SOME RELATIONS BETWEEN SYSTEMS OF SPECIFIC AND BASIC MOTOR DIMENSIONS WITH BOXERS

Stipe Blažević[1], Vesna Širić[2] and Žarko Bilić[3]

[1] *Faculty of Economics, University of Rijeka, Croatia*
[2] *Faculty of Law, University „J.J. Strossmayer", Osijek, Croatia*
[3] *Faculty of Natural Sciences, Mostar, Bosnia & Herzegovina*

Original scientific paper

Abstract

The sample of respondents in this research presented 92 boxers, age from 22 to 29, Croatian clubs, described with 15 basic motor and 8 specific boxing variable, in order to primarily use cross - correlation analysis and calculate connection between systems of manifest specific and basic motor variables. Then we applied canonical correlation analysis to determine structure of canonical factor and their correlation in order to ,based on this information, enable possibility of forming more rational procedures for their optimal modeling, planning, programming and training control, as well as optimal monitoring of relevant skill development during continuing selection of sportsmen and training process. The results of canonical correlation analysis indicated that relations between canonical factor from specific motor skills variable system, interpreted as integral canonical factor of speed – strength boxer coordination and canonical factor from basic motor skills variable system, interpreted as basic canonical factor of speed - coordination motor skills (conditional, agility), indicates they are statistically significant on the level .00 (p=.00) what completely confirms hypothesis about positive connection of this two areas. Based on obtained research results can be concluded that for deriving variables from the specific motor skill system, optimal motor skill of boxer is needed, based on integrally-interactive base, which completely confirms the assumption it is not possible to develop only one segment of anthropological status and that the other remains intact on such influence. This information can present important factors of transformational processes of programming in boxing, and more specifically that with development of basic motor skills in indirect way relevant boxer's specific motor dimensions can be developed.

Key words: *boxers, specific motor, dimensions, basic motor, relations*

Introduction and aim

Determining correlation of certain anthropological status segments and their impact on specific motor skills in certain sports, presents basic, but current practical and theoretical problem, which is significant because of possibility of forming more rational procedures for optimal orientation and sportsmen selection, planning, programming and control of training as well as effective monitoring of relevant anthropological feature development during training process (Savić, 1986; Malacko & Popović, 2001; Malacko & Rađo, 2004). Bearing in mind that boxer in ring is solving many problematic situations; it is assumed that determining correlations between basic and specific motor skills of one boxer can be one of essential indicators in achieving the best results. Considering complexity of boxing specification formula it is hard to assume which anthropological characteristics are more and which less relevant for success in this sport. For this reason, in current conditions their foundation is more the result of subjective estimation then real hierarchy within equation of boxing specification. Understanding hierarchical factor structure that results in boxing depend on, as well as their correlations and impacts, presents fundamental assumption (Gredelj, Metikoš, Hošek & Momirović, 1975; Filimonov, 2000; Blažević, 2006; Blažević, 2007; Blažević, Širić & Matas, 2008).

The aim of the research is to primarily with cross correlation analysis measures connection between system of manifest specific and basic motor dimensions and then with canonical correlation analysis for each area determine structure of canonical factors and their correlation in order to , based on this information, created possibility to form much more rational procedures for their optimal modeling, planning, programming and control of training and optimal monitoring of relevant skill development during continuous selection of sportsmen and training process.

Methods

On the sample of 92 boxers from Croatian boxing clubs, of different weight categories, system of 23 variable was prepared, out of which 8 variables of specific motor skills (as criteria variables) and 15 variables of basic motor skills (as predictor variables). For assessment of specific movement structures following variables were applied: 1 skipping rope "SKIP" 10 sec (S SKIP10), 2. the speed of 100 straights onto a punch bag (S BR100D), 3. speed of performing combined punches on the punch bag: two straights, two hooks and two uppercuts (SBR100K), 4. legs together jump 10 sec performing left, right straight

