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Structural analysis of the situational efficiency in the kickboxing disciplines full contact and low kick

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Abstract
Main purpose is determination of the latent dimensions of fight that are derived from the specific situational conditions, ie Kickboxing competitions, on sample of 78 examinees, participants on the Balkan's championship in kickboxing from Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Montenegro and Serbia, aged from 18 to 33 years, that took place in Tesanj (BiH) in 2007. On the championship, in each category participated one competitor who is the winner of the national championship at the country he represents. Given variables were esimated by three competent assessors with the special protocol. All fights were recorded with two digital cameras covering from two angles. Fourteen latent dimensions have been determined with the component factor analysis together with the 76.32% of complete explained variability.

Key words: **Structural analysis, kickboxing, full contact**

Sažetak
S ciljem utvrđivanja latentnih dimenzija borbe koji proizilaze iz specifično situacionih uslova tj. Kickboxing takmičenja, na uzorku od 78 ispitanika, učesnika Balkanskog prvenstva u Kickboxingu iz Albanije, Bosne i Hercegovine, Bugarske, Hrvatske, Makedonije, Crne Gore i Srbije, uzrasne dobi 18 do 33 godine, koje se održalo u Tešnju (BiH) 2007 godine. Na takmičenju su učestvovali u svakoj kategoriji po jedan takmičar koji je pobjednik nacionalnog prvenstva u zemlji za koju se takmiči. Zadate varijable su procjenjivala tri kompetentna procjenjivača uz poseban protokol. Sve borbe su snimljene sa dvije digitalne kamere iz dva ugla. Komponentnom faktorskom analizom je utvrđeno četrnaest latentnih dimenzija uz 76.32 % ukupno objašnjenog varijabiliteta.

Ključne riječi: **Strukturalna analiza, kik box, ful kontakt**

Introduction

Regarding the clasification of sports, taking into account their complexity, kickboxing belongs to the group of polystructural acyclic sports, which means that it is not possible to predict the solutions or they are highly compoundly structured, ie in which structure dominates the direct conflict and symbolic destruction of the opponent (Malacko 1986). These are the reasons why kickboxer has to be in dispose of comprehensive and purposeful repertoire of motoric activities, automated in training and refinement process with high efficiency and operationalisation on the competition (Kapo, 1999). Consequently, kickboxing is characterised by: continuous change of movement structure in the undetermined conditions, with variable work intensity and load duration. Kickboxing structure consists of: attack, defense, counterattack, and offensive interceptic form of fight, which depends on technical-tactical abilities of kickboxer, that are in the immediate connection with the motoric preparedness (Kapo et al., 2004). Last twenty years were marked by the expansion of researches about situational efficiency in combat sports (Kajmović et al., 2004; Kajmović 2003; Radjo, 1999; Huremović, 2002; Marić, 1996; Kuleš, 1985), while the practice showed quite a disharmony in techniques-tactics, trained until perfection that are being improved in the trainig process and the techniques used during the competition ie real fight by the same competitor. The goal of this research is to determine the specific activities in situational conditions of performing the sport's techniques-tactics, ie during the competitive activity.

Methods

Data processing methods

For the determination of the latent dimensions of success in kickboxing disciplines Full Contact and Low Kick has been used the component factor analysis.

Examinee sample

Examinee sample for this research consists of 78 top competitors in kickboxing discpilines- Full Contact and Low Kick, and only semifinalists and finalists are taken into account, 17 in Full Contact and 15 in Low Kick, all of them males from all weight categories from XIII Amateur Balkan's Championship in Kickboxing that took place in Tesanj (BiH) on 1st and 2nd of September in 2007. This competition is enlisted in the oficial championship calendar of World Kickboxing Federation-WAKO (World Association of Kickboxing Organisations).

Variables sample

Variables sample consists of 37 tehnical elements (Variables taken from: Kapo (2006) Structural analysis and model of top

K-1 fighters super heavy category. Dissertation. Faculty of Sports and Physical Education, Sarajevo), that are presented in kickboxing disciplines during 17 fights in Full Contact and 15 fights in Low Kick:

- Technical characteristics of punches and kicks in kickboxing by disciplines: Full Contact and Low Kick

Methods for situational-motoric variables assessment

Real (situational) qualities of expressed motoric and sports techniques-tactics are the most objective in the authentic conditions of performance during the competitions or by applying the situational and motoric tasks. Therefore, the observation technique is used for this research. In the observation technique, for the registration of the basic data about examinees and their activities, we used appropriate mensural instruments that needed a special protocol (observation list), whose shape and structure formulation were based on the problems, subjects and goals of research. Observation for this research has been executed with the help of the technical aids (DVD snapshots and DVD players) for the sake of higher objectivity in the process of gathering data by competent persons.

