Sara Prot
Department of Psychology, Iowa State University, USA
Adrijana Banožić
School of Medicine, University of Split, Croatia
Ksenija Bosnar, Franjo Prot
Faculty of Kinesiology, University of Zagreb, Croatia

Latent class analysis of the revised Short Test of Music Preferences on a Croatian sample

The Short Test of Music Preferences (STOMP; Rentfrow & Gosling, 2003) has been developed to measure liking of different music genres. In previous studies on American samples it has been shown to measure four broad music-preference dimensions: Intense & Rebellious; Reflective & Complex; Upbeat & Conventional; and Energetic & Rhythmic. Croatian translation of revised version of STOMP was used on a sample of 1005 university students to explore possible intercultural differences in the structure of music preferences. To obtain the latent structure in the space of STOMP items, component analysis with promax transformation was done, with PB factor retention criterion (Štalec & Momirović, 1971). Four extracted factors clearly corresponded to the structure suggested by Rentfrow & Gosling (2006; 2003). Latent class analysis was conducted by four taxonomic algorithms representing agglomerative, hierarchical and polar taxonomic approach; i.e. K-means procedure (MacQueen, 1967), Ward method of hierarchical clustering (Ward, 1963), MORFOTAX algorithm for detection of polar taxa (Szirovicza & al., 1978), and TRIATLON algorithm for detection of clusters by neural networks (Momirović, 2003). The number of clusters was fixed corresponding to PB criterion. Efficiency of classification was evaluated by a series of discriminant analyses in manifest and latent space, showing statistically significant differences between groups defined by all four algorithms, after Bonferroni correction of probabilities was applied. Interpretation of taxonomic solutions was based on comparisons of group mean vectors of initial variables, as well as of 4 factors. Different algorithms produced different, but interpretable solutions. MORFOTAX algorithm produced solution where three of four dimensions matched those obtained in the factor solution.

Latent Class Analysis of the Revised Short Test of Music Preferences on a Croatian Sample

Sara Prot[1], Adrijana Banožić[2], Ksenija Bosnar[3] and Franjo Prot[3]

Department of psychology, Iowa State University[1]
School of Medicine, University of Split[2]
Faculty of Kinesiology, University of Zagreb[3]

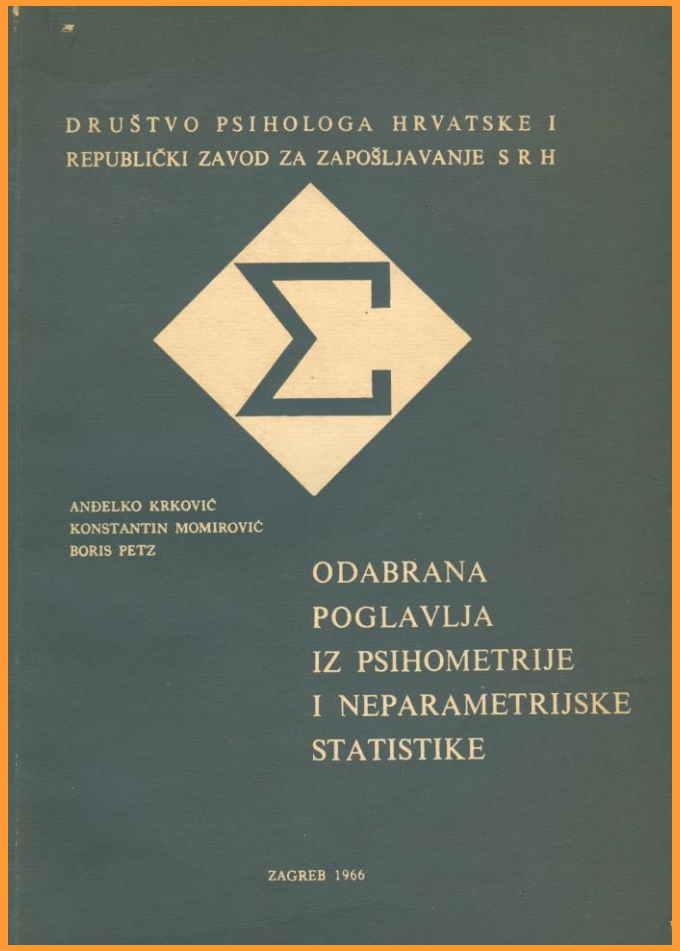
- VALJANOST
  - APRIORISTIČKA VALJANOST
  - SIMPTOMATSKA VALJANOST
  - PROGNOSTIČKA VALJANOST