punch (SSUNPOD), 5. legs together jumps 10 sec and performing left – right hook (SSUNPOK), 6. legs together jumps 10 sec and performing left-right uppercut (SSUNPOA), 7. defense from left straight punch and parrying three straight punches – defense from right straight punch by step aside and parrying three straight punches onto the coach's hands (SKONTRA) and 8. and series of 100 combined punches onto the coach's hands: left straight punch , right uppercut, left-right hook, step aside from the left straight punch and parrying with the right straight punch (SSER100). Metric characteristics, standardization and procedures of 8 mentioned specific motor variables were determined in the research of Savić (1986) using factor validity, in which 89.40% of the common variance was used by the main component. For the estimation of basic motor skills the following variables were applied; 1. pulling through and jumping over (MBKPOP), 2. agility in the air (MKTOZ), 3. polygon backwards (MREPOL), 4. hand tapping (MBFTAP), 5. leg tapping (MBFTAN), 6. leg tapping against the wall (MBFTAZ), 7. long jump from a stand (MFEDM), 8. throwing medicine ball while lying down (MFEBML), 9. 20 m run from a high start (MFE20V), 10. leg lifting while lying down (MRCDNL), 11. Deep squats with load (MRLDCT), 12. pulling up body on high bars arms in backward grip (MRAZGP), 13. Forward bend on the bench (MFLPRK), 14. Forward bend straddle (MFLPRR), and 15. forward bend to the right (MFLPRD). Metric characteristics of basic motor dimensions were determined in many researches (Gredelj, Hošek, Metikoš & Momirović, 1975) by factor validity and reliability parameters. Correlation of applied manifest variables for both areas (specific motor and basic motor) was conducted with canonical correlation analysis. Starting with assumption that two applied multidimensional anthropological variable systems are linearly connected, first we conducted interpretation of cross correlation matrix and then with solving characteristic equations we obtained the roots of these (λ). Applying Bartlett's χ^2-test on the level $p<.01$ statistical significance of canonical correlation coefficient (Rc) was tested, which explains linear combinations of the variable sets i.e. connection between two different variable systems. By solving characteristic equations of cross correlation matrix, we obtained the roots of these equations and squares of canonical correlation (Rc^2) which explain common variable variance from two sets. Using this we can predict percentage (5) of success in applied system of criteria variables.

Results

Table 1. Basic statistical parameters (specific motor)

Variable	M	min	max	S	Se	Sk	Ku
SSKIP10	20.70	13	25	2.73	.28	-1.11	.43
SBR100D	185.80	139	269	25.93	2.70	**.79**	2.00
SBR100K	249.86	160	345	37.65	3.92	**-.29**	1.39
SSUNPOD	18.96	12	24	2.43	.25	**-.41**	.55
SSUNPOK	17.95	11	23	2.45	.25	**-.46**	.61
SSUNPOA	17.48	11	24	2.75	.28	**.08**	-.06
SKONTRA	21.48	14	32	4.79	.49	**.76**	-.41
SSER100	262.31	180	329	37.38	3.89	**-.81**	-.13

Table 2. Basic statistic parameters (basic motor)

Variable	M	min	max	S	Se	Sk	Ku
MBKPOP	104.09	70	190	24.45	2.54	1.38	2.73
MKTOZ	59.79	38	118	16.47	1.71	1.57	2.67
MREPOL	87.29	59	140	16.17	1.68	**.64**	1.64
MBFTAP	40.54	30	49	3.94	.41	**-.41**	-.26
MBFTAN	57.38	43	72	6.42	.67	**-.39**	-.26
MBFTAZ	28.85	20	36	3.49	.36	**-.28**	-.40
MFEDM	237.13	168	279	23.62	2.46	**-.52**	.09
MFEBML	79.39	61	98	10.29	1.07	**-.04**	-1.31
MFE20V	30.55	27	38	2.96	.30	**.36**	-.08
MRCDNL	72.36	46	97	12.73	1.32	**.29**	-.68
MRLDCT	28.31	18	41	4.48	.46	**.59**	.25
MRAZGP	17.63	9	28	5.02	.52	**-.03**	-1.05
MFLPRK	28.03	6	41	7.94	.82	**-.57**	.10
MFLPRR	59.01	27	78	9.81	1.02	**-.75**	1.53
MFLPRD	46.29	20	65	9.08	.94	**-.67**	1.07

Table 3: Cross-correlations (specific and basic variable)