Variables for the registration of punches application during competition activity		
1	LIJDIRGL	Left direct to the head
2	LIJDIRST	Left direct to the abdomen
3	DESDIRGL	Right direct to the head
4	DESDIRST	Right direct to the abdomen
5	LIJKROGL	Left cross to the head
6	LIJKROST	Left cross to the abdomen
7	DESKROGL	Right cross to the head
8	DESKROST	Right cross to the abdomen
9	LIJAPEGL	Left uppercut to the head
10	LIJAPEST	Left uppercut to the abdomen
11	DESAPEGL	Right uppercut to the head
12	DESAPEST	Right uppercut to the abdomen
13	DESRUKOKR	Right punch from turn
Variables for the registration of kicks application during competition activity		
14	LIJNNAPR	Left kick forward
15	DESNNAPR	Right kick forward
16	LIJBNAPR	Left side kick forward
17	DESBNAPR	Right side kick forward
18	LIJKAKAT	Left kakato geri
19	DESKAKAT	Right kakato geri
20	LIJNKRUD	Left low rotary kick
21	DESNKRUD	Right low rotary kick
22	LIJUDNOGTJ	Left kick to the body
23	DESUDNOGTJ	Right kick to the body
24	LIJVKRUD	Left high rotary kick
25	DESVKRUD	Right high rotary kick
26	LIJUSGER	Left kick backward ushiro geri
27	DESUSIRG	Right kick backward ushiro geri
28	DESUSMAV	Right ushiro mavashi geri
Variables for the registration of defence techniques application during competition activity		
29	LIJBLRRU	Left hand block from punches
30	DESBLRRU	Right hand block from punches
31	LIJBLRNU	Left hand block from kicks
32	DESBLRNU	Right hand block from kicks
33	LIJBLNNU	Left foot block from kicks
34	DESBLNNU	Right foot block from kicks
35	ESKIVAZEL	Evasion to the left
36	ESKIVAZED	Evasion to the right
37	IZMICANJ	dodging

Results and Discussion

Eigenvalues are inherent values of correlation matrix. From the total number of isolated latent dimensions, 14 are significant together with **76.32%** of complete explained variability, which is relatively a large amount (Table 1). This testifies about the good conceived and implemented experiment, because otherwise the variables (as well as the latent dimensions) would be unrelated. In order of easier interpretation, the principal component is rotated into the Varimax position (Varimax normalised). This way we get the significantly clearer situation through which we can see how the variables are grouped (Table 2).

Table 1. Eigenvalues Extraction: Principal components

		% total	Cumul.	Cumul.
	Eigenval	Variance	Eigenval	%
1	5,02	13,21	5,02	13,21
2	3,04	8,00	8,06	21,21
3	2,90	7,64	10,96	28,85
4	2,62	6,88	13,58	35,74
5	2,23	5,86	15,81	41,60
6	1,98	5,22	17,79	46,82
7	1,88	4,95	19,67	51,77
8	1,67	4,40	21,34	56,17
9	1,51	3,97	22,85	60,14
10	1,48	3,88	24,33	64,02
11	1,31	3,44	25,63	67,46
12	1,20	3,17	26,84	70,63
13	1,11	2,92	27,95	73,55
14	1,05	2,77	29,00	76,32