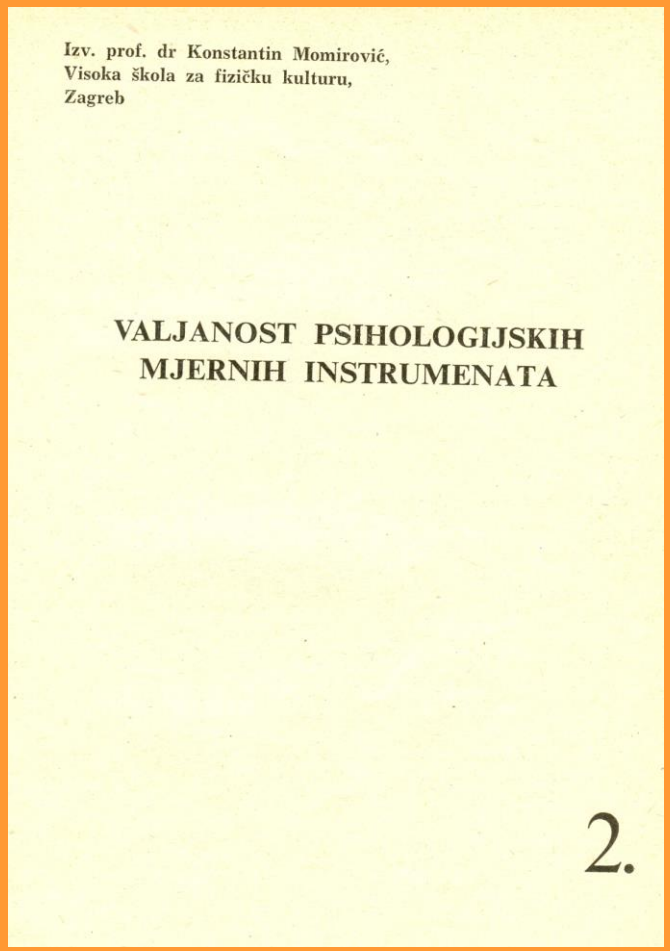
Bujas (1965)

- VALJANOST
  - SADRŽAJNA VALJANOST
  - SIMPTOMATSKA VALJANOST
  - PROGNOSTIČKA VALJANOST

Krković (1977)

Momirović, K. (1966) Valjanost psihologijskih mjernih instrumenata. U Krković A., K., Momirović i B. Petz (1966) Odabrana poglavlja iz psihometrije i neparametrijske statistike.Društvo psihologa i Republički zavod za zapošljavanje.

