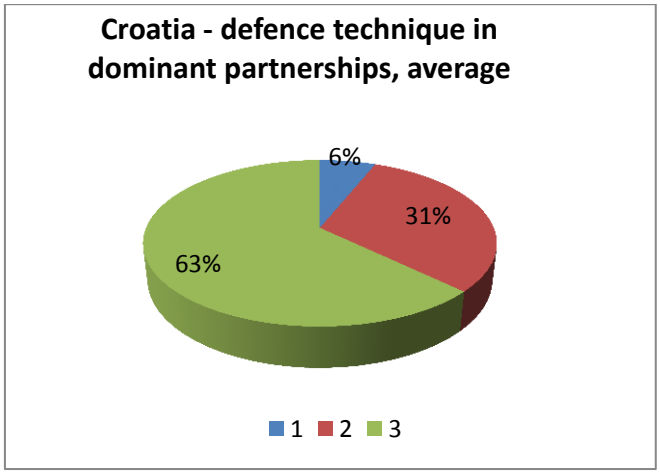




Study of Croatia's defence technique in dominant partnerships

MATCH	Defence technique in dominant partnerships							
	1. Gliding		2. Approach		3. Switch		TOTAL	
	cases	%	cases	%	cases	%	cases	%
Croatia – Denmark 2008 European Championship Final	1	*4*	5	*22*	**17**	***74***	23	*100*
Croatia – Spain 2009 World Cup Main round	2	*8*	7	*29*	**15**	***63***	24	*100*
Croatia - Serbia 2011 World Cup Main round	1	*4*	9	*33*	**17**	***63***	27	*100*
Croatia – Sweden 2011 World Cup Semi-final	2	*8*	10	*40*	**13**	***52***	25	*100*
Average	2	6	8	31	**16**	**63**	25	100

Chart 5



Study of club team partnerships in 3:2:1 defence

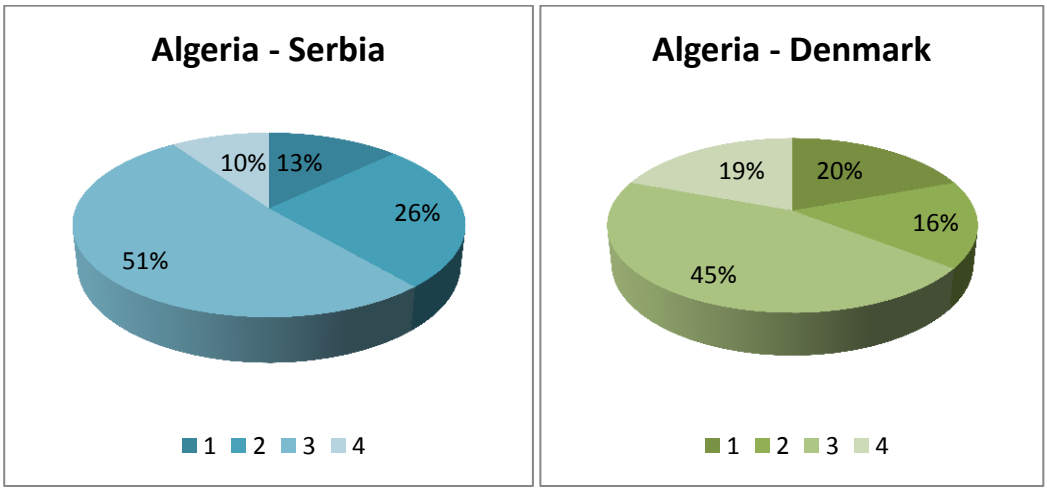
MATCH	Type of partnership in 3:2:1 defence									
	(1) **Defenders 1 - 2**		(2) **Def. 2 – Back Centre**		(3) **Def. 2 - Destroyer**		(4) **Destroyer– Back Centre**		**TOTAL**	
	cases	***%***	**cases**	***%***	**cases**	***%***	**cases**	***%***	**cases**	***%***
O.Zagreb – THW Kiel CL Match	10	*20*	9	*18*	**24**	***48***	7	*14*	50	*100*
THW Kiel O.Zagreb CL Match	10	*20,8*	8	*16,7*	**22**	***45,8***	8	*16,7*	48	*100*

Chart 6

Study of Algeria's dual partnerships

MATCH	Type of dual partnership in 3:2:1 (defence)									
	(1) Defenders 1 - 2		(2) Def. 2 – Back Centre		(3) Def. 2 - Destroyer		(4) Destroyer– Back Centre		TOTAL	
	cases	%	cases	%	cases	%	cases	%	cases	%
Algeria - Serbia 2011 World Cup preliminaries	4	*13*	8	*26*	**16**	***52***	3	*10*	31	*100*
Algeria - Denmark 2011 World Cup preliminaries	6	*19*	5	*16*	**14**	***45***	6	*19*	31	*100*

Diagram 7



V. Development

Analyzing the 5:1 defence system

The studies can clearly show the differences among the numbers of "cases" covered by defending pairs as well as the way of co-operation of two defenders.

1. <u>Partnership of defenders No. 1 and 2</u>

   At those matches where the attacking teams placed the line player between the defender pairs and built their attacking system upon it – defence actions performed by these defending pairs were more frequent.

   Generally speaking, the attacking teams changed to a game with running up at the wings**,** with two line players. Initiation of attacks started on the territory

between the defenders No. 1 and 2, from the pick-and-roll game of the left/right back players and line players, the defence against it was generally achieved by switching.

2. Partnership of defenders No. 2 and back centres

   In this system, these defending pairs are most charged, as the number of actions is the biggest here. These players must play with high concentration, timing and an adequate "aggression" as well, to break the attackers' partnership and the rhythm of the attack. The most frequently used way to perform 2 against 2 playing in defence: is switching.

3. Partnership of the disrupting player and the defender No. 2.

   In the basic strategy of defence, in the activity of these two defenders we can frequently see that, reacting to the cross-motions, the get to the same "altitude" and closing is performed by changing. In this partnership, the biggest challenge for the middle back is to run into the defenders' wall, which is also frequently performed by switch.

4. Partnership of the disrupting player and the back centre

   Building up the attack by closing in on the destroyer (point) will result in a 2-2 situation for the defenders, from the view of the line player. The frequently used defence tactic against this is switch. Co-operation with the point, against pick and roll, is mostly developed after escorting the cutting players, when the point steps back to the defence line. The way to perform this is generally switch.

Analyzing the 3:2:1 defence system

1. Partnership of defenders No. 1 and 2

   It is getting typical at those matches, just like the 5:1 defence system, where attacking teams, after "running in", changing to two line players, place the line players in these areas. Partnership of two defenders in a "2 against 2" game – is usually defence by switching.

2. Partnership of defenders No. 2 and central backs

   As a consequence of the back centre's defence job it was not as typical partnership as it was at 5:1 defence, as back centre, doing "flanker motions", could follow the running of the ball, and did not leave the front line of the defence, so there was less co-operation between the two defence lines. In the construction of the defence, in this partnership we see the biggest difference compared to the 5:1 defence system. When using the "running in" method, transition to two line players, defence of the central area is dominant in the play of the disrupting player's zone defence.

3. Partnership of the disrupter and the defender No. 2.

   In this kind of co-operation there was a spectacular difference compared to the 5:1 defence. Good partnership between the two defenders is crucial in the basic concept of 3:2:1 defence, because the main task of these players is stopping the incoming back players, and crowding them out of this area. It is a very important defence strategic intention to stop the attackers' efforts to gain the central area and a good position for goal shooting. During the matches there is a big number of attacks like that, so fighting against them requires good physical and mental condition. The defending pair was given the support by the back centre's play, providing control and help from the back side. Regarding defence technique, problems were solved by falling-out (by-passing), and switching. "Basic pillar" of 3:2:1 defence is a close, anticipative and assertive activity of these three defenders. Breaking this kind of defence is only possible by a very orderly planned, well-established tactical game, which requires an exceptional investment of energy of the attacking team.

4. Partnership of the disrupting player and the back centre

   Following the logic of the game there were just a few "2 against 2" game situations, against building up an attack by "running-in", sometimes they crop up after the return steps of the point player. To solve this problem, players were usually defending by falling-out and switching.

Analyzing 3:3 tone defence

Only a few teams choose this kind of difficult zone defence, requiring covering a large area, which is very hard to learn, and very energy demanding... Mainly those teams chose this kind of defence form, that have a great form (shape) and in the attacks they have just a few players having a big shooting power. Because of the larger distance between the two defence lines, we can also see elements of side-by-side blocking as well. Changing happens, when – if crossing motions – defenders stay in the same defence line, and they can solve timing of "gives and takes". This kind of alternative way of defence does not really allow a continuous running of the ball, but permanently keeps players under pressure, motivates them to initiate. Smooth possessing of the ball has a very important role in the attackers' play close to defenders (dribbling, ball technique, etc.), because otherwise "steals" happens, which can result a fastbreak.

Defending pairs set up in a flexible way, they are not pre-determinated, but the co-operation between them comes into existence according to the situation. Most partnerships emerge among the 3 defenders "working" in the 2nd defence line. Taking over the defence activity, winning 1:1 (1 against 1) fights, these are the preconditions of a successful defence. In the 2:2 (two against two) game, the "pass on – take over" rules of "side-by-side blocking" defence will appear.

VI. Results and Discussion

Multi-line defence systems require a high standard of defence activity in the 1:1 (one against one) game. It forms the base of the team tactic in each of the studied systems, supporting the successful defence play. It also reflects the defence philosophy, represented by the team. It carries on the style marks, characterizing the team. Its typical marks are: the outstanding constitutional capabilities, perfect physical condition, co-ordinated motion, and personality marks, which can help fighting clashes and difficulties. Having a special spiritual and mental outfit, that helps the players keep motivated all along, and achieve their own aims. The standard of the individual defence tactic, applied in the defence systems, has special "posting" requirements, and has a crucial importance in owning the "scope of duties". The more open is the defence system, the stronger is the 1:1 (one against one) defence, demanding a more active and more aggressive defence activity in practice. The body-to-body (man-to-man) fight

is a decisive factor in the sport. Risking body checking, forcing out the attackers' faults, breaking up the rhythm of the play are challenges and exercises that all players have to keep in their "repertoire".

Tactics at the defending positions

Defence at wing position

Wing defenders choose 1:1 (one against one) defence against their respective attackers in nearly all actions. Also in wing defence we must distinguish playing against "with ball" and "without ball" attackers. Playing against an attacker having the ball, outside defenders want to achieve a "fault" by a well timed stepping-out, disturbing like that the start of an attack. They force the opponent to pass the ball from a "fault" situation or even before the "fault", causing confusion in performing an attack. Important task of wing defenders is to stop "running-in" actions, which could be performed in the direction of passing or against... The speed of the running-in players must be slowed down by (body) checking, defenders may not let them into the defence wall, instead: they must be forced to the zone in front of the defence, and provide co-defenders with information. In cases of running-in actions, performed at the opposite side of the ball passing, it is very important that – besides observing the ball technique – central players have to monitor their direct opponents, when the ball is approaching them... Line players arriving to the wing zone must be "taken over" and defended by switching usually. An important task of wing defenders is "back up", because attackers preferably go to the zone between the defenders 1 and 2. Efforts to gain the ball, in the situations created by ball-steals, and "interceptions" need a good sense of timing, missing it can result a direct score. Blocking as a defence technique is rarely applied by wing defenders.

Activity of defenders No. 2

Getting impetus is important in arresting the speed-up of the attacking play. Against a fast and continuous ball technique, in open defence, the offensive and "getting impetus" activity of defenders No. 2 is crucial. This kind of fight is the base of an open defence. In the 5:1 defence system, used for example by the French National Team, the approach of the defender No. 2 at the line player's side aims to force the back player(s) towards the shooting hand, closes the opposite direction. In these situations, defence is performed according to the rules of 2:2 (two against two) playing. In 3:2:1 defence, the defender No. 2 at the lone player's side, moves ahead and gets out of a locked situation by fall out. Closing the passing ways as well as provoking free throws and attacking faults also belong to the challenges of the defenders No. 2. The position of defenders No. 2 at the opposite side is diagonal (crossing), which means that after a step-back, one of the legs is in front of the six metres line, the other leg tends towards the other shooting (back) player. The defender No. 2 playing at the "blank" side closes the ways of long passing by moving ahead.

Tactic and challenges of back centre defenders

Back centre's role is the base and one of the most important defending posts of all open systems. It is not "by chance" that they are the basic players of successful teams, having great experience, they are skilled and qualified. Their job is commanding the defence, arresting the "playing-in" actions and double passing, and in the "running-in" play –taking over the running-in players and controlling defence. The most typical difference between 5:1 and 3:2:1 defence is: while in the 3:2:1 defence, the back centre defenders are continuously moving in the area between the two No. 2 defenders, they rarely leave the line. Important technical element of their defence play is "blocking", defence of the lone player acting from the ball's side. In 5:1 defence, after switching, the player might step out as far as 10 metres. The most frequent used technique is blocking, even by (body) checking, defence against pick and roll is mainly performed by switching. Back centre players will not allow themselves being locked, or let the line player or the "running-in" player move behind them. Leading defenders of the studied teams are: Didier Dinart, Spoljaric.

Tactic and challenges of the “destroying defender (point)”

The role of the point changes, depending on the offensive tactics of the opponent. Defence tactic focuses on the opponent, gets flexible, aims to force attackers to give up their initial concept. During the studied matches disrupting defenders performed different defence concepts, resulted by the different philosophies of defence systems, and the traditions of the team. There were some disrupting defence situations, where the purpose was to lock out the middle back player, and there were some others where the defender stepped back and “escorted” them to the defence wall... We saw players who – aggressively – tried immediately “place” a fault on the attacker. The moving direction of the disrupting players can change depending on the tactic, in case of “running-in” play their task is to attack the “ball-carrying” side, in other cases: to escort the “running-in” player to the defence wall by side-by-side blocking, and staying in the centre of defence, moving a little bit back in depth. The role of the disrupting defender to block passing, filtering long passing actions, control the territory behind. It is another position in open defence systems, which most sharply determines the defence system. It requires a kind of complex defence technical and tactical skills, and capability of anticipation, that will help those players ”reading” the play of the attacking team.

The success of the French Team has been supported by the variability of their defence tactic. Back centre players represent stability, while disrupting defenders act for variety of tactics. There were different defence tactics used when disrupting defender was Bertrand Gille, or Nikola Karabatic, or Daniel Narcisse.

In the past few years the 3:2:1 defence of Croatia has been marked by the name of Igor Vori.

Defending quadrants – defending “rhombuses”

In the multi-line defence systems, sharing of tasks shows up not only in dual partnerships of players, but it also requires a purposive co-operation of several players, depending on the pre-planned tactic. The quality of the 2:2 (two against two) defence also has an effect on it. Dual partnerships emerge from the local and spatial positions of the players. These kinds of motions can complement each other, and they also include the success of

defence play. If we imagine the co-operation among defenders spatially, we will see defending quadrants, or defending "rhombuses", the angles of which always move to the direction of the ball, being a part of a continuous transformation, depending on the responses to the emerging situations.

A spatially projected defence can show the diversity of individual defence tactics, as well as playing elements like "attacking out" (breaking out), supporting, closing back, or moving towards the ball. These individual solutions can make the defence play spectacular, as well as the players themselves. Thanks to the defenders' prestige deserved like this the attackers will lose their assertiveness, their self-confidence, their adventurous attitude.

In the open defence systems, based on the above listed studies and on my own experiences I can declare that – in the selection process – finding and training the right back centre players and disrupting players is the most important challenge. The personality and the skills of people playing in these positions, provides the stability of the defence system. Their characters have a significant effect on the team-mates, their accuracy and decision-making ability has a highlighted importance in the defence philosophy. During the trainings, handball teams can be inspired by effortful and excruciating exercises to do their jobs with joy, with efficiency, and consciousness.

We also can declare that once we find the right people fitting in these two slots, we will easily be able to build up our defence, because filling in all the other posts will give us much less difficulties.

VII. Conclusions

In my thesis I have been trying to show dual partnerships of different open, multi-line defence systems, as well as their importance in the successful defence play of handball teams.

Comparing different open defence systems

The clearest difference between 5:1 and 3:2:1 defence systems is how they respond to the attacking play, based on "running-in". 3:2:1 defence keeps the basic line-up, even if the opponent performs a change to two line players. At the same time, 5:1 system uses a defence against it – either by eliminating the sides or by "escorting back". 5:1 system is much more flexible, defence tactic is oriented upon the opponent's strategic concept, forcing the attackers

to give up their initial concept. Organization of defending game can change anyway, by the sideward dislocation of the disrupting player towards the "neutralization" of a more dangerous goal-shooting player, up to setting up a 4:2 defence line, or up to man-to-man blocking of back players by wingers. A determinative difference can be found in the tasks of the back centres, which – in the 3:2:1 defence – never will fall out to the No. 2 defenders' line, while in the 5:1 defence even the front-back situation can be changed, which means that after the disrupting player's step back, the back centre can get into the position of a "disrupting player". 3:2:1 defence focuses on protecting the central, most dangerous zone for makes, tries to move out the game from this area by continuous "step-in" actions, to have the completions from the wing areas. The 5:1 defence is about locking out a dangerous back player many times, and then forcing the attacking play to a smaller area, so the defence of the central area is less important in these cases than it is at the 3:2:1 defence.

My long time coaching experiences can prove that dealing with "more open" defence forms is the right way... Getting used to these methods is laboursome, it requires a lot of patience and pedagogical delicacy, but a consequent using of these ways has a significant influence on the efficiency of the team, and the invested work will be remunerated. Players' attitude will change; they realize the tough but nice task in defence... Aggressive defence, focusing on the ball, opportunity of quick scoring is a great motivation. The concept of the open defence system generates a demand of developing individual skills, which has a favourable influence on the player's career later on... It also provides less skilful and more powerful players with an opportunity of "breaking out". Its difficulty is that it requires some change of attitude in the team, and – as explained above, it is very hard to find the right people for the two decisive defence positions. During my own coaching career, I have been successful by using two main ways in open defence: 1. with players who arrived for example from an (ex) Yugoslav country, which means from a handball culture using open defence on a high level, or 2. with players who were educated in this defence system, starting from their childhood, and who were skilled and trained by coaches understanding the essence of the open defence. It was much harder to deal with older players: they were raising objections against it, because its labour some character, so they hardly adapted this kind of playing philosophy.

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IX. List of diagrams

Declaration of originality

Undersigned Károly Nagy, graduating student at the International Coach Training Centre of the Hungarian Handball Federation, being aware of my criminal responsibility, I hereby declare and certify by my signature that my thesis titled:

"COMPARING MULTI-LINE DEFENCE SYSTEMS BASED ON THE SIGNIFICANCE OF DUAL PARTNERSHIPS OF HANDBALL PLAYERS"

is my own and independent (original) product, and using references in it has been accomplished (carried out) according to the rules of source handling (usage).

I take notice of the fact that in a thesis the following cases are considered as plagiaries:

- using a literal quotation without quotation marks and naming references
- quotation of a content without naming references
- marking another author's published ideas as own ideas.

Undersigned person I declare, that I got acquainted with the meaning of the plagiarism, and I notice that in case of plagiary my thesis will rejected.

I also declare that the printed and CD copies of my thesis are completely the same, in their text and content as well.

Budapest, 26th November, 2012.

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Károly Nagy

Student

PERFORMANCE ANALYSIS

A way to improve coaching methods in handball

by

Zoltán Marczinka

Hungarian Handball Federation, Hungary

Summary

Monitoring and analysing performance is an integral part of everyday sporting life. In team sports particularly, it is very important to recognise successes and failures and analyse them in relation to a preset team plan or tactic. At major international handball events, there is the availability of the official match statistics which satisfies the needs of the coaches from match to match. However, it is necessary for every coach to draw up a match statistic sheet which is tailored to suit a team's needs and also functions as a useful coaching tool.

The aim of my study is to enhance performance analyses by designing a match statistics sheet which includes as much information as possible and collecting documentary evidence about the regularity of the most important technical-tactical elements at a handball game. In order to achieve these objectives I used a number of matches from the 10th Women's European Handball Championship 2012 in Serbia, as the field of testing for observing and collating data on the spot.

The results showed that data collated and formatted systematically provides an excellent opportunity for various analyses. Apart from categories that are traditionally used, I introduced others which add more detail to the analysis. I found that this type of performance analysis is a practical tool used to continually enhance the team's overall performance.

Keywords: performance indicators, match statistics, collating data, analysis, bench marks

1. Introduction

Constantly monitoring and analysing performance is an integral part of everyday life as an instrument for enhancing achievement. In sport generally, it is very important to recognise successes and failures and analyse them in relation to a preset team strategy or tactic. In team sports particularly, where performance thus success is made up of several elements, it is difficult to take note of and recall all the important episodes of the game.

As part of their job, teachers and coaches are experts at observing events and performances yet are unable to commit everything to memory. In their studies about coaches observing and remembering key performance factors, Franks and Miller (1986 and 1991) concluded that no matter how well trained in observation coaches were, generally they were only able to recall 30% to 50 % of what they had witnessed. [1,2] However, it is obvious that a thorough analysis based on systematic and accurate observation is a fundamental instrument for enhancing performance.

1. 1. Review of the Literature

Official match statistics are created at all major handball events. International and Continental Handball Federations produce quantitative analyses made up of statistical data using the expertise of specialist companies: at the Olympic Games - Omega, Atos, Acer [3]; at the World Championships - PHMS Pictorial Handball Match Statistics [4] and MSL technology and at the European Championships - SWISS TIMING and WIGE Data with the University of Gdansk [5]. These specialist companies produce computerised data on individual and team statistics in different set categories. On a daily basis they produce Match Team Statistics, Play by Play/Running Score, Results and Match reports to satisfy the daily needs of coaches and journalists. Immediately after the competition ends, Top Team, Top Scorer (including: Goalscorers, Assists, Goals and Assists, Steals, Blocked shots, Punishments), Goalkeeper Statistics (including: Saving shots, Saving Penalty shots), Overall Team Statistics (including: Players and Goalkeepers), Team Fair Play and Tournament Summary are produced to facilitate further comprehensive analyses.

The advantages of these statistics are that they are made on the spot, usually four scouts enter the data to increase accuracy, they are pictorial and well set out and they are easily accessible on-line. Unfortunately, this type of analysis is only produced at major international events

thus making the format unsuitable for the everyday needs of a coach. Furthermore, the disadvantage is that the categories are pre-determined and the coach may want a different set (e.g., positive-negative fouls, individual defence errors, penalty earned) to better suit his/her team. Therefore, it is advisable to draw up a match statistic sheet which is tailored to suit a team's needs and also functions as a useful coaching tool.

Nowadays technology is a useful tool and there is a lot of analysis software on the market. AlmaSport [6], Dartfish [7], Utilius vs Handball [8], SportScout [9] or Visualcoach [10] are all good programs for analysing. However, there are times and places where the use of a computer is not viable and in these instances it is necessary for coaches to be able to draw up their own personal method of analysis.

1.2. Coaching process

"The coaching process is about enhancing performance by providing feedback about the performance to the athlete or team." (Hughes, M.) [11] Since human memory is limited and the coach's opinion is often emotional and biased, the use of measuring and recording tools is necessary to support the feedback process. Data for movement analysis, technical - tactical evaluation or for statistical purposes can be complied by hand and/or through a computerised notation system. Both these systems are used either independently or together and both have advantages and disadvantages.

A more traditional form of collating data either during a match or after it from a recording, the *hand notation system* is generally very accurate. However, to present the data to the coach and athletes meaningfully is time consuming and storing the information is impractical. A more modern form of collating data, the *computerised notation system* on the other hand solves this problem by recording and storing data simultaneously. It can convert data into a graphical or pictorial form to make it easier for players and coach to understand and at the same time it adds to the data base. Unfortunately operator, hardware or software errors might occur in this system and are difficult to correct particularly in real-time recording. Therefore, it is crucial to have an experienced operator to enter the data quickly and correctly.

No matter which notation system coaches prefer, two main factors must not be neglected: the analysis must be objective and systematic. Objectivity can be achieved through a careful and neutral notation system. While a well established coaching process provides a systematic framework for performance analysis.

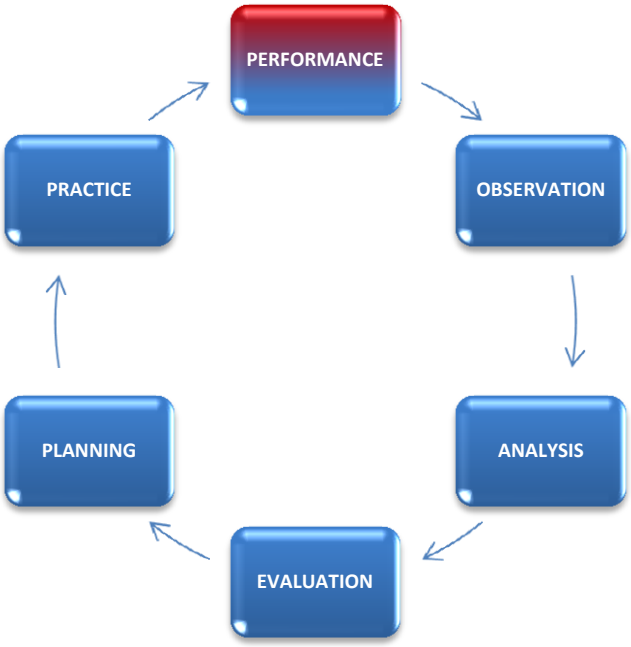


Fig.1. Coaching process

The coaching process is cyclical – it starts and ends with PERFORMANCE as the main objective is to always improve. In order to make the process more manageable, it is best to break it down into smaller elements.

OBSERVATION – *accurately quantifying performance during or after the match*

1. establish key performance indicators
2. collect data systematically
3. format data to facilitate analysis

ANALYSIS – *the collated data can be used in different ways:*

1. direct comparison with the opponent player in the same position
2. comparing the data of two players of the same standard
3. measuring the data against a player's previous performance

EVALUATION – *drawing conclusions based on the analysis*

1. classification/ ranging the results of analysis
2. comparing the results to the set key performance indicators
3. interpretation of findings

PLANNING – *converting the findings into practice*

1. to work out a training strategy
2. goal setting / bench marks
3. designing exercises and training schedule

PRACTICE – *implementing new training schedule*

1. changing the training routine
2. measuring the effect of the new exercises
3. including the changes into the game strategy

A well designed coaching process ensures that the performance analysis is carried out in an organised, systematic and cohesive manner, with respect to the teaching-learning scheme.

1.3. Objectives

The aim of my study is to enhance performance analyses by:

1. Designing a match statistics sheet which includes as much information as possible and can be easily filled in/completed;
2. Collecting documentary evidence about the regularity of the most important technical-tactical elements at a handball match in order to provide data for further studies.

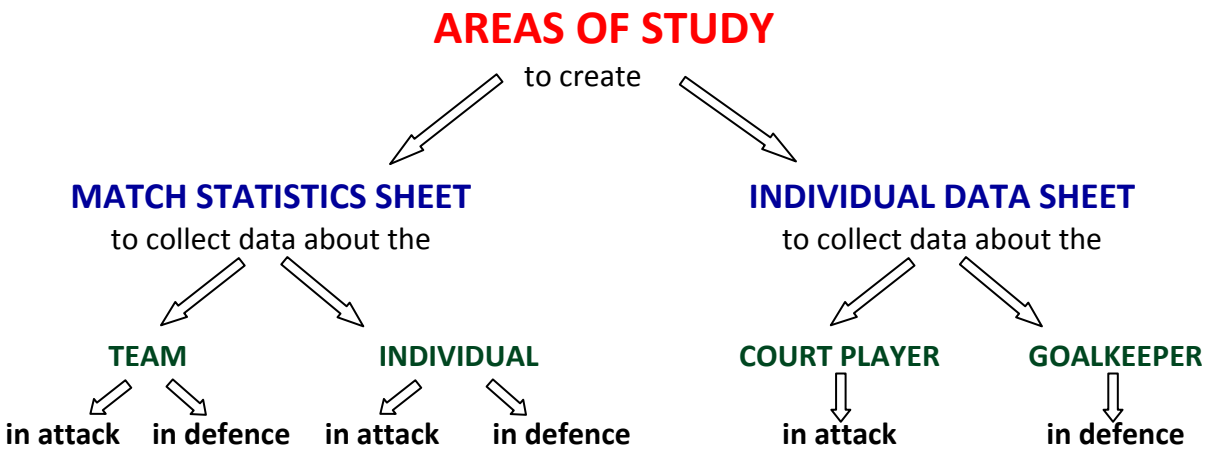


Fig.2. Areas of study

2. Methods

In order to achieve these objectives I used a number of matches of the 10th Women's European Handball Championship 2012 in Serbia, as the field of testing for collating data on the spot.

As part of their practical course requirements, a group of Hungarian students from the ICEC level III Coaching Course were given the task to observe, collate data and annotate the preliminary matches of Group C in Novi Sad. Each student had to make at least one match analysis as part of their group and also to collect individual data on at least one playing position. The 30 coaches (listed in the Appendix) involved all had previous experience in collecting data and doing match analyses as they are all active coaches at present. In order to have a uniform and standardised notation system, I designed a template with set criteria and I pre-trained them beforehand in order to ensure accuracy in the notation system. My aim was also to design a system that is self explanatory, easy to summarise onto one sheet, to computerise and evaluate (see Attachments 1-3, Hungarian version).

Such a large group of observers allowed me to divide them into groups for match analysis (4-6 observers / match / team) and for collecting individual data about the court players and goalkeepers (1 observer / position / team).

We used a manual notation system during the matches then transferred the data into Excel after the event. This method of processing data proved to be practical as I was able to take advantage of both manual and computerised notation systems.

2.1. Match statistics

The main reason for compiling match statistics is to get an overall picture of the match through recorded evidence of what happened for further analysis. Visual information seen on court is converted to tangible statistics on paper and thus, in this way numbers can be analysed statistically so that conclusions can be drawn based on factual evidence.
When designing a match statistics template, the following should be taken into consideration:

- The aim of statistics is not to record everything but rather to record only the relevant facts, therefore it should be done in combination with the official match report. Thus,

it is not necessary to include all the elements that are already recorded in the match report; rather it should be used as a valid support document.

- Every coach should ideally design his/her own statistical form according to his/her own needs, yet all match analyses should include the characteristic handball specific categories such as goalshooting efficiency, saving ratio, errors, assists and so on.

- Match statistics can be completed on the spot, during the match or after the event from a recording. However, one observer/operator can record only one team's activity at a time. During a game, experience or more man power is needed to be precise while from a recording it is easier to be accurate as there is always the possibility to rewind, re-watch and check.

- To maintain objectivity, the match statistics should reflect the referees' decision not personal opinion. However, personal opinion/subjectivity can be discussed when analysing match performance with the team. (For example, a statistical symbol may suggest that a player has made an error but in light of the match circumstances it may have been acceptable.)

- It is more practical to do match statistics manually on a prepared template and then convert it to the electronic version. However, with good computer skills an observer can recorder the data directly into a computerised template. (For example, copying/pasting the symbols directly into the Excel template.)

2.1.1. Designing a Statistical Template

The set up of the template sheet is very important because it needs to facilitate easy recording of as much information as possible and to allow easy analysis later on.

For ease of recording,

- it is practical to use A4 paper horizontally because of the many categories needed;
- the key to the symbols used should always be displayed on the same page;
- the symbols used for notations should be simple and easy to draw;
- the two halves of the match should be marked with different colours.

2.1.2. Analytical Categories

The two basic units of attack and defence can be further sub-divided into smaller categories (key performance indicators) such as goalshooting, assists, errors (in attack) and blocking, stealing, individual errors (in defence) for cross comparison thus analysis. Therefore, it is important to define and clarify each category to avoid misconceptions.

- **Fast break** (F.B.) - a player shooting at the goal after completing a counter attack.
- **Break through** (B.T.)- an attacker shooting at the goal from close range after penetrating the defence wall.
- **Through shot** (T.S.) - a player's direct scoring attempt from a long range, through or over the defence wall
- **Wing shot** (W.S.) - an attacker shooting at the goal from an acute angle, from the wing position
- **Pivot shot** (P.S.)- an attacker shooting at the goal from close range, around or above the goal area line
- **7m shot/save** (7M sh/sa) - a penalty throw either taken by an attacker or saved by the goalkeeper
- **7m earn** - a defender's infringement which earns the attacker a penalty throw
- **Assist** (AS.) - a pass which provides a team mate with a clear scoring chance
- **Steps** (S.P.) - infringement of the step rules
- **Line** (L.N.) - stepping on or over the goal area line
- **Lost ball** (L.B.) - losing possession of the ball while in attack
- **Cause Attacker's Fault** (c. A.F.) - an attacker causes a fault by turning into or running to the defender
- **Negative Foul** - when an attacker with the ball is stopped by the defender
- **Positive Foul** - when a defender stops an attacker with a ball by checking
- **Blocking** (BL.) - a way of averting goal shooting by using the body above the knee
- **Steal** (ST.) - gaining possession of the ball from the attackers by knocking the ball away or intercepting a pass
- **Earn Attacker's Fault** (e. A.F.) - a defender provokes the attacker to make an incorrect body contact thus gaining possession of the ball
- **Individual Error** (I.E.) - any obvious individual mistake which leads to losing possession of the ball or being scored against (Table 1)

Place: ● - goal ○ - missed 1st half 2nd half x = assist or error and goal Teams:
Date: ⊗ - saved ⊘ - post / bar ⊙ - blocked NP - not played / = assist or error and no goal Final score:

MATCH STATISTICS		GOALSHOOTING							ATTACK Activity						DEFENCE Activity					Goal or Save / Shot
No.	Name	Fast B.	Break-T.	Through-S.	Wing S.	Pivot S.	7 M sh/sa	7 M earn	Assist	S.P.	L.N.	L.B.	c. A.F.	negative FOUL	positive FOUL	BL.	ST.	e. A.F.	I.E.	
	Goal / Shot - Total																			

Key of Symbols: F.B.= Fast break, B.T.= Break-through, T.S.= Through-shot, W.S.= Wing shot, P.S.= Pivot shot, 7M = Penalty-throw, sh/sa = shot/saved, AS.= Assist, S.P.= Steps, L.N.= Line, L.B.= Lost Ball, c.A.F. = causing an attacker's fault, negative FO.= stopped by a defender in attack, positive FO = stops an attacker in defence, BL= Blocking, ST = Steal, e.A.F = earning an attacker's fault, I.E.= Individual Error

Table 1

2.2. Individual Data Sheet

The frequency of certain technical and tactical elements during a handball match impacts on the training program, that is, how much and how often they need to be practised by each position. However, it is difficult to find any data relating to the appearance of these elements in handball literature. Therefore, using the same event (the Women's European Championship), I experimented by recording and collating some data on the technical-tactical repertoire of the *court players* and on the saving techniques of the *goalkeepers*.

2.2.1. Designing the Template for the Individual Data Sheet

As for the match statistics, the format of the template sheet has great importance because it needs to facilitate easy recording of as much information as possible and allow for easy analysis later on.

For ease of recording and practicality, I

- used A4 size paper horizontally in order to be able to put in a time scale;
- designed a separate sheet for each position (RW, RB, CB, PV, LB, LW and GK);
- used simple symbols (G, J, W, W/o) with the key displayed on the same page;
- marked each match half on a different sheet then added the data together;
- divided the halves into 5-minute periods;
- left room for 8 attacks / defences within these 5-minute periods;
- focused on the court players' technical-tactical elements in attack only;
- recorded the goalkeepers' saving techniques in defence only;
- used a separate section for recording attacking / defending time and substitution.

2.2.2. Categories for Collating Data

Similarly to the match statistics, when designing a template for collating individual data, it is important to define and clarify each category to avoid misconceptions.

COURT PLAYERS

- **Passing -** A player throws the ball to his/her teammate either from the ground (G) or while jumping (J).
- **Bouncing the Ball -** The player in possession either bounces the ball once (B) or dribbles continuously (D) while in motion. The number doesn't represent the number of repetitions rather it indicates how many times the same player gains possession and bounces/dribbles.
- **Faking -** Any recognisable faking movement such as starting fake, arm swinging fake, rotation fake, passing and shooting fake with (W) or without (W/o) the ball.
- **Position Change -** When the player changes his/her original playing position and either:
    - temporarily swaps position with another teammate *(Switching)*
    - crosses paths with another teammate *(Crossing)*
    - runs in or out from the defence wall *(Running In/Out)*
    - moves to same position on the other side of the court – eg. the right back moves to the left back position *(Running Across)*

- **Offensive Blocking -** When an attacker restricts the opponent's freedom of movement by physically obstructing him/her
- **Goal shooting -** When the player concludes the attack by throwing the ball at the goal.
- **Attacking time –** the time measured from the moment a team gains possession of the ball to the moment they lose it.
- **Number of substitution –** Indicates how many times a substitution is made within a given position. (Table 2)

GOALKEEPERS

- **Saving from Wing position -** when a player shoots at the goal from the section of the court where the horizontal shooting angle is not larger than 15 degree.
- **Saving from Pivot position -** when an attacker jumping over the goal-area line shoots at the goal from close range, in the middle section of the court.
- **Saving from a Clear Scoring Chance -** when a player after a fast break, shoots at the goal undisturbed.

- **Saving after Break Through -** after beating a defender 1vs1, a back court player jumps over the goal-area and concludes the action with a goalshot.
- **Saving Through Shots -** when a back court player shoots at the goal from long range, through or over the defence line

    - from left back position, ground shots
    - from left back position, jump shots
    - from centre back position, ground shots
    - from centre back position, jump shots
    - from right back position, ground shots
    - from right back position, jump shots

- **Saving from Penalty Throws -** when an attacker executes a penalty throw from the 7 metre line.
- **Defending time -** the time measured from the moment a team loses possession of the ball to the moment they re-gain it. (Table 3)

The number of categories can be extended or reduced but, the important thing is that there shall be enough for a thorough analysis including acknowledged handball specific areas where key performance indicators can be set. It is also important that the data collated should present a realistic picture and give a fair judgement of the team. No matter how precise the collation of data is, the observer must face the fact that certain factors or circumstances may influence the result of the observation. For example:

- *The team's playing style* (that is, the wingers are instructed to stay in the corner, to focus only on goalshooting or pivots are told to support the attack mainly with blocking);
- *Consistency of the team* (an outstanding player in a back court position or technically less skilled player in wing position);
- *The opposition's style in defence* (they apply a ball or player oriented defence system with a closed or a more open formation).

Therefore, it is necessary to observe a number of matches in order to be able to make realistic and valid statements. The more matches observed the larger the data base, thus giving stronger credibility to the conclusions drawn.

INDIVIDUAL DATA SHEET - Court players							
Attacking position:	Team:	Half:	Place:	Date:	Teams:	:	
Period	**0-5 mins**	**5-10 mins**	**10-15 mins**	**15-20 mins**	**20-25 mins**	**25-30 mins**	**Total**
Progression of score	:	:	:	:	:	:	:
Passes							
Bouncing the ball							
Faking							
Position change – **Switching**							
Position change – **Crossing**							
Position change – **Running in / out**							
Position change – **Running across**							
Offensive blocking							
Goalshooting							
Time spent in Attack							
Number of substitutions							

G= ground pass, **J**= jump pass, **B**= bouncing, **D**= dribbling, **W**= with the ball, **W/o**= without the ball, **T**= Total

Table 2 and 3 Individual data sheet – Court players/Goalkeepers

INDIVIDUAL DATA SHEET - Goalkeepers

Goalkeepers: Team: Half: Place: Date: Teams: :

● = goal ⊗ = saved ○ = missed ⊘ = post/bar ⊙ = blocked

Period		0-5 mins	5-10 mins	10-15 mins	15-20 mins	20-25 mins	25-30 mins	Total
Progression of score		:	:	:	:	:	:	:
from Wing H = Hand/s, L = Leg/s, B = Body								
from Pivot H = Hand/s, L = Leg/s, B = Body								
in Clear scoring chance H = Hand/s, L = Leg/s, B = Body								
after Break-through H = Hand/s, L = Leg/s, B = Body								
Saving Through-shots from	**Left Back, ground s.** H = Hand/s, L = Leg/s, B = Body							
	Left Back, jump s. H = Hand/s, L = Leg/s, B = Body							
	Centre Back, ground s. H = Hand/s, L = Leg/s, B = Body							
	Centre Back, jump s. H = Hand/s, L = Leg/s, B = Body							
	Right Back, ground s. H = Hand/s, L = Leg/s, B = Body							
	Right Back, jump s. H = Hand/s, L = Leg/s, B = Body							
from Penalty - throw								
Time spent in Defence								

3. Development

Following the Coaching Process model, the next step is to work out how to analyse the data collated through observation. As mentioned, it is practical to transfer the data directly at the match or indirectly from the observation sheet into an excel table because the system allows for quick and accurate mathematical calculations.

3.1. Analysing the data – Match Statistics

The Match Statistics table was designed in such a way that it is possible to analyse the data both horizontally and vertically.

- The **horizontal analysis** describes each player's individual performance by going through the statistical categories from *left to right*.
- The **vertical analysis** describes the team's performance by adding up the individual performance of the players from *top to bottom*.

In **Goalshooting** by calculating the *shooting/saving efficiency* ratio in each position (e.g. 2 goals / 3 attempts from pivot position), then working out the sum of them as the total efficiency (e.g. 13 / 19) indicates the players' effectiveness in the concluding phase of the attack. The advantage of this marking system is that the symbols don't just show whether there is a goal or not, rather it shows why the shot is unsuccessful (e.g. missed, blocked, post etc.), giving the analyst a fuller picture. The order of symbols within each section shows the sequence of shots at the goal, while the different colours denote the shots made in the different halves. With the help of this marking system, a player's goalshooting progress can be tracked to give a full picture of his/her performance throughout the match. (Table 4)

MATCH STATISTICS		GOALSHOOTING						
No.	Name	Fast B.	Break-T.	Through-S.	Wing S.	Pivot S.	7 M sh/s	Goal or Save / Shot
14	NORMAN Gordon	● ● ⊗ ●	● ⊗ ● ●	⊗ ● ● ⊗ ⊗ ●	●	● ⊘ ●	●	13 / 19
21	GROSS Andreas	●		⊗ ● ● ●	● ⊗ ●			6 / 8

Table 4 Goalshooting performance

In the first two categories of the **Attack Activity** section the players' positive actions are recorded: *earned 7m penalty - throw* and *assists* given to the team mates. They are also important indicators regarding the players' involvement in attack organisation/ setting up scoring positions. While in the other categories the marks specify the areas where the players lose possession of the ball as a result of *step* mistakes, *line* infringements, *lost ball* or *causing an attacker's foul*. These are considered to be negative actions. A "*negative foul"* signifies that although the attacker does not lose possession of the ball, he/she is stopped by the defender with checking. This slows and breaks down the attack organisation and thus is not advantageous for the attackers. (Table 5)

MATCH STATISTICS		ATTACK Activity							
No.	Name	7 M earn	Assist	S.P.	L.N.	L.B.	c. A.F.	negative FOUL	
14	NORMAN Gordon	x x	x / x x / x x		x	x x / x x /		x / x / x / x / x	
21	GROSS Andreas	x	x /	x		x	x	x / x	

Table 5 Offense activity

Defence activity starts with "*positive foul"*, so that the two categories are next to each other for ease of comparison. Since it is advantageous for a defender to stop an attacker, this move is considered to be a positive action. The next categories, *blocking* a goalshot, *stealing* the ball by intercepting a pass or snatching it out from an attacker's hand as well as *earning an attacker's foul* are also considered positive actions for the defender. While *individual error* is an identifiable and obvious mistake, a negative action of the defender. (Table 6)

MATCH STATISTICS		DEFENCE Activity				
No.	Name	positive FOUL	BL.	ST.	e. A.F.	I.E.
14	NORMAN Gordon	x /	x	x x /		/ x x
21	GROSS Andreas	x x		x	x	x x / x x

Table 6 Defence activity

The " / " symbol signifies an assist or an error but when crossed " X " it also represents the consequence of the action – a goal, giving further information to the observer.

Place: **Novi Sad, SRB** ● - goal ○ - missed 1st half 2nd half **x** = assist or error and goal Teams: **CRO** vs **HUN** ECh
Date: **04. 12. 2012** ⊗ - saved ⦸ - post / bar ⊙ - blocked NP - not played / = assist or error and no goal Final score: **28:27** (15:14)

MATCH STATISTICS		GOALSHOOTING						ATTACK Activity							DEFENCE Activity					Goal or Save / Shot
No.	Name	Fast B.	Break-T.	Through-S.	Wing S.	Pivot S.	7 M sh/sa	7 M earn	Assist	S.P.	L.N.	L.B.	c. A.F.	negative FOUL	positive FOUL	BL.	ST.	e. A.F.	I.E.	
12	HERR Orsolya (GK)	● ● ● ⊗ ●	● ● ● ● ● ●	⊗ ● ● ⊗ ⊗ ●	● ●	● ● ●	● ●					/		/ / / / /	/				x x x	4 / 25
21	KISS Éva (GK)	●		⊗ ● ● ●	● ● ●															1 / 8
6	VÉRTEN Orsolya		⊗ ●		⊗ ⊗ ⊗					/	/	x		/ / / / /	/				x x	1 / 5
7	SZUCSÁNSZKI Zita		● ⊗	⊗			⊗		x x			x x	/	/ /	/ / / / /	/	x x	/			1 / 4
11	SZABÓ Valéria													/	/ / /	/			x /	0
13	GÖRBICZ Anita		●	● ⊗ ⊗			● ● ⊗ ● ●	x x	x x x x x x x	/		x / x / x	/	/ / / / / / / /	/ / /		x / x	/	/ x x	8 / 11
15	KLIVINYI Kinga		●																	1 / 1
18	SZAMORÁNSKY Piroska	● ●				⊗		x x			/			/ / / / / / /	/ / /	/	x	x x	x x x	1 / 3
20	RÉDEI-SOÓS Viktória		● ● ⊗	⦸ ● ⊗ ⊗	⊗			x x	x	/		x x	x	/ / / /	/ /		/		x x x x	3 / 8
22	BÓDI Bernadett										/		/	/ /		/				0
23	SZEKERES Klára														/ / / / /	/ /	x		/ x x	0
83	KOVACSICZ Mónika	● ●		⊗	●			x	x x	/		x		/ / / /	/ / /		x		x x x x	3 / 4
87	TOMORI Zsuzsanna		● ● ●	● ● ● ⊗ ⊗ ⊗ ● ● ● ⊗								x /	/	/ / / / / / / / / /	/ / / /	x /	x	x /	/ x x x x	9 / 13
	Goal / Shot - Total	4/4	9/12	8/19	1/5	0/2	5/7	7	12	4	5	14	5	48	29	6	10	6	29	27 / 49 55%

Key of Symbols: F.B.= Fast break, B.T.= Break-through, T.S.= Through-shot, W.S.= Wing shot, P.S.= Pivot shot, 7M = Penalty-throw, sh/sa = shot/saved, AS.= Assist, S.P.= Steps, L.N.= Line, L.B.= Lost Ball, c.A.F. = causing an attacker's fault, negative FO.= stopped by a defender in attack, positive FO = stops an attacker in defence, BL= Blocking, ST = Steal, e.A.F = earning an attacker's fault, I.E.= Individual Error

Table 7: Completed Match statistics

3.2. Analysing the data – Individual Data Sheet

Figure 3 summarises the process of analysing the data and this method can be applied to both court players and goalkeepers.