Table 2. Varimax position of the technical variables

		Factor	Factor	Factor	Factor	Factor	Factor	Factor	Factor	Factor	Factor	Factor	Factor	Factor	Factor
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
LIJDIRGL	VAR01	**0,81**	0,16	0,03	0,24	0,02	-0,01	-0,07	0,09	0,03	0,07	-0,13	-0,01	0,24	-0,09
LIJDIRST	VAR02	0,07	-0,07	-0,02	0,25	**0,75**	0,13	-0,13	0,02	-0,07	0,09	-0,02	-0,26	-0,17	-0,03
DESDIRGL	VAR03	0,29	0,34	0,17	0,09	-0,14	-0,10	-0,15	0,01	**0,63**	0,05	-0,03	0,10	0,09	0,00
DESDIRST	VAR04	-0,05	0,11	-0,15	**0,80**	0,08	0,03	0,04	-0,01	-0,03	-0,13	0,19	0,14	-0,08	0,02
LIJKROGL	VAR05	0,32	**0,58**	0,07	-0,10	-0,03	0,02	0,02	0,11	0,04	0,46	0,10	0,17	0,33	-0,03
LIJKROST	VAR06	0,14	0,29	-0,17	-0,22	**0,53**	0,07	0,00	-0,04	-0,25	0,38	0,23	0,08	0,09	0,16
DESKROGL	VAR07	0,06	0,26	0,17	0,00	-0,27	-0,01	0,01	-0,01	0,35	0,31	0,03	0,00	**0,41**	-0,25
DESKROST	VAR08	-0,17	0,15	0,02	-0,09	**0,78**	-0,14	0,03	0,06	0,09	-0,10	0,03	-0,01	0,07	0,11
LIJAPEGL	VAR09	0,15	0,07	0,24	-0,20	-0,08	0,08	-0,03	0,21	**0,58**	0,09	0,26	0,09	0,10	-0,01
LIJAPEST	VAR10	0,12	0,00	-0,06	-0,09	0,21	-0,03	-0,03	-0,10	**0,68**	-0,10	-0,08	-0,29	0,34	0,18
DESAPEGL	VAR11	-0,14	0,12	**0,42**	-0,09	0,06	0,05	0,05	0,32	0,26	0,07	0,03	0,37	0,33	-0,19
DESAPEST	VAR12	0,03	-0,09	0,09	-0,01	-0,05	0,02	-0,04	0,05	0,16	-0,06	-0,12	-0,15	**0,86**	-0,01
DESRUKOKR	VAR13	0,09	-0,06	0,07	0,04	0,05	-0,07	0,05	-0,03	0,05	**0,84**	0,00	0,02	-0,09	0,04
LIJNNAPR	VAR14	0,08	0,00	0,11	**0,75**	-0,15	-0,01	-0,20	-0,01	0,04	0,25	-0,07	-0,29	0,12	-0,01
DESNNAPR	VAR15	-0,10	-0,01	0,16	0,10	0,00	-0,05	0,04	-0,02	-0,01	0,03	**-0,84**	-0,01	0,09	-0,03
LIJBNAPR	VAR16	-0,05	0,15	-0,11	-0,02	-0,18	0,10	**-0,85**	-0,06	0,14	0,05	0,09	-0,15	0,09	0,03
DESBNAPR	VAR17	0,02	0,14	0,00	0,05	-0,21	0,01	0,05	**0,83**	0,00	0,02	0,02	-0,35	0,10	0,03
LIJKAKAT	VAR18	0,08	-0,18	-0,08	0,11	0,25	0,00	**-0,79**	0,16	0,07	-0,12	-0,01	0,15	-0,15	0,04
DESKAKAT	VAR19	0,03	-0,05	0,02	-0,03	0,31	0,03	-0,11	**0,83**	0,09	-0,06	0,03	0,19	-0,06	-0,07
LIJNKRUD	VAR20	**0,76**	0,04	-0,01	-0,11	0,01	0,15	-0,06	-0,06	0,34	0,04	0,10	0,00	-0,08	0,14
DESNKRUD	VAR21	**0,77**	0,15	0,19	-0,04	-0,16	-0,03	0,03	0,00	0,14	-0,11	0,03	-0,30	-0,12	0,09
LIJUDNOGTJ	VAR22	-0,13	**0,50**	0,06	0,09	0,19	-0,19	-0,21	0,34	0,38	-0,01	0,05	0,16	-0,01	-0,19
DESUDNOGTJ	VAR23	0,23	0,23	0,18	**0,59**	0,11	-0,17	0,21	0,15	-0,18	-0,03	-0,18	0,06	-0,10	-0,24
LIJVKRUD	VAR24	-0,07	0,29	0,02	-0,15	0,24	-0,27	**-0,51**	-0,03	-0,35	0,01	0,03	-0,21	0,07	-0,19
DESVKRUD	VAR25	-0,09	0,03	0,00	0,18	-0,07	**-0,71**	-0,03	-0,01	-0,14	0,07	0,00	0,03	0,02	-0,48
LIJUSGER	VAR26	0,02	0,15	-0,08	0,02	0,17	0,05	-0,06	0,04	0,01	-0,05	0,07	**-0,82**	0,16	-0,01
DESUSIRG	VAR27	-0,05	-0,03	-0,10	0,03	-0,09	0,01	0,02	0,01	-0,04	-0,05	0,03	0,00	0,04	**-0,88**
DESUSMAV	VAR28	-0,07	-0,02	-0,10	-0,06	0,05	**-0,84**	0,05	-0,03	0,10	0,01	0,04	0,02	-0,01	0,15
LIJBLRRU	VAR29	0,04	0,02	**0,86**	0,03	0,01	0,11	0,09	-0,05	0,20	0,11	0,02	0,02	0,00	0,03
DESBLRRU	VAR30	0,10	-0,01	**0,92**	-0,07	-0,04	-0,01	0,10	0,07	0,04	0,06	0,01	0,00	0,01	0,06
LIJBLRNU	VAR31	-0,14	0,25	0,29	0,34	-0,15	0,05	-0,01	**0,47**	-0,19	-0,03	0,01	0,30	0,26	0,24
DESBLRNU	VAR32	0,15	0,31	**0,55**	0,20	-0,07	0,00	-0,16	0,06	-0,16	-0,16	-0,29	0,15	0,12	0,06
LIJBLNNU	VAR33	**0,65**	-0,04	0,06	0,04	0,02	0,13	0,15	-0,06	-0,11	0,33	0,16	0,23	0,05	-0,02
DESBLNNU	VAR34	0,03	0,18	-0,14	-0,17	-0,06	0,11	0,05	-0,03	-0,04	-0,04	**-0,75**	0,07	-0,04	0,06
ESKIVAZEL	VAR35	0,03	**0,67**	0,32	0,09	0,03	0,00	-0,06	0,04	0,31	-0,10	-0,02	-0,13	-0,12	0,03
ESKIVAZED	VAR36	0,02	**0,64**	-0,02	0,29	0,13	0,25	0,03	0,03	-0,02	0,06	-0,12	-0,14	-0,06	0,04
IZMICANJ	VAR37	0,37	**0,71**	-0,12	-0,02	0,02	-0,26	0,01	0,01	0,02	-0,20	-0,19	-0,14	0,12	0,03
	Expl.Var	2,88	2,82	2,67	2,19	2,12	1,64	1,92	1,96	2,22	1,72	1,80	1,72	1,88	1,45
	Prp.Totl	0,08	0,07	0,07	0,06	0,06	0,04	0,05	0,05	0,06	0,05	0,05	0,05	0,05	0,04