Variable	SSK IP10	SBR 100D	SBR 100K	SSU NPOD	SSU NPOK	SSU NPOA	SKO NTRA	SSE R100
MBKPOP	**-.72**	**.91**	**.85**	**-.88**	**-.88**	**-.86**	**.83**	**.84**
MKTOZ	**-.83**	**.90**	**.85**	**-.88**	**-.88**	**-.85**	**.89**	**.80**
MREPOL	**-.69**	**.86**	**.84**	**-.87**	**-.87**	**-.88**	**.79**	**.92**
MBFTAR	**.71**	**-.49**	**-.43**	**.63**	**.63**	**.51**	**-.72**	**-.44**
MBFTAN	**.70**	**-.64**	**-.59**	**.79**	**.78**	**.73**	**-.85**	**-.68**
MBTTAZ	**.65**	**-.59**	**-.49**	**.70**	**.70**	**.62**	**-.76**	**-.54**
MFESDM	.16	.12	.19	-.20	**-.20**	**-.31**	.09	**.52**
MFEBML	**-.43**	**.66**	**.67**	**-.73**	**-.73**	**-.76**	**.69**	**.83**
MFE20V	**-.52**	**.44**	**.33**	**-.52**	**-.53**	**-.48**	**.45**	**.36**
MRCDNL	.08	.16	**.23**	**-.27**	**-.26**	**-.36**	.17	**.50**
MRLDCT	.01	.15	.18	**-.22**	**-.22**	**-.26**	**.21**	**.37**
MRAZGP	**.31**	-.05	.02	**-.08**	-.08	-.15	-.10	**.35**
MFLPRK	**-.25**	**.42**	**.50**	**-.48**	**-.48**	**-.57**	**.49**	**.74**
MFLPRR	**-.27**	**.47**	**.56**	**-.46**	**-.45**	**-.55**	**.49**	**.72**
MFLPRD	**-.34**	**.55**	**.64**	**-.50**	**-.49**	**-.59**	**.54**	**.71**

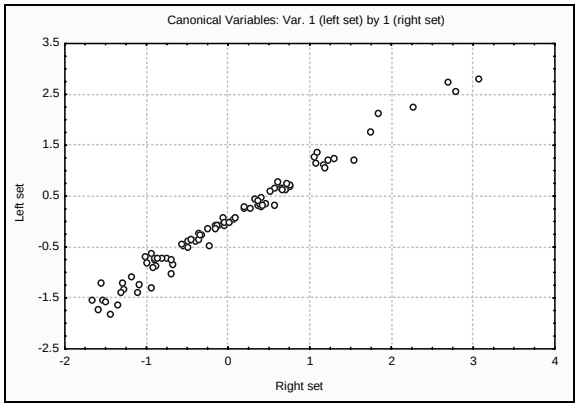
	λ	Rc	Rc^2	χ^2	p
1	.00	.98	.97	729.0	**.00**
2	.00	.93	.86	424.9	**.00**
3	.03	.85	.72	264.4	**.00**
4	.12	.76	.58	161.8	**.00**
5	.30	.64	.40	92.7	**.00**
6	.52	.55	.30	51.1	**.00**
7	.75	.45	.21	22.6	.20
8	.95	.22	.04	3.9	.86

Table 4: Canonical factors of specific motor skills

Variable	Fc-1	Fc-2	Fc-3	Fc-4	Fc-5	Fc-6
SSKIP10	**-.77**	-.43	-.11	.24	.24	.15
SBR100D	**.92**	-.15	.16	.24	.11	-.01
SBR100K	**.90**	-.04	.36	.18	.03	.07
SSUNPOD	**-.92**	-.01	.10	-.01	.15	-.23
SSUNPOK	**-.91**	-.00	.10	-.02	.14	-.23
SSUNPOA	**.91**	-.14	.00	-.03	-.01	-.19
SKONTRA	**.89**	-.23	-.00	-.31	.01	.16
SSER100	**.91**	.38	.08	.01	-.03	-.00

Table 5. Canonical factors of basic motor skills

Variable	Fc-1	Fc-2	Fc-3	Fc-4	Fc-5	Fc-6
MBKPOP	**.96**	-.06	-.11	.14	.00	-.01
MKTOZ	**.96**	-.18	-.03	-.02	-.05	-.06
MREPOL	**.96**	.14	-.01	.04	-.10	-.11
MBFTAP	**-.64**	.33	.34	.32	.38	.00
MBFTAN	**-.82**	.09	.29	.36	.09	-.13
MBFTAZ	**-.73**	.23	.43	.25	.06	-.06
MFEDM	.26	**.79**	-.04	-.07	.25	-.01
MFEBML	**.80**	.31	-11	-.09	.13	.20
MFE20V	**.51**	-.19	-35	-.05	-.07	-.25
MRCDNL	.29	**.66**	-.01	-.11	.17	.23
MRLDCT	.27	**.40**	-.12	-.13	.19	.10
MRAZGP	.07	**.79**	-.10	.10	-.07	.13
MFLPRK	**.59**	.56	.15	-.36	.20	.02
MFLPRR	**.58**	.49	.29	-.27	.24	-.03
MFLPRD	**.62**	.36	.37	-.22	.25	-06