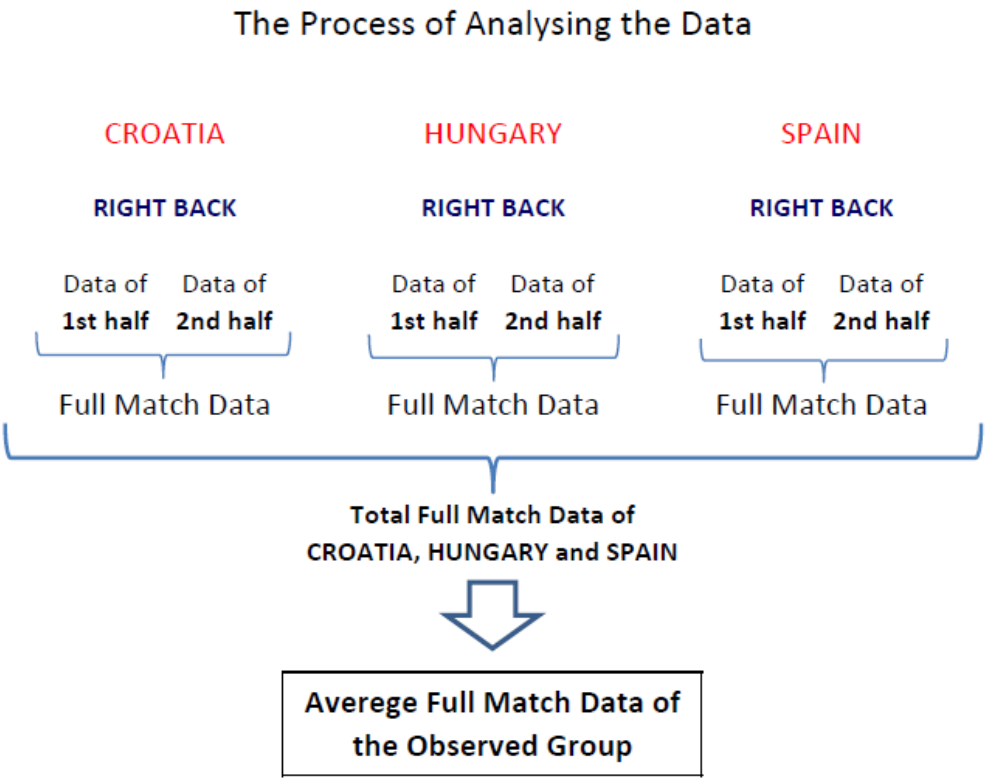


Fig.3 Process of Analysing the Data

Following the recording, the data of each half can be merged into a Cumulative data sheet, (see Table 8 and 9) where each position's performance in each category can be seen on one sheet. Viewing the data *horizontally*, the frequency of the technical-tactical elements or goal saving techniques can be analysed half by half, position by position. Whereas reading it *vertically*, the sum of data indicates how many actions are carried out by each position. Through this cumulative data sheet the technical-tactical repertoire of a team's individual positions are described. Then, by summarising the total full match data of each team onto one sheet, the average full match data of the observed group is analysed (see Attachments 5 and 6). In this set up, the teams' total data is put next to each other by position in separate columns to give opportunity for cross comparison.

CUMULATIVE DATA SHEET (Court players)

Team: **SPAIN** Match : **ESP - CRO** Place: **Novi Sad, SRB** Date: **05. 12. 2012.** Score: **25:21** (13:10)

Playing Position			RIGHT WING			RIGHT BACK			CENTRE BACK			PIVOT			LEFT BACK			LEFT WING			Total	
Period			I.	II.	total	I.	II.	total	I.	II.	total	I.	II.	total	I.	II.	total	I.	II.	total		
Passes		G	20	26	**46**	74	64	**138**	122	111	**233**	35	17	**52**	82	84	**166**	27	29	**56**	**691**	**707**
		J			**0**		1	**1**	2		**2**	2		**2**	5	2	**7**	2	2	**4**	**16**	
Bouncing the ball		B	3	4	**7**	5	10	**15**	8	15	**23**			**0**	15	12	**27**	4	3	**7**	**79**	**100**
		D	1		**1**			**0**		1	**1**			**0**	5	2	**7**	5	7	**12**	**21**	
Faking		W	2	6	**8**	5		**5**	1	5	**6**	1	1	**2**	12	4	**16**	2	2	**4**	**41**	**51**
		W/o			**0**		5	**5**			**0**		1	**1**	1	1	**2**	2		**2**	**10**	
Position change	**Switching**	W	1		**1**	1	1	**2**	1	2	**3**	1		**1**	15	5	**20**			**0**	**27**	**54**
		W/o			**0**		3	**3**	9	3	**12**			**0**	5	6	**11**	1		**1**	**27**	
	Crossing	W			**0**	2		**2**	3		**3**			**0**		3	**3**		1	**1**	**9**	**20**
		W/o			**0**	1		**1**	3	2	**5**		2	**2**	3		**3**			**0**	**11**	
	Running in / out	W	2	2	**4**		3	**3**		2	**2**	2	5	**7**			**0**		3	**3**	**19**	**46**
		W/o	2		**2**	8	2	**10**	1	3	**4**	6	2	**8**			**0**		3	**3**	**27**	
	Running across	W			**0**		1	**1**			**0**	3		**3**			**0**			**0**	**4**	**11**
		W/o			**0**			**0**	1		**1**	4		**4**	1	1	**2**			**0**	**7**	
Offensive blocking		W			**0**			**0**		4	**4**	2	5	**7**			**0**			**0**	**11**	**44**
		W/o			**0**	1	0	**1**			**0**	12	15	**27**			**0**	3	2	**5**	**33**	
Goalshooting		G			**0**		2	**2**	1	2	**3**	1	1	**2**		1	**1**			**0**	**8**	**43**
		J	3	2	**5**	3	4	**7**	5	5	**10**			**0**	6	2	**8**	3	2	**5**	**35**	
Total			34	40	**74**	100	96	**196**	157	155	**312**	69	49	**118**	150	123	**273**	49	54	**103**	**1076**	

G= ground pass, **J**= jump pass, **B**= bouncing, **D**= dribbling, **W**= with the ball, **W/o**= without the ball

Table 8 Cumulative data sheet – one team

CUMULATIVE DATA SHEET (Court players)

Teams: **CROATIA, HUNGARY, SPAIN** Event: **Women's ECh** Place: **Novi Sad, SRB** Date: **4-7. 12. 2012.**

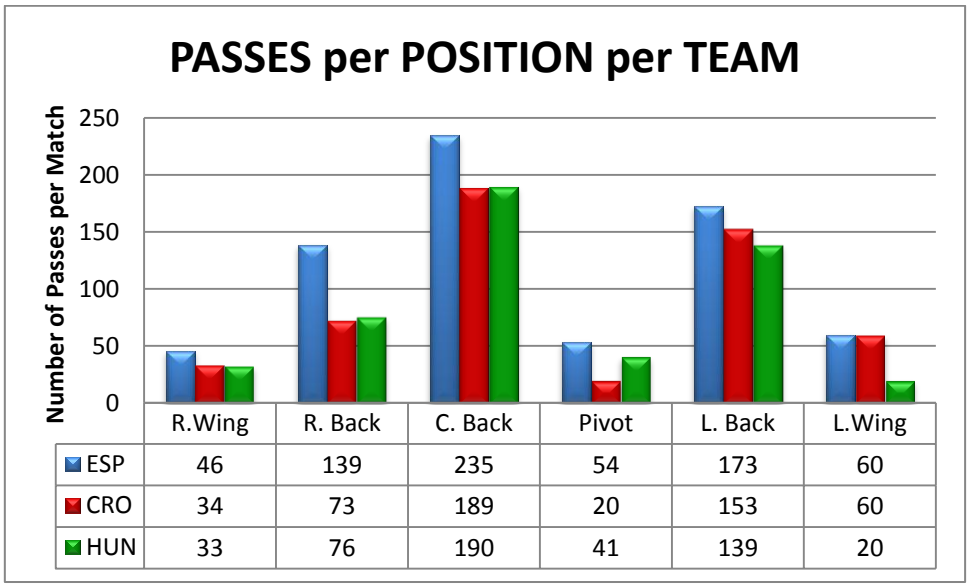
Playing Position			RIGHT WING				RIGHT BACK				CENTRE BACK				PIVOT				LEFT BACK				LEFT WING				Total	
Full Match			HUN	CRO	ESP	T	HUN	CRO	ESP	T	HUN	CRO	ESP	T	HUN	CRO	ESP	T	HUN	CRO	ESP	T	HUN	CRO	ESP	T		
Passes		G	26	34	46	106	72	71	138	281	189	188	233	610	41	20	52	113	135	150	166	451	18	58	56	132	1693	1740
		J	7	0	7	14	4	2	1	7	1	1	2	4	0	0	0	0	4	3	7	14	2	2	4	8	47	
Bouncing the ball		B	4	4	8	16	21	13	15	49	9	24	23	56	3	3	0	6	22	29	27	78	13	21	7	41	246	296
		D	4	2	1	7	0	6	0	6	0	2	1	3	0	1	0	1	1	4	7	12	3	6	12	21	50	
Faking		W	5	0	8	13	8	10	5	23	13	19	6	38	1	0	2	3	22	22	16	60	0	14	4	18	155	155
		W/o	0	0	0	0	0	1	5	6	0	0	0	0	0	0	1	1	2	1	3	3	0	0	0	0	0	
Position change	Switching	W	4	1	1	6	3	7	2	12	9	41	3	53	0	0	0	0	1	25	20	46	0	4	0	4	121	204
		W/o	0	0	0	0	2	4	3	9	19	9	12	40	0	0	0	0	17	2	11	30	0	3	1	4	83	
	Crossing	W	0	1	0	1	5	0	5	5	5	16	3	24	0	0	0	0	7	4	3	14	0	0	1	1	45	71
		W/o	0	0	0	0	1	6	1	8	1	0	5	6	0	0	2	2	0	4	3	7	0	3	0	3	26	
	Running in / out	W	0	1	4	5	0	0	3	3	1	0	2	3	2	2	7	11	0	1	0	1	3	0	3	6	29	113
		W/o	9	5	2	16	5	5	10	20	5	1	4	10	6	7	8	21	1	2	0	3	1	10	3	14	84	
	Running across	W	1	0	0	1	0	0	1	1	0	0	0	0	0	2	3	5	0	0	0	0	1	2	0	3	10	32
		W/o	1	0	1	2	0	2	0	2	0	0	0	0	5	7	4	16	1	1	2	2	0	0	0	0	22	
Offensive blocking		W	0	0	0	0	0	0	0	0	0	0	4	4	1	1	7	9	0	0	0	0	0	0	0	0	13	74
		W/o	0	0	0	0	3	4	1	8	0	0	0	0	9	10	27	46	0	1	0	1	0	1	5	6	61	
Goalshooting		G	0	0	0	0	0	4	2	6	7	2	9	18	0	1	1	2	6	4	1	11	0	0	0	0	37	150
		J	2	3	5	10	13	4	17	17	4	9	10	23	8	5	0	13	10	4	8	22	4	9	5	18	113	
Total			63	51	83		137	139	209		263	312	317		76	59	114		229	257	274		45	133	101		2835	
						197				463				892				249				755				279		

G= ground pass, **J**= jump pass, **B**= bouncing, **D**= dribbling, **W**= with the ball, **W/o**= without the ball, **T**= Total

Table 9 Cumulative data sheet – one group

4. Results and Discussion

Data collated and formatted appropriately provides an excellent opportunity for various analyses. Taking the category of "passes" as an example, teams can be compared by the number of passes done in each position (differences and similarities between the teams). This data can also be used to draw comparisons between the average number of passes of the observed teams per position (differences and similarities between the positions).



	R.Wing	R. Back	C. Back	Pivot	L. Back	L.Wing
ESP	46	139	235	54	173	60
CRO	34	73	189	20	153	60
HUN	33	76	190	41	139	20

Diagram 1 Total passes of the teams by position

When analysing diagram 1, several facts can be pointed out:

- Spain produced more passes in each position then the other two national teams and as a consequence they had more ball contacts in total (707) than Croatia (529) and Hungary (499);
- Advancing from the side to the centre, the number of the passes increase: left or right back court players generally make 2-3 x more passes than the wingers while the centre backs make 4x more passes than the wingers or the pivots;
- The wingers of the Hungarian team were less involved in passing (53) than the same players in the other two teams (106 / 94);
- The back court players of Hungary and Croatia produced approximately the same amount of passes. (215 / 226)

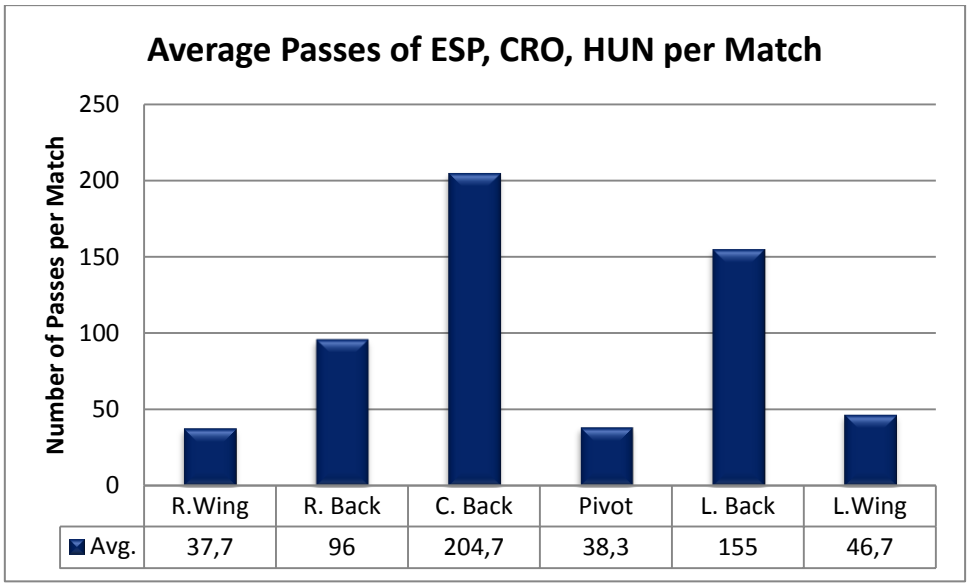


Diagram 2 Average passes of the teams by position

When comparing the average passes of the three teams position by position, several observations can be made.

- It is obvious that those players who play in the first line of the attack (R. Wing, Pivot, and L. Wing) do fewer passes than those who carry out their activity in the second line of the attack (R. Back, C. Back, L. Back);
- In fact, players in the R. Back, C. Back, L. Back positions together did almost 4 times more passes than those who played in R. Wing, Pivot, L. Wing positions;
- Moving from the side to the centre, the number of passes increase: Left or Right back court players generally execute 2-3 times more passes than the Wingers and the Centre Back even does 4 times more passes than the Wingers or the Pivot;
- The Wingers together play only as many passes as the players in the R. back position, while the C. Back players pass more times than these three positions together;
- There is not a significant difference in the number of passes between the two wingers, yet the L. Back does approximately 1.5 times more passes than the R. Back on the other side of the court;
- Players in the L. Back and the L. Wing positions together and alone use more passes for attack organisation than the players in the R. Back and the R. Wing positions.
- When analysing the minimum – maximum values of the diagram, it is clear that the Pivots had the least contact with the ball (38.3 passes) and the C. Back handled the ball the most (204.7 passes). The difference is more than the total number of passes done by the L. Back position during the whole match.

Apart from the previous example where the passes were compared to the *positions* the **cumulative data sheet of court players** provides opportunities for various comparisons. Continuing to use the category of "Passes" as the example, the data collated *separately in each half* can be compared so that the differences between the frequency of passes (in the halves) can be see and then analysed as an indicator of the collective work. The ratio of passes made *from the ground* and *from the air* can be measured against each other half by half or as a total. Comparing the number of passes to the goals scored in the *5 minute* intervals, at *halftime* or *at the end,* can be used as a performance indicator in terms of success. A comparison between the *different categories* (e.g. comparing the pivot's running in /out to the passes made) can indicate a correlation between them (e.g. the position change and the number of passes could suggest that there are more passes as a result of more movement). More examples could be given suggesting that both the individual's and team's performances can be well described using this data.

Although there is not enough data neither to comprehensively analyse the goalkeepers' performance (only one match per team) nor to draw definitive conclusions, when analysing the **goalkeepers' cumulative statistics** (Table 10), it is clear that the set up of the data sheet will allow for various comparisons to be made.
Looking at the table vertically, the goalkeepers' saves per team can be viewed *half by half* and *section by section*. This data then is added up at the bottom of the table as *total saves* allowing for a cross comparison between the teams. Moving down the table, the goalkeepers' saving performances can be compared in each section, even on the basis of which *body part* was used for saving. Then, by adding up the results of all four teams in the section, the *frequency of saving* can be read at the end of the line. By doing this from top to bottom and left to right, conclusions can be drawn and certain tendencies can be established. In the section of 'saving through shots', the saving ratio from the *different back court positions* can be compared to each other. Moreover, the number of saves and which body part is used for saving can be compared, then analysed. It is also possible to compare the *sections to each other* (e.g. saving from pivot position versus saving from the wing) not just on the total savings, but also based on which body part the goalkeepers used.

Once enough matches have been observed and a data bank established, the different categories provide benchmarks for comparison. The result of this comparison then helps the analysis-evaluation process which in turn allows for conclusions to be drawn.

CUMULATIVE STATISTICS (Goalkeepers)

Event: **Women's European Championship** Place: **Novi Sad, SRB** Date: **04-07. 12. 2012.**

Teams			CROATIA			GERMANY			HUNGARY			SPAIN			Total	
Goalkeepers			*M. Zderic* *I. Jelcic*			*K. Schülke* *C. Woltering*			*O. Herr* *É. Kiss*			*C. Gonzales* *C. Navarro*				
Matches			ESP vs CRO			GER vs ESP			HUN vs GER			GER vs ESP				
Halves			I.	II.	T	I.	II.	T	I.	II.	T	I.	II.	T		
SAVING																
from Wing		H	1		1	1		1	2		2	1		1	5	
		L					1	1	1	1	2		1	1	4	10
		B				1		1							1	
from Pivot		H								1	1				1	
		L														1
		B														
in Clear scoring chance		H														
		L					2	2							2	2
		B														
after Break-through		H	1		1	1	1	2				1		1	4	
		L														5
		B											1	1	1	
Saving through - shots from	Left Back, ground s.	H								1	1				1	
		L														1
		B														
	Left Back, jump s.	H				1		1	1	1	2	2	1	3	6	
		L											1	1	1	7
		B														
	Centre Back, ground s.	H														
		L														0
		B														
	Centre Back, jump s.	H	4		4	1		1							5	
		L					1	1							1	6
		B														
	Right Back, ground s.	H				1		1							1	
		L							1		1				1	3
		B				1		1							1	
	Right Back, jump s.	H							2		2	1		1	3	
		L										1		1	1	4
		B														
from Penalty - throw		H				1	1	2	1		1		1	1	4	
		L								1	1				1	5
		B														
Total			6			8	6		8	5		6	5			
					6			14			13			11		44

H = saving with Hand/s, **L** = saving with Leg/s, **B** = saving with Body

Table 10 Cumulative statistics - goalkeepers

5. Conclusions

After the data has been collected and collated, what can be gained from analysing and evaluating this information? How can a coach use this material to plan training exercises and put them into practice?

During this study, one of my aims was to design a match statistics sheet which includes as much information as possible and can be easily completed. As previously mentioned match statistics provide a comprehensive overview of any given match and this data can be used to characterise the performance of both the individual and the team. Apart from the traditionally used categories (e.g. shooting / saving ratio, assists, errors), I introduced other categories which further help to make the analysis more detailed. For example, *earning* either a *penalty* or an '*attacker's foul'* demonstrates the player's positive involvement in attack and in defence respectively. Whereas, causing an *attacker's foul* or making an *individual error* count as mistakes in attack or in defence. Establishing the categories of '*positive'* and '*negative' fouls* give further information about the player's attacking and defending behaviour (e.g. marks in the section 'positive foul' mean that the player in defence stops the attacker with the ball by checking and this is a positive remark, whereas if the player in attack is stopped by a defender and marked as a 'negative foul' then this is not a good indication of his playing attitude in attack). My experience, based on many matches analysed in this way, is that most of the time the team that has more marks in the section of 'positive faults' (stopping the attacker with ball by checking) wins the game. I also applied a new marking system: although the *goalshooting symbols* are the same for court players and goalkeepers, the interpretation of the results is different (for example, "save" is not good from the court players' perspective but means success for the goalkeeper). Using the '/' symbol signifies an assist or an error but when crossed 'X' it also represents the consequence of the action – a goal. The summary of the horizontal and vertical analyses of the data provides the opportunity to compare this data to the pre-established key performance indicators. In this way benchmarks can be set for either the individual and /or the team for future performance.

My other aim was to collate information of the areas that have not been adequately dealt with in the past. By collecting documentary evidence about the regularity of the most important technical-tactical elements at a handball match, (individual data sheets for court players and for goalkeepers) the following conclusions can be drawn:

The *number of bouncing and dribbling* indicates how much initiative a player has and perhaps how much of an individual player he/she is. The data gained in the category of *faking* can characterise the player's level of skill and demonstrates how much this player's individual activity supports the attack build up. The number of *offensive blockings* is also a measurement of how much a player helps the attack organisation and particularly in setting up shooting positions for teammates. The amount of *position changes* indicates if a team tends to build up the attack either with static or mobile attack. We can even go further, that is from the data sheet we can ascertain *what kind of* position change there is, in what proportion they appear and in which position. The more marks next to a player's name suggest his/her dominancy in a particular area of the game and demonstrate his /her place in the team's playing hierarchy. The *time-scale* shows how active a player is in the different phases of the match. By recording the number of substitutions and the duration of each attack, information about the frequency of *player substitution* in one particular position and the duration of an attack period can be tracked. The data collected about the goalkeepers indicates *how many saves* they have in each section, each playing half or in total. The marking system also shows *which body part* they tend to use more often for saving section by section, or if the goalshooting is executed *from the ground* or *from the air*.

As can be seen from this study, if the data is collated in an organised way and evaluated systematically, the conclusions drawn can facilitate performance analysis. All this information can be and should be converted into the practical work of the coach. In order to take full advantage of this information, the coach devises training sessions based on the weaknesses and strengths of his /her team derived from his/her analysis. This type of performance analysis is a practical tool used to continually enhance the team's overall performance.

Special thanks to the participants who took part of the observation process:

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(Cited websites were visited during the period of February and March, 2013.)

Attachment

Pages 28, 29 and 30 are examples of the original data sheets (in Hungarian) which were used for observation during the 10th Women's European Handball Championship 2012, in Serbia.

Helyszín: NOVISAD
Dátum: 2012.12.04.

● - gól ○ - mellé / fölé
⊗ - védett ⊘ - kapufa ⊙ - sáncolt
x passz - gól / hiba - gól
/ passz - nem gól / hiba - nem gól

Csapatok: HUN - ESP
Végeredmény: 32 : 31
(17 : 14)

		TÁMADÁS									VÉDEKEZÉS				HIBÁK					
Sz	Név	INDÍTÁS	BETÖRÉS	ÁTLÖVÉS	SZÉLSŐ	BEÁLLÓ	7 m-es dob / véd	7 m-es kiharcol	GÓLPASSZ	megállító FAULT támadásban	megállító FAULT védekezésben	SÁNCOLÁS	L. SZERZÉS	T.hibára kény.	E. VÉDŐHIBA	LÉPÉS	VONAL	L.VESZTÉS	BELEMENÉS	ÖSSZ. 66%
12	HERR O	⊗⊗⊗ ⊗●●	⊗●●● ●⊗●● ●●	⊘●●⊘⊘ ⊘●○●○ ●⊗⊗	●●●● ●●⊗ ●⊗	●●●●	●●											/		41/11
21	KISS É						●													1/0
6	VÉRTES O	●⊗			●				X/		/		/		X X X				/	3/2
7	SZUCSÁNSZKI Z		●	⊙●⊗				/	X	/	/ / / / /	/	/		/ X X		/	/	/	4/2
8	KOVACSICS A																			
9	VINCZE M				●								/		X					1/1
10	BULATH A																			
13	GÖRBICZ A		●●	●			●	/	X / X X	/ / / /			/					/ /		4/4
87	TOMORI ZS		●●●	●⊙●⊙●			●●		X X X X /	/ / / / /	/ /	/ / /	/		X X X X					15/12
22	BÓDI B	⊗	●							/	/ /		/		X					2/1
18	SZAMOSVÁSZKY P					⊗⊗⊗ ⊗● ●⊗				/ /	/		/		X X X			/ /		8/4
23	SZEKERES K	●								/	/ / /	/ / /	/ /		X X X X					1/1
20	VÉDEI SOOS		●⊙⊗⊗ ⊗	●⊗			●●	/ /		/ / /			/		X X			/ / /		10/5
33	KOVACSICZ M									/	/		/		X X					
	ÖSSZ. 66%	4/2	13/9	15/9	2/2	10/6	4/4	4	12	20	16	5	13		23		1	10	3	48/32

KÉSZÍTETTE: György László

STATISZTIKAI ADATLAP - Mezőnyjátékosok

Támadó pozíció: ***bal átlövő*** Csapat: ***Horvátország*** Félidő: ***I.*** Helyszín: ***Novi Sad*** Dátum: ***2012.12.05.*** Csapatok: ***ESP : CRO***

Időszak		**0-5. perc**				**5-10. perc**				**10-15. perc**				**15-20. perc**				**20-25. perc**				**25-30. perc**				**Összesen**
Eredmény állása		2:2				4:4				7:6				9:8				12:10				13:10				***13:10***
Átadások		5T	4T	5T	5T	3T	2T	4T	5T	3T	4T	5T	5T	5T	5T	2t	4T	3T	2T	3T	4T	3T	4t	2T	2T	
T=talajról, L=levegőből		3T	4T			1T				2L																97T, 2L
Labdaleütések		2		2	1	1		2	1	1	1		2	2			1				1		1			
		1																								19
Labdavezetések						1								1												
																										2
Cselezések		1L		1L		1L				2L			2L				1L	1L			1L		1L			
L=labdával, N=labda nélkül								1N																		11L, 1N
Pozícióváltoztatások	**Helycserék**	1L	1L	1L			1L	1N			1L		1L	1L		1L		1N	1L	1L		2L		1L		
	L=labdával, N=labda nélkül	1L																								13L, 2N
	Keresztezések	1L			1N					1L							1L	1L					1N			
	L=labdával, N=labda nélkül	1N																								4L,3N
	Kifutások / Befutások					1L								2N												
	L=labdával, N=labda nélkül																									1L, 2N
	Átfutások																									
	L=labdával, N=labda nélkül																									
Elzárások														1N												
L=labdával, N=labda nélkül																										1N
Kapuralövések														2/2T								1/0L				
T=talajról, L=levegőből																										2/2T, 1/0L
Támadási idő		32	28	36	26	32	19	21	36	56	12	40	57	24	32	9	41	39	31	27	42	21	37	14	25	
		36	26			5																				13:24
Cserék száma														1								1				
																										2

Készítette: Deáki István

STATISZTIKAI ADATLAP - Kapusok

Kapusok: ***M.Zderic, I.Jelcic*** Csapat: ***Horvátország*** Félidő: ***I.*** Helyszín: ***Novi Sad*** Dátum: ***2012.12.05.*** Csapatok: ***ESP : CRO***

● = gól ⊗ = védett ○ = mellé / fölé ⊘ = kapufa ⊙ = sáncolt **X** = passz - gól / hiba - gól **/** = passz - nem gól / hiba - nem gól

Időszak		0-5. perc	5-10. perc	10-15. perc	15-20. perc	20-25. perc	25-30. perc	Összesen
Eredmény állása		2:2	4:4	7:6	9:8	12:10	13:10	***13:10***
Védések szélről		● K	● KL			● K	● K ⊗ K	Védés: 1 Gól: 4
K=kézzel, L=lábbal, T=testtel								
Védések beállóból					● L			Gól:1
K=kézzel, L=lábbal, T=testtel								
Védések ziccerből		● KL ● K	● L	● K				Gól: 4
K=kézzel, L=lábbal, T=testtel								
Védések betörés után					● KL	● KL	⊗ K	Védés: 1 Gól: 2
K=kézzel, L=lábbal, T=testtel								
Átlövések védése	**Balátlövőből talajról**							
	K=kézzel, L=lábbal, T=testtel							
	Balátlövőből levegőből							
	K=kézzel, L=lábbal, T=testtel							
	Irányító-átlövőből talajról							
	K=kézzel, L=lábbal, T=testtel							
	Irányító-átlövőből levegőből	⊗ K	⊗ ○	● K	⊗ K	● L	⊗ K	Védés: 4 Gól:2
	K=kézzel, L=lábbal, T=testtel							
	Jobbátlövőből talajról							
	K=kézzel, L=lábbal, T=testtel							
	Jobbátlövőből levegőből			○ K ● L				Gól: 1
	K=kézzel, L=lábbal, T=testtel							
Védések büntetődobásból			⊘ K					
Védekezési idő		28 32 24 34	28 41 39 24	41 50 20 29	34 28 51 19	41 39 33 38	39 43 46 35	
		44	55					15'58"

Készítette: Koi Endre

Assessing defence strategies whilst in numerical superiority

Eszter Mátéfi

Hungarian Handball Federation, Hungary

Summary

Introduction - Over the past decade, handball's two most prominent tendencies are an increased playing speed and the importance of physical attributes (for example speed, strength, height and so on). These factors result in a greater amount of offense plays and frequent physical contact, leading to much more 2-minute suspensions and therefore more numerical superiority match situations. Therefore, a well organized defence during numerical superiority periods of the match can either extend an advantage or turn around the score.

Method - During my study and research I applied the method of observation. I chose this method because one can observe what is happening from a distance and not interfere in any way, but let events unfold in their natural way. Also, observing allows one to select and analyze important segments of different situations.

Results - I was able to answer the questions I proposed and found evidence to support my theory that, effective defence in numerical advantage and effective offense play can impact the final score largely.

Key words – suspension, numerical advantage, method of observation, zone defence, efficiency

1. Introduction

Over the past decade, handball's two most prominent tendencies are an increased playing speed and the importance of physical attributes (for example speed, strength, height and so on). These factors result in a greater amount of attacking plays and frequent physical contact, leading to much more 2-minute suspensions and therefore more numerical superiority match situations. The introduction of new rules, one of which is the quick restart after conceding a goal, all contribute to a faster and more spectacular game. Therefore, a well organized defence during numerical superiority periods of the match can either extend an advantage or turn around the score.

In modern day handball, it is vital to prepare teams to be able to defend against an incomplete offense line up and to effectively thwart the opponents' attacking strategies to force them to make mistakes in order to regain the chance to attack.

In all team sports, especially handball, the attraction for spectators is usually created by an impressive offensive play and many goals. On the other hand, defensive play also has a very important role which might influence the final result to a greater extent than the more spectacular attacking play.

Modern day handball has become more balanced in terms of skills, abilities and the dispersion of "the European style game". Compared to the past, nowadays it is not enough for a team to have one or two outstanding players, but to have tactically, technically and physically well prepared individuals who form a cohesive team. There are more and more teams that are able to apply many different offensive and defensive strategies. Modern handball has become faster, there is no longer any static attack in front of the goal area rather the attackers are more mobile; the tempo is quicker during the game, and players have an extremely varied technical repertoire.

As a consequence of the new rules and tendencies, matches today show more goals, more fast breaks and more quick goals, meaning that defensive strategies have had to adapt as well. I was inspired by this topic for my thesis, because I am interested in finding out how a defence system - especially during numerical superiority – can neutralise the attacking team which is left short-handed. Based on my experience as a player, scoring goals was the most enjoyable part of my career yet organizing and implementing a successful defence was always more challenging.

1.1. Literature Overview

There are various places where international and Hungarian studies relating to this topic can be found. For me, the specialised literature was easiest to locate at the library of the Semmelweiss University in the Faculty of Physical Education, but during my research, I bought and used many other books as well.

While researching, to be as exact and precise as possible, I focused on the constantly changing aims of the players; when in attack to score goals, and when in defence to thwart the opponents in their attempt to do so.

Handball stands out among other team sports for the values it promotes in Physical Education. That is, although it is pre-dominantly a contact sport, the technical-tactical aspect of the game has equalled if not taken a more prominent role in attack and in defence as well.

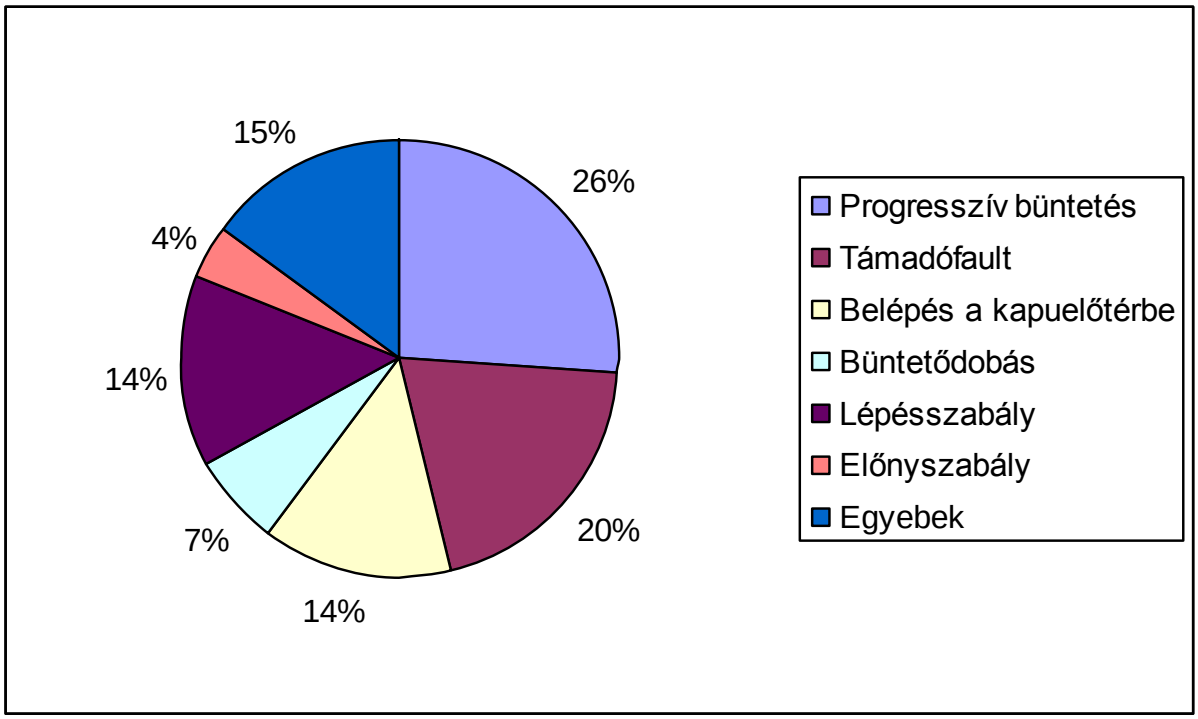
1.1.1. General code of conduct towards the opponents

Modern handball is defined by the competition between attacking and defending players, with and without the ball. The more creative the play, the more spectacular the game is for the supporters. The alternation between attack and defence provides the speed and rhythm of the game. "Modern handball is defined by physical contact, intense and variable attacking plays, and a well articulated defence in width and depth. All these elements make handball a modern and attractive sport." (Madarász, 2005)

"An opponent shouldn't be perceived as the enemy. One should compete against opponents while abiding by the rules. Arms and hands should only ever be used to take the ball away, to pass the ball, and if necessary to avoid conceding a goal." (Madarász, 2005)

In other words, the ball must be taken from the player, not the player from the ball. "Tough play" in handball is essential but there is a fine line between tough and rough play. This line should be determined primarily by the referee. In some instances a player's drive to win can push him/her overboard and coaches are not always tolerant either. Players perform according to their tactical and technical preparation and also in accordance with the decisions made by the referee. All actions that are rough, dangerous or that can cause injury should be prevented if possible. Therefore, referees are under a lot of pressure to maintain a "clean game" without influencing the final result in any way.

István Madarász's diagram (Graph 1) can be instructive as to the decisions referees make during a match. The diagram shows that most of the problems derive from the behaviour of players towards their opponents and these are the crucial areas for the referees to apply the rules.



Graph 1.

Legend: Progresszív Büntetés – Progressive Punishment
Támadófault – Attackers' Fault
Belépés a kapuelőtérbe – Entering the goal area
Büntetődobás – Penalty-throw
Lépésszabály – Steps Rule
Előnyszabály – Advantage
Egyebek – Other

Also, an interesting fact is that players commit up to 200-300 fouls throughout a match (Madarász, 2005) but referees only call punishments for about a third of these. Although it may seem odd to say, fouls form an integrated part of today's game.

1.1.2. Defending while in numerical superiority

During a numerical superiority situation, an obvious expectation of the defending team is that it should not concede a goal; rather, it should take advantage of any opportunity for gaining possession and/or executing a fast break to score a quick goal. To achieve this, the defence must be increased in depth, yet not enough to weaken it. Consequently, all defence systems provide good options and it is more practical to choose the most appropriate defence formation according to the individual ability of the defenders and based on the knowledge of the opposition. For example,

- If a team is losing close to the end of the match, the most aggressive defensive strategy should be chosen. That is, full court close man to man marking with one extra defender around the goal area line to support any teammate in need;
- Another effective strategy is half court close man to man marking also with one extra defender. This player has the hardest task, as he/she has to position him/her self so that he/she is able to back up any teammate at any time.
- If and when the actual defender is beaten, the extra player must take on this role and try to stop the attacker while the defender, left without a player, should try to back up the extra player. If two attackers manage to break away from their defenders then the extra player must approach the player who is most dangerous to the goal.
- The extra player in the vicinity of the free throw line should position himself/herself to face the ball and should assist teammates while defending.
- Another situation the extra defender must be ready for is when the attacking team's goalkeeper becomes a court player.
- A combined defense strategy can be applied when some players closely mark dangerous opponent players (a dangerous shooter or centre back or perhaps both) man to man while the rest of the team continues with zone defence.
- A very effective way of defending is to quickly and temporarily convert from zone defence to close man to man marking. However, it is a difficult move and requires a lot of training. It is vital that the whole team (excluding the extra defender) will be alert and once the signal is given, every player approaches the closest offense player immediately.
- Usually this strategy is most effective when there is a throw in or the ball is either close to the sideline or an attacking player has exhausted all possible opportunities (for example, the player has finished bouncing/dribbling) and can be forced into an error.

- Another effective defence strategy during numerical superiority is a 5:1, 4:2 or 3:2:1 formation of zone defence, where the extra defender with the intention of stealing the ball, moves into the second line of the attack. Consequently the defence formation stretches out in depth disturbing the offense organisation. This forces the attackers to change their strategy and to either take long, risky passes or dribble the ball and effectively lose it.
- For the attacking side playing in numerical inferiority, small fouls that result in free throws are suitable for winning time. Therefore the defending side should avoid any unnecessary contact, and commit a foul only if this seems absolutely necessary.

1.1.3. Defensive Tactics

Apart from the examples in the literature overview section of my paper, I feel it necessary to discuss the tactical side of general defensive play in order to better understand my research topic.

"Attacking – both theoretically and practically – is the main priority. However, to achieve success a team must have a strong defence which is based on good individual defence activity. This is a complex yet very important aspect of the game that is a measurement of the knowledge level of the team. Therefore, defending should be considered as equal to attacking." (Madarász, 1986)

While defending in a numerical superiority situation, the team's obvious aim is to score more goals than they concede. An effective defence covers the whole court, yet it is concentrated mainly around the score dangerous area. Conscientious defending is determined by two general principles: only one player can score a goal at any given time and the opponent team can only score using the ball. These aspects should form the pillars of a good defence attitude.

Defending can be divided into four time phases:

1. Getting into a defensive position/formation quickly.

The team must retreat to its own half as quickly as possible, so as to stop conceding a goal from fast break.

2. Temporary marking and zone defence.

In the case of a disorganized defence, the players are unable to occupy their usual defence positions therefore, they should use both elements of a combined defence system.

3. Organising/setting up the defence

Can be carried out in one of two ways, during play or while the play is stopped temporarily. In both cases, the process should be quick, flawless, conscientious and precise. (Coaches can give instructions during the game or when there is a team time out.)

4. Defending in a certain formation

These can include man-to-man, zone or combined strategies, but all are based on individual and group defence tactics. Defending against an organized attack can be divided into three main tactical elements. That is, individual, group and team.

Individual Tactical Elements

"In defence, it is particularly true to say that even the strongest chain is as strong as its weakest link. In handball, this means that no matter how strong each defender is, if only one is unable to carry out his duty and the opponents are able to constantly score through his position, then the whole defence is ineffective." (Marczinka, 1993)

Therefore every individual's tactical and technical knowledge is of great importance. An individual's main qualities such as toughness, discipline, sense of responsibility and ability to mark man-to-man, all contribute to good group or team defence. On the other hand, the scope of duties that developed through the evolution of the game, allows every single player to take a defence position which is suited to his/her skills and abilities. In modern handball substituting one defender for an attacker is regular, but switching several can be risky. It is advisable to choose players for certain positions according to their abilities and skills.

Individual roles in defence are:

- Man-to-man marker
- Zone defender
- Forward defender ("point")

Individual skills needed in defence include:

- Ability to intercept a pass
- Ability to knock the ball away
- Defensive blocking of shots
- Goalkeeper movements/activity

Group Tactical Elements

Although defending one-on-one is vital, in modern handball a successful defence has to be unified and individuals must work as a group. In defence play only a group of players is active usually while the others are prepared to intervene at any given moment. This practice forms the basis for all defence systems. The work of defensive groups is further justified because one sole defender requires help to stop several attacking players. Furthermore, by working in smaller groups, defence work becomes more economic, the groups share the workload and players with the best abilities can be used to a greater extent. Group work between two, three or even four defenders at a time – especially in half defenders' positions - can really impact on the team's performance in defence.

The following are typical group tactical elements of defence

- Falling out, securing, rejoining
- Taking on, guarding, handing on
- Evading and Switching
- Setting a defensive wall when there is a free throw

The direction in which attacking players move and their aims determine how the defence has to work together. To increase the effectiveness of the defence it is important to be able to select the most appropriate tactical element at any given time. Thus, when the attackers move around in depth and attack the goal directly, it is best to fall out, back up fellow defenders, and then quickly rejoin the main defence line. When the attackers chose to play more extensively in width, the most suitable form of defence is to take on an attacker, guard that attacker while possible, and then hand on that same attacker to a fellow defender. To prevent the pivot from blocking a defender, it is best to evade him/her, and switch with a fellow defender.

Team Tactical Elements

The effectiveness of a team's defence depends on its collective teamwork and organisation. A team's defence consists of both the individual and group tactical defence elements, making it the biggest structural unit in handball. Team defending allows for players to maximise the effectiveness of their special abilities. On the other hand, because it's a team effort the weaker abilities can be better concealed as everyone support one another if needed. The framework of

the defence also enables players to utilize their better skills in positions that are best for them. This leads to every link of the formation to work well separately and even better together. Generally speaking, organising individual players and the defence of groups is much easier and less complicated than preparing a whole team's defence.

I feel it necessary to mention the defence systems, as these set plays do determine the players' positions and roles in defence, ensure that everybody shares the workload and encourages maximum efficiency.

Basic defence systems:

- Man-to-man defence (full court, half court, score dangerous area)
- Zone defence (6:0, 5:1, 4:2, 3:3, 3:2:1)
- Combined defence (5+1 and 1+5, 4+2 and 2+4)

"It is common knowledge that the development of handball and the balance between attack and defence is determined by the interpretation of the rules of the game." (Ökrös, 2005) It is important to apply these defence systems while defending in numerical superiority situations. In my thesis, I would like to analyse the defence during numerical superiority periods based on the 2011 Women's World Championship.

1.1.4. Conditions of defence work

In this part of my paper, I gather certain factors and conditions – from a coaching point of view - that are necessary to create an effective defence. It is not enough to want to make the players good defenders; one must know the abilities and skills required for each individual to be able to perform well at an international level. The physical abilities and attributes of players, who can perform at such levels, exceed those of average people by far.

Motor skills can be considered the basis of performance and are a result of learnt and inborn abilities. The abilities that we consider physical attributes are all those which change as one grows and develops due to conscientious training and external influence.

- Coordination

"The term coordination can be defined as the combination of our sensory, movement and nervous systems which work simultaneously together to form the basis of physical movements." (Dubecz 2009)

These coordination abilities form a unique system responsible for regulating the movements we do. This ability is closely linked to the evolution of the nervous system which on one hand determines our abilities and on the other limits the possibilities to develop them.

Coordination can be traced back to our ability to control, adapt, learn and change certain movements. Some abilities such as reaction time, reflexes, thinking speed, hand-eye coordination and problem solving have a great effect on one's development and on becoming an excellent defender. Additionally, being able to predict what is going to happen next and having a good sense of rhythm are necessary for a successful defender. Other important abilities for the defender are: to have a sense of anticipation, a good sense of balance, spatial awareness and timing in order to be able to, when forced, take up many different positions, sometimes holding them for a long time.

- Fitness

"As one of the most basic conditions of physical activity, fitness primarily means strength or power, speed and stamina." (Nádori, 1991)

It is more appealing for a spectator to watch a player who is physically well built, muscular, and obviously quick and can run for the entire 60 minutes on court, than to see a slow, generally powerless player who gets tired quickly.

Strength appears in many ways, for example as maximal power, relative power, endurance strength, rapid strength and reactive power. All of these determine and influence a player's performance during a match. Thus, a high level of these is vital.

Speed is mainly reaction time and making movements in the shortest possible time. In order to be a good defender, it is important for a player to be able to react quickly to situations during a game. For example, reacting to an attacker changing direction and predicting which way he/she will continue, while moving limbs and torso into suitable positions. Being fast is most important after losing possession of the ball and being able to move back before the opponent scores.

Often, the final result comes down to the fitness level of the players. Throughout attack and defence, players do vigorous and intensive physical activity and after a while will experience tiredness. Hence, the question is how long can a player sustain peak level performance?

- Technical and Tactical Knowledge

"The team's tactic is a collective term for all the game elements with which one can achieve the best possible results. The strategy is the plan or theoretical guideline and the tactic is the instrument to put the strategy into practice. Therefore, in given situations the use of technical elements can be considered a tactical weapon." (Szabó, 2004)

Defence tactic consists of the following 3 parts:

- Individual Tactics
- Group Tactics
- Team Tactics

- Player's Personality

    - Emotional Factors
        - Attitude
        - Motivation
        - Persistence
        - Coping with monotony
        - Discipline/Self Discipline
        - Joy and Sorrow

    - Cognitive Factors
        - Sense of judgement
        - Perception
        - Sense of recall
        - Decision making

1.2. Research questions and Hypotheses

According to the method of research, when selecting a topic, we must be able to define what we are researching and why (deeper knowledge, creating new links between different areas), and also to predict the final outcome of the research. There are many factors that influence the selection process. Of these, the most important is having a thorough theoretical and practical knowledge of the topic.

