

Analyses typologiques – 1. Introduction

But :

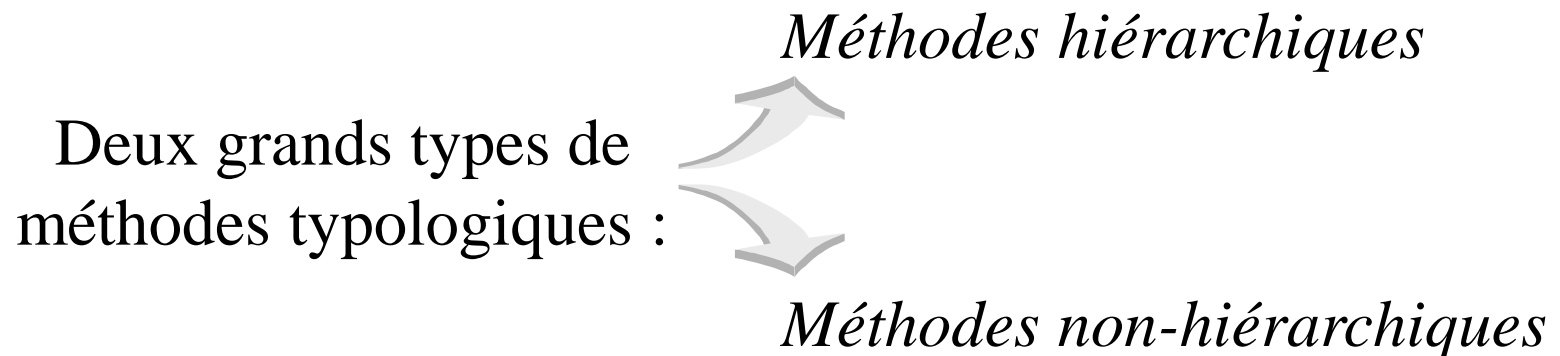
Classer en groupes (les plus homogènes possibles) des unités statistiques en partant d'un ensemble de variables.

Supposition préalable :

Les regroupements existent ou peuvent exister.

Remarque :

La typologie, une fois constituée, peut devenir un nouveau critère de description et/ou d'analyse.



2. Classifications hiérarchiques

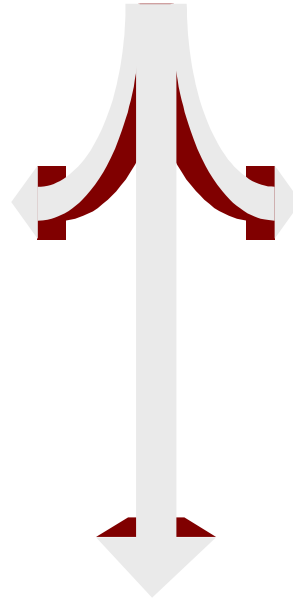
2.1. Méthode ascendante vs. descendante

Représenter les individus par un ensemble de parties hiérarchiquement emboîtées.

Méthode « descendante »



Du groupe aux individus



Méthode « ascendante »



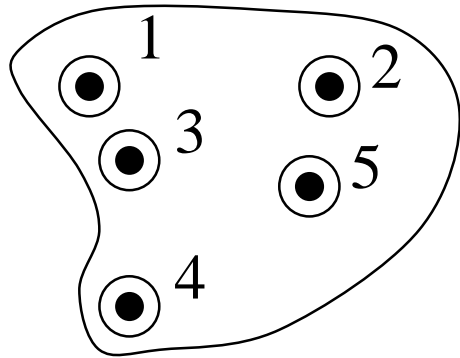
Des individus au groupe

Les différents regroupements peuvent être représentés graphiquement à l'aide d'un **dendrogramme**.

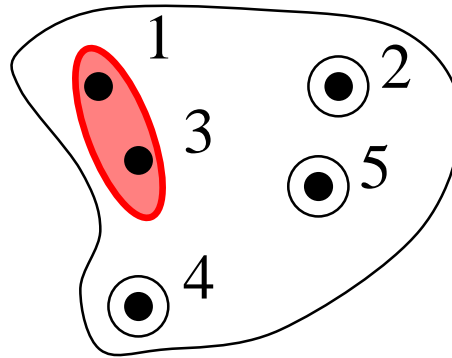
Classifications hiérarchiques

Méthode « ascendante »