First factor is saturated with the variables LIJDIRGL (0.81), LIJNKRUD (0.76), DESNKRUD (0.77), LIJBLNNU (0.65) and statistically important (although not primary for this dimension) variables LIJKROGL (0.32) and IZMICANJ (0.37). According to this it is all about **left hand and foot activities, in principle those closer to the opponent**. As the left hand and the left foot are closer to the opponent, competitors fight and prepare for punches and kicks with the dominant right hand ie right foot. With this reasearch we showed the significance of the left hand and foot in kickboxing disciplines Full Contact and Low Kick, as well as the statistical significance, which is big as shown.

Second factor is saturated dominantly with the variables LIJKROGL (0.58), LIJUDNOGTJ (0.50), ESKIVAZEL (0.67), ESKIVAZED (0.64), IZMICANJ (0.71), as well as DESBLRNU (0.31), DESDIRGL (0.34) and LIJKROST (0.29). It seems that this is the factor that describes **the rotational activities in space** which goal is defensive activity with purpose of infliction the DESDIRGL (0.34) (right direct to the head). Taking all this into consideration we may say that **the body balance is the dominant part of the second factor.**

Third factor is projected mostly by the variables DESAPEGL (0.42), LIJBLRRU (0.86), DESBLRRU (0.92), DESBLRNU (0.55), and somewhat by the ESKIVAZEL (0.32). These are **the specific defense actvities** ie hand and foot blocks enhanced with an evasion for the efficiency.

Fourth factor is described with the variables: DESDIRST (0.80), LIJNNAPR (0.75), DESUDNOGTJ (0.59) and somewhat with the LIJBLRNU (0.34). This is obviously **the specific offensive activity.** This factor, from the tactical position, is used against the taller opponents, and consists mainly of strong punches and kicks to the body so that opponent would lower his guard and expose his vital head points.