On the handball court, the referees are there to recognize a foul, determine its severity and to impose the correct punishment. In the event of a 2 minute temporary suspension, one team is lessened by one (or more) player(s), leading to the other team's numerical advantage.This results in a separate, two (or more) minute battle between the teams.

The suspension causes both teams to change strategies with both having different priorities. The team in numerical superiority tries not to concede any goals and score as many as possible as the time elapses, while the shorthanded team's main priority is to keep the ball, provoke fouls and waste time until they regain their full strength.

While undergoing my research the following questions arose:

- During my research I would like to find out how effectively a team defends while playing in superiority. Can they extend their existing score advantage, equalize, or do they fall further behind? So effectively, do they score more goals than they concede?
- While working on this topic I would like to know if national coaches change their defensive strategies immediately, or do they continue with an already proven strategy.
- As the game gets faster, more and more fouls result in 2 minute suspensions. I would like to know in which period of the game most of these fouls occur.

I have drawn up 4 hypotheses based on the previous questions that I plan to prove or disprove using data and statistics I have collated.

1. Teams in numerical superiority concede less and score more goals than teams in numerical inferiority.

2. Teams in advantage don't change defensive strategies but maintain the formations prior to the suspension.

3. Most suspensions happen in the final 5 minutes of a match.

4. Coaches usually apply a 5+1 combined defence system when their team is in numerical superiority.

2. Material and Method

During my study and research I applied the method of observation. I chose this method because one can observe what is happening from a distance and not interfere in any way, but let events unfold in their natural way. Also, observing allows one to select and analyze important segments of different situations in a planned and structured way.

I used the 2011 Women's World Championship as a basis for my research utilising data from 10 matches as a sample in my paper. I used video footage to analyze these matches and drew up statistics from the analysis which I will present in table form. The statistics were based on: time of suspension, score, defence system applied prior to the suspension, did the system change after the point of suspension, score changes during suspension. I used 5 minute intervals to analyze time spent in numerical superiority, because international statistics also use this time interval. The teams I chose as case studies are national teams that belong to the international elite. I wanted to find out how internationally successful teams utilize numerical superiority situations.

3. Results and Discussion

During the 10 matches, referees called a total of 77 suspensions, which means that one team spent 15.4 minutes in numerical advantage, while the other in numerical disadvantage. This is a quarter of the playing time. Of these I took into account only those suspensions which were clearly 2 minutes without any other interference. As seen in Table 1, I was only able to record 3 suspensions in the first 10 minutes of all the games. This is due to referees preferring to caution players of the match or show a yellow card before giving a 2 minute suspension. During the

Number of suspensions for the attacking team in time frames

Matches	Suspensions											
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60
Montenegro-Spain		I		I			I			I	I	
Denmark-Japan			I		I			I				I
Sweden-France				I	I		I		I	I		
Sweden-Denmark				I		I			I	II	III	II
France-Brazil			II					I				II
Russia-France			I	II	III	I		I				I
Spain-Brazil		I			I	I			III	II	II	III
Croatia-Sweden			I	I	I		I	I	I		II	I
Denmark-Spain					I	II		I		III		I
France-Norway	I		I	II		I		I	I			I
Total:	**1**	**2**	**6**	**8**	**8**	**6**	**3**	**6**	**7**	**9**	**9**	**12**

Table 1

30th and 35th minute there were fewer suspensions, presumably because of the positive effects of the half-time break. Referees tended to call the most progressive punishments between the 55th and 60th minute. In this period of the second half, players tend to become more aggressive, tiredness becomes more evident and players feel they need to "chase the score" or avoid defeat in a close match. This is when players feel the pressure and importance of a game, when any minor error or mistake can prove to be very costly. Some players don't handle this type of pressure as well as others. When some players become over excited, they can be punished by suspensions which in other circumstances could have been avoided. In fact, coaches can cause a disadvantage to their team by making comments and complaining to the referee thus receiving a 2 minute suspension. The highest number of suspensions was in the Spain vs Brazil semi-final, 13 altogether, 10 of them in the second half only. The lowest number of suspensions was called in the Brazil vs France, and Denmark vs Japan matches, 1 for each team.

The change of scores during suspension

Serial Number	Teams	Final Score	Minutes spent in numerical superiority	Goals scored by team defending in numerical superiority	Goals conceded by team defending in numerical superiority
1.	Montenegro	19	4	1	1
	Spain	23	6	5	2
2.	Denmark	23	2	2	1
	Japan	22	8	3	1
3.	Sweden	23	4	0	2
	France	26	2	2	2
4.	Sweden	19	6	4	1
	Denmark	20	4	2	0
5.	France	22	-	-	-
	Brazil	26	2	2	0
6.	Russia	23	8	4	4
	France	25	6	2	0
7.	Spain	27	4	0	2
	Brazil	26	4	4	1
8.	Croatia	27	6	3	2
	Sweden	26	8	3	3
9.	Denmark	18	4	1	1
	Spain	24	4	2	0
10.	France	24	4	2	1
	Norway	32	6	4	3

Table 2

As shown in Table 2, I collated data according to how many goals the team in numerical advantage conceded and how many they scored - again only analyzing “clean” 2 minute suspensions.

During a total of 88 minutes spent in numerical advantage, teams scored 46 goals and conceded 27 altogether. These numbers show that starting attacking play from a defence position in numerical superiority is almost 2 times more effective than attacking in numerical disadvantage even though defenders have to adapt to attacking play.

An obvious connection cannot be made between the number of minutes spent in numerical advantage and the number of goals conceded and scored, because it depends on how effective the attacking play of the team in numerical superiority is, and how well the shorthanded team can keep the ball and waste time.

A defence system is always designed against a given attack system and it can change according to the attack. To maximize success rates, one must figure out what the attackers are trying to achieve with their offense system, and what kind of response they expect from the defenders. With this knowledge, one can apply the most suitable defence system and its formation to halt the offense organisation in its early phase.

During my research, I analyzed the correlation between defence systems before and after the point of a suspension being issued. While playing in numerical equality, teams generally chose 6:0 and 5:1 zone and 5+1 combined defence systems. This does not mean other systems were not used, but in the games I analyzed, most changes were made to these formations. Table 3 shows the defence systems national teams used prior to the suspension in order of most frequent use. The statistics demonstrate that the 6:0 and 5:1 zone defence formations were the most dominant.

Based on the Table 3, I made the following assumptions. In total there were 77 suspensions issued, of which 44 were clear 2 minutes, where one team was in numerical superiority, and the other in numerical inferiority. There were 72 cases of a team defending in numerical superiority. 80.5% (58 times) of cases showed that defending teams did not change defence systems while the remaining 19.5% did change system. When teams did change, they chose a 5+1 combined defence system to exclude the best player of the opposition. Only Japan changed to a 1+5 combined defence once, where 5 players were defending man-to-man with one extra defender as a safety in front of the goal area line.

- Changing defence systems from 6:0

Coaches do not tend to change a defence system which works well in width not even for a more open, attacking yet riskier system. This could be due to the main aim, not to concede any goals while in numerical superiority. Of the 63 times that teams defended in a 6:0 zone defence, 55 times (87%) they maintained the previous defence, 7 times (11%) they changed to 5+1 combined defence (eliminating the most prolific goal scorer), and only once they changed to 1+5 combined defence.

The changes of the defence system/Formation after suspension

Defence Systems		
System pre suspension	System post suspension	Reoccurrence
6 : 0	6 : 0	55
	5 : 1	-
	4 : 2	-
	3 : 2 : 1	-
	1 + 5	1
	5 + 1	7
	4 + 2	-
5 : 1	6 : 0	-
	5 : 1	3
	4 : 2	-
	3 : 2 : 1	-
	1 + 5	-
	5 + 1	6
	4 + 2	-
3:2:1	6 : 0	-
	5 : 1	-
	4 : 2	-
	3 : 2 : 1	-
	1 + 5	-
	5 + 1	-
	4 + 2	-
5+1	6 : 0	-
	5 : 1	-
	4 : 2	-
	3 : 2 : 1	-
	1 + 5	-
	5 + 1	-
	4 + 2	-

Table 3

- Changing defence systems from 5+1

By studying the data in Table 3, we see that teams originally choosing an open defence system prior to the suspension, didn't change to 6:0 at all, instead they either remained in a 5:1 zone defence system (3 times, 33.3%) or changed to 5+1combined defence (6 times, 66.6%). I noticed that the Scandinavian teams (NOR, SWE, DEN) did not change their 6:0 zone defence at all regardless of the score or their numerical superiority.

4. Conclusions

I believe I researched and studied my topic, defence in numerical superiority, to maximum capacity and presented the most relevant data. I chose this topic to find evidence to support my theory that, effective defence in numerical superiority and effective attacking play can impact greatly on the final score.

By thoroughly analyzing numerical superiority in 10 matches, I was able to answer the questions I proposed.

The *first hypothesis*, in which I stated that the team defending in numerical superiority would concede less and score more goals compared to the team in numerical inferiority was proven correct and is logical in my opinion. During temporary suspensions based on the 10 games I analyzed, the teams in numerical superiority scored 46 goals and conceded only 27. These figures show that, starting an attack from an advantage in defence is almost twice as effective, even if defenders have to adapt to attacking players.

In my *second hypothesis*, I ascertained that defence formations do not change after a suspension is issued, but teams continue with the defence system prior to the suspension. This statement was also proven true, although I found it surprising that the team defending in numerical superiority did not take more risks, even if they had an "extra" defender. Furthermore, I noted that teams that were in an open zone defence (5:1) did not change at all to a 6:0 formation and those teams in a 6:0 zone defence remained in that formation 80% of all cases.

The *third hypothesis* stated that most suspensions would occur in the 55^{th}-60^{th} minute when the matches are often decided and based on my research and statistics, this is the case. I noted that there were also many suspensions between the 45^{th} and 55^{th} minute (18) and I believe this is due to players starting to feel the fatigue and this caused the suspensions.

In my *fourth* and final *hypothesis*, I wanted to investigate if coaches preferred to use a 5+1 combined defence system when in numerical superiority. However, this statement was proven false. I found that teams generally used 6:0 zone defence and coaches rarely changed successful defence systems. I noted that the Scandinavian teams regardless of the score and numerical superiority always remained in 6:0 zone defence.

There were several areas I did not research in my thesis. For example, defending in double numerical superiority, and match situations in which several players are temporarily suspended but one team is in numerical superiority. These areas can be further researched by handball experts and analysts.

In summary, my research supports the conclusion that in today's fast handball the effectiveness of defending in numerical superiority does have a remarkable impact on the outcome of a match.

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Peculiarities of offence at reduced strength against organized defence

Taken from the Women's Handball World Championship 2011

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Abstract

In my study I examine the problem of attacking at a reduced strength using the statistical data gained from the observation of 11 matches played at the Women's Handball World Championship in 2011. After analysing the effectiveness of offence against various types of defence systems, the importance of the zones of finishing the attacks, the influence of the suspensions exerted on the final scores, the peculiarities in the offence tactics of five countries (Russia, Denmark, Spain, France and Norway) and the various types of playing methods, I come to the conclusion that numeral inferiority does not necessarily mean real disadvantage and that the performance achieved in this phase of the game has a considerable impact on the final score only in case the team's performance at a reduced strength deviates from the average significantly.

Key words: suspension, reduced strength, numeral inferiority, defence system, effectiveness

I. Introduction

The permanent development of modern handball, the acceleration of the game, the lively turns of the matches and the continuous changes in the results are together making this sport more and more popular. The number of high quality players basically influencing the results of their teams keeps growing; the power relations between the teams are getting more and more balanced. We can see plenty of extremely strained close matches at the world competitions and international tournaments. In the gradually strengthening field it is becoming more and more difficult to win, the number of the mistakes must be reduced more and more, and the creation of positive playing situations may be of fateful influence on the final result of the match.

The gradually accelerating game strongly influences the evolution of the teams' playing philosophy, and the fact that the various phases tend to merge into one another is part of this process. In defence, fast break, attack and reorganization, as well, quick and precise tactical implementation is gaining a growing emphasis. According to the acceleration of the game, with physical advantages becoming more and more important, the number of collisions and fouls has grown, and the number of suspensions has risen proportionally. Keeping the defenders under permanent pressure, provoking errors of defence or punishments are important elements of the strategy of the attacking team. In accordance with the current dynamics of the game, the rate of short and long time attacks have, as well as effectiveness, shifted towards the offences implemented during a shorter period of time. The vertical structure of the defence systems, targeted aggression and the restrictions in the rules basically influence the time spent in an outnumbered or an outnumbering position. These periods can bring success or failure for the team. In tough situations fouls are committed more often; the referees must apply progressive punishment after the warnings in order to keep the game within the regular frames. Thus for the teams it is an organic part of the game to prepare consciously for playing at a reduced strength or the contrary, in a numerical superiority during offence and defence, as well.

When six attackers are trying to score against five defenders, or five defenders must counteract six attackers, theoretically it is the team outnumbering the other

one that will gain profit of the situation. But is this the way things really happen in practice? Does the team playing at a reduced strength have any chance to score one or two goals, or defeat the attacks conducted by the opponent? Is the final result really influenced by the number of suspensions? What possibilities do the teams playing at a reduced strength have against organized defence? By the examination of the Women's World Championship 2011 I will look for the answers to these questions.

I.1 Reasons for choosing this topic

Watching the Women's World Cup 2011 in Brazil I found that the differences between the participating teams had lessened, many of the national teams had caught up with the forefront, and that the developing teams, too, were approaching the international middle rank. The players are becoming stronger and stronger in their fitness, techniques and tactics, adapting to the requirements of modern handball.

The more balanced power relations evidently bring closer matches, and the final results of the games are unpredictable. But where are these fights decided? What are the turning points determining the final result? What are the special game elements possibly influencing the team's result during attacks or defence?

Watching the World Championship I paid special attention to the game of the teams playing at a reduced strength, in offence and defence, as well. I examined the tactical elements used in these situations by the national teams representing various handball schools; whether they change the rhythm of their actions depending on the actual score; whether they apply any solutions unexpected in the certain situation and what the results of these solutions are. I paid special attention to the matches played by Norway, Spain, France, Russia and Denmark since these national teams represent characteristic styles, differ in their tactical philosophy, and had performed very well in the latest years' world contests.

Another important aspect applied in the assessment of the teams attacking at a reduced strength was how I could utilize these experiences in the game of my own

team, and how I can use and reform these experiences so that they fit into the character of my team and serve its success.

II. Methods

In the process of analyzing the chosen aspects I search for the answers in the game – in the strategies implemented by the professionals – itself. The observation and evaluation of the permanently developing game presents the tendencies and further opportunities, and so it is very important for me to analyze the World Championship results and the matches of the best teams and to elaborate the data. The various methods of elaboration offer data that are not only objective but inspiring and innovative, as well.

For my study I used the statistics about the Women's World Championship 2011 and the film shootings about 11 matches; I try to analyze the chosen aspects by utilizing these. My aspects are:

- number of suspensions,
- number of minutes played at a reduced strength by teams,
- the impact the suspension rates exerted on the final results,
- analysis of the successfulness of attacks conducted at a reduced strength in terms of organized and disorganized defence,
- analysis of the attacks conducted at a reduced strength against organized defence:

- effectiveness,

- spot of finishing the attacks,

- against various defence systems on the basis of the chosen tactical elements.

Observation offers a stable fund for the analysis of the game elements and the elaboration of an objective stand point in case information on the matches is registered in writing, drawing and optically, so it is controllable. The utility of the analysis of the aspects considered important and chosen by me depend on the precision of the methods; thus when selecting and using them in relation to the topic of the study I strived to assure the provision of sufficient information through the assessment of the attacks implemented at a reduced strength.

Problems and hypotheses

It is the referees' responsibility to apply and have the rules adhered to during the game. It is their right and obligation to punish all fouls.

Consequently, a team may be forced to play at a reduced strength – by one or even more players -, and so the other team may outnumber the first one.

Generally, in this special situation lasting for two or more minutes the team outnumbering the other one strives to realize the advantageous situation in the result, as well, while the outnumbered team tries – in compliance with the actual phase of the match – to "survive" this period.

However, in many cases I experienced that the team in this preferential position becomes dubious as a result of the "possibility pressure" and plays unsuccessfully, while the outnumbered team improves in defence and offence, as well. These symptoms indicate the fact that this special situation must be dealt with since the outnumbered team may achieve positive changes in the result, and this can basically influence the final score.

In my study I will examine the following points:

- impact of the time spent at a reduced strength on the final score,
- efficiency of the attacks led by the outnumbered team against organized and disorganized defence,
- peculiarities of attacking at a reduced strength by the teams representing various tactical styles,
- possible chances on offence at a reduced strength against various systems of defence.

III. Development

Examination of the Word Championship in terms of playing at a reduced strength

According to the final results of the matches in the World Championship, in the preliminary rounds scores of relatively high goal differences were sometimes born, while in the rounds of 16 and the placement matches many of the final results were, because of the more balanced power relations, really close. In such matches each of the game phases – including those played at a reduced strength – are of enormous importance and may exert a decisive impact on the final score.

In Table 1 we can see the suspension rates of the matches the details of which are included in the Appendix by groups:

Table 1: Numbers of suspensions at World Championship matches

Name	Number of matches	Number of suspensions
Group A	15	117
Group B	15	111
Groups C	15	117
Group D	15	104
President's Cup	8	51
Round of 16	8	54
Quarterfinals	4	36
Placement matches	8	58

In 88 matches 648 suspensions were judged by the referees against the teams which means a rate of 1 296 minutes of suspension per 5 280 minutes of game. Thus during an average match 14.7 minutes were played at a reduced strength by one or the other team. This means that the teams were given 3.67 suspensions and played 7.35 minutes in numeral inferiority which was 12.27 percent of the total playing time. Although this hardly exceeds 10 percent of the matches, this accelerated period of the game may include a lot more attacks and defences which may influence the evolution of the final result. In some cases we could see situations of multiply reduced strength or two teams being punished with two minutes suspension at the same time, however, statistical objectivity was not influenced by these.

Tables 2, 3 and 4 indicate the numbers of the suspensions called on the winning and the losing teams:

Table 2: Suspension rates at World Championship matches, preliminary rounds

	GROUP A	GROUP B	GROUP C	GROUP D	TOTAL
WINNING	5	4	7	7	23
LOSING	9	9	5	3	26
EQUAL	1	2*	2	5	10

*One of the 88 matches was a draw; this is not included in the table.

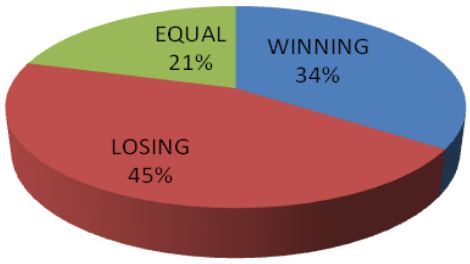
Table 3: Suspension rates at World Championship matches, finals

	PRESIDENT'S CUP	ROUND OF 16	QUARTERFINALS	PLACEMENT MATCHES	TOTAL
WINNING	2	2	1	2	7
LOSING	4	4	2	3	13
EQUAL	2	2	1	3	8

Table 4: Suspension rates at World Championship matches, sum

SUM	
WINNING	30
LOOSING	39
EQUAL	18

Diagram 1: Suspension rates - percentages



From the data it is clear that the losing teams were punished by suspension slightly more times than the winning ones, but the suspension rate of the winning teams is surprisingly high. This strengthens the hypothesis that being outnumbered is not always a disadvantage. The "scoring pressure" on the team in numeral superiority and their "obligatory" performance on defence and offence may cause psychological pressure which can be advantageous for the shorthanded team. Each of the successful defences and scoring attacks achieved at a reduced strength may give some momentum to the shorthanded team and make the other team insecure. At the same time, in nearly half of the matches the losing team was punished with more than one 2-minute suspensions which can be a decisive factor in case of close matches. These suspensions play an important role not only in that very part of the game when one of the teams is playing at a reduced strength but they influence the team's defence strategy, the tactics of the defending players, the selection of the defence systems and the trainers' variation possibilities which can exert indirect but decisive impacts on the final result.

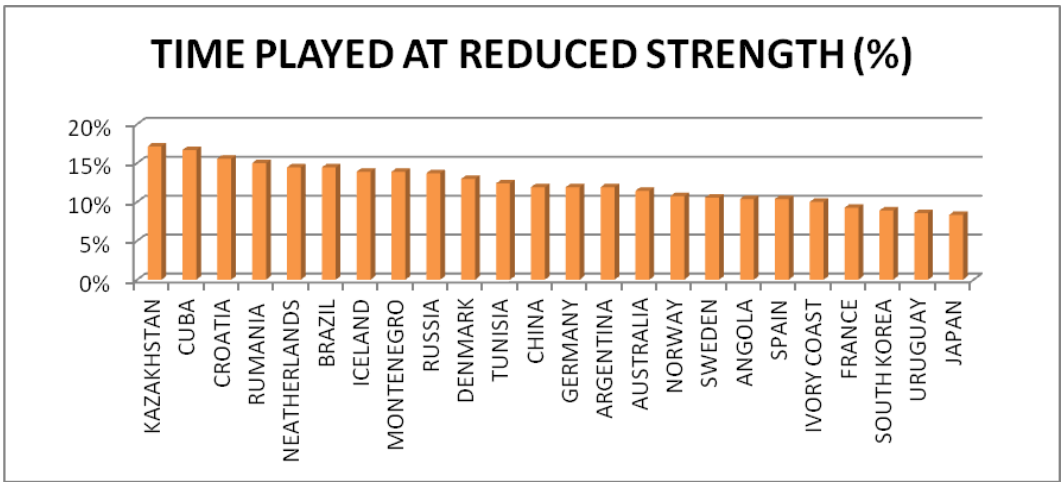
When evaluating suspensions, the referees' role cannot be omitted. The permanently accelerating pace of the game demands changes in the referees' approaches. The growth in the number of attacks and the resulting defences necessarily result in an increase in the number of suspensions, however, the quicker and quicker process of the attacks, the offences against disorganized defence and the number of fast breaks may as well reduce their number. In the second part of the matches, when pre-warning and warning had already been exhausted by the referees, progressive punishments came into the foreground. The suspensions given during the final phase - primarily in balanced matches – are of outstanding importance since there is no more time to correct the possible mistakes done during the offence and defence actions in the last five minutes. However, it is clear that the referees' tolerance against the shorthanded team can help their performance to some extent by providing longer time for the attack and also more preferential judgements may be born when the fouls committed on them are evaluated.

In the next table I summarize the suspension rates of the teams participating in the World Championship (Table 5):

Table 5: Time played at a reduced strength by World Championship participants

NAME OF TEAM	NUMBER OF MATCHES	NUMBER OF SUSPENSIONS	TIME PLAYED AT REDUCED STRENGTH (%)
KAZAKHSTAN	7	36	17.14%
CUBA	7	35	16.67%
CROATIA	9	42	15.56%
RUMANIA	6	27	15.00%
NEATHERLANDS	6	26	14.44%
BRAZIL	9	39	14.44%
ICELAND	6	25	13.89%
MONTENEGRO	6	25	13.89%
RUSSIA	9	37	13.70%
DENMARK	9	35	12.96%
TUNISIA	7	26	12.38%
CHINA	7	25	11.90%
GERMANY	7	25	11.90%
ARGENTINA	7	25	11.90%
AUSTRALIA	7	24	11.43%
NORWAY	9	29	10.74%
SWEDEN	6	19	10.56%
ANGOLA	9	28	10.37%
SPAIN	9	28	10.37%
IVORY COAST	6	18	10.00%
FRANCE	9	25	9.26%
SOUTH KOREA	6	16	8.89%
URUGUAY	7	18	8.57%
JAPAN	6	15	8.33%
TOTAL	**176**	**648**	**12.27%**

Diagram 2



According to the statistics, the national team the least punished with suspensions (Japan) played less than half as many minutes at a reduced strength as the team punished with the most suspensions (Kazakhstan). According to my observations, the top teams of the World Championship take the bottom places in the suspension hierarchy which has several reasons: their players were suspended in considerably less cases in the preliminary rounds ending with high differences in the score than in the quarterfinals and the placement matches. The application of the various defence systems used by the leading national teams, the knowledge level demanded by these systems and the personal skills of the players together influence the effectiveness of defence, and the level of the necessary and required aggression affects the number of suspensions.

III.1 Efficiency analysis on the basis of various aspects of attacks led at reduced strength

By a detailed examination of 11 matches of the World Championship we can get a picture of:

- the number of attacks conducted in numerical inferiority against organized and disorganized defence,
- the effectiveness against various kinds of defence systems,

- the final results of the attacks implemented at a reduced strength in terms of the various zones.

The matches analyzed:

Preliminary rounds:

Sweden-Denmark

Norway-Montenegro

Norway-Angola

South Korea-Spain

Spain-Russia

France-Tunisia

Round of 16:

Brazil-Ivory Coast

Quarterfinal:

Norway-Croatia

Placement match (5th place):

Brazil-Russia

Placement match (3rd place):

Denmark-Spain

Final:

Norway-France

During the examined 11 matches (660 minutes of playing time) 91 suspensions were called which means 182 minutes of play at reduced strength. This makes 27.5 percent of the total playing time which means that in more than one quarter of the matches one or the other team played at reduced strength.

During the 182 minutes of suspensions I registered 168 attacks initiated by the shorthanded team which means nearly one attack in every minute. 38 percent of the attacks (64) were led in the first part of the matches, and 62 percent (104 attacks) in the second. The clear reason for this is the progressivity required by the regulations. 11 of the 168 attacks were finished against disorganized defence by fast break which is 6.5 percent of the total. This means that the shorthanded teams

did not make much effort to start rapid attacks, and that the teams in numerical advantage created the possibility of a 6 on 5 setup advantageous for them by adequate re-organization. When playing at reduced strength, rapid attack bears the possibility of creating a sudden scoring situation. However, only six out of the eleven surveyed attacks ended in scoring, one was halted by the re-organized defenders and a punishment was given, and the other four attacks ended with a technical fault of the attacking team; all in all, 54 percent of the rapid attacks resulted in scoring. This is a low number considering the fact that in this phase of the game the difference in the number of players may practically disappear, the team playing at reduced strength can even outnumber the other team. Despite this fact, most of the teams – keeping in mind that they are playing at reduced strength for two minutes – tend to play offence against organized set defence which is a lot more difficult and slows down the passes; the teams decrease the time spent at reduced strength by forced fouls and so they reduce the attacking time of the shorthanded team as well.

According to the statistical analysis, he teams in numerical superiority tried to disturb the attackers or force them to apply bad solutions by various defence systems rather successfully. The results of the examined 157 attacks against organized set defence are indicated in Table 6:

Table 6

Results of finished offences												
defence system	**number of attacks**	**left wing**	**right wing**	**left court**	**centre back**	**right court**	**pivot**	**break-through**	**lost ball**	**attackers' technical faultl**	**forced punishment**	**passive play**
		WING AREA		**DISTANT AREA**			**CLOSE AREA**					
6 - 0	95	5/2	5/0	22/2	11/5	9/3	8/5	6/1	15	8	6	0
5 - 1	15	1/1	0	3/2	0	3/1	1/1	0	4	2	0	1
5+1	35	1/0	0	8/1	0	5/3	2/2	1/0	6	7	4	1
4+2	10	1/0	0	0	0	0	0	1/1	4	4	0	0
man-to-man defence	2	0	0	0	0	0	0	1/1	0	0	0	1
total	157	8/3	5/0	33/5	11/5	17/7	11/8	9/3	29	21	10	3
efficiency		13/3 (23%)		61/17 (27.8 %)			20/11 (55%)					

During the 157 examined attacks the referees signalled passive play 20 times (three times they even took the ball away from the attackers) which has two reasons: the defenders consciously seize the opportunity of throwing from the attackers, they disturb them by offensive defence and oust them from the potential throwing zones. The other reason is that the attackers do not necessarily strive to shorthanded team's time for offence.

According to my opinion, however, the number which can be explained by the conscious and collective tactical objectives of the defenders is rather low. Forcing shots thrown from relatively safe zones, creation of ball traps or the pushing a less resolute player into a decision-making position are the defenders' conscious tactical aims which might be effective if adapted to the current opponent reducing by this their attacking time and utilizing the impreciseness of their team-work and the uncertainty about the method of ending the attacks.

III.2 Examination of the attacks ended from the wing zones

The wing areas are the zones of lateral shots, which are of the smallest area, are situated symmetrically, on the two sides of the goal, and include wing players' main movement area. These zones are peculiar because, despite the fact that they lie within the optimal throwing distance from the goal, for reason of their lateral position, the horizontal throwing angle is considerably narrow. This may be a reason why only 8.2 percent of the surveyed 157 attacks were finalised from these zones, and only three of the 13 attempts (23 percent) resulted in scoring. According to the data, it is clear that the possible success of the individual actions of the wing players is minimal, the full number team can hold their defence area under control more easily, and the angle of the shooting situations developing in the lateral zones is smaller than it is in case of equal number players. If the shots are forced to be done at the lateral sides, the decisive factor will be the goal keeper's defence style which is part of the tactics. In many cases the wing players try to create a scoring opportunity or disturb the defence wall by breaking through, so the wing position is usually taken by a back court player who can make advantage of the evolving situation in ways different than a real wing player, so in such cases the attacks are finished from this wing position less often (see Diagrams 3 and 4).

Diagram 3: Efficiency of the attacks finished from the left wing zone

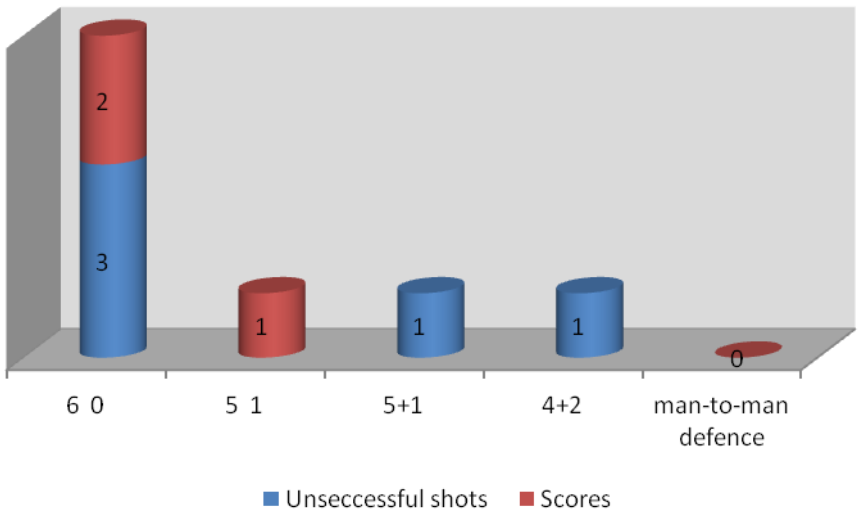
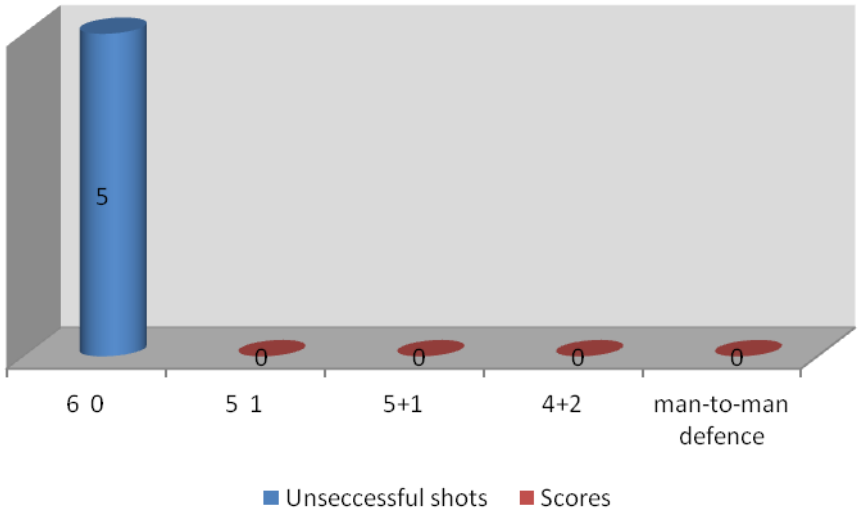


Diagram 4: Efficiency of the attacks finished from the right wing zone



III.3 Examination of the attacks finished from a close area

The zone of close shots is the space at the goal-area line. This is primarily the area of the pivots and the back courts and centre backs trying to break through. One speciality of this area is that, although the angle and distance of shots is the best possible, the attacker has to throw the ball close to the defenders which makes the preparation and implementation of shooting difficult, especially in numeral inferiority.

12.7 percent (20 attacks) of the examined attacks were finished from this zone, 11 times from the pivot's position and 9 times subsequent to the break-through. It is not by chance that this number was so low; it is this area that offers the best possibilities to score, so the defender team, having chosen any of the defence systems, paid the most attention in keeping control of this area. It is rather interesting that only 11 goals were scored from this zone (55 percent of the shots) which is a low number considering the fact that the attacking team succeeded to create a scoring situation in which the shorthanded situation is of no importance. The rate of the attacks finished from the pivot's position (8 scores out of 11 shots, 72%) is satisfactory, but the number of the shots on goal after breaking through (3 scores out of 9 shots, 33%) is not. This is worth attention because in many cases it

was not the pivots who finished the attacks from the pivot's position but wing players, centre backs or back court players breaking into the defenders' wall (see Diagrams 5 and 6).

In the zone of lateral and close shots 10 attacks ended in punishments. The results of implementing the penalty is of no importance from the respect of our topic, however, it is significant that in ten other cases the attackers approached the two zones nearest to the goal, and created a scoring situation this way.

Diagram 5: Effectiveness of finishing from pivot's position

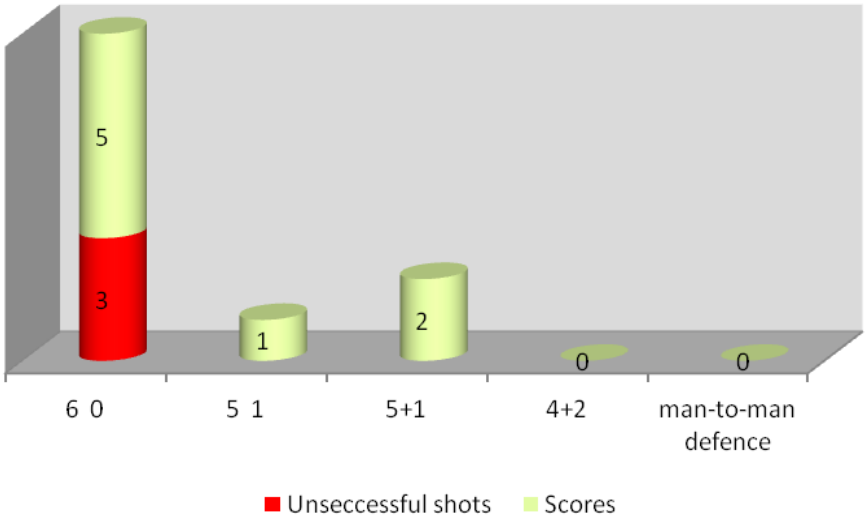
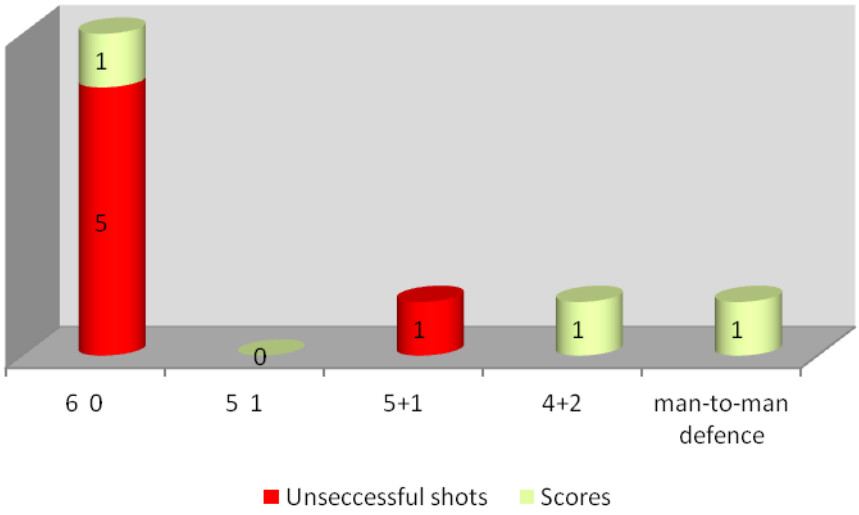


Diagram 6: Effectiveness of finishing by breaking through



III.4 Examination of the attacks finished from the zone of distant shots

This is the zone of the biggest extension and farthest from the goal which includes the main movement area of the back court players and the centre backs. The speciality of the zone is that the average throwing distance is relatively big, the shooting angle is favourable, and the attackers play at the biggest distance from the defenders here. This is why shots on goal are most often sent from this area. It is an obvious tactic of the most defender teams to drive the attackers into this zone and force them to finish their offence from there.

Most of the attacks were finished from this zone: 38.8 percent (61) of the attacks ended in shooting through the defence wall, and the result speaks for the defenders: only 17 goals were scored out of 61 attempts (27.8 percent). In compliance with the defence systems, the attackers tried to score primarily from the two back court players' positions since the central sector in many cases was closed down by the defenders by structured or combined defence (5:1, 5+1 or 4+2 defence) driving the attackers to the considerably less dangerous external zones. Since most of the defender teams chose the 6:0 zone defence system (95 defences, 60 percent of the total, were implemented in this system), the easiest chance to score was offered for the attackers by this sector.

It is, however, disadvantageous for reason of the distance from the goal, it is not by accident that the rate of shooting on goal was low, and 37.7 percent of the attacks conducted in this zone ended in the attackers' technical fault (8) or losing the ball (15) which is a high number with respect to the defenders' actions (see Diagrams 7, 8 and 9).

Diagram 7: Effectiveness of finishing from left back court position

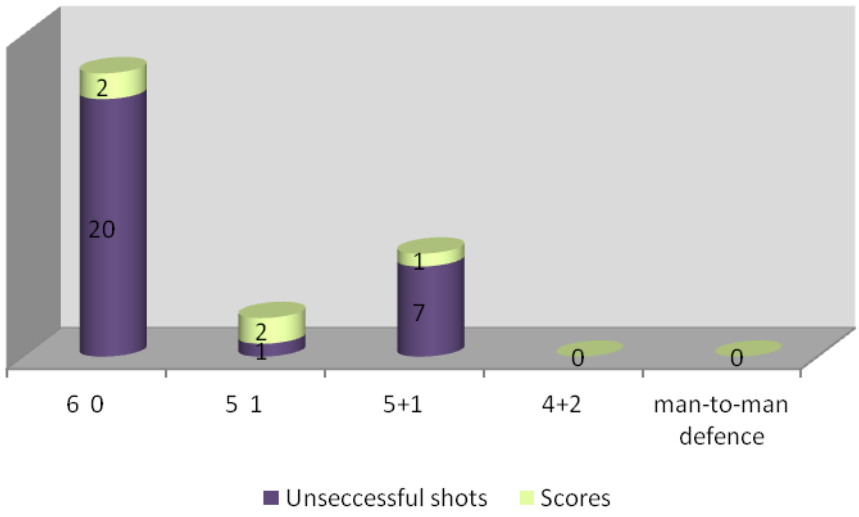


Diagram 8: Effectiveness of finishing from right back court position

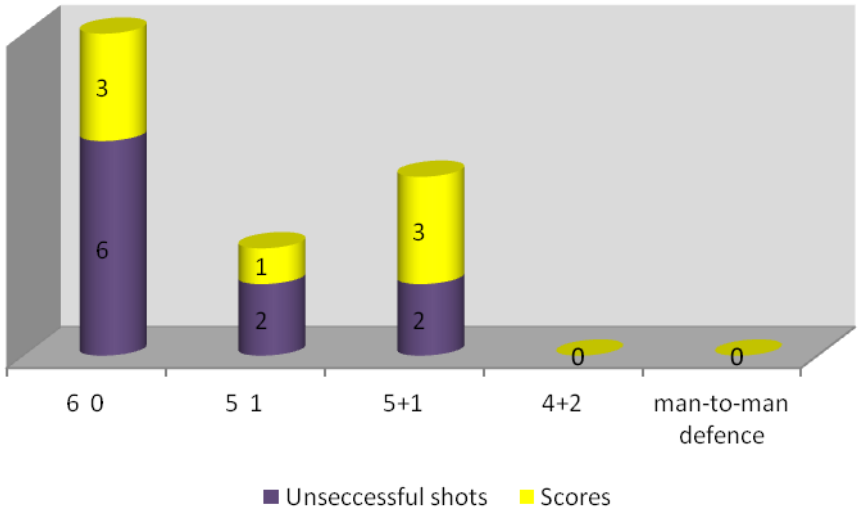
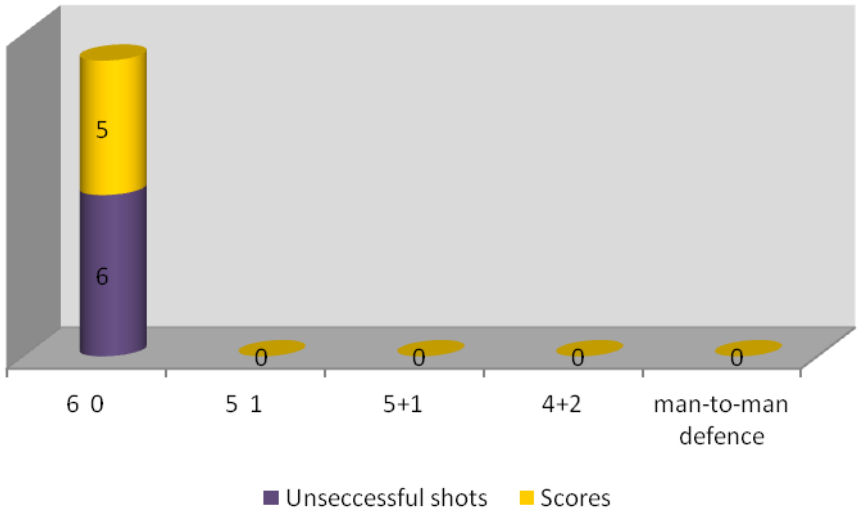


Diagram 9: Effectiveness of finishing from centre back position



III.5 Examination of the effectiveness against various defence systems

During the 11 examined matches the attacking teams playing at reduced strength tried to create the chance of shooting on goal and scoring against various defence systems. The selection of a certain system depends on the character of the defender team and the strong will to indirectly influence the result and to get the ball. The one-line and vertically structured zone defence and the combined defence systems are strongly advantageous if the team is outnumbering the opponent, and in this phase of the game their risks can be reduced. The selection of the defence systems proved to be proper in the light of the results. The 38 goals and punishments (24.2%) out of the 157 attacks mean that every fourth attack resulted in scoring. This effectiveness means that the team performing a higher percentage when playing at reduced strength will not be removed from the continuous process of the game, and their success is less influenced by this special situation.

According to the statistics, the most effective defence system was the 4+2 combined system, this, however, was chosen by only a few teams because of its risk, the increased size of the area controlled by every single defender in front of the goal-area line. Most of the attacks by the teams playing at a reduced strength,

95 of them which meant 60 percent, were conducted against some 6:0 zone defence. The essence of this system is to let the shorthanded team play continuously, forcing them to make bad decisions at the end of the attacks, and allowing an increased control over the defended area at the same time. The clear objective of the combined systems (5+1 and 4+2, 29.9 percent of all of the defences) is to exclude the most dangerous attacker or attackers from the game influencing by this the organization and end of the offence and forcing technical faults. In terms of the relation of the possible risks and the effectiveness of the defence systems chosen by the teams it seems to be proved they had made good choices since most of the systems achieved their aims. They were able to influence the effectiveness of the team playing at a reduced strength against organized defence by adapting to the tactical character of the defender team.

Table 7

EFFECTIVITY OF DEFENCE SYSTEMS		
DEFENCE SYSTEM	**ATTACK/SCORE OR PUNISHMENT**	**EFFECTIVITY**
6:0	95/24	25.2%
5:1	15/5	33.3%
5+1	35/7	19.9%
4+2	10/1	10%
Man-to-man defence	2/1	50%
Total	**157/38**	**24.2%**

IV. Results and Discussion

Application of various tactical elements against different defence systems

The teams participating in the World Championship were prepared to conduct attacks at reduced strength employing various group-tactical or team tactical solutions against different defence systems. The utilization of the opportunities is, of course, reciprocally proportional with the defenders' efficiency. The selection and result of the tactical elements chosen by the five national teams (Norway, France, Spain, Denmark and Russia) were different as well as the teams' strategic ideas of this phase of the game.

In the 157 attacks examined positional static, position changing and combined games appeared. Positional static game includes the offensive solutions in which the players of the attacking team organize the attack and find their final places mainly in their fixed positions. In case of fast passing and counter-game sufficient footwork may allow the creation of equality in the number of players within a narrow area and a relatively favourable shooting position. When switching positions, the primarily transversal lateral movement of the players of the offending team may stimulate an error of exchange in the defender team during offense organization, and by creating a hub the defenders can be forced to a smaller area, and so some space can open up for the attackers on the other side. Post-switching tactics is a frequent and beloved tool of the teams playing at reduced strength. In most cases they try to disturb the defenders' vertical and lateral movement and their distribution of the control over the defence area and the attacking players by (usually the wingmen's) running into the pivot's position. Combined game, the connected and common application of positional and position changing game, may be successful within one action owing to their advantages, however, depending on the defenders' activity the number of faulty-ending attacks and that of losing possession of the ball may increase. The selection of the type of playing method was influenced by the defence system of the defending team and the effectiveness of the tactical elements preferred by the attacking team. However, the analysis of the offence tactics of the world's leading teams shows differences in effectiveness. The reason for this is that although the defence and offence activities are developing continuously and nearly in parallel,

the effectiveness of the certain national teams depends on the current level of their tactical repertoire in offense and is built on the players' personal skills and their employment in the adequate parts of the team. The technical faults committed during the attacks and the numbers of lost balls basically affect the efficiency of the teams. The efficacy of the shots on goal varies primarily according to the final position, but the spot of finishing an attack partly depends on the shooting position created by the defenders and partly on the individual and team strategic decisions of the attackers.

The objective of most of the offence tactical ideas made at reduced strength is to create equality or perhaps even numerical superiority of the players within a small area. This can be achieved by actions done by pairs, groups or the whole team. In a shorthanded situation individual actions may also be effective but this needs the proper preparing activity of the team, i.e. the preparation of an offense area for the finishing player in which she has good chances to score. With the analysis of the five national teams it is possible to assess and compare the various tactical trends against different defence systems.

IV.1 Russia

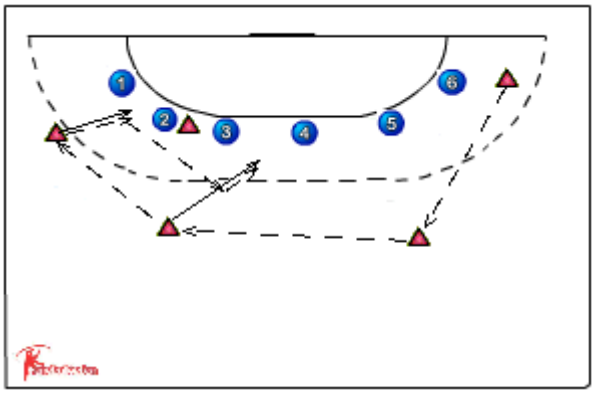
The Russian team tried to create shooting positions by building up relatively simple attacks based on the connection between the backs and the pivot. The effectiveness of a static, position keeping attack using a less wide area but utilizing the area closed down by the pivot was rather low. The reason for this was that the back court players possessing great shooting power were unable to utilize the possibilities offered by the shooting path and to score because of the harmony between the defenders and the goal keeper. By isolating the pivot they created an empty area for a short while, this is how they were able to score and to attain a punishment. The effectiveness of passes to the pivot was reciprocally proportional with their risks since the team was able to score and fight out penalties only from this position, however, the number of lost balls was high, as well, for reason of late and bad timed passes to the pivot (see Table 8).