Graph 1. Canonical variables

Discussion and conclusions

Analyzing table 1, where we presented central and dispersive parameters of specific motor skill variables, as well as their discrimination with skewness, it is clearly visible that with all applied variables distributions is normal (symmetric), since they do not exceed the value higher then 1.00 and they are marked with an asterix (*), while variable of skipping rope "SKIP" 10 SEC (S SKIP 10) is slightly abnormally distributed, and its symmetric is expressed negatively, which means that one part of respondents had increased values (actually weaker results), but since the values are expressed in seconds), where the lower value is actually the better one, this means that the majority of respondents in this variables had better values. Unlike the specific motor variables, in the system of basic motor variables (table 2) all applied variables possess satisfactory discrimination, regarding the fact the skewness values do not exceed 1.00, which indicates they are adjusted to respondents and appropriate for further process and interpretation. Only in variables pulling through and jumping over (MBKPOP) and agility in the air (MKTOZ) the respondents achieved lower values, but still in satisfactory limits. From the analysis of cross correlation matrix of criteria variable system of specific motor skills and predictor system of basic motor variable (table 3) relatively high and statistically significant correlations of variable pairs of both anthropological areas are noted. Variable pulling up body on high bars arms in backward grip (MRAZGP), statistically correlates only with skipping rope "SKIP" 10 sec (SSKIP10) and series of 100 combined punches onto the coach's hands: left straight punch, right uppercut, left-right hook, step aside from the left straight punch and parrying with the right straight punch (SSER100) but does not correlate with any other variable in criteria system of specific motor variables, what indicates that it this variable is almost completely specific, since it is performed only by hands and in slow rhythm. Variable deep squats with load (MRLDCT) is not in statistically significant correlations with variables skipping rope "SKIP" 10 sec (S SKIPQ0), the speed of 100 straights onto a punch bag (S BR100D), and speed of performing combined punches on the punch bag: two straights, two hooks and two uppercuts (SBR100K), while with other variables is in relatively weak correlations.

Basic motor variable lifting legs while laying down (MRCDNL) is not in statistically significant correlations with variables skipping rope "SKIP" 10 sec (SSKIP10), the speed of 100 straights onto a punch bag (S BR100D) and Defense from left straight punch and parrying three straight punches – defense from right straight punch by step aside and parrying three straight punches onto the coach's hands (SKONTRA), but with other specific motor variables is also in week correlation. Basic motor variable long jump from a stand (MFEDM) is not in statistically significant correlation with variables skipping rope "SKIP" 10 sec (S SKIPQ0), speed of performing combined punches on the punch bag: two straights, two hooks and two uppercuts (SBR100K), the speed of 100 straights onto a punch bag (S BR100D) and defense from left straight punch and parrying three straight punches – defense from right straight punch by step aside and parrying three straight punches onto the coach's hands (SKONTRA). Solving characteristic equation of cross correlation matrix roots of these equations as 6 canonical factors were isolated. During determining correlations applying Berlet's Hi – square test (χ^2) of criteria system of specific motor variables and predictor system of basic motor variables (table 1) very high canonical correlations were obtained for all 6 isolated canonical factors that rate from .55 (Rc=.55) to .98 (Rc=.98) and statistically significant on the level of .00 (p=.00). Squares of canonical correlation (Rc2) that explain common variable variance from two sets of total variability of analyzed variable system rate from .30 to .97 (Rc^2 =.30 do Rc^2 =.97).

Based on obtained results contained in canonical factor structure matrix in variable system of specific motor skills (table 4), according to expected, statistically significant correlations of all aplied specific motor skill variables and the first canonical factors are noted. Isolated canonical factor is defined with relatively high values of statistically significant canonical coefficients of correlation ranging from .77 to ,92. Considering that the structure of isolated canonical factor constitutes of all applied manifest variables of specific motor abilities, it can be interpreted as integral canonical factor of speed-strength boxer's coordination.