Fifth factor is described with the LIJDIRST (0.75), LIJKROST (0.53), DESKROST (0.78), and significantly with the DESKAKAT (0.31). This structure presents **the offense enactment to the center body (abdomen)** with hand techniques, that are, as well as in the previous factor, used against taller opponents, but unlike the previous factor it is about offense enactment to the abdomen region. Complex technical element DESKAKAT (0.31) confirms the fact that the participants and competitors were referent in the technical-tactical sense, meaning that they are probably the competitors coming from the Tae Kwon Do sport where the foot techniques are dominant.

Sixth factor is defined by the variables DESVKRUD (-0.71), DESUSMAV (-0.84) that clearly present **the offense activities by big trajectories with lower, right extremities**. From biomechanical point of view this structure is highly effective because it has high velocity of kicks at the expense of circumferential velocity, but it is extremely hard to perform and that is why it is in the negative relation. It is highly possible, from the tactical point of view, if the DESUSMAV (-0.84) is used for feinting the opponent or breaking his guard after which should be continued with the DESVKRUD (-0.71).

Seventh factor is saturated mostly with the variables LIJBNAPR (-0.85), LIJKAKAT (-0.79), LIJVKRUD (-0.51) which present **the offense activities with the left extremities** that are likely developing the struggle and are done in the combinations.

Eight factor is saturated with the variables DESBNAPR (0.83), DESKAKAT (0.83), LIJBLRNU (0.47), and significantly with the DESAPEGL (0.32) and LIJUDNOGTJ (0.34). This set describes the specific combination of activities, probably blocks, punches and kicks. These are mostly the situations where you must receive the kick and block in order to be able to give one aferwards. **This is probably the agressive offense tactic.**

Ninth factor is described with the variables DESDIRGL (0.63), LIJAPEGL (0.58), LIJAPEST (0.68), and even to a lesser extent, but significantly with the variables DESKROGL (0.35), LIJNKRUD (0.34), LIJUDNOGTJ (0.38), LIJVKRUD (-0.35) and ESKIVAZEL (0.31). These are wide arched kick activities used against the closed positions of the opponent as well as against shorter fighters.

Tenth factor is defined by the dominant variable DESRUKOKR (0.84), and secondary by the variables LIJKROGL (0.46), LIJKROST (0.38), DESKROGL (0.31) and LIJBLNNU (0.33). This dimension in principle presents the rotary kicks with lower range used in melee.

Eleventh factor is described with the variables DESNNAPR (-0.84) and DESBLNNU (-0.75), that clearly present **the specific combination of defense and attack from the right side of the body.** Movement structure of both kicks and punches enables defense and offense enactment – kick and punch are preceded by the block.

Twelfth factor is defined by the variables LIJUSGER (-0.82), and lesser by the variables DESAPEGL (0.37) and DESBNAPR (-0.35). It seems to present **the specific offense enactment with the goal of provoking the opponent, breaking his guard** or enabling the counterattack.

Thirteenth factor is saturated with the variables DESAPEST (0.86) and DESKROGL (0.41), and lesser with the LIJKROGL (0.33), LIJAPEST (0.34) and DESAPEGL (0.33). The best description of this factor could be sumsumed under **the specific attack with the right hand** but with the logical support from the left hand – specific actions that are manifested by the boxing elements and obviously applied in kicks and punches series.

Fourteenth factor is saturated with the variables DESUSIRG (-0.88) and lesser but significantly with the variable DESVKRUD (-0.48). It seems to present **the specific attack with the right foot** with the potential opening of the opponent.

Component factor analysis picturesquely shows how the real fight imposes special actions that had not been learned sistematically in the training process, and describes in details the structure of the competitive fight. All gathered results show the necessity of implementing further researches in the competitive kickboxing discipline in order to improve the trainig process.

Conclusion

Varimax position of the technical variables presents 14 ways of enactment and probably even the 14 combinations, maybe even those which had not been learned in the training process as school examples of the technical-tactical enactment but are the product of the specific situational conditions. From all this we can conclude that they need to be learned in the training process, because, by the results of this research, they gave the great importance and they structured the hierarchy of application in the situational efficiency. This could be a quality data source for trainers to construct the programs and preparations for the situational efficiency.

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