Table 8: Peculiarities of Russia's offenses

name of national team	defence system	wing	shooting through	pivot	break-through	attack ending in punish-ment	lost ball	technical fault	passive	effectiveness
Russia	6:0	2/0	4/0	1/1						7/1
	5:1									
	5+1			1/1			2	1	1	5/1
	4+2						2			2/0
	man-to-man defence									
	total	**2/0**	**4/0**	**2/2**			**4**	**1**	**1**	**14/2 (14.2%)**

The left wing player initiates fast passes moving in between Defenders 1 and 2. The left back sweeping inwards tries to create a favourable shooting position by attacking the area between Defenders 3 and 4. Meanwhile, the pivot closes down the inner side of Defender 2, and so for a short time provides the possibility for the back court player to pass on the ball to her in case Defender 3 steps out of the defence wall to obstruct the back court shooting on goal (Figure 1).

Figure 1: Offense by Russia at a reduced strength against 6:0 area defence



Keys:
▲ Attacker
● Defender
——— goal-area line
_ _ _ free-throw line
→ direction of movement

IV.2 Denmark

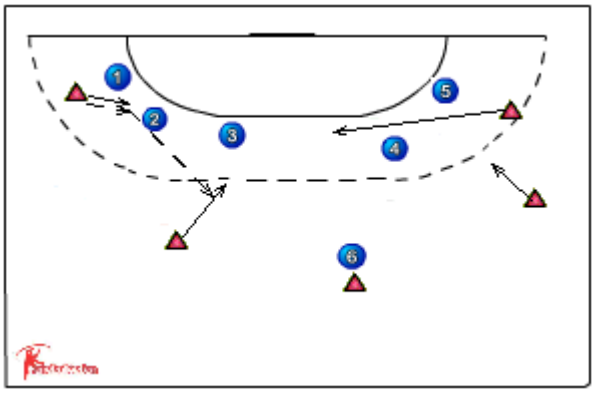
Of the examined national teams Denmark was the least effective in attacking at reduced strength. Because of the lack of success in the situations created by applying the elements of post switching and combined play their attacks ended at a low efficiency. After fast passes they tried to force error of exchanging or to finish the attacks by shooting or breaking through by one of the contra lateral wing players' running in. The effectiveness of the offensive game was based on a lot of lateral movements, however, because of the deficiencies in finishing the actions it remained pretty low (see Table 9).

Table 9: Peculiarities of Denmark's offenses

name of national team	defence system	wing	shooting through	pivot	break-through	attack ending in punish-ment	lost ball	technical fault	passive	effectiveness
Denmark	6:0	2/0	2/0	2/1		1	1			
	5:1									
	5+1		4/0		1/0			2		
	4+2									
	man-to-man defence								1	
	total	**2/0**	**6/0**	**2/1**	**1/0**	**1**	**1**	**2**	**1**	**16/2 (12.5%)**

The left wing player starts an attack against the 5+1 defence system towards the area between Defenders 1 and 2, and at the same time the left back pushes towards the goal in the area defended by the inside defender, and the right wing player suddenly runs into the area between Defender 2 and the inside defender. The left back can shoot on goal, she may pass the ball to the wing player running in, or pass it to the right wing player attacking the area between Defenders 1 and 2 (see Figure 2).

Figure 2: Offence by Denmark at a reduced strength against 5+1 mixed defence



Keys:
▲ Attacker
● Defender
——— goal-area line
_ _ _ free-throw line
→ direction of movement

IV.3 Spain

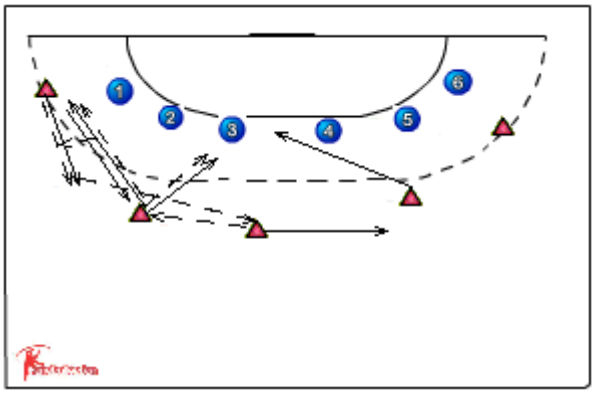
The offence effectiveness at reduced strength of the Spanish national team proved to be the best among the five teams analyzed; its 33.3 percent effectiveness exceeds the average. They tried to achieve good positions by applying different tactical elements, mainly by breakthroughs and the activity of the player taking the pivot's position. The risk of this solution, the distance from the defenders makes continuous team playing and passing to the pivot difficult. By employing fixed position, position switch and combined attack they kept the defenders playing at a numeral superiority under permanent pressure. After dynamic passes they created shooting situations or the possibility of breaking through or passing to the pivot (see Table 10).

Table 10: Peculiarities of Spain's offenses

name of national team	defence system	wing	shooting through	pivot	break-through	attack ending in punishment	lost ball	technical fault	passive	effectiveness
Spain	6:0		2/0	3/2		4	5	3		17/6
	5:1									
	5+1		1/0				2			3/0
	4+2									
	man-to-man defence				1/1					1/1
	total		**3/0**	**3/2**	**1/1**	**4**	**7**	**3**		**21/7 (33.3%)**

After fast passes the left back court changes positions with the left wing player who then passes the ball to the centre back, and takes her original position without the ball. The left back court player, returning to the back court position attacks the goal with the counter-pass gained from the centre back in the area between Defenders 2 and 3, and meanwhile the right back runs in between Defenders 3 and 4 making them insecure about stepping out. After the counter-pass the centre back shifts to the position of the right back (Figure 3).

Figure 3: Offence by Spain at reduced strength against 6:0 zone defence



Keys:
▲ Attacker
● Defender
——— goal-area line
_ _ _ free-throw line
→ direction of movement

IV.4 France

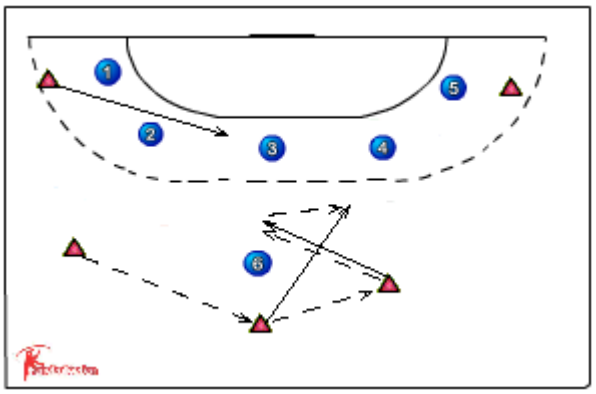
The French national team strived to create shooting situations by switching positions and combined attacks, finishing the offence mainly from the back court position. In case of vertically structured area defence and combined defence, as well, they usually finished their attacks in the inner sector. They established good positions for the back court players and passing possibilities for the wing player running in by the exchange and then running out of the two wing players forcing mistake in the movement of the defenders by this (see Table 11).

Table 11: Peculiarities in France's offenses

name of national team	defence system	wing	shooting through	pivot	break-through	attack ending in punishment	lost ball	technical fault	passive	effectiveness
France	6:0		7/1	1/1	3/1		1			12/3
	5:1		2/1				1	1		4/1
	5+1									
	4+2									
	man-to-man defence									
	total		**9/2**	**1/1**	**3/1**		**2**	**1**		**16/4 (25%)**

The right back court player forces the disturbing player and the outside-half defender to react by breaking towards the area behind the disturbing player. The centre back, by passing the disturbing player, turns to the position of the right back court, and shoots the ball gained from the right back court on goal. At the same time, the left wing player runs into the area of the outside-half defender without the ball obstructing her in moving towards the centre back (Figure 4).

Figure 4: Offence by France at reduced strength against a 5-1 zone defence



Keys:
▲ Attacker
● Defender
——— goal-area line
_ _ _ free-throw line
→ direction of movement

IV.5 Norway

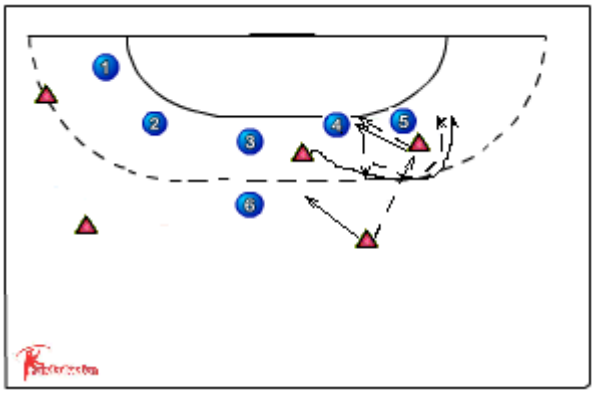
The offence actions of the World champion were, in nearly each case, based on the elements of fixed position play. They strived to finish their attacks by many individual actions and various technical implementations. Their effectiveness was changing; the structure of their attacks was based on tension in each position and the permanent possibility of creating direct scoring situations. The pivot played an important role: primarily when facing a mixed defence system, she often stepped out of the defence wall, generating the possibility of scoring by attacking the goal or making a hub offering an open space for one of her team-mates in a certain point of the defence wall (see Table 12).

Table 12: Peculiarities in Norway's offence play

name of national team	defence system	wing	back court	pivot	break-through	attack ending in punishment	lost ball	technical fault	passive	effectiveness
Norway	6:0	1/0	3/0		1/0					6/0
	5:1		3/2				1	1		5/2
	5+1		4/1		1/1	3	2	3		13/5
	4+2	1/0		1/1			1	3		6/1
	man-to-man defence									
	total	2/0	10/3	1/1	2/1	3	4	7		30/8 (26.6%)

The right wing player initiates an impulsive break-through with the ball between Defenders 1 and 2. The right back court player, implementing a parallel break through without the ball, divides the defenders' attention. Meanwhile, turning out from the inner side of Defender 2, the pivot tries to break through on Defender 1's external side with the ball gained from the wing player. After the possible failure of the break-through the pivot initiates fast passes, and then changes positions with the right wing player running out of the pivot's position (Figure 5).

Figure 5: Offence by Norway at reduced strength against a 5-1 zone defence



Keys:
▲ Attacker
● Defender
——— goal-area line
_ _ _ free-throw line
→ direction of movement

V. Conclusions

In my study I assessed the impacts of the number of suspensions on the final results and the effectiveness of offense play at reduced strength on the basis of the statistics and analysis of matches played at the Women's World Championship 2011. My objective was to highlight the factors determining the success of this phase of the game. According to the survey, it seems to be clear that the number of the suspensions influences the final result in case the effectiveness of the attacks conducted at reduced strength deviates from the average.

According to the analysis of the 7.35 minutes played at a reduced strength by matches (12.2%), the shorthanded team implemented 7 attacks against organized defence which has a decisive impact only if these periods of the game do give an effectiveness lower or higher than the average. The impact of the low number of attacks depended on the time span spent in numerical inferiority by the two teams.

The average of the effectiveness of the attacks initiated at reduced strength was 24.2 percent according to the analysis of the 11 matches which means that every 4^{th} attack ended in scoring. The effectiveness of the examined teams was different, but the importance of this was determined by the position taken by this phase in the whole process of the match.

The dominant role of the defenders in efficiency was clear. The influence exerted by the defenders on the direction of the attack and the spot of finishing the offense and the control they had over the playing situation gives reason of the high number of lost balls and faults committed by the attackers which destroyed the effectiveness of the offence and improved the chances of fast breaks for the defenders. The objective of one-line and vertically structured zone defence is to direct the offence to a less dangerous area and to obstruct the continuity of team work. Thus mixed defence eliminating the most dangerous attacker or attackers can be successful because the attacking team's chances are reduced. The basic tactical philosophy of the attacking teams was observable, although it depended on the defence system, even in numerical inferiority. The elements used in case of equal number of players appeared in this special phase, as well.

The regularity and importance of the attacks led at reduced strength was of different significance concerning the effectiveness of the teams. According to my experiences, this phase of the game is a bit neglected; it is rather about "surviving". The supposed objective was not realized in the attackers' individual, group or full team actions, and the situations created in narrow areas with equal number of players were not utilized. According to the experiences, the direct intention to score at reduced strength against organized set defence is rather low. Since the time to form this situation is rather short in the game, the attackers will find themselves in a situation depending on the defenders' conscious actions or their mistakes.

As a summary, we can state that practicing the attacks at reduced strength is important and necessary in the teams' preparation process, proportionally to its appearance during matches. The conscious learning of the situations possible to be created against various defence systems, the personal roles and the players' readiness to take responsibility are useful not only in these situations but in case of attacks with equal number of players, as well.

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Appendix

Rate of suspensions and the results

GROUP "A"				
National teams abbreviations		**Rate of suspensions**		**Final result**
Team 1	**Team 2**	**Team 1**	**Team 2**	
MNE	ISL	6	1	21-22
NOR	GER	0	2	28-31
ANG	CHI	2	3	30-29
GER	MNE	3	2	24-25
CHI	NOR	5	0	16-43
ISL	ANG	3	4	24-28
MNE	ANG	2	3	28-26
NOR	ISL	4	5	27-14
GER	CHI	6	5	23-22
MNE	CHI	2	4	42-15
ANG	NOR	5	6	20-26
ISL	GER	5	5	26-20
ANG	GER	3	6	25-22
NOR	MNE	4	10	28-27
CHI	ISL	5	6	16-23

GROUP "B"				
National teams abbreviations		**Rate of suspensions**		**Final result**
Team 1	**Team 2**	**Team 1**	**Team 2**	
AUS	KAZ	4	4	9-37
RUS	KOR	3	2	39-24
NED	ESP	6	5	27-34
KOR	KAZ	2	2	31-19
ESP	RUS	5	5	22-28
AUS	NED	4	2	15-53
AUS	RUS	2	2	8-45
KAZ	NED	6	5	20-32
KOR	ESP	2	4	26-29
NED	RUS	6	3	26-35
KAZ	ESP	5	1	18-27
AUS	KOR	4	1	11-45
AUS	ESP	5	0	9-39
NED	KOR	3	2	26-38
RUS	KAZ	6	10	34-19

Group "C"				
National teams abbreviations		**Rate of suspensions**		**Final result**
Team 1	**Team 2**	**Team 1**	**Team 2**	
BRA	CUB	3	4	37-21
ROM	TUN	4	1	30-28
FRA	JAP	0	1	41-22
CUB	ROM	2	2	27-33
TUN	FRA	4	4	17-25
JAP	BRA	4	5	24-32
TUN	CUB	8	5	32-29
ROM	JAP	7	4	28-28
FRA	BRA	1	4	22-26
JAP	TUN	4	7	32-31
FRA	CUB	0	6	38-18
BRA	ROM	7	6	33-28
CUB	JAP	5	1	24-32
ROM	FRA	3	5	20-39
BRA	TUN	6	4	34-33

GOUP "D"				
National teams abbreviations		**Rate of suspensions**		**Final result**
Team 1	**Team 2**	**Team 1**	**Team 2**	
ARG	SWE	3	2	11-37
URU	DEN	2	3	10-36
CRO	CIV	6	3	36-20
CIV	SWE	2	2	25-28
ARG	DEN	3	3	13-31
URU	CRO	2	0	15-45
SWE	URU	4	1	31-14
DEN	CRO	7	5	23-19
ARG	CIV	4	6	19-25
CRO	SWE	5	5	27-26
DEN	CIV	0	3	38-17
URU	ARG	3	3	19-16
CIV	URU	2	2	31-24
SWE	DEN	4	5	19-20
CRO	ARG	10	4	23-18

PRESIDENT'S CUP				
National teams abbreviations		**Rate of suspensions**		**Final result**
Team 1	**Team 2**	**Team 1**	**Team 2**	
GER	KAZ	0	5	37-14
TUN	URU	0	4	34-17
AUS	CHI	2	2	11-45
CUB	ARG	11	7	25-20
KAZ	URU	4	4	31-22
AUS	ARG	3	1	12 30
GER	TUN	3	2	33-25
CHI	CUB	1	2	30-29

ROUND OF 16				
National teams abbreviations		**Rate of suspensions**		**Final result**
Team 1	**Team 2**	**Team 1**	**Team 2**	
KOR	ANG	7	2	29-30
RUS	ISL	5	5	30-19
NOR	NED	4	4	34-22
MNE	ESP	3	2	19-23
SWE	FRA	2	3	23-26
ROM	CRO	5	4	27-28
DEN	JAP	4	1	23-22
BRA	CIV	1	2	35-22

PLACEMENT MATCHES				
National teams abbreviations		**Rate of suspensions**		**Final result**
Team 1	**Team 2**	**Team 1**	**Team 2**	
RUS	ANG	5	5	41-31
CRO	BRA	4	4	31-32
FRA	DEN	3	5	28-23
NOR	ESP	4	3	30-22
RUS	BRA	3	3	20-36
ANG	CRO	2	3	29-32
DEN	ESP	4	3	18-24
FRA	NOR	5	2	24-32

QUARTER FINALS				
National teams abbreviations		**Rate of suspensions**		**Final result**
Team 1	**Team 2**	**Team 1**	**Team 2**	
RUS	FRA	5	4	23-25
ANG	DEN	2	4	23-28
CRO	NOR	5	5	25-30
ESP	BRA	5	6	27-26

SAVING THE SIDE SHOTS

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1. Introduction

The goalkeeper has a special position within the team. He is the only player, who is positioned in the goal area. This is his special territory and different rules apply there than those for the court-players (for instance he has chance to move more than 3 steps with the ball, he can use his legs for savings and so on). He can also play as a court-player, when he steps out from the penalty area. But the way, he is the last member of the team, who can stop the ball in front of the goal line. He is the first player mostly, who can take part in the fast breaks. So we can say, the goalkeeper is the end and the beginning in the handball game.

The goalkeepers need specific selections and trainings because of their cue than the court-players have.

We have to take care in the selection: only those children will be good in the goalkeeper position later, who are brave enough and painless against the ball from the beginning. It is also important for them to tolerate those training practices, which are sometimes monotonous. The learning and the repeating of the correct technical elements and movements are very important for the good results.

The good psychological, mental and physical abilities and condition level are also as important, as the aptitude, the height, the length of the arms. The taller children with long arms have more chance for good savings than the others have. The best women goalkeepers' height average is about 180cm, the men over 190cm.

The most important physical ability for the goalkeepers is the *movement speed*, but the *flexibility* is a basic requirement also. Aerobic endurance is important as well for longer, good level achievement. It is needed because of the numbers of moving and movements.

A high anticipation level gives more chance for the goalkeepers to anticipate the way of the ball from the moving of the opponents.

If somebody has these type of conditions, we can say, he has chance to be a good goalkeeper.

There is not as much literature about the goalkeepers, as about court players. Their technics about saving the balls from different positions are not so developed. This can be

the reason for the different technical actions which we see against the wing-shots. Another important thing is that the wing player's shots are very variable and colourful (the spin, the lob shot, the twisted shot and so on).

I have been a coach of goalkeepers for a long time. I train players from the beginners to the adults (national team players as well). I think the biggest problem for all goalkeepers is saving the wing players shots (the high and low shots for the juniors, the law and hip-high shots for the adults). The young goalkeepers' problems are the saving of the higher shots because of their height, and the low shots. The reason may be that their foot-coordination is not so good. The biggest problems of the adults are the hip-high shots. If they start their arms from high position it may cause problems at the savings of law shots. They start to move their leg up earlier than it would be necessary. These are the reasons why I teach the basic positioning with different arm and leg set-up.

That's why I began to examine the side shot saving styles in my thesis. I would like to know what kind of moving is used world against the side shots by the best goalkeepers of the world and where do they get the makes mostly.

I am also interested if the numbers of the wing shots has increased or not between the two Olympic Games and what is the percentage of these types of shots of the total shots in the handball games. This was the reason why I examined the statistics of the handball matches played in Peking and London. I analysed 2 female and 2 male goalkeepers' actions.

2. Literature reviews

As I mentioned earlier only a few pieces of literature are dealing with the technical elements of the goalkeeper in handball. The basic positioning of the goalkeepers against the long range shots is clean-cut and is well analysed in every book. The teaching method is nearly the same everywhere. The basic position is a shoulder-wide stride face to the ball, the legs are bended by the knees and ankle, and the feet are turned out a bit. The bodyweight is on the first part of the sole because of the preparation of the leg's muscles for the fast moving. The trunk leans forwards a bit; the arms are on both sides a little bit behind the shoulder height, the flat of the hand is turned up front, the fingers are straight and opened. The hands are nearly in the eyes line as wide as the keeper could see both peripherally.

We can say that the basic position is a standby position; it is an optimum status for saving the next shots.

Is this the same position against the side shots as well?

István Tóth: The analysis of the goalkeepers activity (World Championship 2003):

He mentioned 3 various styles:

1. Saving parallel with the goal line.
2. Saving on the middle of the shooting angle 0,5-1m. from the goal.
3. Positioning towards the long corner, saving the short corner actively and the long corner passively. He wrote that the best technic against the law corner shots is the following: jump forward from both legs towards the short side of the goal and straight that one arm is down to the knee. The opposite arm is over the head.

Béla Bartalos wrote, that the best basic position for the goalkeepers is 1,5 foot from the goal side and forward.

András Novák wrote about the wing shots in his thesis („Side shots savings on the top level, 2011"). He examined which way start the wing-players mostly, from the corner or from the 9m line. He found, that they start mostly from the corner and he suggested for the goalkeepers the middle shooting pile positioning and close-knit saving style instead of moving the leg up.

I found the best specification in the book of *Béla Fekete („Technics of Handball" 2007)*

„Savings by positioning to the short corner:

The goalkeeper's best position is 1-2 meter in front of the post. The basic position is a small stride, the distance between the post and the keeper is so close that the ball can't go through to the goal. The goalkeeper saves the short upper corner passively with the arm over his head or with both arms (the first is better). The shorter keepers move both arms over the head.

The goalkeepers push their hip towards the post against those balls which come between the hip and the post. Saving the short low corners could be passively or by turning the foot side and out.

The saving of the long side shots is totally different. The goalkeeper has to step out or jump side and he has to save with his arm or hands actively. If the ball comes towards the long upper corner, he has to step or jump sheer to the way of the ball to the direction of the middle of the court and he has to stretch his arms to the side and a little bit forward in front of the ball. The muscles of the arms and hands are intense and the flat of the hands has to be turned unto the ball with opened fingers. Some of the goalkeepers move up their leg under the arms because of the bigger surface.

How can save the balls in hip-high? The keeper has to move his arm down and the same leg up with bended knee at the same time.

Saving the long low corner: fast side step with turning the foot out, and fast arm moving down over the leg (with bending side) or only with leg-turning.

The goalkeeper can move also forward (attack the wing player). He covers bigger surface in this case but he gives chance for the shot between the legs. But the wing-players from high position bounce the ball over the goal because of the big distance from the post. If the attacker changes his mind, his moving will be slower and the keeper has more time, so he can close his legs.

We have to mention the twisted shot (the spin) as well. The goalkeeper has to turn the opposite leg out with a side step, and he has to extend this knee, if the ball bouncing close to him. If the ball moves over his head, his arm has to bend and move very fast over his head.

The goalkeepers can be positioned to the long corner direction. The saving here is the same as I mentioned earlier, but to the short side direction.

If the goalkeeper is positioning on the middle line of the shooting angle, he has to save both sides actively."

Laszlo Kovács: Technics of the goalkeepers.

„There are two possibilities for goalkeepers to save lob shots:

1. Knocking the ball away in the upward trajectory
2. Fast running out towards the attacker, then fast running back and diving back.
   - The first case: the goalkeeper runs out close to the attacker in the moment of the jumping. He jumps up and covers the ball with one or two hands. The jump up moment must be correct; the height of the jump must be top, from one or two legs. The top height is higher with one hand.
   - The second case: the goalkeeper runs forward two-three steps, showing to the wing-player that he has only one chance: using the lob shot over his head. Than he stops and begins to run back with maximum speed towards the post and

knock the ball over the post generally with the far hand. If he is in deeper position, he has to dive or jump back!”

While the goalkeepers wait the long range shots in optimal position, the situation is different at the side shots:

- there is shorter time to take up the saving position;
- the arm-positions are various mostly;
- the defenders can’t help the goalkeeper;
- the distances of the shots are short;
- the goalkeeper has to identify the shooting type by the position of the shooting arm and the ball;
- the goalkeeper has to take care for the place and the direction of the attacker’s jump;
- it is important if the wing player plays on his throwing hand side or on the opposite side (the first case is not common with the top-level teams);
- the “life” of the goalkeeper is hard because they get some makes from the ground (the attackers’ leg touches the ground too early).

3. Hypothesis:

1. The number of shots coming from the wings has increased during the last four years (between the two Olympic Games).

2. Is there a general basic position and saving technic against the side shots?

3. Where the arms should be held before the wing shots: in symmetrical or asymmetrical position?

4. Are the goalkeepers using the same technique all the time or do they change the moving sometimes?

5. Where do the goalkeepers get more makes:
   a. shots:
      - over the shoulder (high level)
      - middle high level (between the shoulder and the knee)
      - low level (under the knee)
- b. lob shot:
- c .twisted shot (spin)

6. Are the saving techniques on the short and the long side different or are they the same?

7. What is the basic technique against the side shots? What do we need to teach the young players?

4. Methods:

I used the cumulative statistics for the Olympic Games matches in Peking and London. (appendix 33.-36 p.)

I differently analysed the matches of female and male teams.

The average of the results showed me the order of the shots in terms of frequency and the side shots ranking among all shots. It shows us the numbers of the different shots savings.

I tried to find the answers for the other questions (2-6) with the video-analysis.

I chose two men team according to the cumulative statistics. I chose Spain (Esp.) and Sweden (Swe). The Spanish goalkeeper's achievement was 53 % on 6 matches. The Swedish goalkeepers were weaker: 41% on 8 matches. (appendix34.p). I analysed the achievements of the goalkeepers individually.

I choose 2 teams from the women as well. Both the teams played 8 matches and their statistics were the best from the aspect of savings. These two teams were Korea (KOR) and Norway (NOR). It is interesting that the Norwegian goalkeepers were the same in Peking and in London as well. The statistics:

In Peking: KOR 46%, NOR 47%

In London: KOR 47%, NOR 41% (supplement 35.p)

I made a special statistics about the shots from the wing, and I got the answers for the questions 2.-6. The conclusions showed me what I have to teach and how I should train the beginners and the young players to save the side shots effectively.

5. Results: (for the first question):

Peking: men

The teams played 84 matches totally. I got the following results from the cumulative statistics:

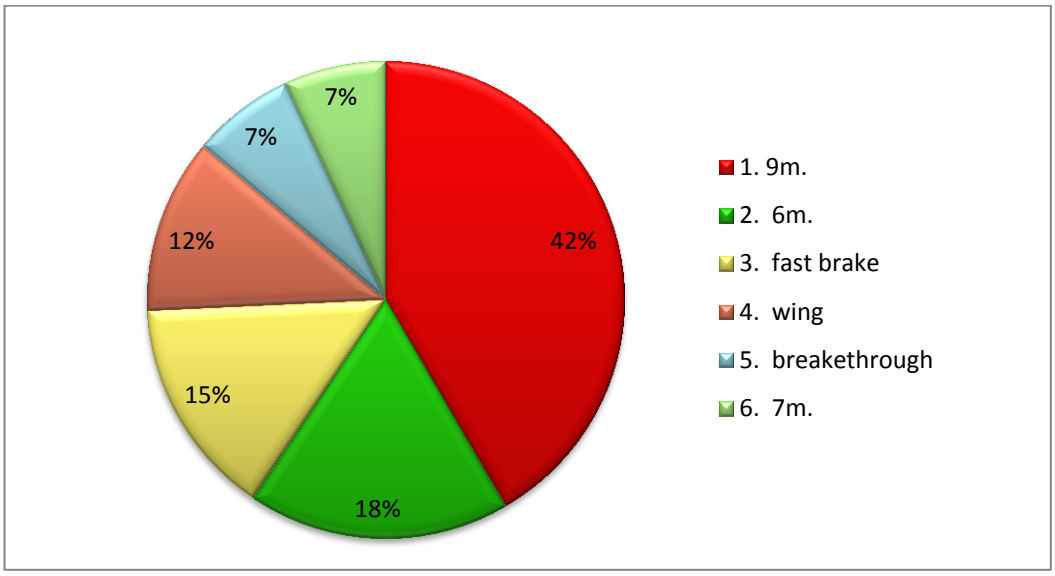
all shots	6m	side	9m	7m	fast break	break thrue
4131	739	481	1719	277	627	288
100%	18%	12%	42%	7%	15%	7%

Table 1

Percentages:

1. 9 m. (long range shot) 42 %
2. 6 m. (clear chance) 18%
3. fast break 15%
4. wing 12%
5. 6 m.(breakthrough) 7%
6. penalty (7m.) 7%

1. Diagram: Peking men ranking



London: men

76 matches:

All shots	6m	wing	9m	7m	fast brake	break through
3568	556	562	1526	241	405	278
100%	16%	16%+	43%	7%	11%	8%

Table 2

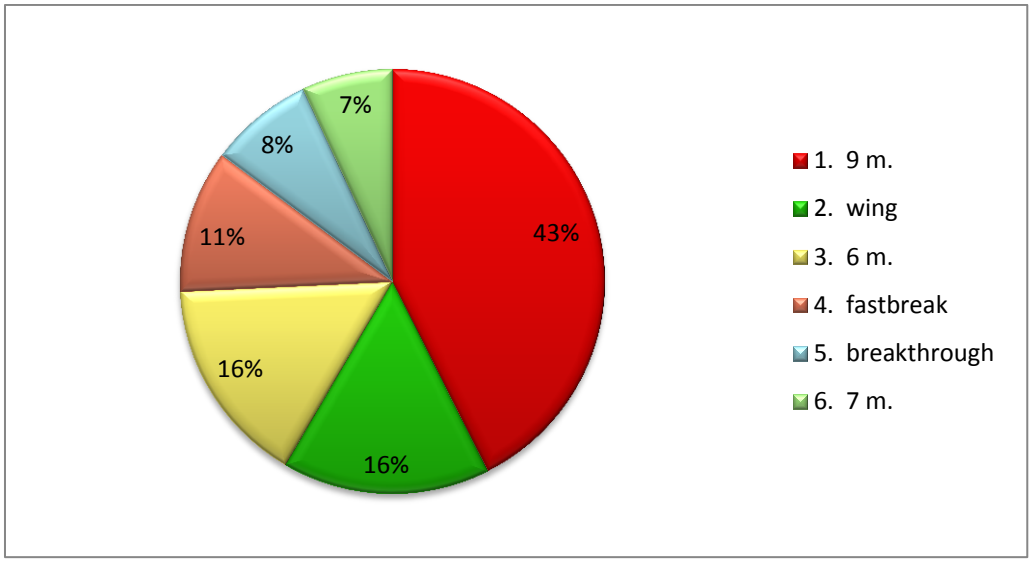
Percentages

1. 9 m. (long range shot) 43%
2. wing 16% +
3. 6m. 16% -
4. fast break 11%
5. brake through 8%
6. penalty (7m.) 7%

16% + = 6 goal, then from 6m.

16% - = 6 goal less, then from wing

2. Diagram: London: men ranking



It is interesting that the statistic average was 49 attacks / match in Peking but only 47/ match in London which means that the number of the attacks

decreased. Wing shots climbed up to the 2nd rank from the 4th. This means that we have to take care for long range shots saving as the most important task, than for the 6 meter and the side shots saving.

If we examine the saving effectiveness of all goalkeepers, the result is nearly the same: it was 35% in Peking and 36% in London. It is also interesting, that while the goalkeepers had to save 428 times in PEKING (84 matches), while 488 times in in London (76 matches).

So we can say that the numbers of the shots increased in the handball matches of the Olympic Games. This means that the first hypothesis is true!

Peking: ***women***

There were 84 matches played in Peking

All shots	6m	wing	9m	7m	fast brake	break-through
4274	576	558	1671	382	679	408
100%	13%+	13%-	39%	9%	16%	10%

Table 3

Percentages:

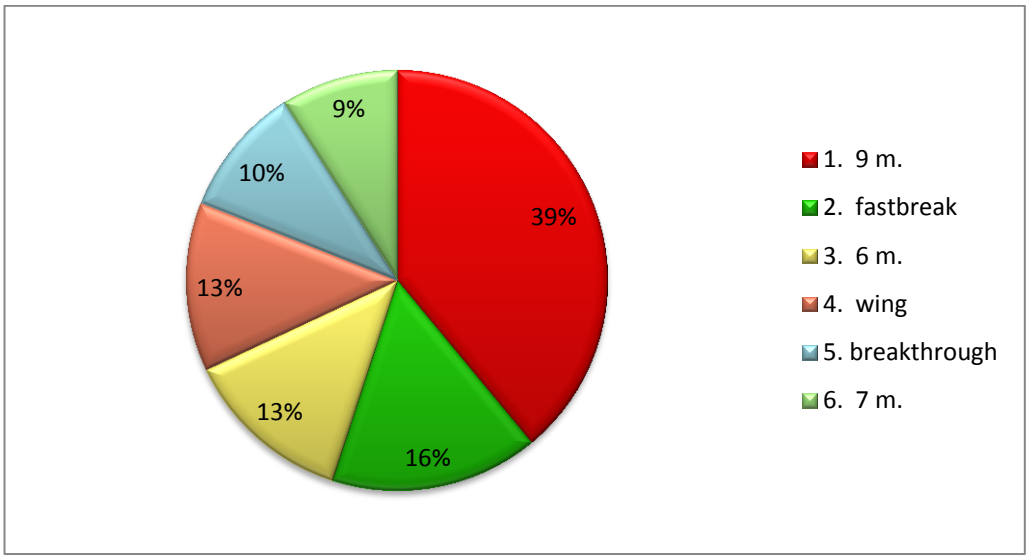
1. 9 m. (long range shot) 39%
2. fast break 16%
3. 6m. 13% +
4. wing 13% -
5. breakthrough 10%
6. penalty (7m.) 9%

13% + = 0,4%- more shots, than from wing

13% - = 0,4% less shots, than from 6m.

Statistically this isn't important, this is the reason, that I signalled it simple with + and -.

3. Diagram: Peking: women ranking



London: women

There were 76 matches played in Peking.

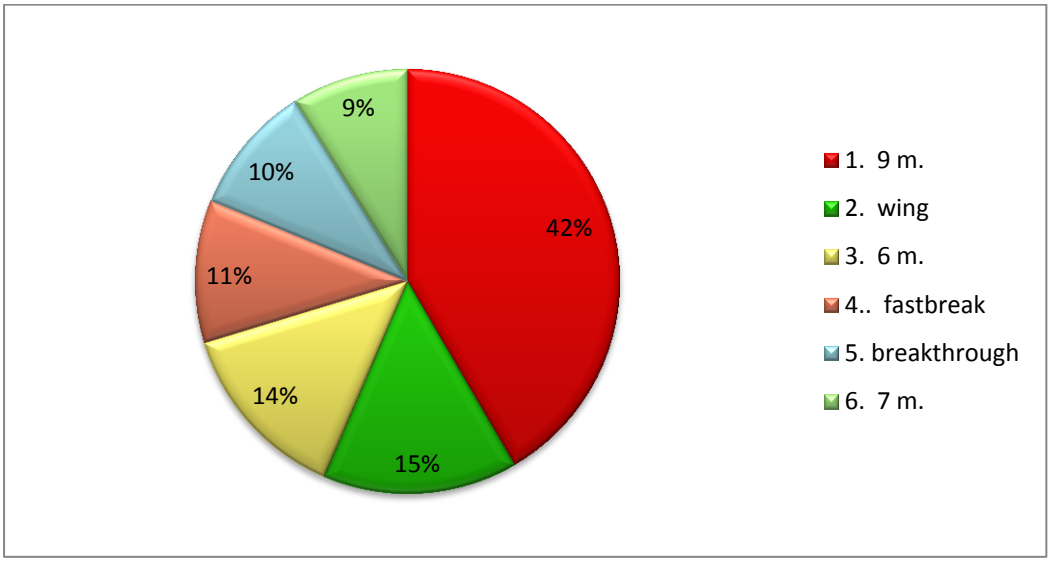
All shots	6m	wing	9m	7m	fast break	break through
3498	495	521	1456	308	376	342
100%	14%	15%	42%	9%	11%	10%

Table 4

Percentage

1. 9 m. 42%
2. wing 15%
3. 6 m. 14%
4. fast break 11%
5. Breakthrough 10%
6. 7 m. 9%

4. Diagram: London: women ranking



The numbers of the attacks significantly decreased per matches. It was 51 attacks / match in Peking, and 46 attacks / match in London.

We can't say that the number of the wing shots increased, but its ratio didn't change, because of the less attacks. In this case the 9 meter shots were the most popular shots (42%), but the wing shots came up to the second place with 15%.

If we examine the effectiveness of the saves, we can see that it changed a lot: it was 42% in Peking, but only 32% in London.

It is not the aim of my thesis to examine it, but I think, the women learned to shoot better from wing which may be the reason of the lower saving results.

The data of the examined goalkeepers:

Men:

Sweden:	*age*	height	weight
1. Andersson Matthias	34	186cm	93kg
2. Sjöstrand Johan	25	195cm	95kg

Spain

1. Hombrados Ibanez Joze	40	197cm	98kg
2. Sterbik Árpád	32	200cm	119kg

Women:

Norway

1. Grimsbo Kari Áálvik	27	180cm	-
2. Haraldsen Katerine Lunde	32	181cm	72kg

Korea

1. Ju Hui	22	180cm	68kg
2. Moon Kyeongha	32	176cm	62kg

The results of the men:

- ***Andersson(Swe):***

Basic position, basic technics:

Small stride, the body weight on the front of the sole, on the tiptoe. The arm is bended in high position, the hands are near to each other. The goalkeeper positioning about 1-2m. from the post.

The position of the arm:

The arm position is symmetric.

Adaptation of the technique:

He uses a combination of 3 types of the technique: positioning to the short corner, to the long corner and sliding. If he positions to the long side, he jumps up and saves the long side with his trunk, but he saves the short corner with his arm and leg moving up.

The goals from wing:

High area: 7 goals

Hip high area: 5 goals

Low area: 1 goal

Lob: 2 goals

Table 5: The statistics of Andersson in the matches against wing shots:

match	result	wing shot	saves	goals	saving %	Play time
SWE-TUN	28:21	5	2	3	40	60’
GRB-SWE	19:41	2	1	1	50	30’
SWE-ISL	32:33	5	1	4	20	34’
FRA-SWE	29:26	4	0	4	0	20’
HUN-SWE	26:27	6	3	3	50	60’
total		**22**	**7**	**15**	**32**	**204’**

His saving effect is 32% against the wing shots, this is the minimum of the goalkeepers.

Technical differences:

His technics is similar on both sides’ savings.

- ***Sjöstrand(Swe):***

Basic position, basic technics:

Small stride, the body weight on the front of the sole. The arm is bended in high position. This goalkeeper takes position about 1-2m from the post. He takes a big breath before the shots to cover a bigger surface of the goal.

The position of the arm:

The arm position is symmetric.

Adaptation of the technics:

He uses the combination of 4 types of the technique:

- positioning to the short corner: if the shooting angle is too big for the wing player and he jumps to the penalty line direction, he jumps from both legs and brings up his leg towards the short side, than he change his leg and he moves the opposite arm and leg to the way of the ball. He tries to save this way the high and hip-high shots.
- positioning towards the long side, he saves the short corner with arm and leg moving up without jump.
- positioning on the middle line of the shooting angle he tries to save the low and hip-high shots with sliding out.
- he moves his arm down from the top of his head against the hip-high shots in standing position.

The goals from wing:

High area: 0 goal
Hip high area: 10 goals
Low area: 5 goals
Lob: 2 goals

Table 6: The statistics of Sjöstrand in the matches against wing shots:

match	result	wing shots	saves	goals	saves %	Play time
GRB-SWE	19:41	5	3	2	60	30’
SWE-ISL	32:33	3	2	1	67	26
FRA-SWE	29:26	5	1	4	20	40’
SWE-ARG	29:13	4	2	2	50	60’
SWE-DEN	24:22	7	3	4	40	60’
SWE-FRA	21:22	8	4	4	50	60’
total		**32**	**15**	**17**	**47**	**276’**

Sjöstrand was excellent at 47% against the wing shots.

Technical differences:

He uses different kinds of technique against the short and the long side shots!

Hombrados (Esp):

Basic position, basic technics:

Small stride, the knees are slightly bent. The arms are in the shoulders level, or a little bit lower position bent just a little bit. His position is 0,5-1m from the post.

The arm position:

The arm position is symmetric in deep position, or in the shoulder line.

Adaptation of the technics:

Positioning on the long side, he moves up his leg and he saves the short upper corner with both arms.

He saves the short low corner only with his leg (excellent anticipation), his arm is down.

Positioning on the short side he moves up his leg and arms to the long upper corner direction.

The goals from wing:

High area: 3 goals

Hip high area: 1 goal

Law area: 0 goals

Spin: 2 goals

Table 7: The statistics of Hombrados in the matches against wing shots:

match	result	wing shots	saves	goal	save %	Play time
ESP-SRB	26:21	3	2	1	67	50’
DEN-ESP	24:23	9	5	4	56	60’
total		**12**	**7**	**5**	**58**	**110**

Hombrados had shorter playing time in the matches, but he was excellent against the wing players (58%!).

Technical differences:

He used different kinds of technique on the short and on the long side.

Sterbik(Esp) :

Basic position, basic technics:

Stride position, the knees are slightly bent. The arms are in the shoulders line slightly bent. His position is 1-2m from the post.

The arm position:

The arm position is symmetric.

Adaptation of the technics:

He is positioning mostly on the long side and saves the short corners with arm and leg moving up. If the opponent aims at the long corner he closes his arm to his trunk. Sometimes he touches the ground with his hand.

He tries to save the low shots also with sliding out. He is very elastic, so he is able to move his leg over his head level, and save shots at the high corners with his leg.

He jumps sideways with closed legs if the shooting angle is small,

The goals from wing:

High area: 4 goals

Hip high area: 3 goals

Low area: 2 goals

Lob: 2 goals

Table 8: The statistics of Sterbik in the matches against wing shots:

match	results	shots	saves	goal	saving %	Play time
ESP-SRB	26:21	0	0	0	0	10
ESP-KOR	33:29	8	3	5	38	60’
HUN-ESP	22:33	4	2	2	50	60’
ESP-CRO	25:33	4	2	2	50	60’
ESP-FRA	22:23	4	3	1	75	60’
total		**20**	**10**	**10**	**50**	**240’**

Sterbik also was really good against the wing shots (50% efficiency).

Technical differences:

He takes position at the long side and actively saves the short side.

5.2. The summary of the male goalkeepers:

Basic position, basic technics:

The basic positions are only similar in the stride position by all the four goalkeepers.

*The arm position*s are only similar by the same nationality players. The Swedish keepers hold their arms in high position, the Spanish in side position by the shoulder or little bit lower. The arm positions are symmetric.

Adaptation of the technique:

They use 3-4 saving styles against the wing shots.

Table 9: ***Goals from wing:***

shots	Andersson	Sjöstrand	Hombrados	Sterbik	total
high	7	0	3	3	13
hip-high	5	10	1	3	19
low	1	5	0	2	8
lob	2	2	0	2	6
spin	0	0	1	0	1

It seems, they got the goals mostly by hip-high shots, specially the Swedish goalkeepers, who hold the arms in upper position basically. They got 15 goals from 19 together.

Technical differences:

The saving move is different on the short and the long side, except Andersson, who uses the same action on either side.

5.3.The results of the women:

- Grimsbo (Nor):

Basic position, basic technique:

Small stride, the knee is straight; the arm is on high position. the palms are over the head, close to each other. The distance is within 0,5m from the post. She touches the post sometimes.

The position of the arm:

The arm position is symmetric.

Adaptation of the technique:

She covers the short side generally. She touches the post with her hand first, than she steps side according to the shooting angle than wait for the shot.

If the shooting angle is smaller, she saves the hip-high shots only with her hip (pushing it sideways).

She saves the high shots with both arms with one sidestep.

She saves the low shots and spins with one long sidestep and extends her arm. She also tries to save with sweeping her leg sideways and close the other one. She slides side against the hip high shots with sweeping her arms over that leg.

The goals from wing:

High area: 4 goals

Hip high area: 3 goal

Law area: 3 goal

Spin: 1 goals

Table 10: The statistics of Grimsbo in the matches against wing shots:

match	result	shots	saves	goal	save%	Play time
NOR-FRA	23:24	2	1	1	50	30’
SWE-NOR	21:24	9	5	4	56	60’
NOR-KOR	27:27	4	1	3	25	30’
DEN-NOR	23:24	-	-	-	-	-
NOR-ESP	20:25	4	1	3	25	60’
BRA-NOR	19:21	2	2	0	100	39’
NOR-KOR	31:25	0	0	0	-	21’
NOR-MNF	26:23	0	0	0	-	15’
total		**21**	**10**	**11**	**48**	**255’**

Grimsbo was excellent 48% against the wing shots.

Technical difference:

She saves only the long corner actively.

- **Haraldsen (Nor):**

Basic position, basic technique:

Small stride, the bodyweight is on the first part of the leg. The arms are on high position; the elbows are bended a little. She is close to the post or 1-1,5m forward.

The position of the arm:

The arm position is symmetric on high position.

Adaptation of the technique:

If the shooting angle is smaller, she saves the hip-high shots to the long side only with her hip (pushing it sideways), the arms she keeps up.

She saves the high shots with both arms with one sidestep.

She takes position sometimes towards the long side and steps back to the side.

She covers the short side with her full body.

If she stays at the post, she saves also parallel with the goal-line (sliding as well!).

If the jumping angle is too big, she steps out to long stride (the leg turns out) and saves the hip-high shots with both arms, sometimes with sliding, too.

Sometimes she moves up her leg earlier, than close her legs suddenly.

The goals from wing:

High area: 6 goals

Hip high area: 3 goals

Law area: 2 goals

Lob: 1 goal

Spin: 1 goal

Table 11: The statistics of Haraldsen in the matches against wing shots:

match	result	shots	saves	goals	save %	duration
NOR-FRA	23:24	2	1	1	50	30’
SWE-NOR	21:24	-	-	-	-	-
NOR-KOR	27:27	2	1	1	50	30’
DEN-NOR	23:24	5	2	3	40	60’
NOR-ESP	20:25	-	-	-	-	-
BRA-NOR	19:21	3	1	2	33	21’
NOR-KOR	31:25	3	1	2	33	39’
NOR-MNF	26:23	5	1	4	20	45’
together		**20**	**7**	**13**	**35**	**225’**

Her 35% yield is moderate.