In table 5, where we presented structure canonical factor matrix of basic motor skills, it is clearly visible that in the first canonical factor the rate of statistically significant correlation coefficients goes from .51 to .96, and it consists of coordination variables - pulling through and jumping over (MBKPOP), agility in the air (MKTOZ), polygon backwards (MREPOL), then the speed of alternative movement – hand tapping (MBFTAP), leg tapping (MBFTAN), leg tapping against the wall (MBFTAZ), explosive strength- throwing medicine ball while lying down (MFEBML), 20 m run from high start (MFE20V), as well as flexibility – forward bend on the bench (MFLPRK), forward bend straddle (MFLPRR) and forward bend to the right (MFLPRD).

Considering that the structure of the first isolated canonical factor is made of mentioned manifest variables of basic motor skills, it can be interpreted as canonical factor of speed – coordination basic motor skill (conditionally, agility) of a boxer. The second canonical factor of basic motor skills can be interpreted as basic (explosive and repetitive) strength, regarding it is defined by variables long jump from a stand (MFEDM), leg lifting while lying down (MRCDNL), deep squats with load (MRLDCT) and pulling up body on high bars arms in backward grip (MRAZGP). Results of canonical correlation analysis proved that correlations between the first canonical factor from variable system of specific motor skills, interpreted as integral canonical factor of speed – strength boxer's coordination and canonical factor from variable system of basic motor skills, interpreted as basic canonical factor of speed-coordination motor skills (conditional, agility), indicates they are statistically significant on the level of .00 (p=.00). Modern boxing requires the fight to perform rapidly and to contain many specific motor motions (technical) structured, and of all specific motor skills; speed, coordination, explosive and repetitive strength and speed-strength durability have dominant role. Considering that the boxer, except extremely pronounced desire to fight, is more aimed at realistic then symbolic destruction of the opponent, it is necessary to, within relevant specific motor movement structure, test the significance of basic motor skills. Since the relevance of basic motor skills for boxing is undoubted, it was necessary to determine which of them are more or less required to achieve top results. Based on this empiric research the assumption was confirmed that in boxing specific motor skills of movement speed, coordination, coordination of arms and legs, explosive and repetitive strength as well as anaerobic-aerobic capacity are of large significance.

Almost equally in the boxing fight of great importance are the basic motor skills, body coordination, frequency of movement, flexibility, explosive and dynamic strength. By determining relations with canonical correlation analysis between the first canonical factor from the variable system of specific motor skills , interpreted as integral canonical factor of speed-strength boxer's coordination and the first canonical factor from the variable system of basic motor skills, interpreted as canonical factor of speed-coordination motor skills (agility), that is responsible for ability of resolving basic motor boxer's task, indicates that boxers, in specific motor skills (as system of criteria variables) achieve good results thanks to increased level of speed-coordination basic motor skills (agility) of a boxer and the other way around.

Since the structure of the second canonical factor in the space of specific motor skills was unable to interpret because of nonexistence of statistically significant correlation coefficients of certain variables with another canonical factor, he couldn't be interpreted at all. This means that the second canonical factor in the area of basic motor variables, interpreted as basic (explosive-repetitive) strength, substantially does not contribute directly to specific - situational conditions of boxer's performance.

The results of the research clearly proved that in boxer's training process, program contents were well balanced, which may mean, on the one hand, they are largely focused on developing basic motor abilities, which correlate with specific motor skills, and form the basis of the boxer's training process, or, on the other hand, that specific training program contents, to a large extent, influenced the improvement of the results in basic motor abilities.

Literature

Blažević, S. (2006). *Relacii pomegu specifičnite motorički sposobnosti i morfološkite karakteristiki, bazičnite motorički sposobnosti, kognitivnite sposobnosti i konativnite karakteristiki kaj vrvnite bokseri*. [Relations among Specific Motor Abilities and Morphological Characteristics, Basic Motor Abilities, Cognitive Dimensions and Conative Characteristics at Elite Boxers. In Macedonian.]. (Dissertation). Skopje: Fakultet za fizička kultura.