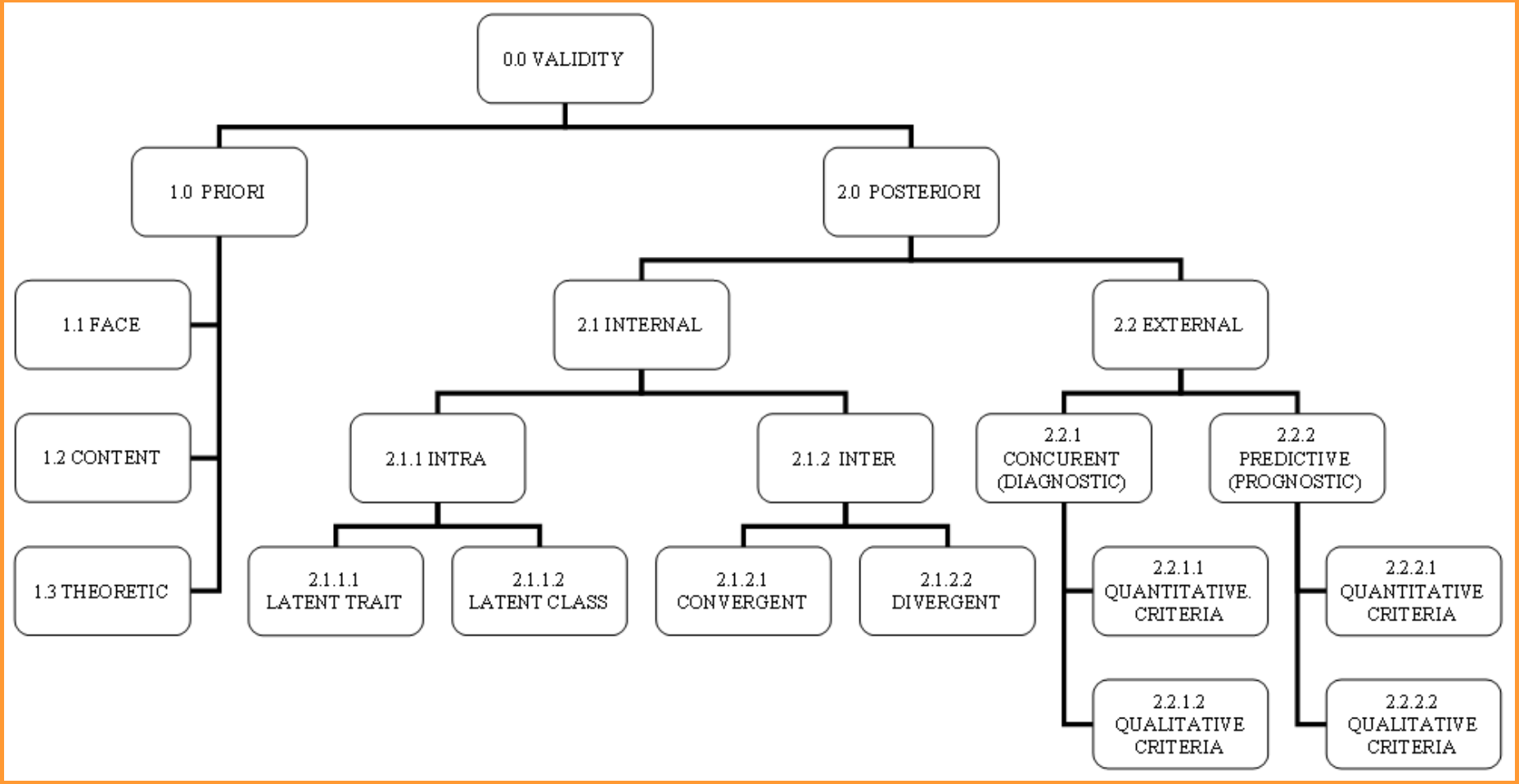




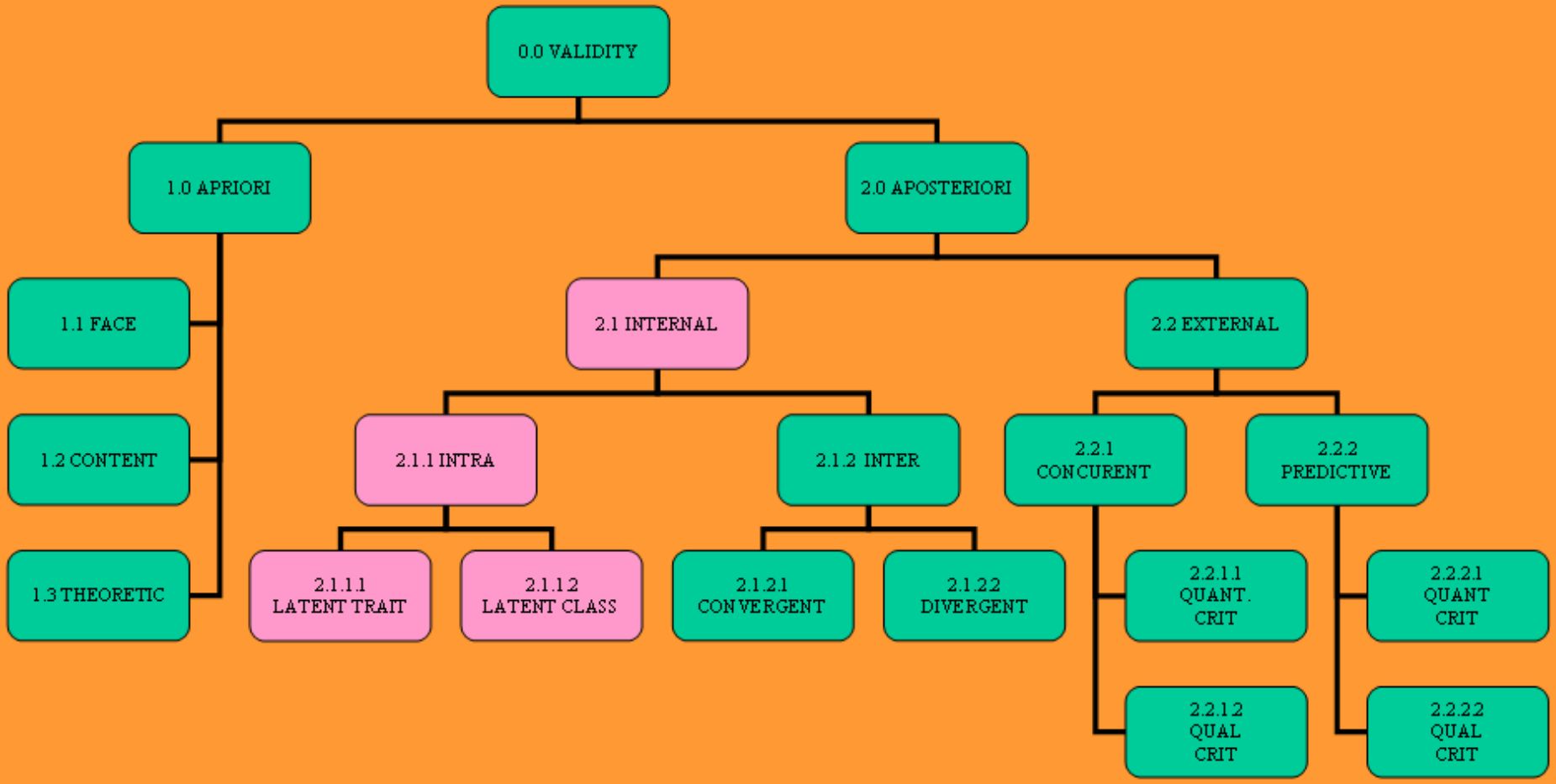
- VALJANOST
  - APRIORISTIČKA VALJANOST
    - POJAVNA
    - SADRŽAJNA
    - TEORIJSKA
  - **FAKTORSKA VALJANOST**
    - **INVARIJANTNA FAKTORSKA VALJANOST**
    - **ARBITRARNA FAKTORSKA VALJANOST**
  - PRAGMATIČKA VALJANOST
    - DIJAGNOSTIČKA KVANTITATIVNA VALJANOST
    - DIJAGNOSTIČKA KLASIFIKACIJSKA VALJANOST
    - PROGNOSTIČKA KVANTITATIVNA VALJANOST
    - PROGNOSTIČKA KLASIFIKACIJSKA VALJANOST