Technical difference:

She uses different technique on the short and on the long side.

- **Ju Hui (Kor):**

Basic position, basic technics:

Small stride, the knees a little bit bended. The distance from the post is about 1m forward.

The position of the arm

The arm position is symmetric in deep position or in the shoulder line.

Adaptation of the technique:

She is positioning in the short side and saves the long side actively. Her style is interesting because of the low arm holding. She brings up the arms saving the upper corner, but she keeps the stride (bigger covered space low). She also uses feints: she starts forward and steps back very fast. Sometimes she starts close to the attacker and jumps up from both legs to cover the shooting angle. The arms are in high position against the lob. She brings her inside leg up and her arm down if the wing player jumps to the 7m line.

The goals from wing:

High area: 3 goals

Hip high area: 7 goals

Low area: 8 goals

Lob 1 goal

Table 12: The statistics of Ju Hui in the matches against wing shots:

match	result	shots	saves	goals	save%	Play time
ESP-KOR	27:31	1	0	1	0	60’
KOR-DEN	25:24	4	2	2	50	60’
NOR-KOR	27:27	4	2	2	50	54’
KOR-FRA	21:24	3	1	2	33	46’
SWE-KOR	28:32	10	5	5	45	48’
RUS-KOR	23:24	5	5	0	100	60’
NOR-KOR	31:25	4	1	3	25	53’
KOR-ESP	29:31	7	3	4	43	60’
total		**38**	**19**	**19**	**50**	**441’**

She was excellent against the wing shots (50%).

Technical difference:

She saves mostly the long corner actively.

- **Moon (Kor) :**

She got only one shot from wing (hip-high, goal) so there is no reason to examine her.

5.4. The summary of the woman goalkeepers:

Basic position, basic technique:

The basic positions are only similar in the stride position.

*The arm position*s: symmetric.

Adaptation of the technics:

The female goalkeepers use 3-4 saving styles against the wing shots too.

Table 13**: *Goals from wing:***

shots	Grimsbo	Haraldsen	Ju	Moon	total
high	4	6	3		13
hip-high	3	3	7	1	14
low	3	2	8		13
lob	0	1	1		2
spin	1	1	0		2

They got the goals mostly from hip-high shots like the male goalkeepers. The numbers of the goals are nearly the same in the high and in the low area.

Technical differences:

The saving move is different on the short and the long side with the women as well. But there were two goalkeepers who saved only the long corner with active moving.

6.Discussion

1. The answer for the first question is very clear: **the number of the wing shots has increased**. Examining the two Olympic Games the wing shots came up to the second place from the fourth in the hierarchy of the different shots. This means that the goalkeeper coaches have to spend more time for saving the wing shots than in the past.

The ranking of the shots is the same with the women and the men:

	men	women
- **long range shots:**	**43%**	**42%**
- **wing shots**	**16%**	**15%**
- **6m. shots**	**16%**	**14%**
- **fast break**	**11%**	**11%**
- **breakthrough**	**8%**	**10%**
- **7 m**	**7%**	**9%**

2. The second question was the following: is there any uniformity by the basic position of the goalkeepers against the wing shots? Only the stride is really same: the arm position is different, because two women and one man goalkeeper hold the arms high. The others use the side or deep positions. (It is interesting that the arms do move faster from down to up than back.)

So the basic position is not the same of the goalkeepers before saving the wing shots: the legs are open but the arm positions are different.

3. The third question was the arm position: symmetric or not? **The answer is uniform symmetric.** The reason for the question was my opinion: I thought that this symmetric arm holding is true only by the positioning on the half line of the shooting angle. If the goalkeeper stays towards the long or short side, one arm saves the short side, near to the post. According to my opinion the optimum of the arm position is that the one arm is over the head a little bit bended next to the post. The other arm is bended on the other side of the trunk in shoulder high. This is an asymmetrical arm-position, what the goalkeepers have to practice for a long time.

4. The fourth hypothesis was: Are keepers using more techniques or only one type? **The answer is again uniform: they do use three or more styles.**

5. The fifth question was: where do the goalkeepers get the most makes? **The hardest shots for the men are the hip high shots**, specially the Swedish keepers, who held their arms in high position. They got 15 from 19 goals.

The situation is nearly the same with the women, but the difference is not so big between the high, middle high and low shots goals as with the men.

According to my experiences the saving effect is better by using asymmetric arm positions against the middle high shots. The goalkeepers didn't use it on the Olympic Games, so I have to examine it later.

6. The sixth question was: are there any differences between the short and long side savings? **The answer is: yes in one situation.** It means if the goalkeeper is on the short side, his saving technic is different against the short side shots, than against the long side ones. But all goalkeepers were positioning sometimes on the short, sometimes on the long side. The saves are blueprints of each other's in these situations. This is very important in the training work of the young goalkeepers: what we teach them on one side, we have to teach it on the other side as well.

7. The last question was: What are the basic positions and basic techniques? What shall we teach the beginners, what will be good in their future as well?

As we saw, **the basic position is a stride with bended knees.** I think the arm position must be asymmetric if they save one side actively, the other one passively. There is no reason to save the territory outside the post.

It seems from my thesis that the good goalkeepers use more techniques for the good result in the handball. I think we have to prepare it from the beginning. We must teach the children to save on both sides against the wing shots to keep the attackers in suspense. They have learnt the different functions of the legs and the arms: specific example saving with leg and the arm comes over the head. They need a lot of coordination drills for the legs and the arms besides of the general technique. This way is the basic for their special technique in the future.

7. Conclusions:

I had double aim with this thesis:

a. First of all I would like to demonstrate that the numbers of the wing shots increased during the last four years. I wanted to know also the shooting scale, what is the position of the side shot among the all shots. This way we can make the decision about the goalkeepers training amount saving the wing shots. The numbers of the wing shots really increased, it means the coaches second duty is to prepare the goalkeepers against the wing shots after the long range shots save drills.

b. I wanted to know which is that basic position and what are the basic techniques, what we have to teach the beginners and will it be useful later? I tried to find the answers with the 2^{nd} - 6^{th} question. There was no definite answer. It means there is no type of technique which is the same all over the world. So we have to teach the goalkeepers different techniques. This way the attacker can't prepare himself so easily against one goalkeeper because he don't know which kind of technique will be used against him.

I think it was an interesting assessment what I tried to work out because I found some concrete facts:

- there is no basic position which is good for all goalkeepers, the stride is general but the arm position is different
- the wing shot saving is the second among the goalkeeper techniques
- we have to teach more different techniques from the beginning.

8.Appendix

HANDBALL
手球 / HANDBALL

MEN
男子项目 / HOMMES

OVERALL TEAM STATISTICS As of 24 AUG 2008
球队技术统计 / STATISTIQUES GÉNÉRALES D'ÉQUIPE

Players

Team	MP	Total Shots		6m Shots		Wing Shots		9m Shots		7m Shots		Fast Breaks		Breakthroughs		Offence		Defence		Penalties			
		G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	AS	TF	ST	BS	YC	2Min	RC	EX
BRA	5	129/252	51	36/60	60	16/29	55	40/102	39	5/14	36	25/37	68	7/10	70	67	79	21	4	15	19	1	0
CHN	5	104/227	46	23/41	56	6/10	60	45/136	33	6/8	75	18/23	78	6/9	67	37	98	16	2	16	14	1	0
CRO	8	218/375	58	52/68	76	29/50	58	39/131	30	28/37	76	48/60	80	22/29	76	124	98	32	33	22	25	1	0
DEN	8	225/414	54	42/65	65	30/55	55	78/195	40	15/21	71	48/61	79	12/17	71	108	89	23	28	23	33	2	0
EGY	5	127/229	55	24/34	71	11/22	50	43/101	43	10/12	83	22/36	61	17/24	71	51	57	15	12	17	28	1	0
ESP	8	246/406	61	56/83	67	52/76	68	46/126	37	22/29	76	38/52	73	32/40	80	130	105	39	47	23	27	2	0
FRA	8	228/381	60	59/76	78	25/48	52	56/137	41	17/20	85	49/71	69	22/29	76	117	91	50	33	26	22	0	0
GER	5	126/233	54	27/39	69	14/32	44	42/95	44	12/15	80	18/30	60	13/22	59	51	72	18	18	16	20	2	0
ISL	8	242/426	57	53/73	73	27/45	60	71/180	39	22/29	76	52/72	72	17/27	63	117	92	34	33	26	38	2	0
KOR	8	198/408	49	26/40	65	11/25	44	96/238	40	20/31	65	31/50	62	14/24	58	71	92	31	17	20	18	0	0
POL	8	235/404	58	46/77	60	30/44	68	57/142	40	19/23	83	61/91	67	22/27	81	129	100	39	38	24	24	0	0
RUS	8	216/376	57	49/83	59	29/45	64	55/136	40	29/38	76	34/44	77	20/30	67	114	110	25	32	24	33	1	0
Totals		2294/4131	56	493/739	67	280/481	58	668/1719	39	205/277	74	444/627	71	204/288	71	1116	1083	343	297	252	301	13	0

Legend:									
%	Efficiency	2Min	2 Minute Suspensions	6m	6-metre Shots	7m	7-metre Shots	9m	9-metre Shots
AS	Assists	BS	Blocked Shots	EX	Exclusions	G/S	Goals/Shots	MP	Matches Played
RC	Red Cards	S/S	Saves/Shots	ST	Steals	TF	Technical Faults	YC	Yellow Cards

HANDBALL
手球 / HANDBALL

MEN
男子项目 / HOMMES

OVERALL TEAM STATISTICS As of 24 AUG 2008
球队技术统计 / STATISTIQUES GÉNÉRALES D'ÉQUIPE

Goalkeepers

Team	MP	Total Shots		6m Shots		Wing Shots		9m Shots		7m Shots		Fast Breaks		Breakthroughs	
		S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%
BRA	5	66/219	30	14/52	27	3/20	15	28/58	48	3/10	30	10/49	20	8/30	27
CHN	5	53/217	24	13/43	30	15/49	31	7/23	30	2/12	17	14/67	21	2/23	9
CRO	8	90/289	31	23/72	32	11/37	30	43/92	47	2/22	9	8/48	17	3/18	17
DEN	8	110/321	34	9/54	17	16/39	41	65/127	51	7/29	24	8/48	17	5/24	21
EGY	5	74/206	36	11/38	29	17/30	57	29/75	39	3/17	18	8/34	24	6/12	50
ESP	8	114/348	33	22/84	26	8/24	33	54/137	39	6/27	22	14/52	27	10/24	42
FRA	8	109/294	37	13/56	23	12/33	36	69/121	57	7/30	23	6/36	17	2/18	11
GER	5	80/210	38	9/27	33	11/25	44	44/101	44	3/15	20	10/33	30	3/9	33
ISL	8	105/339	31	19/66	29	9/33	27	59/137	43	4/28	14	11/41	27	3/34	9
KOR	8	92/316	29	18/72	25	17/49	35	32/91	35	3/16	19	10/48	21	12/40	30
POL	8	116/330	35	12/57	21	14/44	32	72/147	49	5/24	21	8/43	19	5/15	33
RUS	8	122/336	36	28/63	44	15/45	33	50/111	45	5/25	20	16/68	24	8/24	33

Total Wing Shots: s/s = 148/428; % = 35

HANDBALL
手球 / HANDBALL

WOMEN
女子项目 / FEMMES

OVERALL TEAM STATISTICS As of 23 AUG 2008
球队技术统计 / STATISTIQUES GÉNÉRALES D'ÉQUIPE

Players

Team	MP	Total Shots		6m Shots		Wing Shots		9m Shots		7m Shots		Fast Breaks		Breakthroughs		Offence		Defence		Penalties			
		G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	AS	TF	ST	BS	YC	2Min	RC	EX
ANG	5	109/249	44	15/31	48	15/35	43	28/106	26	10/13	77	14/28	50	27/36	75	36	99	29	20	16	15	0	0
BRA	5	124/227	55	21/30	70	14/32	44	38/90	42	15/20	75	23/32	72	13/23	57	59	107	26	11	15	20	0	0
CHN	8	188/399	47	33/48	69	19/38	50	46/169	27	35/46	76	28/50	56	27/48	56	88	130	56	12	25	29	1	0
FRA	8	219/434	50	43/62	69	23/59	39	55/180	31	21/29	72	56/74	76	21/30	70	115	146	48	31	26	30	0	0
GER	5	123/266	46	30/41	73	20/45	44	24/87	28	5/14	36	30/55	55	14/24	58	61	93	34	15	14	16	1	0
HUN	8	211/406	52	37/61	61	38/65	58	56/160	35	23/34	68	32/56	57	25/30	83	106	127	30	28	26	48	2	0
KAZ	5	109/228	48	13/23	57	14/25	56	34/114	30	24/32	75	14/21	67	10/13	77	43	93	14	21	15	26	1	0
KOR	8	247/422	59	31/44	70	39/79	49	55/138	40	37/48	77	56/74	76	29/39	74	128	132	42	11	23	26	2	0
NOR	8	248/407	61	58/80	73	25/42	60	60/140	43	20/26	77	65/93	70	20/26	77	135	108	47	38	22	27	0	0
ROU	8	248/421	59	34/47	72	29/43	67	72/176	41	34/47	72	52/71	73	27/37	73	121	122	38	31	26	34	2	0
RUS	8	229/420	55	38/54	70	14/29	48	57/149	38	28/50	56	52/75	69	40/63	63	92	154	48	41	22	30	1	0
SWE	8	196/395	50	40/55	73	32/66	48	50/162	31	15/23	65	37/50	74	22/39	56	97	117	31	24	29	32	0	0
Totals		2251/4274	53	393/576	68	282/558	51	575/1671	34	267/382	70	459/679	68	275/408	67	1081	1428	443	283	259	333	10	0

Legend:

%	Efficiency	2Min	2 Minute Suspensions	6m	6-metre Shots	7m	7-metre Shots	9m	9-metre Shots
AS	Assists	BS	Blocked Shots	EX	Exclusions	G/S	Goals/Shots	MP	Matches Played
RC	Red Cards	S/S	Saves/Shots	ST	Steals	TF	Technical Faults	YC	Yellow Cards

HANDBALL
手球 / HANDBALL

WOMEN
女子项目 / FEMMES

OVERALL TEAM STATISTICS As of 23 AUG 2008
球队技术统计 / STATISTIQUES GÉNÉRALES D'ÉQUIPE

Goalkeepers

Team	MP	Total Shots		6m Shots		Wing Shots		9m Shots		7m Shots		Fast Breaks		Breakthroughs	
		S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%
ANG	5	57/204	28	5/24	21	1/8	13	34/78	44	1/30	3	5/37	14	11/27	41
BRA	5	54/191	28	7/22	32	9/30	30	16/51	31	6/24	25	13/48	27	3/16	19
CHN	8	78/294	27	14/58	24	16/43	37	31/85	36	1/20	5	11/58	19	5/30	17
FRA	8	143/360	40	16/48	33	19/49	39	57/108	53	11/41	27	24/69	35	16/45	36
GER	5	74/208	36	10/27	37	15/29	52	30/72	42	4/14	29	7/38	18	8/28	29
HUN	8	110/337	33	8/40	20	24/57	42	48/107	45	7/33	21	16/64	25	7/36	19
KAZ	5	58/195	30	13/35	37	7/15	47	22/59	37	2/20	10	10/33	30	4/33	12
KOR	8	119/326	37	21/70	30	22/48	46	47/83	57	7/23	30	12/58	21	10/44	23
NOR	8	130/315	41	10/47	21	22/47	47	74/128	58	11/32	34	8/37	22	5/24	21
ROU	8	120/332	36	16/54	30	24/54	44	54/107	50	6/30	20	12/57	21	8/30	27
RUS	8	107/317	34	11/49	22	27/58	47	48/103	47	6/33	18	12/59	20	3/15	20
SWE	8	96/318	30	5/55	9	18/48	38	47/102	46	10/39	26	8/39	21	8/35	23

Total Wing Shots: s/s = 204/486; % = 42

Handball
Handball
Men
Hommes

Overall Team Statistics
Statistiques générales d'équipe

As of SUN 12 AUG 2012

Players

Team	MP	Total Shots		6m Shots		Wing Shots		9m Shots		7m Shots		Fast Breaks		Breakthroughs		Offence		Defence		Punishments			
		G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	AS	TO	ST	BS	YC	2Min	RC	DR
ARG	5	113/240	47	19/29	66	13/26	50	42/117	36	11/19	58	15/23	65	13/26	50	51	64	24	13	14	15	1	
CRO	8	230/382	60	40/64	63	39/70	56	63/136	46	19/26	73	54/60	90	15/26	58	130	79	29	47	23	26		
DEN	6	146/264	55	30/49	61	31/56	55	39/101	39	20/22	91	11/17	65	15/19	79	84	81	13	14	20	21		
ESP	6	162/280	58	34/47	72	33/49	67	44/116	38	13/18	72	24/32	75	14/18	78	69	56	24	14	20	23	1	
FRA	8	229/363	63	54/69	78	31/59	53	69/140	49	17/23	74	31/38	82	27/34	79	120	88	31	25	26	21		
GBR	5	96/229	42	23/39	59	18/38	47	27/102	26	6/8	75	12/24	50	10/18	56	50	103	21	5	16	25	2	
HUN	8	200/382	52	37/52	71	28/51	55	71/193	37	19/24	79	22/32	69	23/30	77	112	98	25	21	28	31		
ISL	6	200/316	63	31/38	82	32/56	57	68/134	51	13/16	81	41/52	79	15/20	75	96	71	25	28	19	32		
KOR	5	115/246	47	19/27	70	17/32	53	33/120	28	16/23	70	19/26	73	11/18	61	69	54	18	5	14	21		
SRB	5	120/221	54	27/34	79	11/28	39	46/107	43	8/13	62	14/20	70	14/19	74	57	64	13	11	17	25	1	
SWE	8	228/370	62	43/61	70	42/62	68	55/143	38	24/29	83	41/49	84	23/26	88	124	91	28	30	26	31	1	
TUN	6	144/275	52	33/47	70	16/35	46	41/117	35	14/20	70	25/32	78	15/24	63	69	69	27	8	21	31	2	
Totals		1983/3568	56	390/556	70	311/562	55	598/1526	39	180/241	75	309/405	76	195/278	70	1031	918	278	221	244	302	8	

Handball
Handball
Men
Hommes

Overall Team Statistics
Statistiques générales d'équipe

As of SUN 12 AUG 2012

Goalkeepers

Team	MP	Total Shots		6m Shots		Wing Shots		9m Shots		7m Shots		Fast Breaks		Breakthroughs	
		S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%
ARG	5	57/195	29	10/45	22	19/39	49	18/53	34	0/10	0	4/28	14	6/20	30
CRO	8	105/288	36	12/43	28	12/42	29	69/134	51	0/16	0	6/24	25	6/29	21
DEN	6	81/234	35	13/46	28	7/26	27	45/99	45	7/22	32	8/33	24	1/8	13
ESP	6	81/230	35	11/36	31	17/32	53	41/91	45	2/21	10	3/26	12	7/24	29
FRA	8	110/285	39	13/59	22	13/44	30	65/115	57	4/18	22	8/30	27	7/19	37
GBR	5	47/239	20	7/44	16	14/46	30	11/56	20	2/21	10	6/46	13	7/26	27
HUN	8	96/317	30	8/40	20	19/60	32	56/133	42	7/29	24	4/39	10	2/16	13
ISL	6	89/255	35	15/45	33	10/33	30	42/98	43	7/19	37	8/37	22	7/23	30
KOR	5	62/202	31	11/52	21	17/40	43	20/46	43	2/11	18	5/26	19	7/27	26
SRB	5	72/203	35	8/27	30	11/32	34	42/83	51	2/14	14	5/28	18	4/19	21
SWE	8	111/296	38	11/42	26	22/54	41	61/120	51	7/27	26	7/32	22	3/21	14
TUN	6	70/220	32	7/37	19	16/40	40	28/68	41	3/15	20	7/31	23	9/29	31
Totals		981/2964	33	126/516	24	177/488	36	498/1096	45	43/223	19	71/380	19	66/261	25

LEGEND

%	Efficiency	2Min	2 Minute Suspensions	AS	Assists	BS	Blocked Shots	DR	Disqualification with report
G/S	Goals/Shots	MP	Matches Played	RC	Red Cards	S/S	Saves/Shots	ST	Steals
TO	Turnovers	YC	Yellow Cards						

Handball
Handball
Women
Femmes

Overall Team Statistics
Statistiques générales d'équipe

As of SAT 11 AUG 2012

Players

Team	MP	Total Shots		6m Shots		Wing Shots		9m Shots		7m Shots		Fast Breaks		Breakthroughs		Offence		Defence		Punishments			
		G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	AS	TO	ST	BS	YC	2Min	RC	DR
ANG	5	132/235	56	13/26	50	21/30	70	53/120	44	18/24	75	14/16	88	13/19	68	52	70	30	14	14	16		
BRA	6	156/271	58	23/27	85	32/55	58	50/129	39	15/19	79	21/22	95	15/19	79	68	107	30	9	17	19	2	
CRO	6	167/262	64	34/48	71	22/38	58	39/83	47	16/23	70	29/34	85	27/36	75	89	90	29	13	18	26		
DEN	5	113/235	48	19/23	83	15/31	48	40/119	34	15/21	71	16/28	57	8/13	62	50	72	19	21	15	11		
ESP	8	201/348	58	51/75	68	26/46	57	34/104	33	29/43	67	17/25	68	44/55	80	98	156	36	11	23	25	2	
FRA	6	147/285	52	35/51	69	12/26	46	41/128	32	8/12	67	37/47	79	14/21	67	71	89	48	16	19	18	2	
GBR	5	91/204	45	21/27	78	14/35	40	16/79	20	14/20	70	14/20	70	12/23	52	58	112	13	2	14	14		
KOR	8	214/398	54	30/45	67	28/51	55	69/176	39	30/47	64	26/37	70	31/42	74	101	126	40	20	20	24		
MNE	8	210/358	59	41/55	75	44/71	62	47/125	38	27/32	84	29/40	73	22/35	63	131	102	33	16	25	38	2	
NOR	8	196/380	52	40/62	65	32/48	67	66/177	37	14/25	56	30/44	68	14/24	58	110	102	24	26	23	15		
RUS	6	174/293	59	18/23	78	21/45	47	44/117	38	21/26	81	40/48	83	30/34	88	79	88	21	23	18	29	1	
SWE	5	108/229	47	24/33	73	22/45	49	24/99	24	11/16	69	12/15	80	15/21	71	51	91	27	16	18	13		
Totals		1909/3498	55	349/495	71	289/521	55	523/1456	36	218/308	71	285/376	76	245/342	72	958	1205	350	187	224	248	9	

LEGEND											
%	Efficiency	2Min	2 Minute Suspensions	AS	Assists	BS	Blocked Shots	DR	Disqualification with report
G/S	Goals/Shots	MP	Matches Played	RC	Red Cards	S/S	Saves/Shots	ST	Steals
TO	Turnovers	YC	Yellow Cards						

Handball
Handball
Women
Femmes

Overall Team Statistics
Statistiques générales d'équipe

As of SAT 11 AUG 2012

Goalkeepers

Team	MP	Total Shots		6m Shots		Wing Shots		9m Shots		7m Shots		Fast Breaks		Breakthroughs	
		S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%	S/S	%
ANG	5	38/180	21	5/29	17	5/28	18	13/45	29	1/22	5	3/29	10	11/27	41
BRA	6	71/214	33	6/35	17	11/37	30	39/69	57	4/11	36	4/40	10	7/22	32
CRO	6	79/219	36	5/30	17	15/43	35	46/87	53	7/20	35	3/17	18	3/22	14
DEN	5	58/179	32	13/49	27	3/17	18	29/55	53	5/12	42	2/22	9	6/24	25
ESP	8	113/305	37	9/40	23	16/42	38	54/103	52	13/44	30	11/40	28	10/36	28
FRA	6	79/205	39	12/36	33	9/27	33	34/66	52	10/31	32	6/20	30	8/25	32
GBR	5	55/221	25	4/30	13	7/28	25	36/79	46	2/24	8	3/38	8	3/22	14
KOR	8	102/317	32	17/72	24	18/38	47	46/101	46	7/26	27	5/35	14	9/45	20
MNE	8	95/292	33	15/35	43	12/43	28	48/129	37	8/31	26	4/22	18	8/32	25
NOR	8	111/298	37	9/41	22	17/41	41	71/132	54	5/34	15	5/29	17	4/21	19
RUS	6	77/226	34	6/25	24	9/42	21	45/88	51	7/23	30	4/25	16	6/23	26
SWE	5	50/181	28	3/31	10	13/38	34	23/53	43	1/10	10	5/23	22	5/26	19
Totals		928/2837	33	104/453	23	135/424	32	484/1007	48	70/288	24	55/340	16	80/325	25

LEGEND											
%	Efficiency	2Min	2 Minute Suspensions	AS	Assists	BS	Blocked Shots	DR	Disqualification with report
G/S	Goals/Shots	MP	Matches Played	RC	Red Cards	S/S	Saves/Shots	ST	Steals
TO	Turnovers	YC	Yellow Cards						

9.Literature:

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http://www.eurovisionsports.tv/london2012/

Man:

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• ESP-SRB	SWE-TUN
• DEN-ESP	GBR-SWE
• ESP-KOR	SWE-ISL
• HUN-ESP	SWE-ARG
• ESP-CRO	FRA-SWE
• ESP-FRA	SWE-DEN
	HUN-SWE
	SWE-FRA

Woman:

NOR	KOR
• NOR-FRA	ESP-KOR
• SWE-NOR	KOR-DEN
• NOR-KOR	NOR-KOR
• DEN-NOR	KOR-FRA
• NOR-ESP	SWE-KOR
• BRA-NOR	RUS-KOR
• NOR-KOR	NOR-KOR
• NOR-MNF	KOR-ESP

Development and measurement of fitness skills in a second-division girls' team

András Molnár

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Abstract

Introduction – It is important for professional coaches working with teams to always have an accurate picture of the present condition, scope for development and deficiencies of their players in the various stages. For this purpose they may rely not only on their subjective observations, but also on precisely measured results and suitably processed data. The measurements make it possible to monitor which factors have the greatest impact on the handball players' effectiveness, and which are less important.

Methods – I analysed the data both individually and in comparison with the group. I used the same tests for measuring the development of the various skills, but applied the methods differently and recurrently. I elaborated hypotheses in respect of these, which I tested following the processing of the data.

Results – I recorded the data in spreadsheets, showing both individual and team progress. The measured data provided extremely important information relating to the scope for further development, and could serve as a benchmark in the future.

Key words: presentation of changes, statistical analysis, scope for development, individual development, team development.

Contents

Defining the concept of fitness skills

Defining the concept of fitness skills is a difficult task in itself. As a general concept, they can be interpreted in many ways. They may relate to a state of physical strength that is clearly associated with physical fitness, or may refer to the attributes of a physiologically strong, robust state of health. The general concepts are used both in the areas of physical education and sport; but nevertheless, they tend to be more narrowly interpreted.

We use the term fitness skills to refer to those physical, and indirectly psychological, attributes that are constantly needed for dealing with various life situations, or for sporting performance, and which can primarily be expressed in physical units of measurement.

As a fundamental prerequisite for sporting performance, however, we can broadly define them as a group of physical skills that bear witness to these physical attributes. By fitness skills we mean strength, stamina and speed, in all their complex manifestations. Fitness skills are typically quantified using physical measurement units (weight, time, distance and the correlations between them), but in their abstract manifestations – psychological performance – they can only be interpreted on the basis of individual descriptions, using a subjective scale of measurement. Genetic factors are highly determinative, but nevertheless with regular training and personality development the standard of performance, as expressed in terms of the skills, does improve.

Complex fitness skills

Fitness skills are almost never examined in isolation. In the practice of sport they occur in some kind of combination, as the background to the physical skills necessary for activities. At conceptual level, the definitions referring to physical and mental fitness are not generally combined. Rather, they are used to express the essence of physical skills that is manifested in their complexity. Thus, strength, speed and endurance are combined to create a complex whole.

Commonly used terms relating to fitness skills:

- ***Explosive strength***

Explosive strength is an attribute of the functioning of the muscular system, by which it maintains the level of strength necessary for rapid muscle contractions.

It is typified by the overcoming of high resistance through powerful muscle contractions, and the maintenance of a high level of physical performance. Energy is generated by anaerobic means, and we stop referring to it as explosive strength as soon as there is a decrease in the amount of effort exerted. A given series of efforts can also be isolated in order to train a specific part of the body.

Training methods:

- Auxotonic
- Plyometric
- Explosive

- ***Maximum strength***

This is defined as the greatest effort that the muscles are capable of exerting through voluntary contractions, for various functions. It may be dynamic or static.

Training methods:

- Auxotonic
- Isometric
- Intermuscular
- Isokinetic
- Maximum eccentric contraction
- Electric muscle stimulation

- ***Anaerobic alactacid capacity***

An attribute relating to the rapid accumulation of an oxygen deficit during a test exercise performed at maximum effort and speed, involving a relative brief period of exertion at a performance level associated with a supramaximal load.

Fitness and coordination training exercises

(17-21 age group)

The last years of the youth age groups are taking on a special importance in the accelerated training process. The 17-18 and 19-21 age groups represent the final phase of youth training, prior to adult development and training.

Youth training and talent nurturing in Hungary should be aimed at ensuring that these age groups are competitive at the highest international level, and if possible, to surpass this level in terms of professional content and methodology. This is necessary primarily as a response to the declining number of children. Thanks to the deliberate maintenance and improvement of quality, as well as the changing system of requirements, their outstanding skill enables them to hold their own among the youth of countries with a sophisticated handball culture, and which in some cases offer superior conditions. Thus, we could conceivably accelerate the pace of Hungarian youth training for in the interests of international and local success, and the personal careers, of our young players.

The group in question is the transitional group of young adults, who in certain areas are already close to being mature, proven players. The body weight and strength parameters need to approach those that differ from the existing anthropometric data, and are thus inconsistent with standard expectations, so as to converge with the requirements of the adult age group.

The dynamic expectations, the strength of body play, and the speed and variability of tactical thinking, need to be brought closer into line with the adult age groups.

The main objectives of the training include developing the acyclical rhythm and the high-intensity, intermittent pace that typifies competition play, and increasing the speed of practice. In addition to the competition-style endurance training, and the relatively long-distance, 35-60 minute carbohydrate and fat-based aerobic long-distance running that serves to improve heart volume, attention and space increasingly needs to be devoted to the anaerobic training zone, as well as the transition between the two disciplines. The fluctuating load, the rest interval and intensive interval, take the form of a continuous exercise in combination with game-specific methods, and naturally they are specifically linked and adapted to the individual preparation periods.

Strength training also fundamentally supports the development of coordination; besides the continuous building up of the maximum core strength, the

methodological practice of reactive strength training is also present. With the help of special coordination training tools and other the technical ancillary and training methods, the step frequency enters a new, intensive phase.

The development of explosive strength, the improvements in strength and endurance, and the aforementioned building up of the maximum core strength (by the continuous incorporation of strength training techniques), must be paired with carefully selected technical and tactical components, with an increasing tempo. In this way, the game elements are highly accelerated

During the training we should pay attention to the proportionate, symmetrical development of the muscles, using the appropriate ratios of general to specific methods and exercises; and if possible, making an assessment of the young athletes' muscular systems, we should aim for a balanced development. The development of jumping strength, shooting strength, and the components necessary for running and changing direction at various speeds, should be highlighted

Structure of the test

My research focused on an examination of the potential for developing the natural movements that are decisive in the sport of handball; that is, running, throwing and jumping. All three of these natural movements are extremely important, as they have to be couched in the moves of handball. Therefore the objective is for the student, without being consciously aware of it, to achieve a state in which her actions are productive in terms of the game and her own development, and economical in terms of muscle function.

I conducted the research on my division NBI/B girls' team, which trains five times a week in two-hour sessions. The research was carried out over a period of three years, and I had also performed tests prior to its commencement, although the results of these are less informative, as in those years the composition of the team changed a great deal, so it was only possible to monitor the development of one or two persons, and not of the whole team.

Our weekly program included:

Monday: outdoor running, strength training (weights) + individual training

Tuesday: running work + (3 kg medicine ball tosses) + teamwork in pairs and threes;

Wednesday: medicine ball exercises (1 kg) + fast breaks;

Thursday: mixed;

Friday: tactical training.

I conducted my research on children born in ‘89-‘94, most of whom had become adult players under my supervision. (The two exceptions to this, among the players studied, were Anett Molnár and Edit Ilyés.)

I performed the first block of tests at the end of July 2009, in the first week of preparation, during training time (in three days). The 3000 m running was performed in one large group, and the 20 x 20 m running in two groups, the medicine ball throws were performed at various sites, while the standing long-jumps and the bench presses were performed in two groups, alternating. First I conducted a preliminary test in order to determine the baseline.

I repeated the testing at the end of the autumn and spring seasons. Between the tests, the players were given a rest break.

There were twelve players who trained regularly with the team during these years, and it is the results of these players that I present in this study, so as to hopefully give a faithful picture of the potential for development. (At the time the players were aged 16-20.)

Table 1: The subjects of the research:

Name:	Born (year)	Playing position	Number of years spent playing handball	Body height (cm)	Body weight (kg)
Enikő Beke	1989	back	10	172	68
Erika Darabos	1994	pivot	5	173	70
Edit Ilyés	1988	centre	11	167	63
Felícia Juhász	1994	goal-keeper	5	167	60
Mercédesz Karnik	1989	pivot	10	174	67
Szabina Karnik	1990	back	9	177	70
Emőke Martinek	1992	back	7	179	68
Anett Molnár	1986	wing	13	169	60
Nikolett Szűcs	1989	wing	10	172	67
Júlia Tomcsik	1989	goal-keeper	10	173	70
Ágnes Tóth	1991	wing	9	168	56
Flóra Zihor	1993	centre, back	6	167	64

Hypothesis

1. I assume that the weekly repetition of strength training, medicine ball and running work will lead to a continuous improvement in results, since these are young athletes who still have room for improvement, and have probably not yet reached their peak performance.
2. It can also be assumed that in the beginning they will undergo a greater degree of improvement than later on. I am also sure that if we develop the areas separately, each segment will show a better improvement. Therefore I will examine progress separately for each area (running, throwing, jumping strength), as well as all-round progress.
3. It could be interesting to observe how far the abilities can be developed, and what effect the planned training has on the athletes. Cases where a given skill does not improve also have to be studied, in order to determine whether the training is not efficient enough, or if the player is incapable of further improvement.
4. There is also a high probability that the greatest improvement will take place in the autumn, as we can carry out the summer preparation stage without any interruptions due to the players' age, since all of them are at school. The winter preparation period is more complicated as the examination period disrupts the work schedule in several cases, so the improvement – at team level, anyway – is unlikely to be on the same scale.
5. My expectation regarding the tests is that owing to the continuous training, and the expected continuous improvement, the cumulative result, which is likely to be positive, will also have an impact on the team's performance on the court.

I look forward to the results of these tests, and I am especially curious to see which player has fallen behind significantly in which area, which abilities have continued to improve as a result of the training, and which have shown less improvement. I consider my measurements to be important because they enable me to continuously monitor the development of the players, and also to obtain information about cases where somebody reaches the limits of their abilities.

I am trying to make use of my past experience; although the task appears simple, in reality it is not. The task is a complex one, since it involves measur-

ing several types of skill using several types of test; this makes it possible to measure either individual development or overall team development. Both results are important, because they both have an impact on the team's performance. In addition to this, inherent flaws are bound to arise, and naturally the children's level of motor coordination is also very important, since it has an effect on shooting strength, jumping strength and running.

Methods and sequence of the tests

Day 1:

Test of mid-range endurance

- 3000 m continuous running, on a marked 400 m cinder track

Day 2:

Test of the explosive strength of the shoulder, arm and trunk

- 1 kg medicine ball one-handed overhead throw, standing with one foot in front of the other (the players will have 3-5 tries)
- 1 kg medicine ball throw with a run-up; the player starts from the base line and throws from the 6 m line (the players will have 3-5 tries)
- 3 kg medicine ball throw, with feet apart, using a two-handed forward overhead throw, without a run-up (the players will have 3-5 tries)
- 3 kg medicine ball throw, with feet apart, using a two-handed forward overhead throw, without a run-up (the players will have 3-5 tries)

Test of the explosive strength of the legs

- standing long jump (the players will have 3-5 tries)

Day 3:

Running in anaerobic alactacid conditions

- 20 x 20 m running on a handball court (in a sports hall) from the base line to the centre line

Test of maximum strength

- Bench presses using disc weights, with a shoulder-wide grip, on a 55 cm high weightlifting bench

- Weight increases by 15% of the last result
- The player has a maximum of 3 tries

Training techniques

8.1. Jumping program

I had my team work through this program every year in the summer preparation period, and at the start of the autumn season.

Exercise 1: Jumping

Step 1: First squat down to ¼ height

Step 2: Spin the rope so that when jumping over it you jump a minimum of 20-25 cm. If you find this too easy, jump 25-30 cm. When you land, repeat.

Take a 3-4 minute break between each series.

Step 1: First squat down to ¼ height.

Step 2: Jump a minimum of 20-25 cm. If you find this too easy, jump 25-30 cm. Count this as one exercise.

Step 3: The same as step 1

Step 4: The same as step 2

Take a 3-4 minute break between each series.

Note:

Don't do both exercises, only the one that you find more comfortable.

Exercise 2: Calf strengthening

Step 1: For the starting position, take a book and stand on it on one foot, with your heel on the ground.

Step 2: Push yourself up as high as you can.

Step 3: Lower yourself to the starting position. Count this as one exercise.

Step 4: Repeat from step 2.

Take a 25-second break between each series.

Exercise 3: Stepping up onto a chair

Step 1: Put one foot up onto the chair, while the other remains on the ground.

Step 2: With all your strength, push yourself up as high as you can with the foot on the chair.

Step 3: Switch feet in mid-air, so that when you land your other foot is on the chair. Repeat until you are back in the starting position. Count this as one exercise.

Take a 3-4 minute break between each series.

Exercise 4: Jumping up

Step 1: Stand with feet slightly apart.

Step 2: Jump as high as you can.

Step 3: When you land, jump up again as high as you can without bending at the thigh. Only the calves should work. When jumping up, you may swing your arms for momentum.

Take a 1-minute break between each series.

Exercise 5: Fat-burning

Step 1: Elevate yourself on tiptoes as high as you can, to find your upper limit.

Step 2: As fast as you can, jump on tiptoes to a maximum height of 2-3 cm, and make sure to always push yourself to the upper limit. By doing this, you strengthen the upper calf muscles.

Table 2: Number of exercises to be performed, in a weekly breakdown:

Week	Jumping		Calf strengthening		Stepping up onto a chair		Jumping up		Fat-burning	
	series	number	series	number	series	number	series	number	series	number
1.	2	25	2	10	2	10	2	15	1	100
2.	1	50	2	20	2	15	2	20	1	200
3.	1	75	2	25	2	15	2	25	1	300
4.	1	75	2	30	2	20	2	30	1	400
5.	2	50	2	35	2	20	2	35	1	500
6.	1	100	2	40	2	25	2	40	1	600
7.	1	125	2	45	2	25	2	50	1	700
8.	2	75	2	50	2	30	2	60	1	800
9.	2	100	2	55	2	30	2	70	1	900
10.	2	125	2	60	2	35	2	80	1	1000
11.	2	150	2	65	2	35	2	90	1	1100
12.	2	200	2	70	2	40	2	100	1	1200

After performing the exercises, it is advisable to stretch and relax the muscles.
The exercises must be performed 5 times a week, and 2 rest days must be observed.
Don’t do extra exercises, but don’t do fewer than prescribed either. If you follow the instructions precisely, your vertical jump will increase from week to week.

Running programs during the summer preparation period

Autumn 2009

Following the summer break, in the first week of the preparation period I conducted a Cooper test on every single occasion. This was the year in which we wanted to place the players’ stamina on a broad footing, primarily to bring the players closer to each other in terms of their core skills, so the running program

mainly consisted of long-distance runs, which I only changed in the 5th week of prep.

The program comprised a 4-week running program, with 4 sessions a week, in weeks 2-5 of the 7-week preparation period.

In weeks 6-7 they ran with and without balls in the sports hall, over distances of between 10 and 40 meters.

Weekly schedule:

In week 1 we only performed running work on 3 occasions, as follows:

2000 m – 1000 m – 1000 m – 1000 m

500 m – 1000 m – 1500 m – 1000 m – 500 m

5000 m – swimming pool

In the case of these runs, the rest time was equal to the time spent running.

Week 2

Control – Cooper test

2 x 1000 m – 600 m – 400 m

4 x 800 m

2 x 800 m – 2 x 600 m – 2 x 400 m

In the case of these runs, the rest time was equal to the time spent running.

Week 3

2 x 2000 m + jumping

4 x 600 m + jumping

5 x 200 m – 2 x 200 m

800 m – 2 x 600 m – 3 x 400 m – 4 x 200 m

In the case of these runs, the rest time was equal to the time spent running.

Week 4

3 x 600 m – 2 x 400 m – 1 x 200 m

2 x 600 m – 3 x 400 m – 2 x 200 m

2 x 600 m – 2 x 400 m – 4 x 100 m

4 x 400 m – 6 x 200 m – 8 x 100 m

In the case of these runs, the rest time was equal the time spent running.

The runs were performed in two groups from the second week onwards, in keeping with ability. This usually comprised the rest time as well, so we were able to perform the runs continuously by alternating the groups.

2010 - autumn 2011

Week 1

3000 m

Cooper test

2000 m – 2000 m

5000 m

In the case of these runs, the rest time was equal the time spent running.

Week 2

3 x 2000 m

3000 m – 2000 m – swimming pool

2000 m – 2000 m – 1000 m

1000 m – 2000 m – 2000 m

In the case of these runs, the rest time was equal the time spent running.

Week 3

6000 m pace running

2000 m – 1000 m – 1000 m – 1000 m

500 m – 1000 m – 1500 m – 1000 m – 500 m

5000 m + swimming pool

In the case of these runs, the rest time was equal the time spent running.

Week 4

2 x 1000 m – 600 m – 400 m

4 x 800 m

2 x 800 m – 2 x 600 m – 2 x 400 m

4 x 600 m + slope running

In the case of these runs, the rest time was equal the time spent running.

The runs were performed in two groups from the second week onwards, in keeping with ability. This usually comprised the rest time as well, so we were able to perform the runs continuously by alternating the groups.

Running program in the competition season:

Monday: 3000 m running with a time limit, on a measured track around the sports hall, on a concrete surface

Tuesday: 8 sec. full pace, 52 sec. jogging x10 (around a cinder track)

Wednesday, Thursday: dribbling and fast break exercises over 10-30 metres

8.3. Weekly weight training program – medicine ball exercises (1 and 3 kg)

Monday:

Permanent stations in the strength training program (performed as circuit training, alternating in pairs):

- Bench presses (with 70-90% of max. strength, and with a number of series, repeats and rests that is consistent with this)
- Cable lat pulldowns to the chest x12, in 4 or 5 series (with 10-20 kg, depending on strength)
- Pulldown behind the head, on a weight bench, x10, with 15-20 kg in 4 or 5 series
- Wide trunk rotation with 10-15 kg discs, repeated 10-14 times, in 4 or 5 series (in both directions)
- Snatch and clean and jerk with a 20 kg bar, x5-8, in 4 or 5 series (with as many snatches as cleans and jerks in each series)
- Two-handed lifting a 15 kg bar from behind the head, x8-15, in 4 or 5 series depending on strength
- Bending forwards at the trunk, lifting a disc weight (10-15 kg) to the chest 8-12x, in 4 or 5 series

Except for the bench presses, at every station the players perform additional exercises. These are the following:

- Seated knee up with a 3 kg medicine ball, x15
- Trunk lift with 5 kg disc weight on the back of the neck, x25

- Exercises on a balance bench, dribbling 1 ball, dribbling 2 balls
- Keeping a volleyball in the air
- Dribbling a basketball around the body
- Balancing on a fitball, by wall bars

Tuesday:

- 3 kg medicine ball exercises
- Two-handed overhead passing to each other (at a distance of 4 m) sitting with legs apart, x12
- In supine position holding the ball up in the hands, two-handed throw to partner, followed by sit-up, x12
- In supine position holding the ball up in the hands, throw to partner during sit-up, x12
- Standing feet apart, facing partner, with ball held over the head, two-handed overhead throw to partner 6 m away, x12
- Starting from basic stance, starting with the ball hell low, run-up while raising the ball and throwing it overhead with two hands to the partner 6-8 metres away, x12

The players perform the exercises in 2 series.

Wednesday:

- 1 kg medicine ball throws
- Starting with feet apart, one-handed overhead throw to partner 10-15 m away, with both hands, x10 per hand
- Standing with one foot in front of the other, one-handed overhead throw to the ground, so that it bounces into the partner's hand, x12
- Starting from basic stance, one-step jump with an overhead throw to the ground, so that it bounces into the partner's hand, x12
- Starting from basic stance, after 2 or 3 steps, one-handed overhead standing throw to the partner with maximum effort, x6-10
- Starting from the basic stance, after 2 or 3 steps, jump and one-handed overhead throw to partner with maximum effort, x6-10

The players perform the exercises in 2 series.

8.4. Weekly jump training programs

Legend:

1. TALL CONE
2. SHORT CONE
3. Ø 90 cm HOOP
4. Ø 30 cm HOOP
5. BOX FROM SIDE
6. BOX FROM ABOVE
7. MARKER
8. BALANCE BENCH

I.

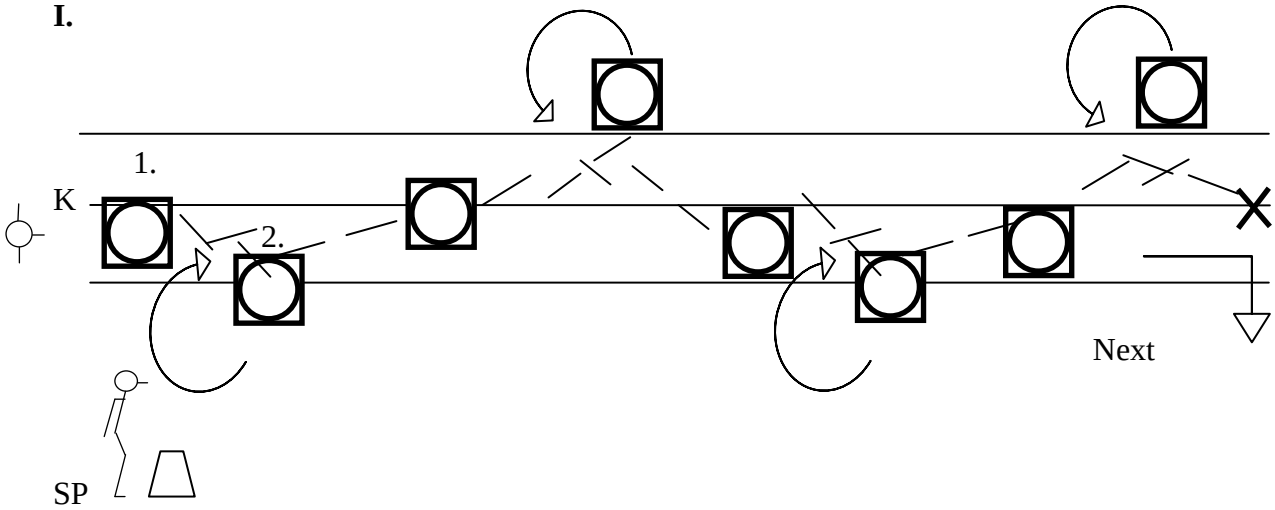


Figure 1

1. Two-footed jump over cone

2. After sidestepping, two-footed jump over the tall cone, then dodging cones while running forward, x4, in a minimum of 3 series

– Same as above, but in the middle row, lifting both knees

– Same as above, performing the same exercise with blocking movement to both sides

Depending on physical condition and training age, the exercises may be performed with: feet, right and left foot

II.