Blažević, S. (2007). Relations between Morphological and Specific Motor Dimensions at Boxers. *Acta Kinesiologica*, *1*(1), 20-25.

Blažević, S., Širić, V., & Matas. A. (2008). Factor Structure of Boxer's Motor Abilities. *Acta Kinesiologica*, *2*(2), 30-36.

Filimonov, V.I. (2000). *Boks. Sportivno-tehničeskaja i fizičeskaja podgotovka*. [Boxing. Sport-techniques and physical preparing. In Russian.]. Moskva: Insan.

Gredelj, M., Metikoš, D., Hošek, A., & Momirović, K. (1975). Model hijerarhijske strukture motoričkih sposobnosti. [Model of hierarchical structure of motor abilities. In Croatian.]. *Kineziologija, 5*(1-2), 7-74.

Malacko, J., & Popović, D. (2001). *Metodologija kineziološko antropoloških istraživanja. 3. izdanje.* [Methodology of kinesiological anthropological researches, 3rd Edition. In Serbian.]. Leposavić: Fakultet za fizičku kulturu.

Malacko, J., & Rađo, I. (2004). *Tehnologija sporta i sportskog treninga*. [Technology of sport and sports training. In Bosnian.]. Sarajevo: Fakultet sporta i tjelesnog odgoja.

Savić, M. (1986). *Relacije bazičnih psihosomatskih dimenzija i specifičnih sposobnosti boksera.* [Relations between basic psychosomatic dimensions and specific boxers abilities. In Serbian.]. (Dissertation). Novi Sad: Fakultet fizičke kulture.

NEKE RELACIJE IZMEĐU SUSTAVA SPECIFIČNIH I BAZIČNIH MOTORIČKIH DIMENZIJA KOD BOKSAČA

Sažetak

Uzorak ispitanika u ovom istraživanju predstavljao je 92 boksača, uzrasta 22 do 29 godina, iz hrvatskih klubova, opisanih s 15 bazičnih motoričkih i 8 specifičnih boksačkih varijabli, sa ciljem da se najprije kroskorelacijskom analizom izračuna povezanost između sustava manifestnih specifičnih i bazičnih motoričikih varijabli, a zatim kanoničkom korelacijskom analizom za svaki prostor utvrdi struktura kanoničkih faktora i njihove međusobne relacije, kako bi na temelju ovih informacija postojala mogućnosti formiranja što racionalnijih procedura za njihovo optimalno modeliranje, planiranje, programiranje i kontrolu treninga, kao i optimalno praćenje razvoja relevantnih sposobnosti u tijeku kontinuirane selekcije sportaša i trenažnog procesa. Rezultati kanoničke korelacijske analize su pokazali da relacije između kanoničkog faktora iz sustava varijabli specifičnih motoričkih sposobnosti, interpretiranog kao integralni kanonički faktor brzinsko snažne koordinacije boksača, i kanoničkog faktora iz sustava varijabli bazičnih motoričkih sposobnosti, interpretiranog kao kao bazični kanonički faktor brzinsko koordinacijskih motoričkih sposobnosti (uvjetno, agilnost), pokazuje da su one statistički značajne na razini p<.01 (p=.00), čime je u potpunosti potvrđena hipoteza o pozitivnoj povezanosti ova dva prostora. Na temelju ovako dobivenih rezultata istraživanja može se zaključiti da je za izvođenje varijabli iz sustava specifičnih motoričkih sposobnosti neophodna optimalna bazična motorička sposobnost boksača, utemeljena na integralno-interaktivnoj osnovi, čime je u potpunosti potvrđena pretpostavka da nije moguće razvijati jedan segment antropološkog statusa a da drugi bude intaktan na takve utjecaje. Ove informacije mogu predstavljati važne faktore programiranja transformacijskih procesa u boksu, konkretnije, da se razvojem bazičnih motoričkih sposobnosti na indirektan način mogu razvijati i relevantne specifične motoričke dimenzije boksača.

Ključne riječi: *boksači, specifična motorika, dimenzije, bazična motorika, relacije*

Received: January 17, 2010.
Accepted: May 10, 2010.
Correspondence to:
Asst.Prof. Stipe Blažević, PhD.
University of Rijeka
Faculty of Economy
51000 Rijeka, Ivana Filipovića 4, Croatia
Phone: 00 385 (0)51 355 111
E-mail: stipe@efri.hr