(Momirović 1966)

validity of measurements (Prot, 2010)



validity of measurements (Prot 2010)



AIM OF THE STUDY

- **Latent Class Analysis of the Revised Short Test of Music Preferences on a Croatian Sample**
- **Methodological tools for their interpretation**

SUBJECTS

	Frequency	Percent
male	394	39.2
female	611	60.8
Total	1005	100.0

Universtiy students mean age 20.23 years

98% of them in the range from 18 to 25 years

VARIABLES

- Music preferences measure liking of 23 different music genres.
- Evaluated on 7 point scale.

The Short Test of Music Preferences

(STOMP; Rentfrow & Gosling, 2003)

STOMP-Revised

Please indicate your basic preference for each of the following genres using the scale provided.

1	2	3	4	5	6	7
Dislike Strongly	Dislike Moderately	Dislike a Little	Neither like nor dislike	Like a Little	Like Moderately	Like Strongly

1. _____ Alternative
2. _____ Bluegrass
3. _____ Blues
4. _____ Classical
5. _____ Country
6. _____ Dance/Electronica
7. _____ Folk
8. _____ Funk
9. _____ Gospel
10. _____ Heavy Metal
11. _____ International/Foreign
12. _____ Jazz
13. _____ New Age
14. _____ Oldies
15. _____ Opera
16. _____ Pop
17. _____ Punk
18. _____ Rap/hip-hop
19. _____ Reggae
20. _____ Religious
21. _____ Rock
22. _____ Soul/R&B
23. _____ Soundtracks/theme song

STOMP-revised,
Croatian translation (example)

STOMP-Revised

Molimo Vas da za iduće glazbene žanrove ocijenite koliko vam se sviđaju koristeći skalu od 1 do 7:

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7

Uopće mi se ne sviđa — Niti mi se sviđa, niti mi se ne sviđa — Jako mi se sviđa

1. 2 Alternativa
2. 5 Blues
3. 5 Klasična glazba
4. 5 Country
5. 3 Dance/Electronica
6. 1 Etno
7. 2 Funk
8. 4 Gospel
9. 6 Heavy Metal
10. 5 Strana glazba
11. 5 Jazz
12. 2 New age
13. 7 Stare stvari
14. 1 Opera
15. 4 Pop
16. 1 Punk
17. 1 Rap/hip-hop
18. 3 Reggae
19. 3 Religijska glazba
20. 7 Rock
21. 5 Soul/R&B
22. 2 Glazba iz filmova i serija
23. 1 Narodnjaci

METHODS

1St PHASE

- Neural network factor analysis
- Principal component analysis with promax rotation

2nd PHASE

- K-means clustering (McQuin, 1967)
- Ward - hierarchical clustering (Ward, 1963)
- MORPHOTAX – polar taxons (Sziravitza & all 1977)
- TRIATLON – neural networks (Momirović, 2003)

Final number of clusters
according to PBC criterion
(Štalec and Momirović, 1971)

3nd PHASE

- Discriminant analyises in manifest and latent spece
- Clustering of manifest scales centroids
- Clustering of standardized promax factors scores centroids

Prliminary analysis

- Nonlinear factor analysis by Hopfield neural network of data transformed to standardized sigmoidal (0,1) form with multigroup computation of initialsolution.
- Principal compoent analysis with number of latent dimensions extracted in feature space of manifest variables according to PBC criterion.