Tall cone

Ø 30 cm hoop

A – Dodging hoops with a sideways movement, forward spurt, two-legged jump over tall cone, with a blocking movement

B – Dodging hoops with a sideways movement, sideways jump over tall cone, then return to position

Exercises should be performed in both directions, in a minimum of 3 series.

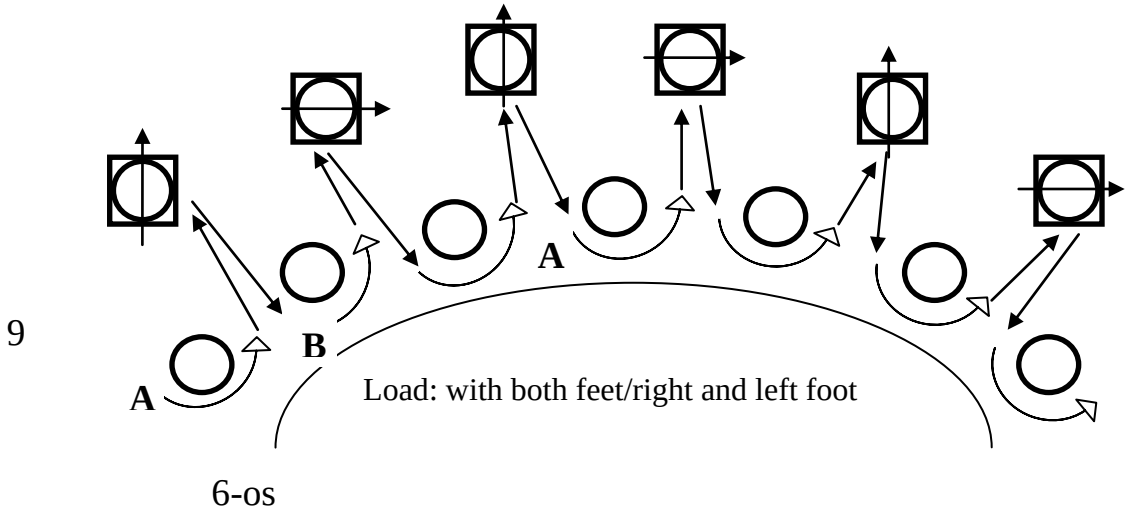


Figure 2

III.

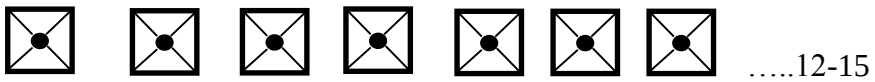


Figure 3

– Between the short cones with high knee lift, x3, with alternating feet–

On both feet, right and left feet, 3 jumps forward, then one backward –

Jumping all the way, lifting both knees; then the same on right and left foot

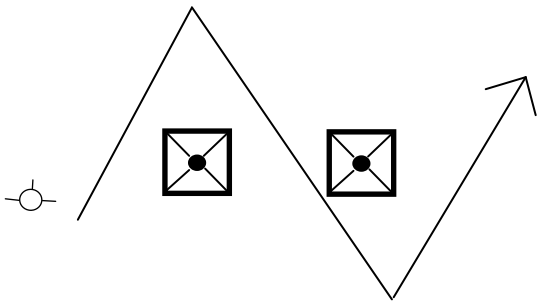


Figure 4

– Spurt forward with a maximum of 3 steps, return to position in the same number of steps, dodging the cone

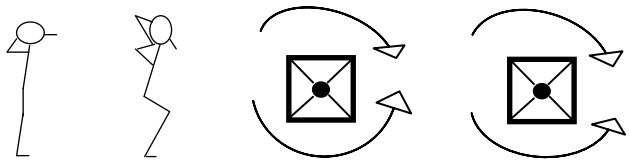


Figure 5

- With hands behind head, two-footed jumping with legs bent forward, opening and closing legs
- The same, but backwards

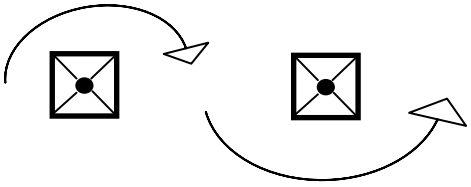


Figure 6

- With a running movement, dodging the cones with the fastest possible foot-work, always turned towards the cone
- The number of repeats is the same as the number of cones, and the exercise must be performed in a minimum of two series

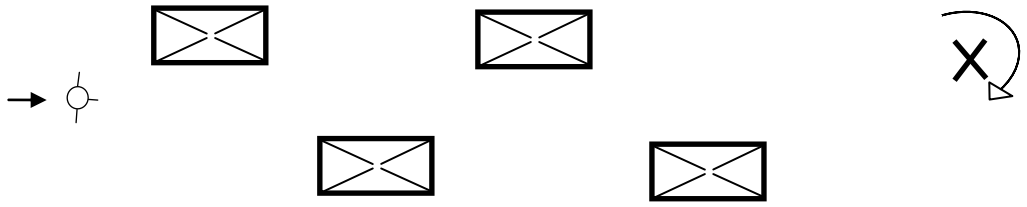
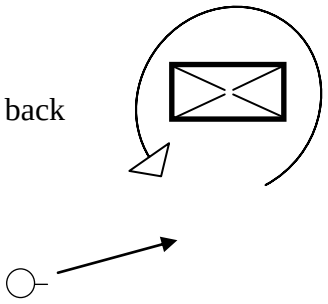


Figure 7

- Jump up from the left-hand box, on the left foot, with a shooting movement From the right-hand box, in the opposite direction, using the hand and foot on the same side
- The same, with a blocking movement, with two-footed jumps, and a running movement between the boxes
- Number of repeats: minimum 8, number of series: minimum 3
- From inside, in a backward direction, dodging the box



① - Two-footed jump over the box
② - Jump over box on R or L foot
③ - Two-footed jump up, and then

④ - Jump up onto the box on the right foot, and back again, then with the left foot and back again, with both feet and back again, then jump over the box
⑤ - Jump up onto the box on the right foot, and back again, then with the left foot and back again, with both feet and back again, then from here jump up onto the box with bent knees and jump off, lifting the knees and landing in a crouching position, x6-8 (see figure 9)

Figure 8

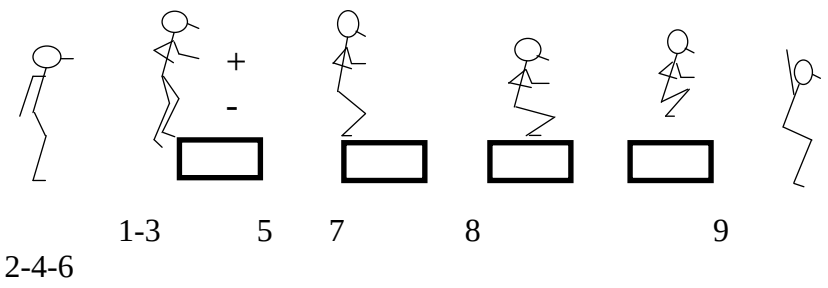


Figure 9

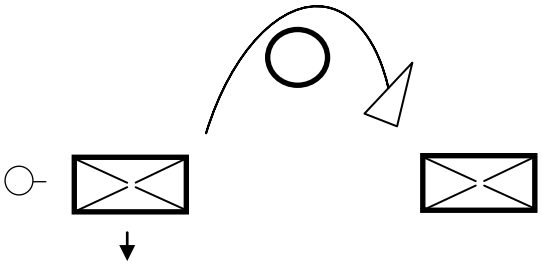


Figure 10

Same as in point 5 of figure 8, but dodging hoop with sideways running motion

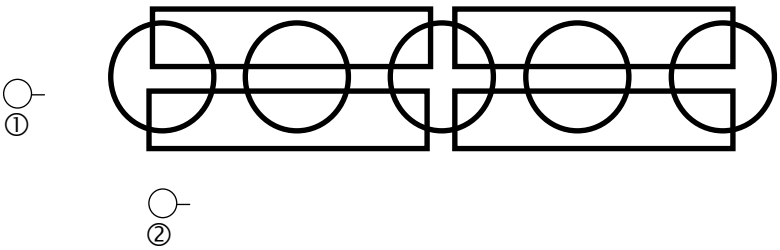


Figure 11

①

- Running with high knee lift over the hoops, stepping into the hoops
- Running at full speed, stepping into the hoops
- Jumping with both feet, the right foot and then the left foot, between the hoops

②

- Jumping in and out with both feet, right foot and left foot, over the hoops and the bench
- Hopping in and out of the hoops, scissoring legs
- (Starting position: bench between the legs, standing in hoops)

8.5. Exercises assigned for the rest period

Recommended weekly minimum training regime

"You can do more, but not less!"

The rest period is 8 weeks, and it is advisable to do the exercises in a schedule that repeats weekly or every two weeks.

Week 1

- 2 x 5000 m (Tuesday-Saturday)
- 5000 m breakdown: 1000 m warm up, 3000 m at above a medium pace, 1000 m wind down
- 1 x 6000 (Thursday) in a similar breakdown and pace, with 4000 m in the middle
- Development of trunk strength on the intervening days

Daily regimen: 5x15 arm bends and stretches, 5x20-25 varying abdominal muscle exercises, 5x30-35 varying back muscle exercises

Week 2

- 2x5000 m (Monday-Friday)
- 2x6000 m (Wednesday-Sunday) with a similar breakdown and pace to week 1
- Developing trunk strength on the intervening days, in a similar breakdown

NB: Any complementary sport may be practiced. It is in our common interest to start the preparation period in the fittest state possible.

Findings, lessons, analysis of observed changes

For the purposes of my work going forward the research has proven to be extremely useful, as it shows that it is beneficial to train young handball players conscientiously and in accordance with a planned schedule; the data shows that they underwent a major improvement as a result of the work performed.

For me, this accurately reflects the state of their progress, the condition of my players, and whether their development continues unabated or whether they are unable to improve further for some reason. It is clear that players who had not performed work of this type before were capable of the greatest improvement, so it can be concluded that this type of work is a highly effective means of training handball players.

It also transpired that none of the players improved continuously; all of them experienced a test in which they performed worse than in the previous one. Those who performed the tests with greater care were less prone to giving a weaker performance than those who did not focus their attention continuously.

It is also apparent that, as I mentioned in the hypothesis, the results improved greatly in the autumn because the summer preparation period was free of disruption, since most of the players are still at school and during in the winter period their preparation was interrupted by the need to sit examinations.

It is also interesting to note that there were four players whose performance in the final test was weaker than at the first, but naturally they too had improved during the interim tests. This involved four separate tests, with minimal differences. Therefore we can conclude that the number of cases where no improvement was measured between the first and last tests was negligible, because – if we line the number of players up against the number of tests – out of 94 tests, a lack of improvement was only shown on four occasions. But as I have already mentioned, this difference was only measured between the initial and final tests, and these players had also shown themselves to be capable of better results.

I also concluded that as the players are young, female athletes, their mood at any given time also has a great impact on their performance in the tests. This is evidenced by the fact that, without exception, at some time or other they all had a

test in which their performance was weaker than in the previous one. Since I was interested in the team's overall performance as well as the individual results, I examined the overall improvement in the individual tests:

- *1 kg medicine ball throw with a run-up:* 48.40 metre improvement - average 4.03 m
- *1 kg standing medicine ball throw with one foot forward:* 42.2 metre improvement - average 3.51 m
- *3 kg forward medicine ball throw:* 15.3 metre improvement - average 1.27m
- *3 kg backward medicine ball throw:* 22.8 metre improvement - average 1.9m
- *Standing long jump:* 1.89 metre improvement - average 15.75 cm
- *20 x 20 metre run:* 81 sec. - average 7 sec.
- *3000 metre run:* 36 minutes 36 second improvement - average 2 minutes 3 seconds
- *Bench press:* 143 kg improvement, average 12 kg

These figures also show the benefit of the work performance, which during these years had a major impact on the team's success, as it was during this period that we won a silver and bronze medal and came 5th in the NBI/B division.

Many of the tested players were still in the youth age group during these years; we won a youth championship for the first time as members of the NBI/B division. These achievements were partly due to these programs, and partly to the fact that the youth players had taken part in adult training work during this period. In view of the fact that, alongside these players, the team was also made up of inexperienced handball players, the achieved described are certainly commendable. These results show that the strength training, running and jumping programs also have a significant impact on the team's performance on the handball court.

Thanks to the steady improvement in results, the players' self-confidence is also being strengthened, which is very important in handball. It is my conviction that the boost in self-confidence has also improved our effectiveness. The test results are closely interrelated, as it is obvious that improvement in terms of 3000 metre running also has an impact on 20 x 20 metre running, just as the increase in maximum strength has an effect on the medicine ball throws.

The tests prove that the results achieved to date can be improved further, perhaps at a faster rate, with the possible exception of 20 x 20 metre running, where I believe that the players have reached their maximum performance capacity. I also base this conclusion on the fact that the tested athletes are still young, so scope remains for the development of their skills.

The proprioceptive exercises performed continuously in parallel with the strength training program have proven their value, as during this period the team – with one exception – avoided serious injury; the effect of these exercises is beyond doubt. Thus, based on my own experience and as a lesson of the study, I can state that it is worth devoting time to prevention, because our aim is to field the fittest and healthiest players we can from one week to the next.

Although this was just an added benefit of the tests, spectacular progress was made in these exercises, especially at the beginning. This has convinced me that in addition to the applied training methods there is also a great need for the proprioceptive exercises, although an effort must be made to vary the exercises.

Summary

For me the evaluation of the three years of measurements yielded some extremely important lessons and results. I will continue the tests and the programs because, as I have already mentioned, the members of my current team are capable of further improvement.

A lesson I learned at a later stage was that I should have performed tests at the end of the preparation period too, as more emphasis was placed on the running, jumping and strength training work here than during the competitive period. In the case of players whose progress has reached a plateau, a different style of training will be required going forward, since this type of work no longer has an improving effect. In the future I will try this, and if this fails to yield any improvement it will show that the player has no more capacity to develop the given skill.

Naturally, the programs carried out by us should be taken as a guide, and may be altered by anyone in terms of quantity or the number of series or repeats, since a great deal depends on the age, fitness and ability of the players. It is also a fact that it is extremely difficult to conduct these programs alone, so the appropriate background and support is necessary, which for colleagues working and a lower level and with fewer training sessions, is virtually impossible. On the other hand, at a higher level it is worth performing the exercises in more depth, and adapting them more closely to suit the individual. The tests have proven unequivocally that it is beneficial to perform work of this type, as it has a positive impact on both individual and team performance.

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Assessment by psychological laboratory instruments and skills development in handball

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CONTENTS

Abstract

In our days it is not enough to use the existing traditional training methods and training theoretical papers; it is worth paying attention to borderline disciplines. One of the unutilized scientific fields is sports psychology and a sub-field of this: psycho-diagnostics. This study is based on the psycho-diagnostic assessment of 14 adult second class female players. The instrumental psychological assessment was done by the implementation and analysis of nine psycho-diagnostic tests. The main objective of the survey was to prepare a condition assessment of the individuals and the team. The tests measure factors like visual capacities, reaction time, motor time, block span memory, persistence, decision making, frustration tolerance and many others. I examined the results by posts and at the team level. The results gained from the psycho-diagnostic assessment give stable ground for the further development of the players and the team.

Key word: psycho-diagnostics, mental skills and capacities, condition assessment, Vienna Test System, skills development.

I. Introduction

In many European countries handball is the second most popular and most watched sports branch after football. The game of great traditions had overgrown its European frameworks and is about to grow a really popular and professional sport in Africa, Asia and even South America; that is why handball is more and more often referred to as the sport of the 21st century. (sportsmarketing.hu/2011)

In professional sports vivid sports branches attract the spectators' interest, and satisfy it at the highest standard. People can identify with the sports branches best adapting to the mentality and life rhythm of our age. Speedy game, spectacular solutions, unexpected changes offer special experiences for the viewers, great challenges and outstanding skills for the sportsmen and always renewing tasks for the trainers. The development of the training methods and all aspects of the technical background are of decisive importance in current competitive sports, thus in handball, as well.

From the above brief introduction it is clear that new paths and fields improving the conditions and popularity of this sports branch must be and are worth being searched. Today it is not enough to use the traditional training methods and training theoretical scientific material, we also need to search into bordering disciplines which can elevate the players', the teams' and the coaches' preparation.

One of these unutilized fields is psychology, sports psychology and within that psycho-diagnostics. By employing these experts can improve their sportsmen's performance increasing by this their success as well as supporting the, hopefully continuously growing, popularity of handball.

Today's modern handball cannot get on without a serious scientific background. In parallel with the development of this sports branch the players' abilities and skills that cannot be assessed merely on the basis of the coache's feelings and impulses any more are more and more often put into the foreground. Sports psychology and within that sports diagnostics is an unutilized field in handball which offers a precise picture and data for the coaches and experts of the abilities and skills that can prove or, on the contrary, disprove their feelings.

The performance focused nature of competitive handball manifests in effectiveness as the unique rating of value. According to the generally accepted training theoretical definition, performance is built up of performance capacities and performance skills. Of the two elements, less attention is usually paid to performance skills although they compose the mental or psychical side of performance. Performance skills can be understood as a bunch of character traits comprehending the player's or individual's full personality and determine his motivational level, the system of his social relations and his attitude towards competitive sports.

By employing psycho-diagnostic tests and assessments the coach can get a precise image of the handball players' performance skills which can highly support the achievement of successes at matches and at high quality training work.

I./1 Psychological skills in sports

I./1.1 Cognitive skills

Perception

Perception is nothing else but experiences connected to simple stimuli. In order to be able to perceive the events taking place in the world the information concerning the events must be received by the sensitive nervous system.

Perception can be approached as a psychological process but it is important to emphasize that there are several trends in psychology.

The study of perception examines how the living organisms elaborate and organize the received raw information in order to create a coherent representation or model of the world they are living in and to be able to solve problems appearing in their environment, like orientation or planning, by using these representations (Atkinson – Hilgard, 2005)

Attention

Attention is a selective process that strengthens the effectiveness of some impetuses and weakens that of others. It is the ability that allows us to highlight some details of certain information and neglect others at the same time.

The term attention has been used in different ways; however, the two meanings used most often are connected to selective elaboration and mental effort or concentration.

It is important to distinguish between focused and distributed attention. When focused attention is assessed, the subjects of the experiment are shown two or more simultaneous impulses, and are asked to respond to only one of them. The researches on focused attention present how efficiently people are able to select certain inputs from others, and allow the detailed analysis of the process of selection and of the story of the neglected stimuli. Distributed attention is also examined by presenting two or more impulses but in this case the instructions urge the respondent to pay attention and respond to all of the impulses. Distributed attention provides useful information on the person's elaboration limits and its attention mechanisms and capacities.

According to some researches, regulated and automatic processes can be distinguished. Unlike regulated processes, the automatic ones are rapid, do not reduce the capacities

necessary for the fulfilment of other tasks and are unconscious. It is generally agreed that long term practicing is of basic importance in the evolution of automatisation. (Selmeci, 2011)

Decision making

According to various theories, decision making means the way people determine the best possible ways of action in compliance with their knowledge on the world, their objectives and desires, i.e. the theories discuss how people get to the optimum decisions.

In a psychological sense, individuals must consider plenty of emotional factors and contradicting beliefs when deciding on the alternative to be chosen.

I./1.2 Personality

Getting knowledge of the personality is perhaps the most important task of psychology and sports psychology. Thus its definition and assessment is of considerable importance. Personality is the complexity of the behavioural, emotional and mental patterns that are possible to be described, characterize the person and thus determine the style of life. Personality evolves and changes as a result of the mutual impacts of partly genetic and partly environmental factors.

Psychiatrist Prof. Robert C. Cloninger published his psycho-biological personality theory in the ’80s which has become widely acknowledged since.

The psycho-biological model of personality distinguishes four dimensions of temperament (novelty seeking, harm avoidance, reward dependence and persistence) and three character dimensions (self-directedness, cooperativeness and self-transcendence).

Temperament

According to Cloninger, temperament is the complex of the automatic responses given to the emotional stimuli, it is hereditable and is observable from the early childhood. In opposition to this, the character shows what the person is able to actualize of himself; it is the complex of our notions concerning ourselves, other people and the world. The temperament exerts influence on the person’s basic emotional pattern while the character includes the intentional behaviour, the attitudes and the personal objectives

(Cloninger, 1987; Cloninger et al., 1993; Cloninger and Svrakic, 1997 cited by Mirnics, 2006).

Novelty seeking means the inherited pattern of the activation and initiation of behaviour. A novelty seeking person is always ready to investigate his environment. When meeting a new impulse, or avoiding punishment, he will feel joy and serenity. He makes his decisions quickly, relying on his instincts and impulses. He hates monotony and tries to avoid punishment.

Harm avoidance may manifest in passive, avoidance behaviour, fear of instability and foreigners and rapid tiring. A harm avoiding person reacts to aversive stimuli rather intensively; he obstructs his own behaviour in order to escape from the imagined or really threatening frustration; as a result, he often remains excluded from new situations.

Reward dependence may appear in sensitivity, social ties or dependence on other people's acknowledgement. A reward depending person is empathic, understanding and very sensitive to social impulses and so rewards, as well. He insists on the positive stimuli even if he has not been given them for a long time (e.g. he lacks acknowledgment).

The fourth temperament factor is *persistence*. Cloninger makes some statements on the order of the development and the relation of the certain temperament dimensions. He thinks that in the course of personal life the first dimension to evolve is harm avoidance which is later followed by novelty seeking and finally reward dependence.

Character

The content of the character reveals what the person's objective of life is and by what roles and values he is driven. In the adult age, when self-image has already grown firm, and so the attitudes, the objectives and the expectancies become harmonized, the character contents are usually possible to be influenced consciously; self-development then is based on meaningful learning. Of course, from time to time there may be smaller changes in the personality as well as full re-organization – Cloninger says.

The notion of *self-directedness* refers to the level of the control the person is able to assert in a certain situation, of sticking to the rules and of his adaption in conduct as well as to the level of the accordance between this control and the personally chosen

objectives and values. It reveals whether the individual is able to identify himself with an imaginary and ideal self-image or on the contrary, his personality is built of a disorganized set of reactive impulses. Strong self-directedness in most cases also means strong self-esteem which means that the person accepts himself just as he is; he attributes meaning and aims to his life, and is able to delay satisfaction in order to fulfil his objectives. According to Cloninger's interesting statement, if someone keeps sticking to clear objectives and values for a long period of time, these will become the so called second nature of him, and start to work in a credible and spontaneous way, almost independently despite the fact that earlier the person had to make enormous efforts to turn his life towards them.

Cooperation means the personal differences in accepting other people. Cooperative persons are socially tolerant, empathic and helpful; they think of themselves as part of a supportive community. Non-cooperative persons are socially intolerant, are not interested in the others, are not helpful and are sometimes rather revengeful – all this originates in the fact that they are inclined to recognize their social environment as an enemy. Strong cooperation skills generally go hand in hand with high level self-evaluation while the non-cooperative ones are exposed to self-evaluation disorders.

I./1.3 Motives, aspiration level and motivation of performance

The two terms are often used as synonyms although they do not properly overlap. Aspiration refers to the behaviour manifesting in a task situation, while performance motivation refers to the tension system stimulating and energizing this behaviour. Thus aspiration level and performance motivation are the two, interdependent sides of performance stimulation. Aspiration level reflects the requirements set by the sportsperson towards him. It is interconnected with the level of self-confidence, self-esteem, distress and the adaption to certain situations. The person's objectives and undertakings are realistic in case they slightly exceed his realized performances. The difference between the actual performance and the succeeding, slightly higher objective indicates the optimum level of the motivating tension (the stress that stimulates performance). This kind of conduct is called success-oriented or ambitious. In case the sportsman sets his objectives at a standard lower than his abilities and technical level, another type of typical behaviour will appear. In this case the motive is missing hence he will easily perform at some level falling behind the earlier. (Lénárt, 2002)

I./2 Psycho-diagnostics in sports

Sports are typically a field where one must face development and its obstacles because this means the real way of personality development. What does a sportsman want to achieve? What power resources does he possess, and what is he ready to mobilize or sacrifice? Sports psychology offers help in understanding what results a sportsman is destined to achieve, and what these can later be used for.

Sports psychology is a collective term, it usually means the study of the personality and behaviour of the people conducting physical sport activities and the application of this knowledge. From the respect of competitive sports the main stress is put upon the regulation of the psychical functions and characteristics building up the personality, and we investigate how these regulations can improve sports performance. Thus the main questions are efficiency improvement and high performance.

Sports psychology tells about boosting the performance of healthy men, about finding his zone of optimal functioning in which he can perform his best. Any of the actual states a sportsman is in can be changed by the help of sports psychology.

In competitive sports it is often the mental skills that determine the difference between victory and defeat. By using carefully selected psychological tests the strengths and weaknesses of the sportsman's performance and personality can quickly be explored. With these tests the psychologist will examine the general and specific skills of the respective sports branch. This allows the application of targeted interventions in order to achieve full potential.

The various sports branches demand very much differing qualities and personal aptness. The performance platform of the various sport branches is so rich that something like a special "carrier mirror" could be drawn of them. These include varying skills that are necessary for the high standard performance in the certain sport. There are psychological requirements that are generally valid and must be met by each professional, and there are special requirements adapting to the characteristics of the certain sport branches.

Psycho-diagnostics is not about thaumaturgy or magic (like most of the outsiders think); it is a service allowing the sportsman and the coach to challenge the mental problems, crises (positive and negative situations as well), situations of distress and difficulties of

motivation. Within the process of sports psychology the assessments, test and the anamnesis are followed by intervention, consultation and, if necessary, therapy.

In today's modern handball psycho-diagnostic exploration can provide further assistance in dynamic development. It may open up new perspectives, may accelerate the recognition of certain problems and also does offer solutions in some cases. Some fields though, of course, require the elaboration of sports branch specific methods.

I./3 Advantages of sports psychological tests

Sports psychological testing offers several vantages:

- provides information on the cognitive skills;
- gives a clear picture of the strengths and weaknesses of the personality;
- provides ground for personally tailored interventions, and makes it possible to monitor the successes of the developments;
- may strengthen or refute the trainer's feelings and thoughts;
- offers a complex image of the sportsman.

II. Methods and the procedure and objective of the survey

The survey was made with the participation of 14 adult, second class female players and with the help of a professional psychologist. The players were aged 22.3 years in average (plus-minus 4 ears), their average age as sportswomen was 10.5 years. Of course, the results are not representative, they only apply to the examined sample. However, the survey (an instrumental psychological assessment) fills in a gap in the field of handball which may incite the experts to conduct similar researches.

When analysing the data the focus was put on the competencies necessary, or at least advantageous, for handball players.

The objective of the survey was actually to make a condition analysis of individuals and the team. The elaboration of the further developments based on the data analysis can be a task for a new research and work of planning. The results of the instrumental tests, however, surely inform the coach on the fields the individual players should and could be improved in.

III. Development

III./1 The examined fields

The fields listed below form only one part of the skills possible to assess, and their diversity indicates the width and depth of the possibilities of gaining new and direct information on a team and its players. On the basis of the list it is obvious how extremely important these skills are in educating better handball team members, professionals from players.

Examined subject areas:

- aspiration to do a precise job;

  (The coach gets a clear picture on the strengths of his player's internal motives during training work.)

- conduct and persistence in decision situations;

  (It may become clear for the coach what kind of decision making skills the players possess in various situations.)

- aspects of motivation;

  (It presents an image of the level of the player's performance motivation.)

- attention and concentration capacities;

  (The coach can get knowledge of the level of his team's and players' attention and concentration capacities in various situations.)

- short-term memory capacity;

  (It gives a clear picture of the handball players' short-term mental chargeability.)

- attention skills;

  (It presents the player's cognitive skills necessary to distinguish between colours and sounds, and then select the relevant responses to the instructions that had been given.)

- reactive stress tolerance;

  (Stress tolerance examines the differences of performance during the implementation of routine work in a basic situation and under increased pressure.)

- reaction speed;

  (It shows the handball player's reaction speed.)

- visual orientation;

  (It informs the coach on the player's focused attention under disturbing conditions and time pressure.)

- simple and multiple choice reaction time;

  (It represents the speed at which the player is able to make a decision or a good decision at.)

- long-term selective attention

  (It gives a picture of the level and persistence of the player's attention as well as its divergence.)

- personality inventory in terms of four temperament and three character dimensions;

  (It provides an image of the player's endeavours towards novelty seeking, harm avoidance, reward dependence and persistence as well as his self-directedness and cooperation skills.)

- ability of assessing speed and movement in space;

  (It gives information on the moves of the player's team mate, the opponent and the ball as well as their expected spatial localization.)

III./2 Presentation of the Vienna Test System

The Vienna Test System is a top world brand of psychological assessment instruments in informatics, and is owned by Schuhfried GmbH (Austria). Schuhfried GmbH has been engaged in elaborating test, research and development since 1947. The company is a market leader amongst the companies dealing with computer-based psychological assessment; their tests are used in 32 countries in the world. The tests of the Vienna Test System are available in 25 languages; there are 37 tests currently available in Hungarian. The test system is innovative and flexible and meets the highest quality requirements. Its tests were elaborated on the basis of the results of international researches; Schuhfried GmbH cooperates with universities, research and other scientific institutions and big companies all over the world, this is how they are able to warrant high quality. One can choose from a wide range of tests that cover all fields of psychological examination – be it clinical, sports, aviation, personality, neuro- or traffic psychology. The advantages of computer based assessment allow the exploration of dimensions impossible to be surveyed by paper and pencil tests. The results appear immediately, precisely and clearly. Some of the tests are adaptive or modular – in the course of using the adaptive tests (e.g. intelligence tests) the difficulty of the exercises adapts to the level of the respondent's answers, and thus provide more reliable results on his skills. (Schuhfried, 2009)

III./3 Applied psycho-diagnostic tests

AHA

The test gives a picture of the player's aspiration to do a precise job, his conduct in decision making situations and several aspects of his motivation.

Concerning working style, the test measures the individual's behaviour in independent decision making situations and his decision making style. The third dimension of assessment gives information on how strongly the respondent is apt to do precise work. Finally, the personal behaviour shown in difficult situations burdened by obstacles is connected to both working style and motivation. Relying on the results of the latter two factors it is possible to draw conclusions on how conscientiously he fulfils his tasks, i.e. how thoroughly and persistently he does his job.

The test includes three subtests. In the first subtest, "Comparing surfaces" the person is to assess the size of two forms and decide which one is bigger. Optionally, it is possible

not to make a decision. In the second subtest, "Coding symbols" he has to mark the corresponding ones of several abstract figures. After each series of tasks he has to appraise how he is going to perform in the next round, and in the meanwhile he is sometimes given feedback on his previous performance. In the third subtest, "Differentiating figures" he is to find and mark the symbol not fitting the others according to the instructions set in advance.

Decision making ability

It assesses the person's conduct in situations demanding independent decision making: it provides information whether the respondent undertakes these situations, and to what extent he builds the feed-backs arriving from his environment into his decisions.

Preciseness

It gives information on how precisely the person fulfils his tasks, whether he pays attention to each small detail, or thinks about the tasks globally, paying less attention to the details.

Aspiration level

The test provides information on the person's judgement of his own performance.

Target discrepancy

The results of this subtest provide a picture of how difficult tasks the person is ready to undertake, and whether he tackles realistic challenges possible to be implemented.

Frustration tolerance

The results reflect the individual's behaviour in situations burdened by difficulties and obstacles. (Schuhfried, 2009)

COG

COG is a test assessing the attention and concentration capacities by comparing figures.

It approaches concentration capacities through three variables: a) the energy needed for the fulfilment of the task, b) the function, since the different tasks demand different levels of concentration, and c) precision which means the quality of the performance. The COG tests without time limits measure the energy variable while those with time pressure assess the function and precision.

The test is filled in by using the response panel or the computer keyboard. The test itself follows an animated presentation phase and an error-sensitive practicing phase. In the test form with no time limits the respondent is to compare abstract figures with a model and decide whether they are identical. After the respond is given, the next element automatically appears. In the test with time limit the person has to answer only in case the figure fits the sample. When presentation time is over, the next element appears. There is no possibility to overjump an element or to return to a previous one. (Schuhfried, 2009)

CORSI

It is a test primarily measuring the short term memory capacities; the memory block span assesses a decisive factor. Short term memory can be divided into verbal and spatial-visual subsystems which may be harmed independently which proves their relative independence from each other. The block test measuring the "immediate block span" surveys the capacity of the spatial-visual sub-system. The theoretical background of the test is built on Baddeley's short term working memory model. The block test assessing "supra-block span" steps beyond the examination of short term memory: it applies sequences exceeding the respondent's memory span by one which needs the activation of learning processes.

Blocks organized disorderly appear on the screen. A cursor points at these blocks according to a certain order. The person's task is to tap the adequate blocks in the adequate order. After three items the number of the blocks is raised by one. The test finishes when the respondent makes two mistakes within three items of the same span.

To examine implicit spatial-visual learning ("supra-block span") immediate block span must be measured first. Subsequent to this, items surmounting in number the result of the immediate block span by one are shown. The test includes 24 items as a maximum and a sequence of the blocks repeated maximum eight times. The test finishes when the respondent is unable to reproduce the target sequence properly (but he can try eight times).

DT

This test measures attention skills, reactive stress tolerance and reaction speed in situations where visual and acoustic stimuli must be given quick, precise and diverse reaction to. The test activates the respondent's cognitive skills necessary to distinguish between colours and sounds, to memorize the characteristics of stimulus configurations and to select the relevant answers that he has been given instructions about. During the DT continuous, random and changing stimuli must be reacted at.

The respondent is given stimuli of colours and sounds which he must respond to by pressing the proper button of the response panel. The impulses may arrive to the testee in three ways: 1. in Adaptive Mode where the presentation speed is adapted to the person's reaction time; 2. in Action Mode which includes no time limits; and 3. in Reaction Mode which operates with a fixed time limit. (Schuhfried, 2009)

LVT

This test measures the visual orientation skill in terms of simple structures in a complex environment.

To examine the more complex dimensions of perception we use special psychological tests. Most of these tests were developed on the basis of practical considerations relevant in experimental psychology or practical situations. The Visual Pursuit Test is not only the re-edited version of an old one but was created on the basis of the experiences and observations of many earlier versions. It surveys the aspects of visual orientation performance in tracking simple visual elements in a rather complex environment. The respondent has to work in a focused way, neglecting all disturbing factors and under time pressure. Thus the test is also suitable to assess selective visual attention.

The test begins with a combined instruction and a practicing phase. In case the respondent makes fewer than three errors in the eight practice items, he can move on to the test phase. Here he is shown a number of lines crossing one another, and he is to find the end of a certain line as fast as possible. The respondent is allowed to work at his own speed. (Schuhfried, 2009)

RT

RT registers the reaction time in milliseconds which means high preciseness, and also measures alertness, the ability to oppress inadequate responses (this latter plays an important role in assessing attention), vigilance and includes the inter-model comparison of these, as well.

Reaction time is the time passing by between the impulse and the start of the mechanic reaction when the person is instructed to react as fast as possible.

RT can be used in measuring both simple-choice or multiple-choice reaction time. The signal may be of light or sound modality, and by using red, yellow or white light the reaction time can be measured by using different stimulus constellations. The reaction time can be assessed by one single or simultaneous stimuli or sequences of these. By using "rest key" and "reaction key" it is possible to distinguish between reaction time and motor time.

The test presents colourful visual and acoustic signals. The respondent is required to press the "reaction key" when a specific signal appears, and then to place his finger immediately back to the "rest key". (Schuhfried, 2009)

SIGNAL

This test was developed to examine the long-term selective attention. The respondent has to distinguish between relevant and irrelevant signals. The test is based upon the signal detection theory, and assesses the registration of complex visual stimuli under time pressure and during a longer period of time.

In the test the person has to detect weak signals against a permanently changing, "noisy" background. The test does not only measure visual differentiation between signals close to the perception threshold. It places the question in general: under what conditions can a person detect a weak signal among irrelevant signals, or among signals that can be confused with the relevant one? It is closely connected to the statistical decision making theory: it considers the reactions of the "signal present" or "signal not present" type not as sensitivity to differences but as a decision-making problem. The testee is to make a choice between two alternatives to which different probabilities are connected.

Dots appear over the entire screen area. In a pseudo-random way they appear and disappear. The testee must recognize the critical constellations and act by pressing the button when they appear. This critical constellation is a square formed of four points. (Schuhfried, 2009)

TCI

TCI is a comprehensive personality inventory providing a picture of the testee's personality through four temperament dimensions and three character dimensions (which are distributed to 24 sub-dimensions).

The test is based on Cloninger's personality theory. To measure personality he considered it necessary – similarly to the personality theories preceding the birth of his theory – to divide the personality into two features: temperament and character, and to develop a valid and reliable instrument of assessment. In his theory Cloninger strived to give a comprehensive analysis of personality in which inherited factors prevail as well as social affects.

According to Cloninger's definition, temperament is an *automatic* response given to situations that involve (and so result in reactions of) high emotional intensity, is partly inherited and relatively stable. Temperaments are features independent of the cultural background. The evolution of the characters is highly influenced by the social impacts reaching the person, so these are features *intently* actualized of the person by himself.

Temperament factors

Novelty seeking

The novelty seeking scale usually assesses the activity attached to new actions which is in connection with the impulsive of reflective style of decision-making, the degree of the regulation of conduct and the preference or avoidance of operating in a regulated environment.

The sub-factors of novelty seeking are:

- exploratory excitability vs. stoical rigidity
- impulsiveness vs. reflectivity
- extravagance vs. moderateness

- disorderliness vs. orderliness

Harm avoidance

The harm avoidance scale means the hereditary pattern of obstructing the behaviour which can manifest in passive, avoiding conduct, fear of instability, timidity and rapid tiring.

The factors of harm avoidance are:

- timorousness and pessimism vs. unhindered optimism
- fear of instability
- timidity against strangers
- fatigability and asthenia

Reward dependence

Reward dependence manifests in the sensibility and the social ties of the individual as well as his dependence on others' acknowledgement.

The factors of reward dependence:

- sensitivity
- attachment
- dependence

Persistence

The persistence factor correlates with the relation to performance. This scale is not divided into sub-scales.

Character factors

Self-directedness

The self-directedness factor examines the degree to which the person is able to keep control, stick to the rules and adapt his conduct, to which he is aware and accepts his strengths and weaknesses and whether he chooses objectives congruent to these.

The sub-factors of self-directedness are:

- taking responsibility vs. lack of taking responsibility
- purposefulness vs. lack of purposefulness
- successfulness, resourcefulness vs. apathy
- self-acceptance vs. lack of self-acceptance
- congruent second nature vs. suspicion

Cooperativeness

Cooperativeness manifests in the acceptance of other people and the relation to team work.

The sub-factors of cooperativeness are:

- social acceptance vs. social intolerance
- empathy vs. social uninterest
- helpfulness vs. lack of helpfulness
- compassion vs. vengefulness
- pure conscience vs. self-interest. (Schuhfried, 2009)

ZBA

The test examines the estimation of speed and movement in space.

In modern life, it is an important ability in several fields to predict the impact of certain movements and to assess properly the spatial movement of an object. This skill is of outstanding importance in sports which is difficult to be assessed by traditional methods. The ZBA test offers a solution to this problem.

A slowly moving green ball is shown on the screen. In an unpredictable moment the ball disappears and two red lines appear. One of the lines crosses the point where the ball has disappeared, and the other one is the target line. Estimation of time is done as follows: the respondent has to press a button when he thinks the ball has reached the target line.

To measure the estimation of the movement the respondent is also required to indicate the point where the ball will cross the target line. He can do this by using two keys that direct an arrow on the screen. The respondent is given a feed-back only in the instruction phase; he is not given it in the test phase. (Schuhfried, 2009)

IV. Results and Discussion

In the test we get a percentile rank (PR) value on each scale, thus the results are shown in a percentile rank form – by which we refer to the deviation from the average. The test results are evaluated on the basis of the characteristics and scales in which the testee shows a result diverging from the average.

The span extends from 0 to100; 0-15 means low, 16-24 is slightly lower than the average, 25-75 means the average span, 76-84 is slightly higher than the average, 85-100 means high.

Half of the persons constituting the norm group fall into the 25-75 PR interval which makes the average of the norm group. The divergences from the average are considered as stronger characteristics of the person in case of high values and characteristics weaker than with other people in case of low values, and their evaluation is based on these divergences.

Two types of column diagrams can be used in the evaluation of the test. The first one shows the average results of the team, the 14 players in each case, while the second one gives a comparison by posts.

Of course, the players can be examined one by one, as well, however, in the case of some tests, the player must give his/her permission for the reason of personality rights.

The most efficient solution is to examine the results by persons, positions and at the team level, as well, so we can get a complete picture of the strengths and weaknesses of the players and the team in terms of the fields examined. Subsequent to this, the steps of development can be determined consulting the psychologist because some of the abilities and capacities are easier and quicker to be improved by mechanical ways, but in most cases it is most reasonable to prepare a handball specific development plan.

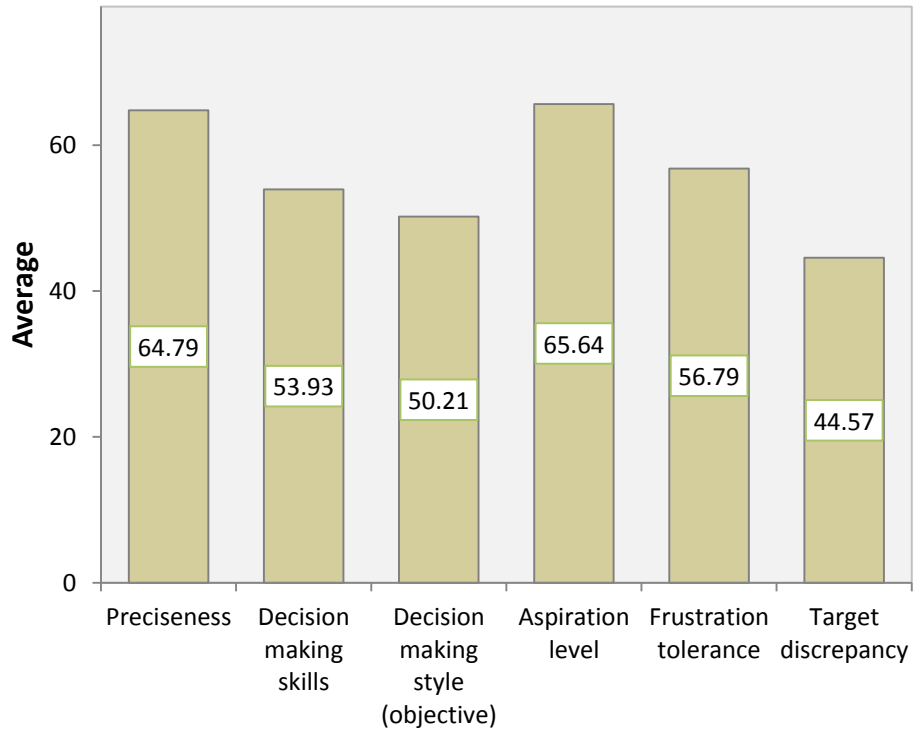
The tests must be evaluated one by one, however, the data can be interpreted precisely and in their complexity by analysing the results of the various capacities (e.g. reaction time, decision factor, etc.) in various situations of behaviour and the picture the player has of himself. Thus it is worth evaluating the personality test and the results of the cognitive capacities in parallel, i.e. assess the capacity tests in the reflection of the personality tests. It must not be forgotten that we are speaking of people, persons and various personalities and not machines.

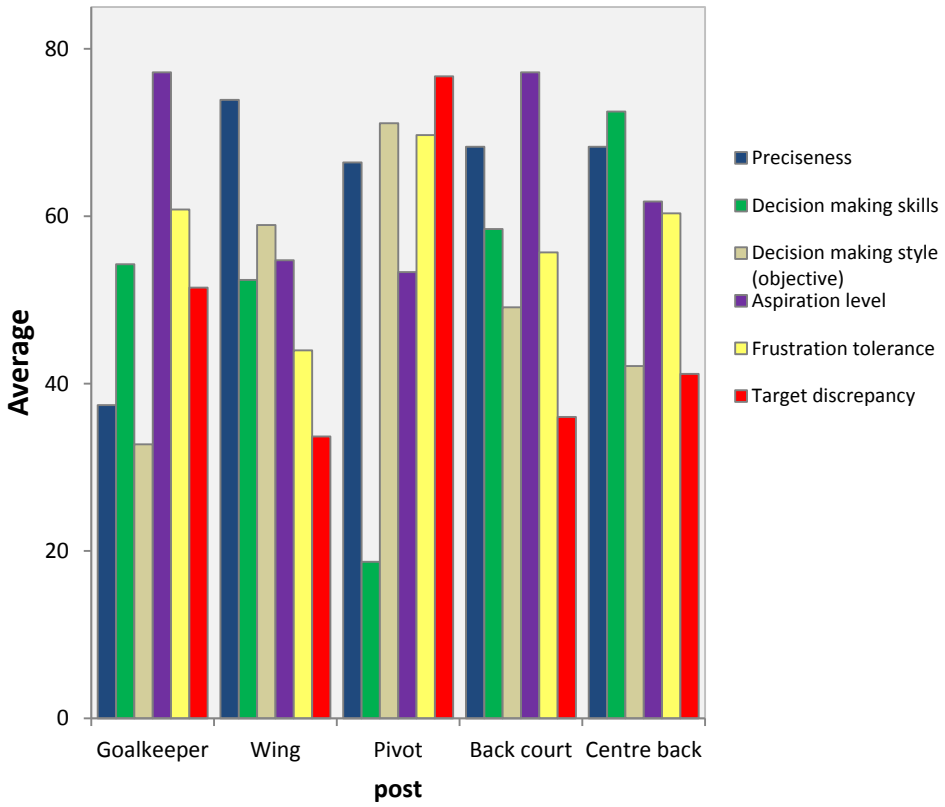
After the tests are analyzed the reasonable question is what the directions of development should be. What is the most expedient way from the respect of the team? There are three possibilities:

- we continue developing the characteristics surpassing or diverging from the average, and so improve the players' and the teams' strongest virtues further;
- we pay special attention to the fields below the average, and so we try to bring the weaknesses closer to the average level;
- or we improve the capacities found in the average span, and so raise the team's strengths in average.

In my opinion, there is no generally perfect solution; it is primarily the coach, perhaps together with the psychologist, who has to determine the directions and ways of the various development fields. This can be done by persons, at the team level or specifically by positions.