Crosscorrelations of promax (PF) and Hopfield (HF) factor scores

	HF1	HF2	HF3	HF4
PF1	**.974**	-.154	.174	.120
PF2	.374	.132	**.990**	.322
PF3	.037	**.988**	.128	.246
PF4	.289	.372	.129	**.988**

Congruences of of promax (PF) and Hopfield (HF) pattern factors

	HF1	HF2	HF3	HF4
PF1	**.994**	-.063	-.083	-.021
PF2	.095	.035	**.988**	.117
PF3	.113	**.992**	.031	-.047
PF4	.192	.115	-.090	**.970**

- Principal compoent analysis with promax rotation and nonlinear factor analysis by Hopfield neural network are offering equivalent solutions.

Promax Factors Correlation Matrix

Component	1	2	3	4
1	1.00	0.27	-0.10	0.11
2	0.27	1.00	0.11	0.20
3	-0.10	0.11	1.00	0.28
4	0.11	0.20	0.28	1.00

Promax Pattern Matrix

	Component			
	1	2	3	4
ALTERNAT	**0.66**	-0.05	-0.11	0.34
BLUES	**0.54**	**0.44**	0.04	0.08
KLASICNA	0.20	**0.67**	0.01	-0.10
COUNTRZ	-0.06	**0.57**	0.08	0.04
DANCE	-0.34	-0.16	0.21	**0.50**
ETNO	-0.15	0.48	-0.33	**0.53**
FUNK	0.11	0.14	0.01	**0.63**
GOSPEL	-0.02	**0.66**	0.14	0.09
HEAVYMET	**0.63**	-0.08	-0.15	0.19
STRANAMU	0.25	-0.20	**0.73**	-0.01
JAZZ	**0.44**	**0.41**	0.14	0.09
NEWAGE	0.17	-0.05	0.04	**0.55**
STARESTV	0.20	0.19	**0.46**	-0.08
OPERA	0.03	**0.70**	-0.03	-0.03
POP	-0.44	0.11	**0.59**	0.05
PUNK	**0.53**	-0.13	-0.03	**0.48**
RAPHIPHO	-0.23	-0.14	**0.42**	**0.44**
REGGAE	0.28	0.02	0.13	**0.54**
RELIGIJS	-0.45	**0.66**	0.02	-0.05
ROCK	**0.71**	0.00	0.29	-0.01
SOULRB	-0.07	0.10	**0.67**	0.17
FILMOVI	0.13	0.26	**0.55**	-0.07
NARODNJA	**-0.68**	0.05	-0.13	0.16

Promax Structure Matrix

	Component			
	1	2	3	4
ALTERNAT	**0.69**	0.19	-0.09	0.37
BLUES	**0.66**	**0.60**	0.05	0.24
KLASICNA	0.37	**0.70**	0.03	0.05
COUNTRY	0.09	**0.57**	0.16	0.17
DANCE	-0.35	-0.13	0.37	**0.49**
ETNO	0.07	**0.52**	-0.11	**0.52**
FUNK	0.21	0.29	0.19	**0.67**
GOSPEL	0.15	**0.68**	0.24	0.26
HEAVYMET	0.65	0.12	-0.17	0.20
STRANAMU	0.12	-0.06	**0.68**	0.18
JAZZ	**0.55**	**0.56**	0.17	0.26
NEWAGE	0.21	0.11	0.17	**0.57**
STARESTV	0.19	0.27	**0.44**	0.11
OPERA	0.21	**0.69**	0.03	0.10
POP	-0.46	0.07	**0.66**	0.20
PUNK	**0.55**	0.11	0.04	**0.50**
RAPHIPHO	-0.26	-0.07	**0.55**	**0.50**
REGGAE	0.33	0.22	0.26	**0.61**
RELIGIJS	-0.28	**0.53**	0.12	0.04
ROCK	**0.67**	0.22	0.21	0.15
SOULRB	-0.09	0.19	**0.74**	0.37
FILMOVI	0.13	0.33	**0.54**	0.15
NARODNJA	**-0.63**	-0.12	-0.01	0.06