AHA


Average
60
40
20
0
64.79
53.93
50.21
65.64
56.79
44.57
Preciseness
Decision making skills
Decision making style (objective)
Aspiration level
Frustration tolerance
Target discrepancy


Average
80
60
40
20
0
Goalkeeper
Wing
Pivot
Back court
Centre back
post
Preciseness
Decision making skills
Decision making style (objective)
Aspiration level
Frustration tolerance
Target discrepancy

The intention of the team concerning *precise work* falls into the average interval. In this respect the wing players can perform above the average, but for the goal keepers this is a capacity to be improved.

Obviously, the training work must be interrupted more often during the implementation of the exercises, mistakes must be corrected more often and attention be drawn to precise work. It is worth getting back to the basic tasks again and again, and to move from the easier to the more complex ones carefully.

The *behaviour shown in decision situations* is of average level, it is perhaps not by chance that the centre backs are outstanding, they surpass the average. The test gives a useful picture to the coach on the fact that in favour of development he will regularly have to adopt exercises improving the players' simple choice capacity level.

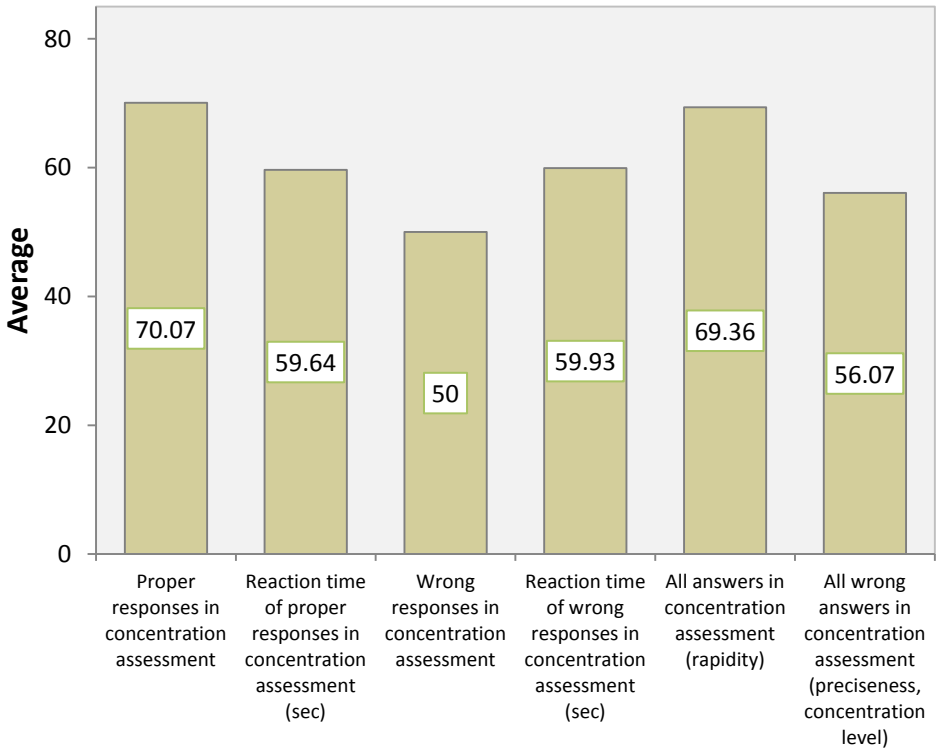
According to the results of the *aspiration level*, the players of the team are aware of their real abilities and performance capacities. Consequently, they make adequate decisions when measuring the possible risk to be taken in certain situations. In case we look at the results by positions, it is clear that the goal keepers and the back court players are able to act above the average in this test.

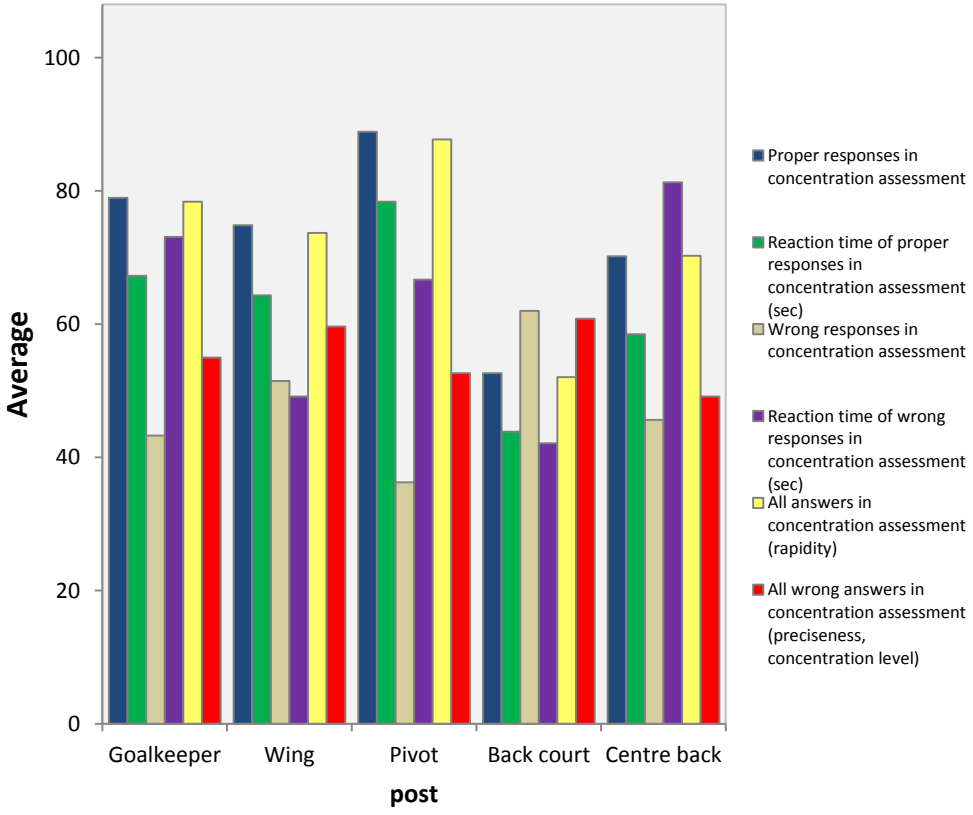
The results of the *frustration tolerance* test give information on the person's behaviour shown in problematic situations burdened by difficulties or obstacles.

The best results in this test were achieved by the pivots which, I think, reflects their role played in the court. However, the result concerning the team gives good reasons of thinking, and asking the question whether, as this factor falls into the average zone, an improvement allowing the achievement of considerable targets can be achieved.

The result of the *target discrepancy* test shows that the team and the players tend to undertake difficult, non-realistic tasks that they are not necessarily able to fulfil.

COG


Average
80
60
40
20
0
70.07
59.64
50
59.93
69.36
56.07
Proper responses in concentration assessment
Reaction time of proper responses in concentration assessment (sec)
Wrong responses in concentration assessment
Reaction time of wrong responses in concentration assessment (sec)
All answers in concentration assessment (rapidity)
All wrong answers in concentration assessment (preciseness, concentration level)


Average
100
80
60
40
20
0
Goalkeeper
Wing
Pivot
Back court
Centre back
post
Proper responses in concentration assessment
Reaction time of proper responses in concentration assessment (sec)
Wrong responses in concentration assessment
Reaction time of wrong responses in concentration assessment (sec)
All answers in concentration assessment (rapidity)
All wrong answers in concentration assessment (preciseness, concentration level)

The results in the test examining the players' attention and concentration skills were satisfactory. The team's capability of high standard concentration is of average level, however, when time limit appears, the results fall back. It is a positive fact, though, that even in the time limit test they strived to do precise work.

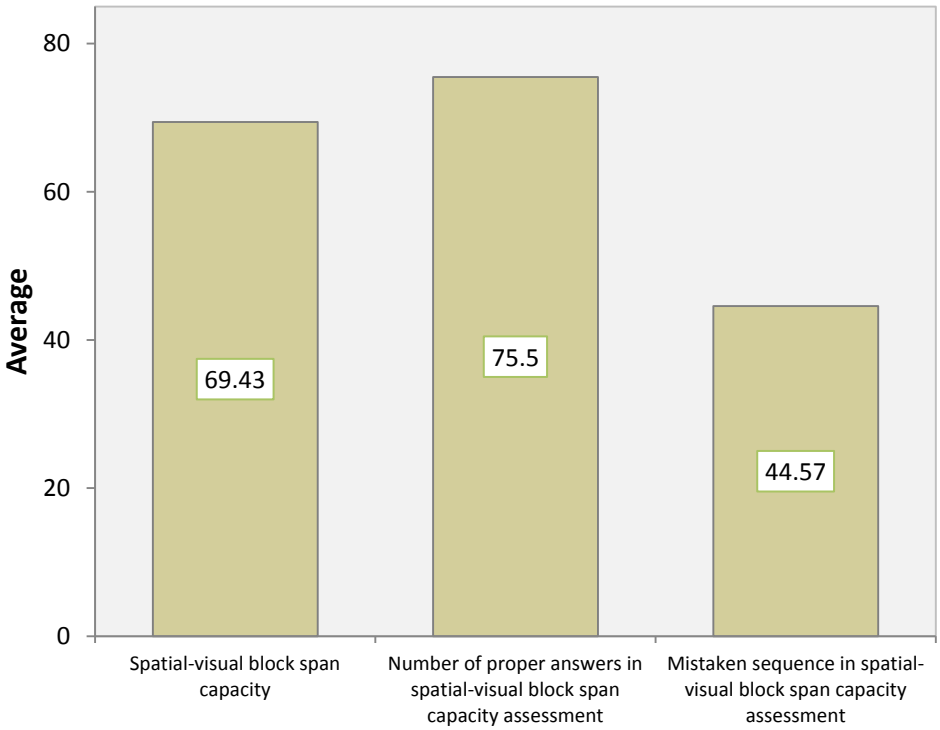
Thus it is both worth and necessary to challenge the team with tasks and objectives demanding strong concentration, and implementation under time pressure must be developed here.

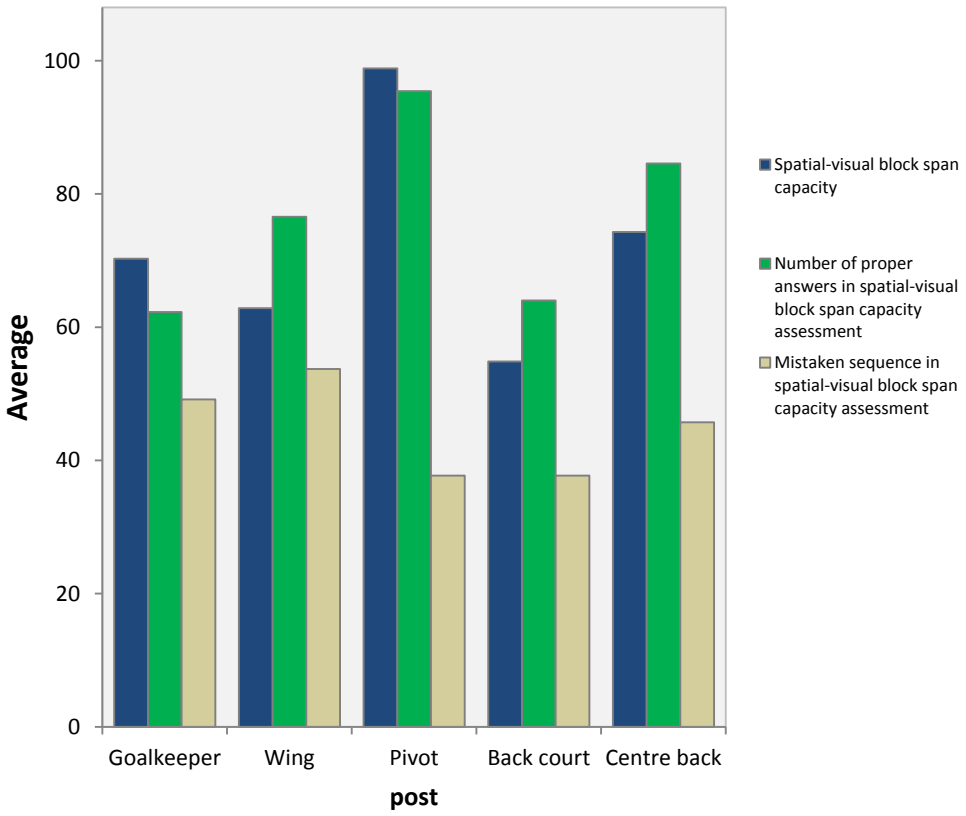
During training work the players must be faced with complex and sports branch specific tasks after the precise acquirement and implementation of which they will be put under time pressure. Since, according to the test, their concentration level is satisfactory, it is worth doing some changes and gradually set up new time limits prior to the automatic attainment and fulfilment of the task.

It is interesting to see that the pivots performed highly above the average concerning the number and the time of adequate answers in terms of rapidity and all of the answers, and at the same time they had the lowest results concerning the number of the inadequate answers.

Concerning preciseness and concentration level the best result was performed by the back court players which is indicated by the red column in the diagram.

CORSI


80
60
40
20
0
Average
69.43
75.5
44.57
Spatial-visual block span capacity
Number of proper answers in spatial-visual block span capacity assessment
Mistaken sequence in spatial-visual block span capacity assessment


100
80
60
40
20
0
Average
Goalkeeper
Wing
Pivot
Back court
Centre back
post
Spatial-visual block span capacity
Number of proper answers in spatial-visual block span capacity assessment
Mistaken sequence in spatial-visual block span capacity assessment

The test primarily serves the assessment of short term memory capacity. Or in handball language: it can, for example, indicate the acquirement and fulfilment of the number and precise implementation of fixed game situations (figures).

It is perhaps not by chance that the team had very good results in this test, as these players, as most of the Hungarian players of the latest times – have grown up in continuous study and practicing of fixed game situations.

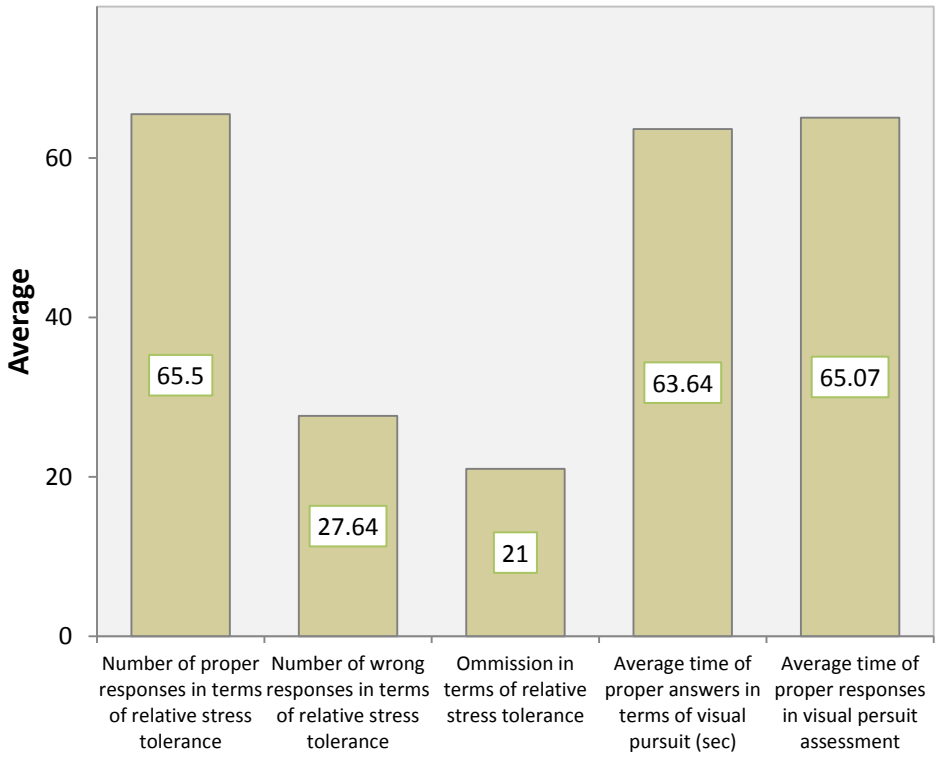
The number of the proper answers concerning the spatial-visual span capacity exceeded the average (75.5 PR), as well as the result in the spatial-visual span capacity itself (69.34 PR).

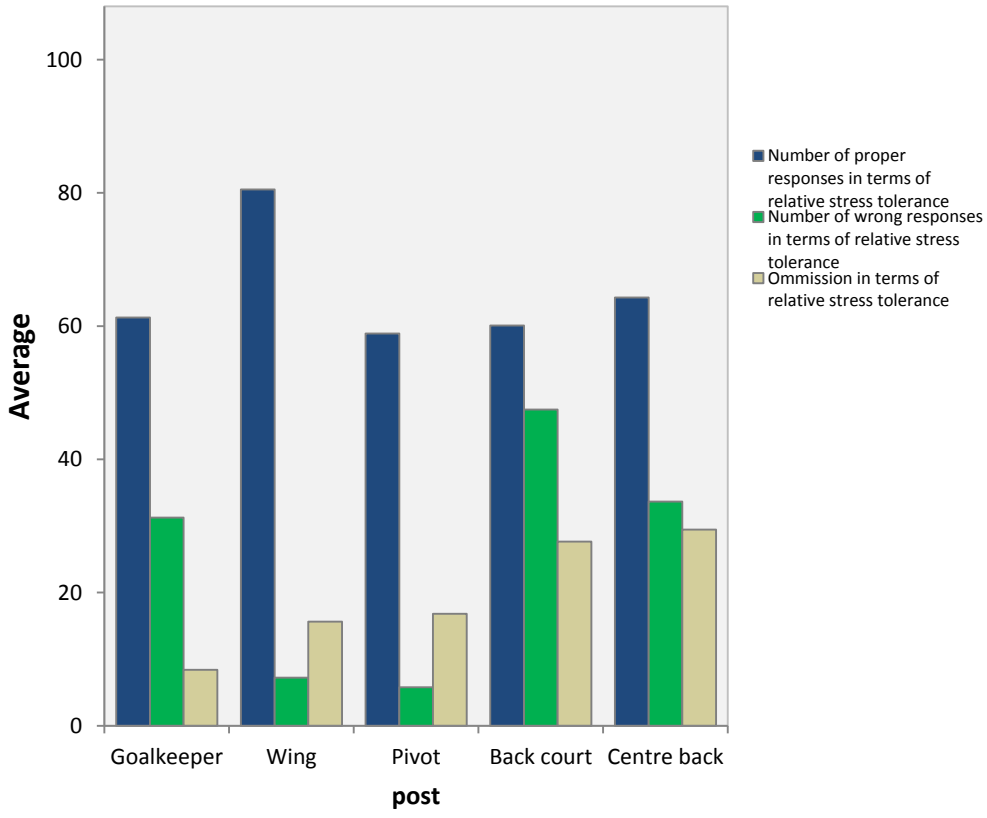
In the case of the goal keepers, for example, this test may evaluate the memorization of the shooting repertoire of the opponent players. As the results fall into the average zone, this competency of the goal keepers must inevitably be developed.

The lowest results within the team were performed by the back court players, so it is reasonable to build the tactics on fixed game situations in the course of which their role can be learnt and memorized more easily and rapidly.

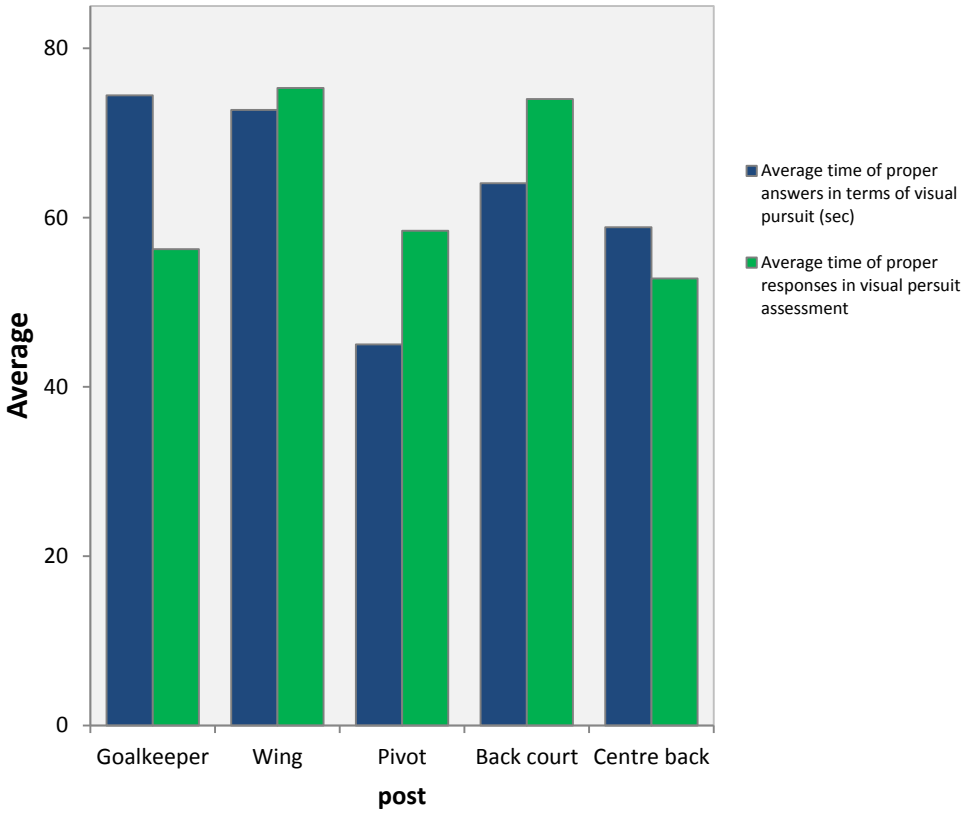
However, the assessment of the spatial-visual span capacity in terms of sequencing errors showed lower results in the case of both the whole team and the certain posts, although it fell within the average category. This also indicates the fact that the knowledge and competency of the players must be improved in this filed, and that in the present period it is reasonable to set fixed tactical elements of faster procession.

DT, LVT


Average
0
20
40
60
65.5
27.64
21
63.64
65.07
Number of proper responses in terms of relative stress tolerance
Number of wrong responses in terms of relative stress tolerance
Ommission in terms of relative stress tolerance
Average time of proper answers in terms of visual pursuit (sec)
Average time of proper responses in visual persuit assessment


Average
0
20
40
60
80
100
Goalkeeper
Wing
Pivot
Back court
Centre back
post
Number of proper responses in terms of relative stress tolerance
Number of wrong responses in terms of relative stress tolerance
Ommission in terms of relative stress tolerance

LVT



DT and LVT tests should be assessed together.

In the DT test omission is slightly below the average in terms of reactive stress tolerance (21 PR) which can be a reason for regular inexact passes. In the case of the goal keepers this field must by all means be developed, and concerning the field players, too, there is obviously a lot to be done.

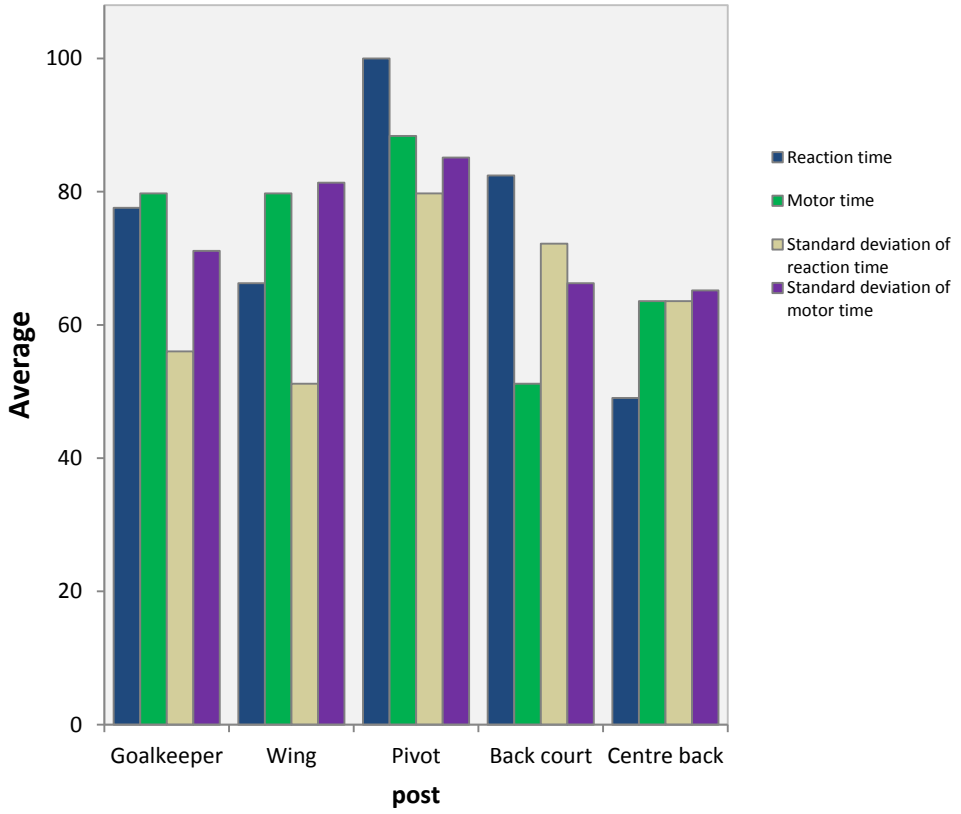
LVT – the average time of adequate answers in terms of capturing visual essence (sec) (63.64 PR)

With regard to the LVT test by posts, in terms of capturing visual essence (by time factors), we can see that the performance of the goal keeper and the wing players exceeds the average (63.64 PR). Concerning the number of the proper answers, in terms of capturing visual essence, it was the wing players and the back court players who performed results above the average.

These competencies and abilities can very well be improved by mechanical tools, but, of course, the coaches must apply handball specific exercises and training practices, as well.

The tests are also suitable for the assessment of selective visual attention.

RT

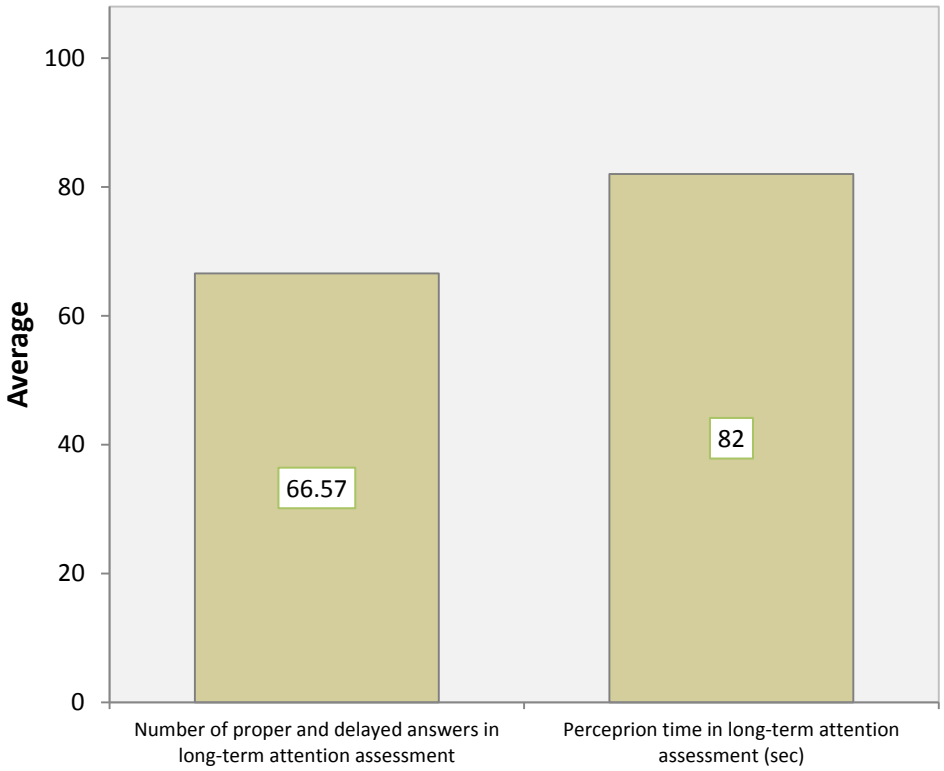


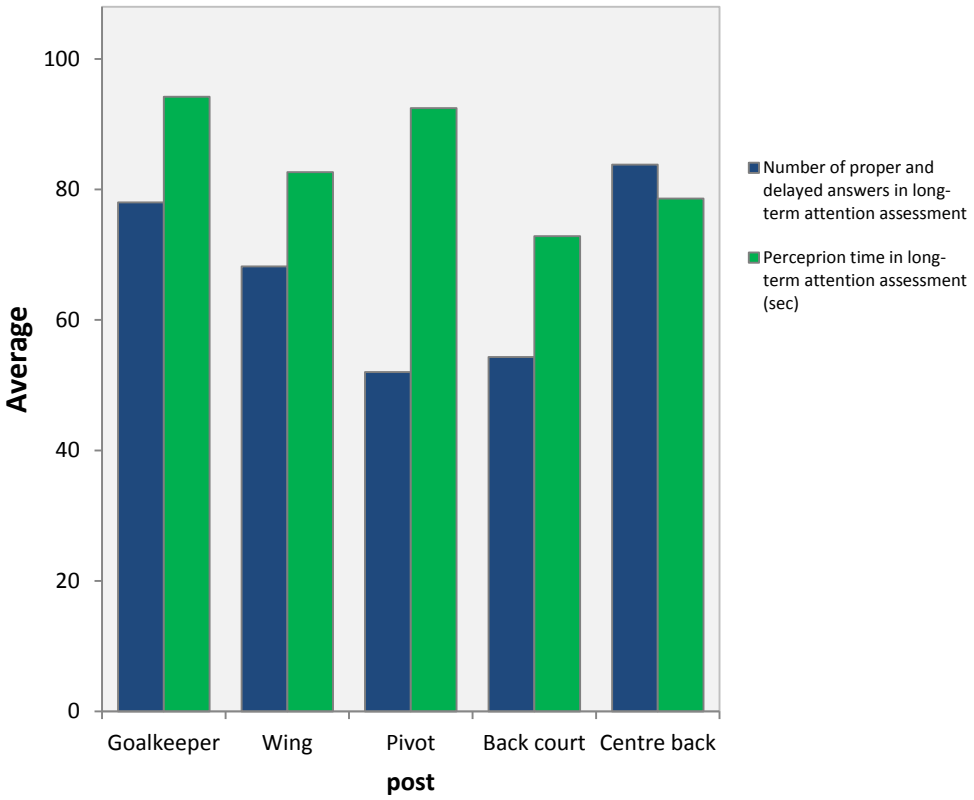
In sports, and so in handball, too, one of the most widely known and most often measured competencies is reaction time. The RT test distinguishes the time of perception from that of mechanical action which is important because in handball perception is not enough, the decisive moment is the initiation and implementation of the action. The RT test gains even greater importance if we take into account that it can assess simple and multi-choice reaction time, as well.

Concerning perception and the initiation of action the pivots performed above the average, and in the case of the goal keepers the motor time was better than the reaction time.

The back court players and the centre backs' motor time, that is the skill to initiat an action is surely worth and necessary to be developed. According to my opinion, this is a field to be improved by sports branch specific exercises.

SIGNAL


100
80
60
40
20
0
Average
66.57
82
Number of proper and delayed answers in long-term attention assessment
Perceprion time in long-term attention assessment (sec)


100
80
60
40
20
0
Average
Goalkeeper
Wing
Pivot
Back court
Centre back
post
Number of proper and delayed answers in long-term attention assessment
Perceprion time in long-term attention assessment (sec)

On the basis of the test, we can state that the team's long term selective attention capacities showed good results. In the test of long term attention the perception time reached 82 PR which is above the average, and the results concerning the numbers of proper and delayed answers in long term attention (66.57 PR, which is around the average), is promising, as well.

It was the goal keepers and the pivots that showed the best results in distinguishing the relevant signs from the irrelevant ones under time pressure and during a longer period of time.

It was only in the case of the centre backs that the result in the perception time was worse than that in the number of proper and late answers.

In this case it is reasonable to conduct training work in which the players are, after having reached a high level of mental and physical tiredness, forced to use their selective attention. Although it is visible that the team can perform well in this field, it is worth being dealt with, and raise it to an even higher standard.

Development can also be achieved by determining only two alternatives of decision at first, and then raising the number of these possibilities. Later these tasks can be fulfilled under stronger and stronger time pressure.

TCI

TCI MAIN FACTORS

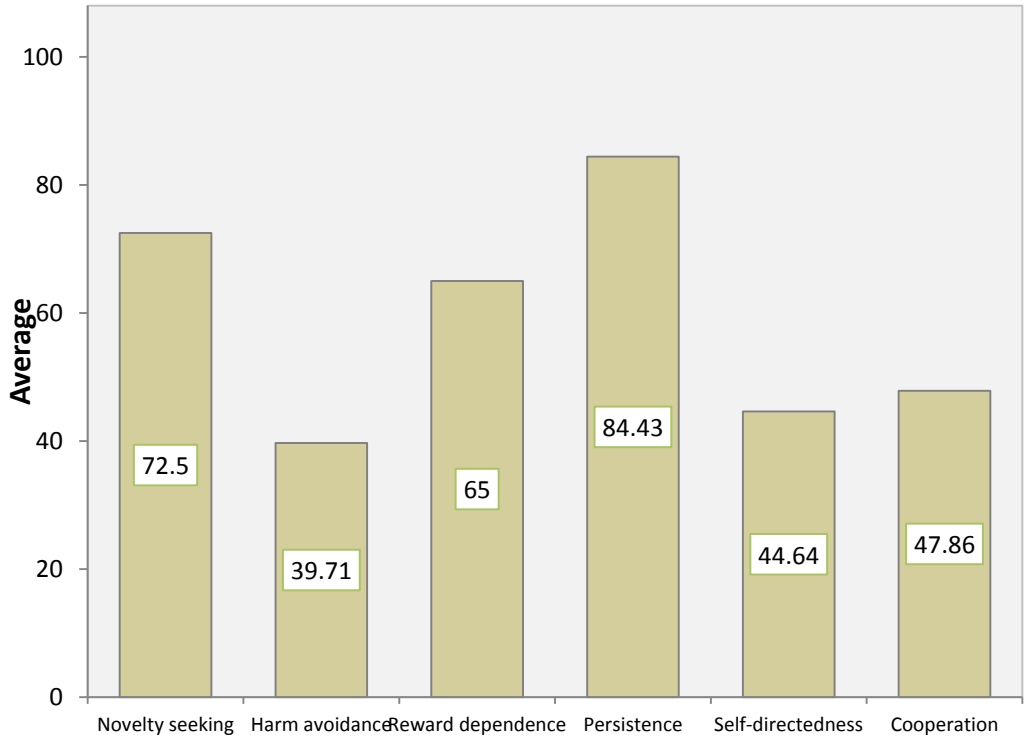
According to the graph, it seems clear that the team's *persistence* (84.43 PR) and *intention to learn*, i.e. openness towards new challenges (77.71 PR) exceeds the average.

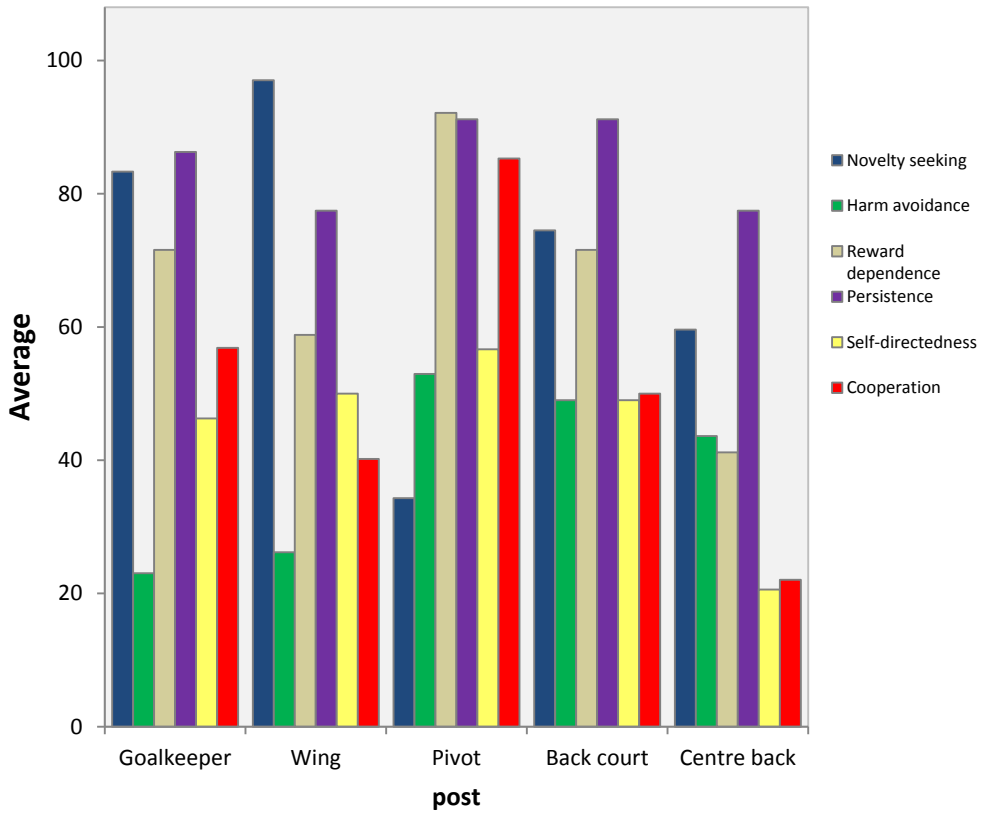
This can be a piece of important information for the coach since it indicates that he has the possibility to burden his players sticking to the basic rules of training theory, can rely on them in the long run, and it is worth applying new, diverse and complex exercises in the training material.

Temperament and character factors show a balanced picture, the result reaches the expected average level in each main factor.

Reward dependence is still relatively high, so the coach must not forget about regularly praising his players during and after work done well.

The factor of harm avoidance reaches the average level, however, it must be kept on the agenda when delegating the personally tailored exercises.

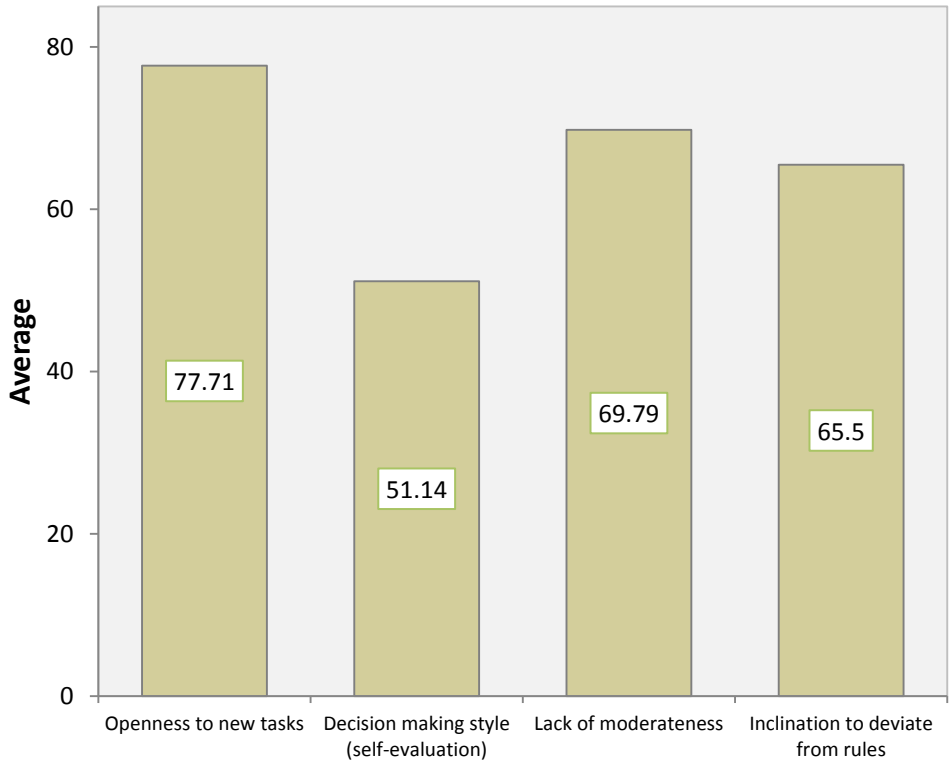


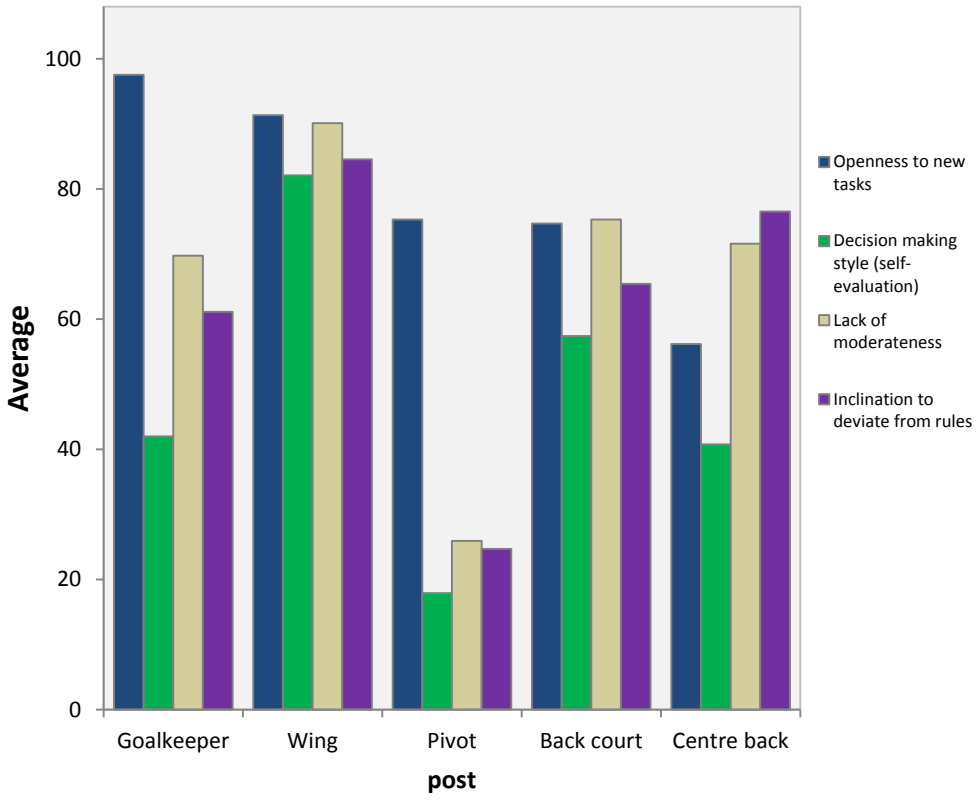


In case we examine the main factors by positions, we can see relevant differences. The factor of persistence is uniform, and search for novelty seems homogeneous, as well. So the coach can really rely on these factors.

The graph of reward dependence seems interesting as there is a great difference between the pivots' and the centre backs' positions. The pivots possess the highest disposition to cooperate which can be explained by the fact that they can get the ball only in case of intense cooperation. The centre backs' low disposition of cooperation is not a mere accident, either, they were probably put into this disposition because they tend to realize their own ideas. It must be immediately added, though, that the group interests must be kept in mind in any case, and low disposition to cooperate in the post acting as the coache's "lengthened arm" or "spokesman", can make the coache's work more difficult.

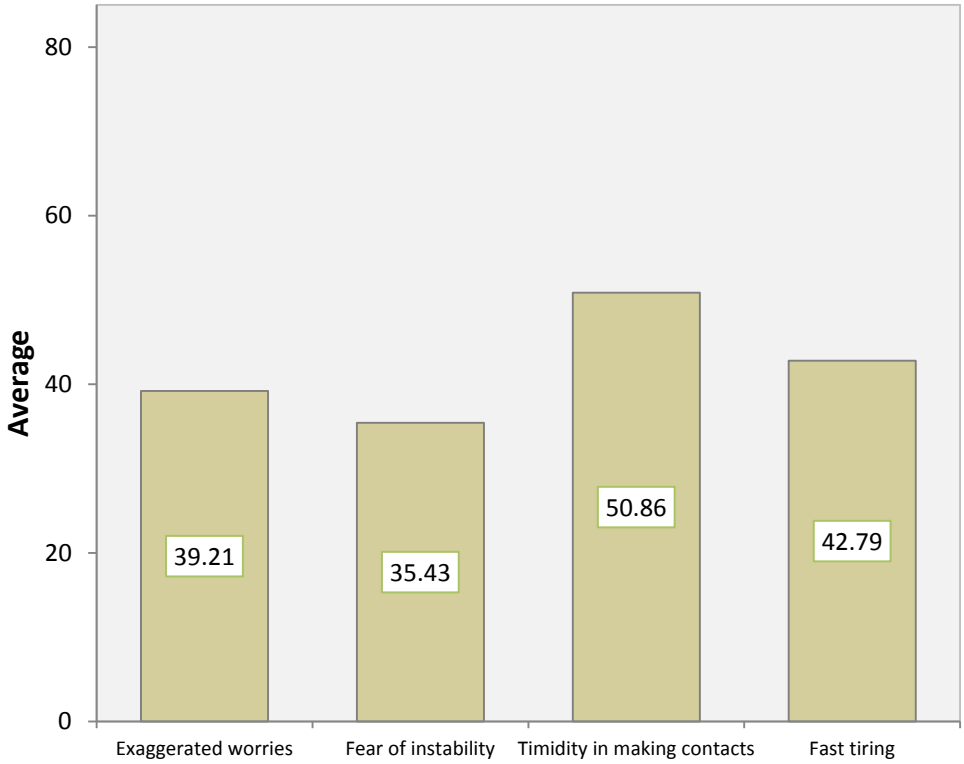
TCI- novelty seeking

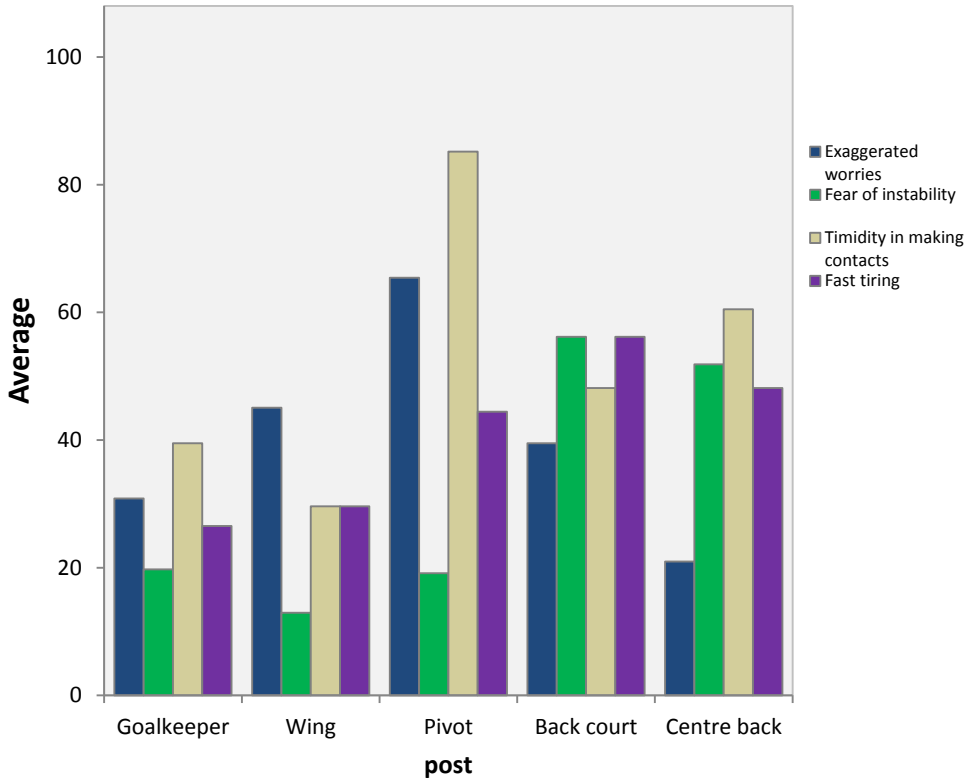




When examining the sub-factors it is worth focusing at the results deviating from the average as these need to be given adequate responses and solutions. According to the results, it seems clear that the wing players should be given new tasks and the pivots' low performances developed.

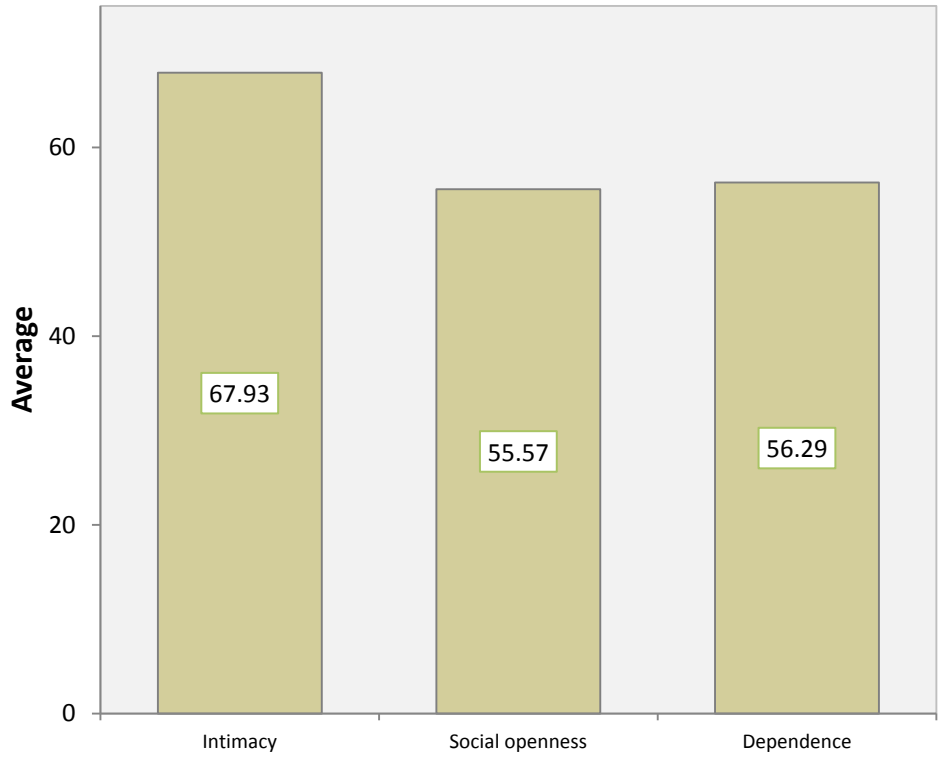
TCI- harm avoidance

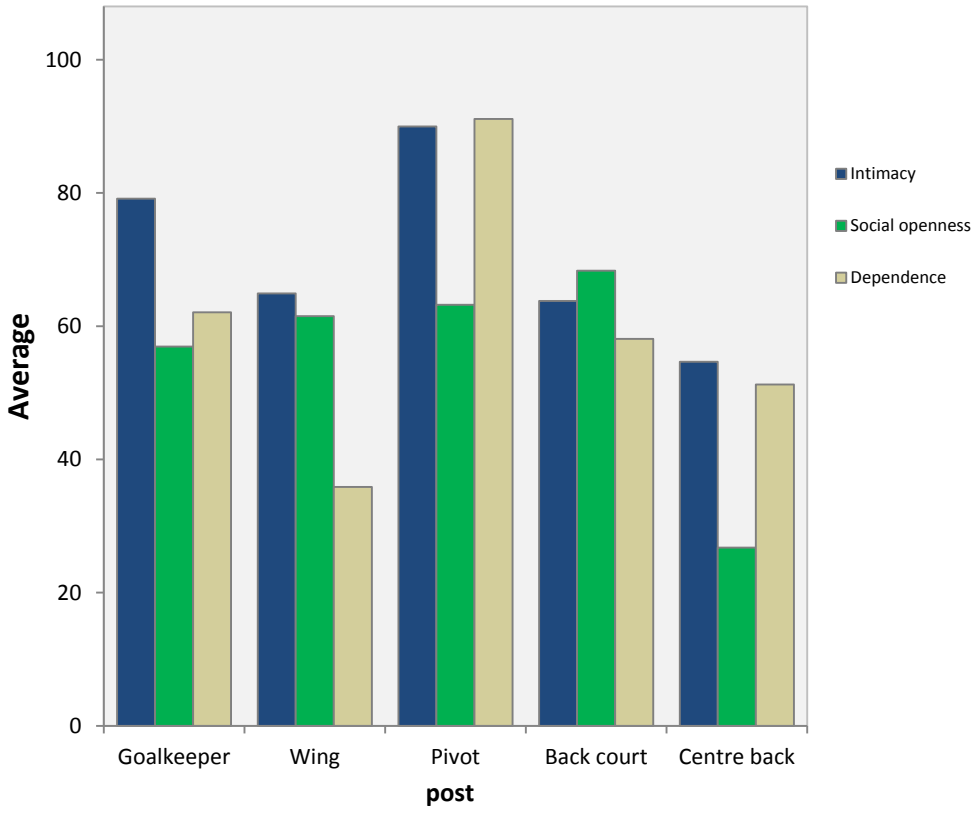




The sub-factors of harm avoidance are very informative concerning the whole of the team and also provide useful post-specific information for the coach. In case the high level of anxiety and fear of instability can be reduced, the team's efficiency will manifest in goals.

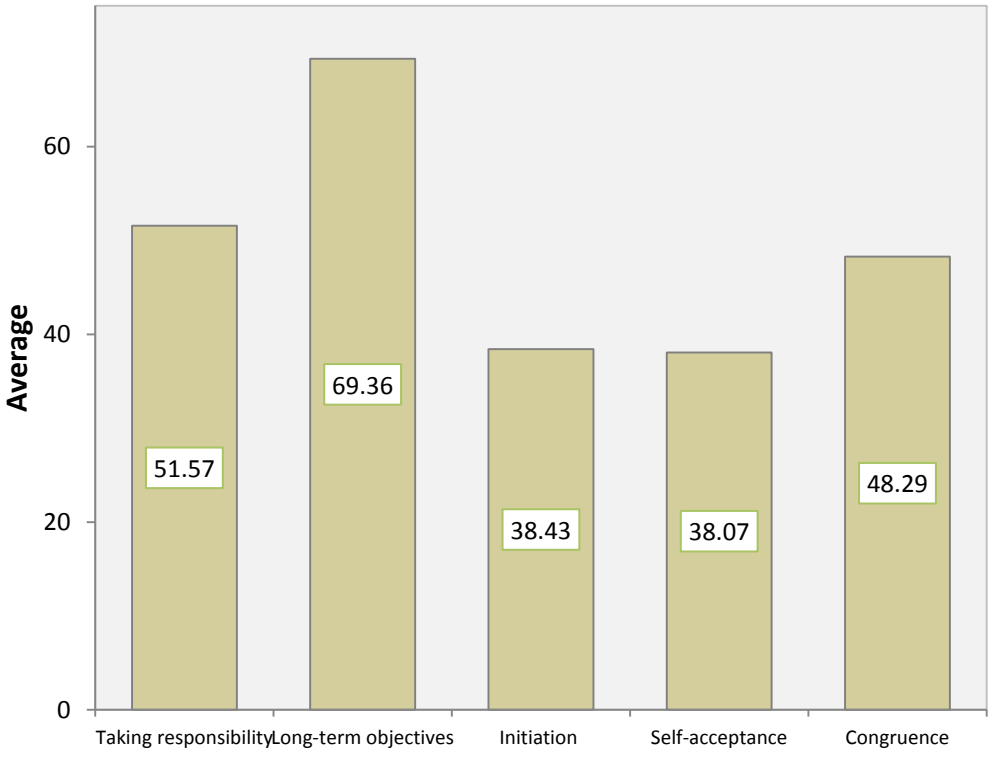
TCI- reward dependence

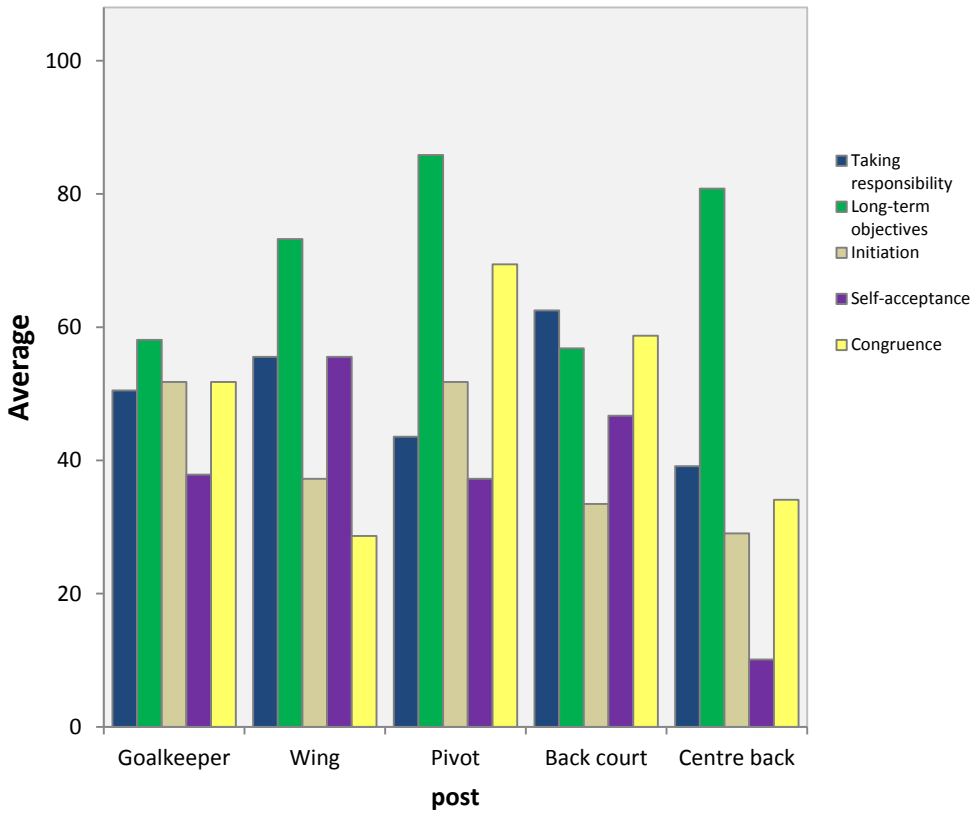




Perhaps one of the most useful parts of the tests is the result of TCI-reward dependency. It can provide a precise picture for the coach of his team and players and their inclination of being sensible to motivation by praises or encouraging words.

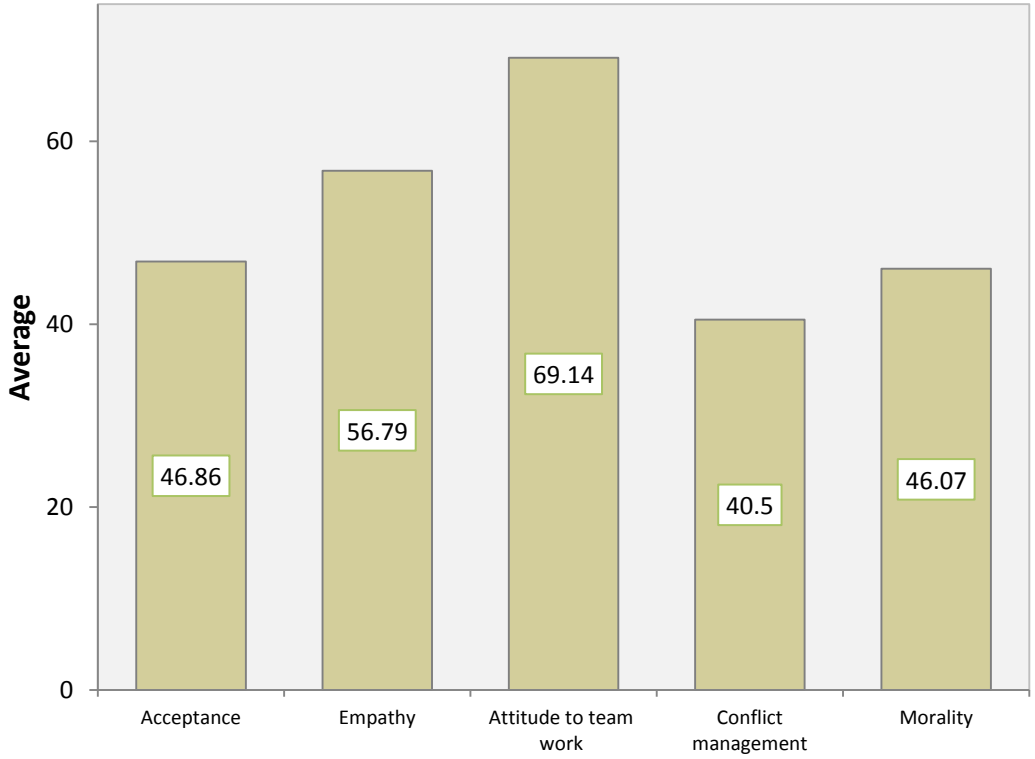
TCI-self-directedness

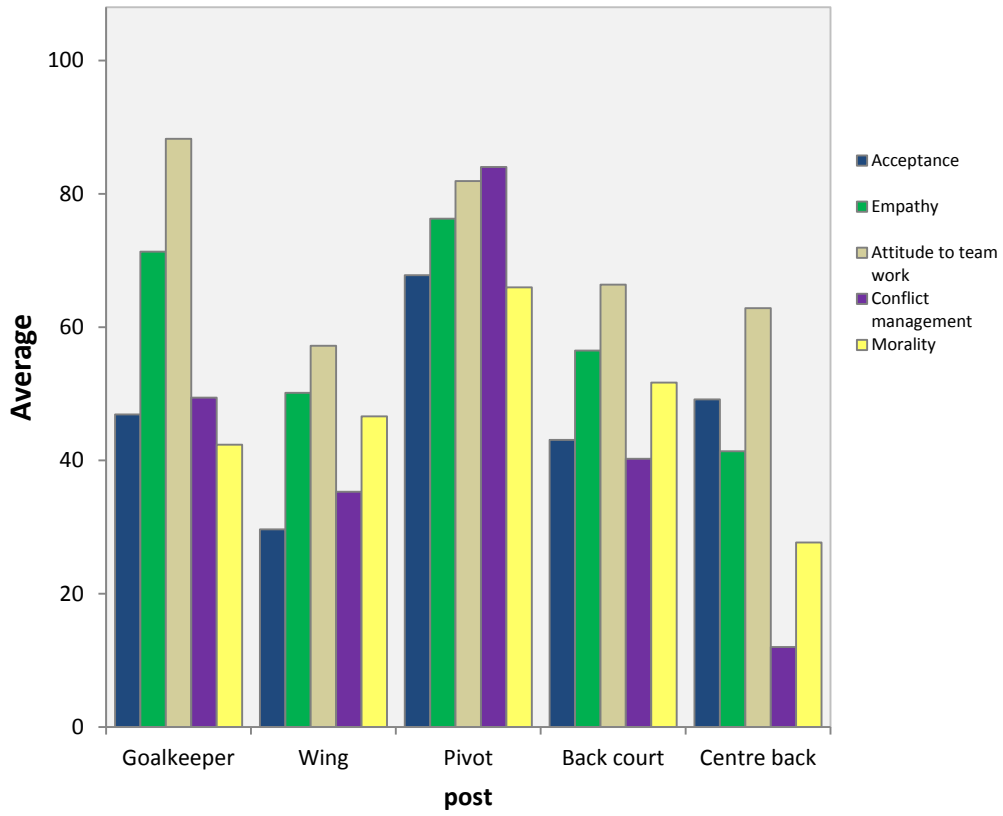




On the basis of the results we can state that in case the club works according to long-term objectives, they have made good choices concerning the players. However, in undertaking responsibility the picture seen is not as bright, although there probably are possibilities and methods for the improvement of this field. It is though thought-provoking that the lowest result in initiative and self-acceptance was shown by the centre backs.

TCI-cooperation

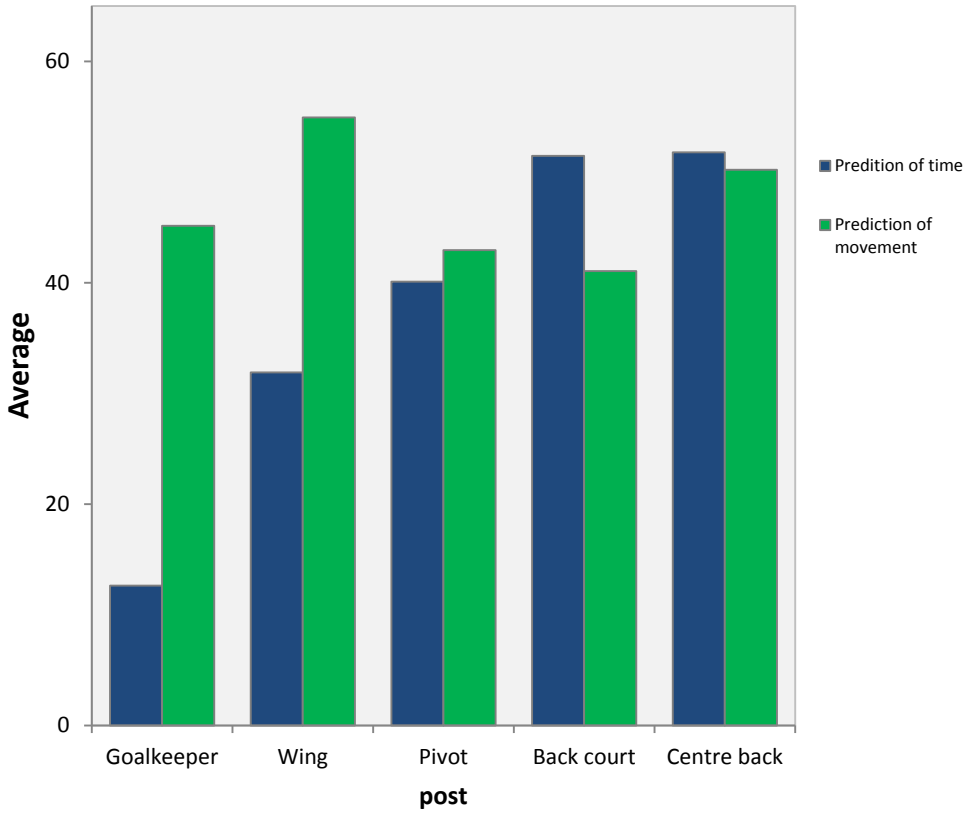




For a coach it may be a pleasure if the test assessing the attitude towards team work brings the results shown in the diagrams. The numbers are satisfying concerning both the team as a whole and the certain positions.

For a coach it is obvious that more attention must be paid to managing the conflicts, this may be a source of danger in the examined team and for the players – primarily with regard to the centre backs.

ZBA



In handball the ZBA test primarily predicts passing the ball to the other player in motion or the passes of the opponent or the team mates' or the opponents' movements.

This is definitely worth being examined by positions or persons.

As far as the goal keepers are concerned, it is visible that the players involved in the test probably throw a lot of bad passes during fast break. It is interesting that the best result in predicting motion was performed by the wing players, but their results are weaker than that of the other field players in predicting time.

This field is worth and necessary to be improved by hand ball specific training exercises: passing tasks growing more and more difficult during which we extend the distance and increase the time pressure.

V. Conclusions

This survey is not representative, it applies only to the sample examined. However, it is a gap filling and thought provoking work in the field of handball.

The result may be even more informative in case the coach and the psychologist do not analyze the data by tests or fields of examination but as a complex whole. Full analyses may provide additional information on the whole team or parts and players of the team besides the usual match statistics.

Within the frames of this material a condition assessment was made of the players and the team; the possibilities of further development may be elaborated within the frameworks of a new research and planning activity. However, our survey gives a clear picture of the fields the certain players should and could be developed subsequent to the instrumental tests. All coaches are responsible for defining the players' skills to be improved and the ways of improvement.

The tests presented above may provide a novelty and so far unutilized scientific background for handball that must not be neglected in the evaluation of a player's performance, relying merely on the feelings and intuitions of the trainer. Besides the development of the training methods and all kinds of technical background, psycho-diagnostic assessments and analyses offer a new, additional opportunity for handball that support the improvement in the capacities and skills, that is the performance of the player.

Thus efficiency, which is the unique standard of value in professional handball, can be realized at a higher level.

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MATCH LOAD EXAMINATION IN PLAYING HANDBALL BASED ON THE ANALYSIS OF THE TIME-SPAN OF BALL POSSESSION

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Abstract

Introduction – In the development of the handball teams' match tactics the time factor always plays a significant role. In the interest of victory it does matter though, how and in what style a team is playing, or how teams are making use of their time available for attacking. Time wise strategy like, how long a team possesses the ball, further stretched in the percentage of utilization within the active and passive game sections are maneuvering among the opportunities.

Methods – In this study I examine the performance of men and women national teams' and clubs' performance during decisive matches from the point of view of the offensive phase, frequencies and efficiency. I compare the results of the winners of the given matches to those of the losers, while I am also looking for a nexus in result variances caused by gender.

Results – Based on the examined sample I find it verifiable, that the duration of ball possession has no direct effect on whether a team wins or loses. Looking at the number of attacks and fastbreaks during a match, women have higher figures than men, but in all other respect of scoring opportunity utilization male teams surpass that of women.

Keywords: time-span, play style, match analysis

I. Introduction

Not only am I a practicing handball coach, but also an Assistant Professor of the Department of Sport Games at the Semmelweis University, Faculty of Physical Education and Sport Sciences, and as that, I do engage with the international top-ranking team play analysis. I have observed that top-level teams have always characterized their effort to have the flow of the match under their „control" for the most possible duration of the match. In my observation, this is primarily manifested in the way a team is "playing" with the match time, or figuratively: as they use time for their own benefit. I am convinced that the best opportunity for this kind of tactic based on the four basic phases (getting back in line of defense,

defending in set defense; fast counter-attack, attack against set defense) is when a team has ball possession, in other words, on the attack (Ökrös and Páll, 2009).

My topic is primarily motivated by the possibility of getting a measured range of pressure put on players by observing the different type of game events and the time left for tactical execution during offense. The teams are either speeding up or slowing down the game which I consider to be the main reason behind the above mentioned variations. This is a most significant aspect in coaching practice, because with this model the waves of "arrhythmic training pressure methods" (Dubecz, 2009) can be designed and dosed, which is the governing principle of handball training. According to my observations, in recent years two basic game concepts have been established by both male and female top-ranking international teams' offensive gameplay:

1, The so called "runfront game", which is a short duration, active attacking style of game play. In this concept, a highly dynamic, fast problem solving and executing style is the standard game, with risk-taking an integral part of the tactical plan. This type of game style increases the handball sport's attractiveness, hypes the media attention and the viewer attraction.

2, The so called. " stable ball possession based game" where the previously mentioned four basic gamestyles are a lot more recognizable. In this type of game the passive play has increased duration, as so even the active introductory part of the game is used for regeneration by the teams. Typical to this game style is attacking against set defense dominated by the long course of attack models and the deliberate organizational attack phases are switched with rhythm-shifts to make them dangerous.

While we are talking about different game concepts, we must see that both gamestyles have values that can be recognized in today's best teams' game. Categorizing a team does not necessarily mean that the dominant game conception leaves no room for different characteristic properties.

Attacks against disorganized defense is the first phase in enabling teams for speeding up or slowing down games. Here the depth and the width of the defense disorganized offers fast scoring opportunity creation and finishing (Ökrös and Páll, 2008). If the attacking team in possession of the ball have no intention to initiate a fast counter-attack, the volume of the attack is placed upon running against set defense. At this stage of the attack, the offense team is preparing the real attack, usually with seemingly pointless series of passes (a relatively

large distance from the goal) trying to deceive their opponent, or simply making position switches between the attacking and defensive lines. This is the so-called "Passive phase", where the passing occurs so far from the defense, that there is no actual attacker-defender contact. Thereafter, the so-called "Active phase", with the opening of a base game (which usually means a change in pace and rhythm), when the real intention of the attacking team is being revealed. Generally, these models are attacks that can help the team to momentarily beat their opponent in numbers in front of the goal-area, or positional advantage is created (Fekete, 2008). The duration of these models, ie the length, are varying. At this stage, the players' intervention capability is down to their timing skill, fast coordination and collective thinking. The defenders' protective activity also increases at this time, aiming to stop the attacks before scoring opportunities fold out, usually by breaking the offence team's rhythm with fouls (Ökrös, 2007).

By analyzing the games, the timely appearance and usage of the above mentioned phases varies per team. Based on previous studies (Aguilar, 2011; Pollany, 2009, Taborsky, 2008) I have examined the mismatch caused by gender distribution and the winning and losing teams. To prove the differences I had experienced, I have created a detailed study on samples conducted on the following hypotheses which I am investigating in this study:

1. The winning teams active gameplay time is longer than that of the losers.
2. The active and passive time is about 80-20% in favor for active participation.
3. The winning teams' ball possession time is longer than the one of the losers.
4. The number of attacks during women's matches is lower than that of men.
5. Fast attacks with active ball possession do occur more often against set defense than long attacks
6. The winning teams are more successful in scoring after fast attacks than the losing sides.
7. The winning teams use more fouls in their game, forcing their opponent to do free throws, than the losers.
8. Both men and women are more successful against disorganized defense

II. Methods

My study is carried out by analyzing many internationally recognized teams' performance during decisive matches (Table 1). In each case the decisiveness meant that the match fought by the two teams ended in a consequence which could not be correctedany more. Since the

teams have very well prepared players, the big stake means an emotional and physical pressure on the players, which gives a realistic picture of their skills.

Table Nr.1.: The basic data of the sample (*w=women, *m=men)

teams	gender	competition	date	place	stage	final score
NOR-FRAw*	women	WC	2011	Brazília	final	32:24
ESP-DENw*	women	WC	2011	Brazília	3. place	24:18
GYÖR1-POD1	women	CL	2012	Győr	final 1.	29:27
POD2-GYÖR2	women	CL	2012	Podgorica	final 2.	27:25
FRAm*-CRO	men	EC	2010	Ausztria	final	25:21
KIEL-BARC	men	CL	2011	Kiel	final	36:34
DENm*-SRB	men	Ec	2012	Szerbia	final	21:19
SWE-HUN	men	Olympics	2012	London	semi-final	27:26

In my study I used match observations. Subsequently, I analyzed the recorded games, because recordings help in a much more accurate noting of events and also made it possible to observe other aspects of the topic. My first step was to create very detailed records of all the attacks played, where I registered all occurring events during the teams' ball possession. My main observation criteria is as follow:

1. Start of the attack, which puts the time of gaining ball possession within the matches game time.
2. The attack is over with the loss of ball possession.
3. The duration of an attack is the time between the start and end of each attacking phase
4. The time interval between gaining ball possession and finishing the attack is categorized within the "active offensive play time", as long as the team attempts a fastbreak. I also deemed to this domain the fast phase against set defense leading up to the attack finish, as well as the loss of ball possession.
5. The "passive play time" includes a lot of game situations: time elapsed between the goal call and throw-off signal, unless the team hurries to start it quickly; time elapsed gaining a free-throw and taking it, if it is more than 3"

6. I included everything when the watch was stopped for any game break: time-out, injury, sending off, judging intermission, into „regular breaks”.
7. Free throw: fouls committed by the defenders during an attack period.
8. Finishing: details the situations before shoot on goal: long range shot, shot from the wing, pivot shot, break through, 7m shot, fastbreak.
9. Finishing effectiveness stands for the results of the attacks, scored goal, hit bar, or kept out by the goalkeeper. Technical errors result in the loss of ball possession.
10. The "match result” was very convenient to this study

III. Development

The teams’ active and passive play’s exact data can be observed in table Nr. 2. It appears that when the FRAm, DENm, ESP, NOR, SWE, KIEL, GYŐR1, POD2 teams left the field victorious, only the ESP, SWE, KIEL, POD2’s active play time was longer than their rivals. This leads to the realization that the active play time equals between winners and losers. In addition, men and women teams stand as equals in this respect as well.

Table Nr. 2: Use of attacking time in distribution of active / passive sections and in respect of winners / losings in the test sample (bolding the winner team, marked with * the longer attacking time)

team	gender/ category	time (sec)	activ (sec)	distribution (%)	passiv (sec)	distribution (%)	goal
FRAm	m/EC	**1583**	**1277**	**80**	**316**	**20**	**25**
CRO		*2017	1588	78,7	429	21,3	21
SRB	m/EC	*2061	1541	74,7	520	25,3	19
DENm		**1539**	**1262**	**82**	**277**	**18**	**21**
DENw	w/WC	1628	1278	78,5	350	21,5	18
ESP		***1972**	**1488**	**75,4**	**484**	**24,6**	**24**
NOR	w/WC	**1552**	**1318**	**84,9**	**234**	15,1	32
FRAw		*2048	1577	77	471	23	24
SWE	m/OL	***1823**	**1463**	**80,2**	**360**	**19,8**	**27**
HUN		1777	1451	81,6	326	18,4	26
KIEL	m/CL	***1841**	**1417**	**77**	**424**	**23**	**36**
BARC		1759	1414	80,4	345	19,6	34
POD2	w/CL	***1916**	**1554**	**81,1**	**362**	**18,9**	**27**
GYŐR2		1684	1289	76,5	395	23,5	25
GYŐR1	w/CL	**1612**	**1199**	**74,4**	**413**	**25,6**	**29**
POD1		*1988	1331	67	657	33	27
average		**1800**	**1403**	**78,1**	**397**	**21,9**	**25,9**

In table Nr. 2, beside the teams' active and passive play's exact data, the results' distribution in respect of ball possession is also represented.

It appears that an average of 1403 seconds of active and 397 of passive gameplay is played by the teams. Thus, the time spent on active attacking shared some 78.1% of their ball possession, while the passive 21.9%. This is where we can clearly see, that the winning teams are not always the ones with the better ball possession percentage. As we already experienced at the active playing time, winners can be found in the same number (ESP, SWE, Kiel, POD2) as losers (CRO, SRB, Frank, POD1) with the usage of longer attacking periods.

Table Nr. 3 shows that women teams attacked 461 times, which meant an average of 58 attacks per team per game.

Table Nr. 4 shows that 426 attacks occurred during men's match, which meant an average of 53 attacks per team. Thus, female teams carry out more attacks than male. On the other hand, in the utilization of scoring opportunities men teams are ahead with 49.1% against women's 44.7%.

The proportion of the attacking time distribution of attacks against disorganized and set defense can also be found in table Nr. 3 and 4.

In the second column are the attacks against disorganized defense (0-13 sec), in the third and fourth columns the fast attacks against set defense (14-30 sec), in the fifth, sixth and seventh column (31 sec and longer) the long attacks.

Table Nr. 3: The women teams' attack frequency and effectiveness regarding the span of active attack time. (Implications: UTR: utilization rate, PU %: percentage of utilization)

team/ time period	**0"-13"**	**14"-22"**	**23"-30"**	**31"-40"**	**41"-50"**	**51"→**	**∑**
ESP	10:3	14:6	20:13	13:2	3:0	0	60:24
DEN	20:5	12:2	15:6	8:3	4:1	1:1	60:18
NOR	15:7	16:9	17:10	10:5	3:1	0	61:32
FRA	7:4	15:6	18:4	18:9	1:1	2:0	61:24
GYŐR1	18:9	20:9	9:5	7:4	0	3:2	57:29
PODG1	13:9	18:10	11:4	7:3	4:1	3:0	56:27
PODG2	7:4	5:3	14:10	18:5	8:5	1:0	53:27
GYŐR2	10:3	15:7	15:10	9:4	2:1	2:0	53:25
UTR	100:44	115:52	119:62	90:35	25:10	12:3	**461:206**
average	12,5:5,5	14,5:6,5	14,9:7,7	11,2:4,4	3,1:1,2	1,5:0,3	**57,6:25,7**
PU %	44	45,2	52,1	38,9	40	25	**44,7**

Women played 234 fast (share: 64.8%) and 127 long (share: 35.2%) attacks against set defense. Men teams played 157 short duration (share: 47.6%) and 173 (share: 52.4%) long attacks. The total sample of 391 (56.6%) short duration and 300 (43.4%) long duration attacks means, that there is a significant difference recognizable, which is mainly because of women's game style.

Table Nr. 4.: Men teams' attack efficiency and frequency in respect of the length of active attack time. (Implications: UTR: utilization rate PU %: percentage of utilization)

team/ time	0"-13"	14"-22"	23"-30"	31"-40"	41"-50"	51"→	∑
SWE	11:6	3:2	8:6	17:8	6:2	5:3	50:27
HUN	10:6	6:3	11:5	10:7	10:5	3:0	50:26
DEN	5:4	7:4	13:4	15:7	4:1	1:1	45:21
SRB	11:3	1:1	4:3	13:5	8:3	9:4	46:19
FRA	17:8	6:5	12:6	12:3	2:2	3:1	52:25
CRO	8:6	6:2	13:4	9:6	14:2	3:1	53:21
KIEL	23:14	12:6	11:6	12:7	6:2	1:1	65:36
BARCA	11:8	23:10	21:10	7:4	3:2	0	65:34
UTR	96:55	64:33	93:44	95:47	53:19	25:11	**426:209**
average	12:6,9	8:4,1	11,6:5,5	11,9:5,9	6,6:2,4	3,1:1,4	**53,2:26,1**
PU %	57,3	51,6	47,3	49,5	35,8	44	**49,1**

By analyzing the two different game styles in respect of gender, we can find that women scored 114 fast attack goals out of 234 attacks which is a 48.7% utilization, while men scored 77 out of 157 attacks (49%). Women in long duration attacks scored 48 goals out of 127 attempts (37,8%), where as men scored 77 goals out of 173 attacks (44,5%). It is no wonder that women teams rather push fast attacks while men had no significant difference in opportunity utilization either way. On the other hand, this also means that the women's handball game is pursuing the acceleration of the play. Table Nr.5 shows the attack data of the winners, while Table Nr. 6 that one of the losers distributed by time periods.

Table Nr. 5: The winning teams fast attacks distributed by time periods. (Implications: UTR: utilization rate PU %: percentage of utilization)

teams/ attacking time	0-13"	14"-22"	23"-30"	UTR	PU %
Women	50:23	55:27	60:38	165:88	53,3
Men	56:32	28:17	44:22	128:71	55,5
UTR	106:55	83:44	104:60	293:159	**54,3**
PU %	51,9	53	**57,7**	54,3	-

Winning teams' fast attacks finished with a 54,3% success rate, while the losings' only 44,6%. It is well recognizeable that the winners were more successful in the time periods, but mostly within the 23"-30" period.

Table Nr. 6: The losing teams fast attacks distributed by time periods (Implications: UTR: utilization rate PU %: percentage of utilization)

teams/ attacking time	0-13"	14"-22"	23"-30"	UTR	PU %
Women	50:21	60:25	59:24	169:70	41,4
Men	40:23	36:16	49:22	125:61	48,8
UTR	90:44	96:41	108:46	294:131	**44,6**
PU %	48,9	42,7	**42,6**	44,6	-

I was also curious to see the time period variations and utilization rate from the point of view of winner and loser within the genders. Women teams' analysis (Table Nr. 7 and 8) made me believe, that there is no significant difference between winners (165) and losers (169), but the winners have a higher succes rate (53.3%) than the losers (41.4%).

Table Nr. 7: The winner female teams' fast attack frequencies and utilization rate. (Implications: UTR: utilization rate PU %: percentage of utilization)

teams/ attacking time	0-13"	14"-22"	23"-30"	UTR	PU %
ESP	10:3	14:6	20:13	44:22	50
NOR	15:7	16:9	17:10	48:26	54,2
GYŐR1	18:9	20:9	9:5	47:23	48,9
PODG2	7:4	5:3	14:10	26:17	65,4
UTR	50:23	55:27	60:38	**165:88**	**53,3**
PU %	**46**	49,1	**63,3**	53,3	-

Table Nr. 8: The losing female teams' fast attack frequencies and utilization rate. (Implications: UTR: utilization rate PU %: percentage of utilization)

teams/ attacking time	0-13"	14"-22"	23"-30"	UTR	PU %
DEN	20:5	12:2	15:6	47:13	27,6
FRA	7:4	15:6	18:4	40:14	35
PODG1	13:9	18:10	11:4	42:23	54,8
GYŐR2	10:3	15:7	15:10	40:20	50
UTR	50:21	60:25	60:24	**169:70**	**41,4**
PU %	**42**	41,7	**40,7**	41,4	-

Looking at the women's numbers it is proved, that the winning sides surpass their opponent in using their opportunities within the 23"-30" time period (63.3% against 40.7%), which is also detecable in the number of goals scored. The fact that fast attacks' (0-13") success rates are below expectations also meets the eye (46% against 42%)

The same is perceptible with men's tendencies (table Nr. 9-10) in respect of attacks played and utilization rate, since the winning sides hardly took more attacks than the losing (128 against 125), while the success rate (55.5% against 48.8%) is better than the womens'.

Table Nr. 9: The male winner teams' fast attack frequencies and utilization rate. (Implications: UTR: utilization rate PU %: percentage of utilization)

teams/ attacking time	0-13"	14"-22"	23"-30"	UTR	PU %
SWE	11:6	3:2	8:6	22:14	63,6
DEN	5:4	7:4	13:4	25:12	48
FRA	17:8	6:5	12:6	35:19	54,3
KIEL	23:14	12:6	11:6	46:26	56,5
UTR	**56:32**	28:17	44:22	**128:71**	**55,5**
PU %	57,1	**60,7**	50	55,5	-

It is eye-catching, that men teams' fast attacks in the viewpoint of time spent on the attack shows the biggest difference within the 0-13" time period (56 – 40), but the succes rate is very close (57.1% - 57.5%), which is still better than the women's rate. The utilization rate that shows the biggest difference is in between the 14"-22" time period (60.7% against 44.4%), even though the number of goals scored in this period is the same.

Table Nr. 10.: The losing male teams' fast attack frequencies and utilization rate. (Implications: UTR: utilization rate PU %: percentage of utilization)

teams/ attacking time	0-13"	14"-22"	23"-30"	UTR	PU %
HUN	10:6	6:3	11:5	27:14	51,9
SRB	11:3	1:1	4:3	16:7	43,7
CRO	8:6	6:2	13:4	27:12	44,4
BARC	11:8	23:10	21:10	55:28	50,9
UTR	**40:23**	36:16	49:22	**125:61**	**48,8**
PU %	57,5	**44,4**	44,9	48,8	-

Faults made by teams are shown in Table Nr. 11.. Women's winner-loser rate is about square (108-121), while men's (134-99), still, as the data shows, the women losing teams fault more

often, while it is the opposite at men, where the winner fault significantly more. A slight difference is read between women and men teams' number of faults per match (229 against 233). Looking at the whole test sample winners commit more fouls (242) than losers (220).

Table Nr. 11.: Number of free-throws (FT) distributed by gender and win/lose aspect.

Winners	Number of FTs	Losings	Number of FTs	Average number of FTs per match
NOR	26	**FRA**	**35**	61
ESP	**28**	**DEN**	26	54
GYŐR1	20	**PODG1**	**31**	51
PODG2	**34**	**GYŐR2**	29	63
winner women ∑	**108**	**loser women ∑**	**121**	**229**
average	27	**average**	30,2	57,2
FRA	**33**	**CRO**	15	48
KIEL	27	**BARC**	**41**	68
DEN	**38**	**SRB**	17	55
SWE	**36**	**HUN**	26	62
winner men ∑	**134**	**loser men ∑**	**99**	**233**
average	33,5	**average**	24,7	58,2
winners ∑	**242**	**losers ∑**	**220**	462
winners' average	30,2	**losers' average**	27,5	57,7

Table Nr. 12.: Various forms of attacks' frequencies and utilization rate by female teams. (UT: Utilization, AFD: attack finishing distribution, GD: goal distribution)

Teams	Attacks against disorganized defense	Fast attacks against set defense	Long attacks against set defense	∑
ESP	10:3	34:19	16:2	60:24
DEN	20:5	27:8	13:5	60:18
NOR	15:7	33:19	13:6	61:32
FRA	7:4	33:10	21:10	61:24
GYŐR1	18:9	29:14	10:6	57:29
PODG1	13:9	29:14	14:4	56:27
PODG2	7:4	19:13	27:10	53:27
GYŐR2	10:3	30:17	13:5	53:25
∑	100:44	**234:114**	127:48	461:206
UT %	**44**	**48,7**	**37,8**	44,7
AFD%	21,7	**51**	27,3	100
GD %	21,4	55,3	23,3	100

The success rate of attacks against organized and disorganized defense can be observed in Table Nr.12-13. 51% of women teams' attacks were fast attacks against set defense (234).

This type of game was also the most successful in utilization: 48.7%. Quite a surprise, that as for the fastbreaks, which are considered some relatively easier type of attacks, the success rate was 44% only, which is still better than the noneffective long attacks (37.8).

Table Nr. 13.: Various forms of led attacks' frequencies and utilization rate by men teams. (UT: Utilization, AFD: attack finishing distribution, GD: goal distribution)

Teams	Attacks against disorganized defense	Fast attacks against set defense	Long attacks against set defense	∑
SWE	11:6	11:8	28:13	50:27
HUN	10:6	17:8	23:12	50:26
DEN	5:4	20:8	20:9	45:21
SRB	11:3	5:4	30:12	46:19
FRA	17:8	18:11	17:6	52:25
CRO	8:6	19:6	26:9	53:21
KIEL	23:14	23:12	19:10	65:36
BARCA	11:8	44:20	10:6	65:34
∑	96:55	**157:77**	**173:77**	426:209
UT %	**57,3**	49	44,5	49,1
AFD %	22,5	36,9	40,6	100
GD %	26,3	36,8	36,8	100

Men teams' attacking playstyle indicates, that the number of fast (157:77 which means a 49% success rate) and long attacks (173:77 which means a 44.5%) against set defense as well as the utilization rate are close to one another. Although, the number of fastbreaks is far behind (96), it's success rate has by far the best indicator (57.3%) It is now safe to conclude, that men's best attacking tactic is the fastbreak (this proves incorrect in terms of women).

IV. Results and Discussion

The occurrence of longer play time was equaly present at the winning and the losing teams of the test sample, **so my first hypothesis was falsified.** Interesting enough that, there was no difference in distribution of the genders.

The average active play time is 78.1%, the average passive play time is 21.9% of the total duration of the matches, **so my second hypotheses was correct.**

The total ball possession of the teams during the matches indicated the same tendency as the active play time of the teams, i.e. the percentage of ball possession was equal between winning and losing teams. **So my third hypothesis was falsified.**

Since the total number of women team attacks was more than that of men **my fourth hypothesis was falsified as well.**

The teams play against set defense was rather effective at short time ball possessions, than at longer ones, **so my fifth hypothesis proved to be correct.**

Winning teams, regardless of gender, were more successful with fast attacks than the losing ones. **Based on this my sixth assumption is correct.**

It has been proved that winning teams force more free throws while defending, i.e. **my seventh hypothesis proved to be correct.**

Since my statement that attacks against disorganized defense are more successful than against organized ones were only correct in respect of men team, **my eight hypothesis was falsified.**

V. Conclusions

The analysis of the world's top-ranking national teams' and clubs' matches always warrants that we will be able to conclude valid ascertainments of handball.

I placed the emphasis of my study on attacks furthermore I investigated match pressure from the aspect of how teams use their attacks in the active and passive periods of the game. The analysis of my work has mainly two guidelines, the first one is the comparison of the winning and losing teams' statistics in the respect of the duration of attacking time, the other one is the observation of differences and similarities between genders in the aspect of occurrence and utilization of alternating attack time durations. In respect of the test sample the following conclusions might be drawn:

According to test results women and men teams are close to each other on indicators of time pressure. Consequently, teaching and evolving of the tempo and rhythm of the game should be solved using similar techniques with both genders.

Since this is an evolutionary process, and this study examined the outcome of this process, it forecasts a further research how this level could be achieved by training different aged groups.

In order to make the game more effective (this goes for top category teams as well) the game against disorganized defense should be qualitatively improved, since even men teams' utilization is barely good, while women's has to be considered poor.

This could be achieved by trying to reduce the number of ball possession losses in fast-paced movement situations and increase the shot efficiency on goal. As there is a well known inverse relationship between speed and accuracy, the highest speed level when players still will not begin to fail passes and shot has to be found and should be practiced during training sessions. In order to maintain an awareness of the time spent on attack, the team has to learn playing in short- and long-course play time intervals, by which they can develop their own rhythm. Spent time and current result must always be in this way connected and considered, because this is what often determines the need of actual playing style and tactics.

Based on the results, I believe that short and long attacks equally suit men teams ergo they can play both styles, if the situation demands so. Women rather pushed to use short duration attacks, in which they are more successful than in longer ones, and a possible reason for this is that they are trying to achieve their interpretation of speed by playing fastbreaks. In another approach, since during the longer attacks the number of ball losses and inaccurate passes, shots are increased it is safe to presume, that a prolonged attack will only result in less possibility to be in goal scoring opportunity. This is why women will not be looking for a better opportunity, when one already presents itself, since their chances to score is only getting slimmer. In addition, men's teams usually have more outstanding players, who can be effective and decisive in unexpected individual actions.

To the representatives of the 'runfront game' in the study are the Győr, the Norwegian and Danish women's teams and the French and Danish men's national teams as well as teams of Kiel and Barcelona. Representatives of the 'stable ball possession based game' in the study are the team of Podgorica and the French and Spanish women's national teams as well as the Croatian, Serbian and Sweden national teams. In my opinion, the Hungarian national team's gamestyle is equally characterized by both approaches. This classification is only meant for the match analysis entertained in this study. Further analysis would be required with more matches of the same team to conclude the real game concept with certainty.

In the dosage of the training pressure, exercises must be included, which modulate the experienced pressure rhythms-arrhythmias in this study.
For example: switching between slow, fast, maximum-intensity exercises, or combination of different types of exercises and tasks like conditional skill development exercises, attacking-

defensive basic element drills and tactical skill development individual-doubles-team participation and whole team exercises, exercising under light and difficult conditions .
But we can add full court games to this section, where we could develop the adaptability of our team to selected special match situations. For example, four minutes before the end, the other team is leading with three goals and we have are awarded a free throw.

Finally, it is very important to note, that the excitement and emotional overheating of the matches cannot be achieved ‘simply’ through exercises. Exercising tasks with consequences (punishment - reward) and competitive situations are needed during trainings, but unfortunately these are just approaching the stress situation which is waiting for our players during the match, for which we want to prepare them. ‘Always keep the team under stress’ I was told decades ago by my great teachers and coaches, some warning that as an eternal truth is still alive.

VI. References

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