PROMAX SOLUTION

1st Intense&Rebellius

2nd Reflective&Complex

3rd Upbeat&Conventional

4th Energetic&Rhythmic

1. factor : **Intense & Rebellious** : (+): alternat, rock, (blues, jazz, punk) (-): narodnjaci

2. factor : **Reflective & Complex**: (+): opera, classical, *gospel, religion, country*, (blues, jazz)

3. factor: **Upbeat & Conventional**: (+): stranamu, soulRB, pop, filmovi, starestv, (raphipop)
/reduced for *gospel, religion country*/

4. factor: **Energetic & Rhythmic**: (+): funk, regge, etno, dance, (punk, raphiphop)

Discriminant analysis (manifest variables space)

Canonical Discriminant Functions in manifest space

Canonical correlations	1st	2nd	3rd
K-means clustering	.83	.74	.65
Ward hierarchical clustering	.82	.72	.27
Morfotax	.75	.73	.70
Triatlon	.88	.79	.73

Discriminant analysis (promax factors space)

Canonical Discriminant Functions in promax space

Canonical correlations	1st	2nd	3rd
K-means clustering	.81	.71	.59
Ward hierarchical clustering	.81	.70	.09
Morfotax	.74	.71	.68
Triatlon	.70	.60	.30

Contingency Table
K-means (QCL_1) : Ward (CLU4_1)
57.5%

		CLU4_1				Total
		1	2	3	4	
QCL_1	1	23	0	8	(85.6%) **184** (62.4%)	215
	2	14	(46.6%) **135** (97.1%)	(42.8%) **124** (54.4%)	17	290
	3	61	4	89	77	231
	4	(91%) **245** (71.4%)	0	7	17	269
Total		343	139	228	295	1005

Contingency Table
K-means (QCL_1) : MORFOTAX (MINTAX4)
63.0%

		MNTAX4				Total
		1	2	3	4	
QCL_1	1	33	0	(65.6%) **141** (58.55%)	41	215
	2	76	(50.1%) **147** (68.4%)	56	11	290
	3	(72.7%) **168** (60.6%)	14	6	43	231
	4	0	54	38	(65.8%) **177** (65.1)	269
Total		277	215	241	272	1005

Contingency Table

K-means (QCL_1) : TRIATLON (TRIATAX)

57.9%

		TRIATAX				Total
		1	2	3	4	
QCL_1	1	14	14	(64.2%) **138** (57.3%)	49	215
	2	77	(55.2%) **160** (72.1%)	37	16	290
	3	(49.2%) **114** (43.2%)	39	35	43	231
	4	59	9	31	(63.2%) **170** (61.2%)	269
Total		264	222	241	278	1005

Contingency Table
Ward (CLU4_1) : MORFOTAX (MINTAX4)
63.0%

		MNTAX4				Total
		1	2	3	4	
QCL_1	1	33	0	(65.6%) **141** (58.5%)	41	215
	2	76	(50.7%) **147** (68.4%)	56	11	290
	3	(72.7%) **168** (60.6%)	14	6	43	231
	4	0	54	38	(65.8%) **177** (65.1%)	269
Total		277	215	241	272	1005

Contingency Table
Ward (CLU4_1) : TRIATLON (TRIATAX)
57.9%

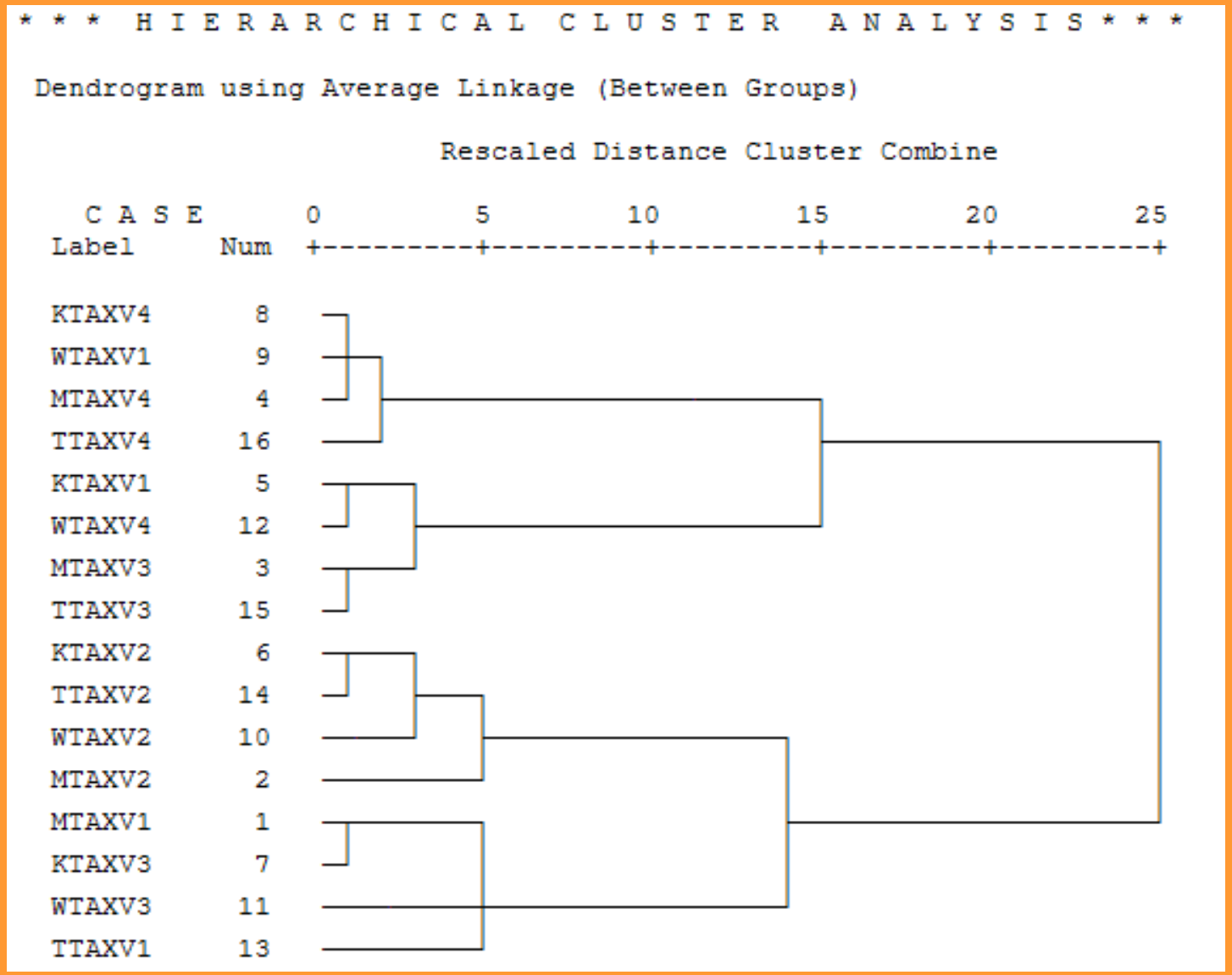
		TRIATAX				Total
		1	2	3	4	
QCL_1	1	14	14	(64.2%) **138** (57.3%)	49	215
	2	77	(55.2%) **160** (72.1%)	37	16	290
	3	(49.4%) **114** (43.2%)	39	35	43	231
	4	59	9	31	(63.2%) **170** (61.2%)	269
Total		264	222	241	278	1005

Contingency Table
MORFOTAX (MINTAX4) : TRIATLON (TRIATAX)
50.4%

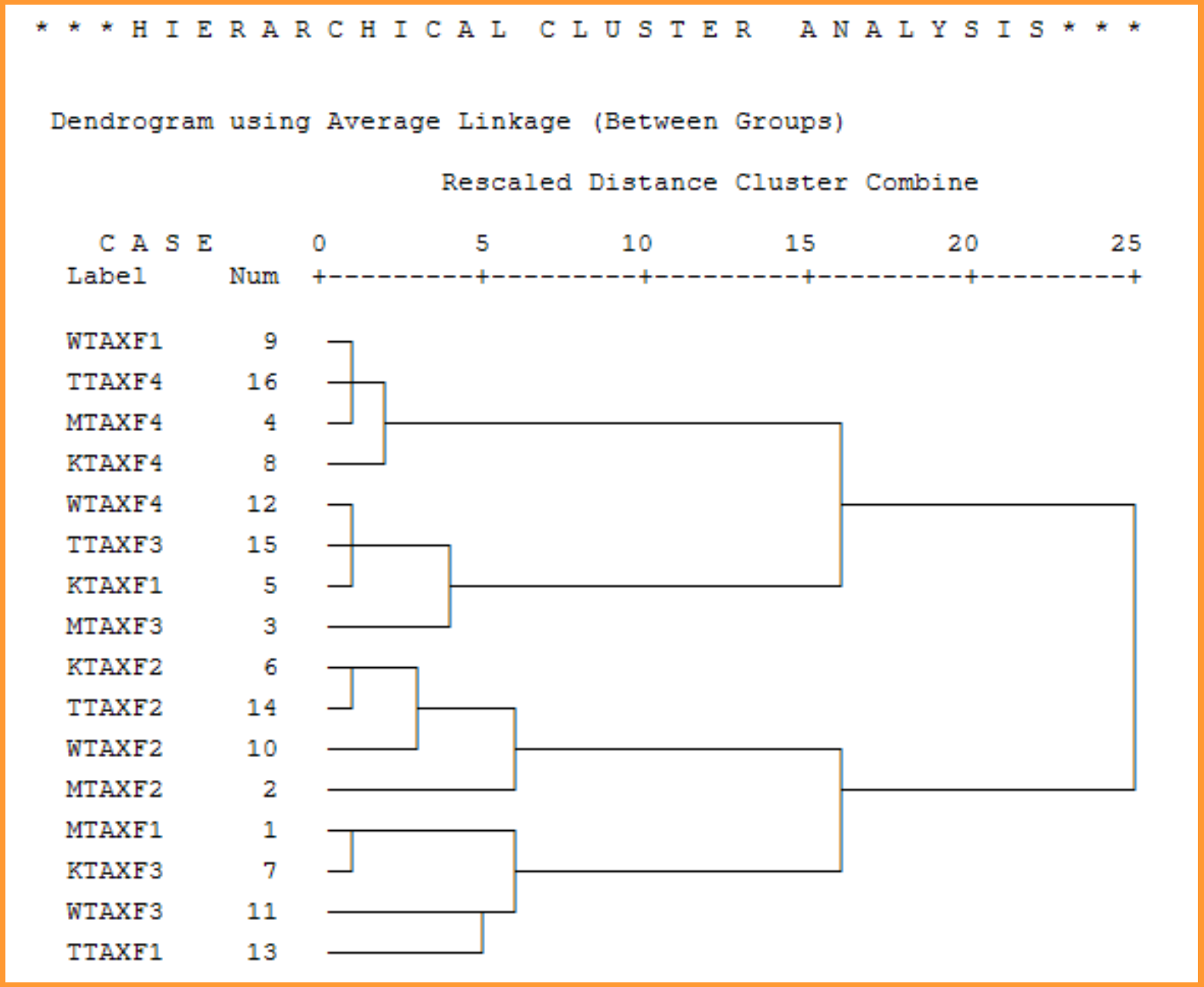
		TRIATAX				Total
		1	2	3	4	
MNTAX4	1	(38.7%) **106** (40.2%)	80	60	31	277
	2	67	(47.0%) **101** (45.5%)	6	41	215
	3	11	38	(59.3%) **143** (59.3%)	49	241
	4	80	3	32	(57.7%) **157** (56.5%)	272
Total		264	222	241	278	1005

CLUSTERING OF MANIFEST SCALES CENTROIDS

(K-means): KTAXV1 KTAXV2 KTAXV3 KTAXV4;**(Ward):** WTAXV1 WTAXV2 WTAXV3 WTAXV4 **(morfotax):** MTAXV1 MTAXV2 MTAXV3 MTAXV4 **(triathlon):** TTAXV1 TTAXV2 TTAXV3 TTAXV4



CLUSTERING OF STANDARDIZED PROMAX FACTORS CENTROIDS



Correlation between promax factor scores (FAC) and morfotax (MORFTY) polar taonomic dimensions.

Intense&Rebellius (FAC1 : MORFTAY4)

Reflective&Complex (FAC2 : MORFTAY3)

Upbeat&Conventional (FAC3 : MORFTAY1)

Energetic&Rhythmic

	MORFTAY1	MORFTAY2	MORFTAY3	MORFTAY4
FAC1	-0.49	-0.27	0.07	**0.79**
FAC2	-0.26	-0.63	**0.84**	-0.04
FAC3	**0.70**	-0.61	0.00	0.18
FAC4	0.38	-0.26	0.02	0.00

CONCLUSIONS

- equivalent solutions of principal compoent analysis with promax rotation and nonlinear factor analysis by Hopfield neural network.
- Four factor solutition resembling to previous studies with some interpretable differences

- Series of discriminant analyses in manifest and latent space, showing statistically significant differences between groups defined by all four algorithms,
- Four taxonomic algorithms representing agglomerative, hierarchical and polar taxonomic approach generates cluster composed by more then 50% of comun subjects.

- Clustering of manifest scales centroids and clustering of standardized promax factor scores centroids separate and group corresponding clusers from all four algorithms applied.

Thank You very much for your attention!

Sara Prot

Ksenija Bosnar

Adrijana Banožić

Franjo Prot

See You next time !!!

ASSISTANCE AND HELP:

- Franjo Prot
- e-mail :

  pipo@kif.hr

- reference to:

  danirizb2011