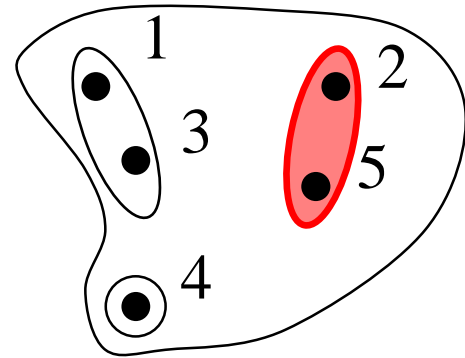
Etape n°0



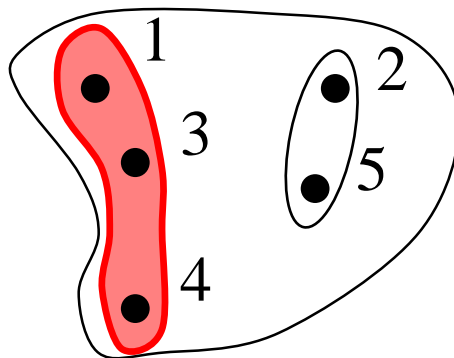
Etape n°1



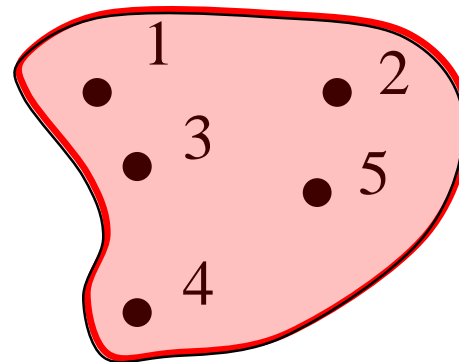
Etape n°2



Etape n°3

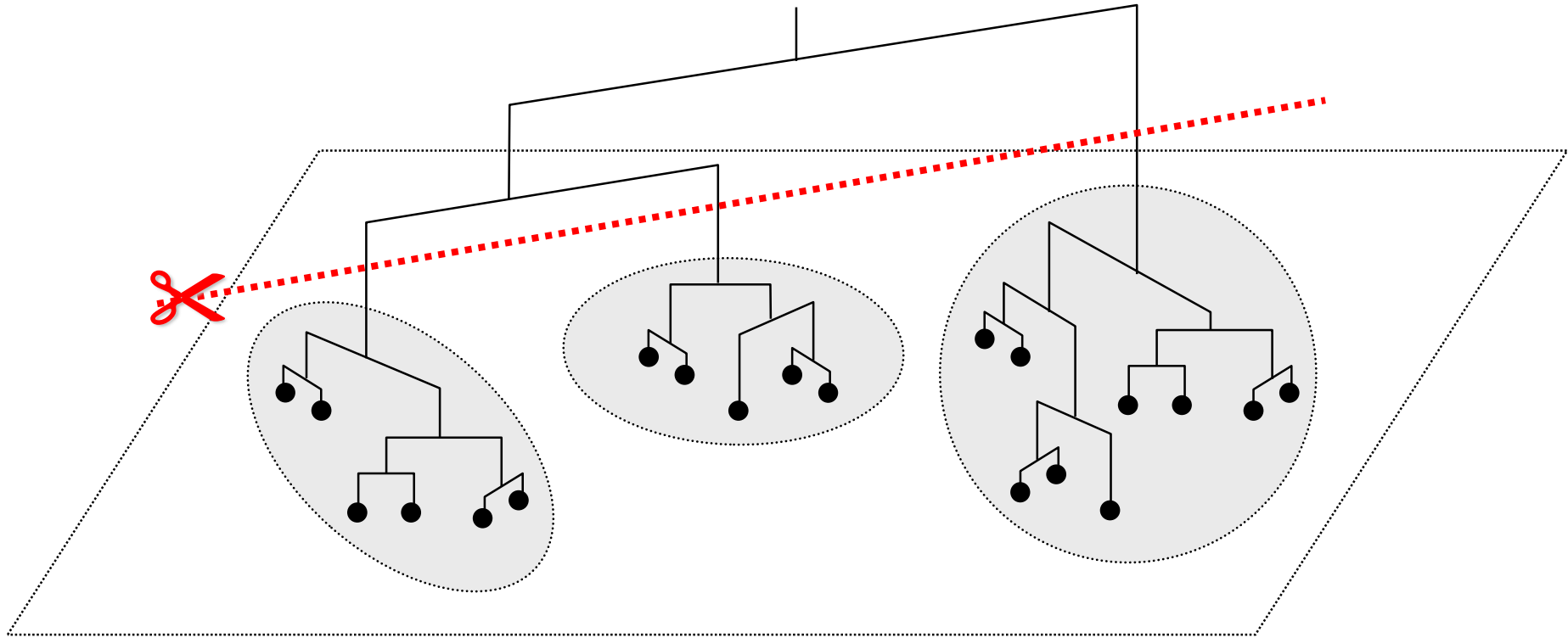


Etape n°4



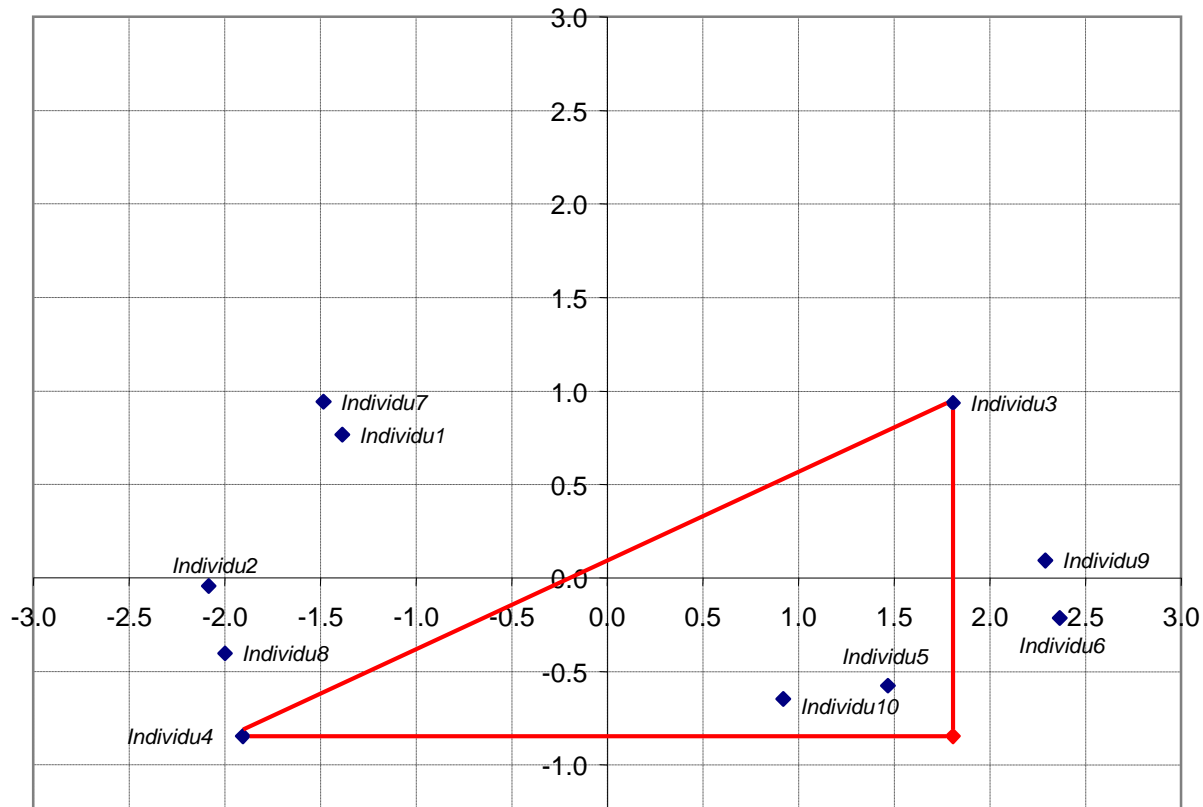
Classifications hiérarchiques

Méthode « ascendante »



Classifications hiérarchiques – 2.2 Exemple pédagogique

	F1	F2
Individu1	-1.3844	0.7654
Individu2	-2.0832	-0.0437
Individu3	1.8071	0.9340
Individu4	-1.9049	-0.8467
Individu5	1.4685	-0.5759
Individu6	2.3667	-0.2153
Individu7	-1.4825	0.9420
Individu8	-1.9978	-0.4031
Individu9	2.2904	0.0925
Individu10	0.9201	-0.6492



$$d(I_3, I_4) = \sqrt{(F_1^3 - F_1^4)^2 + (F_2^3 - F_2^4)^2}$$

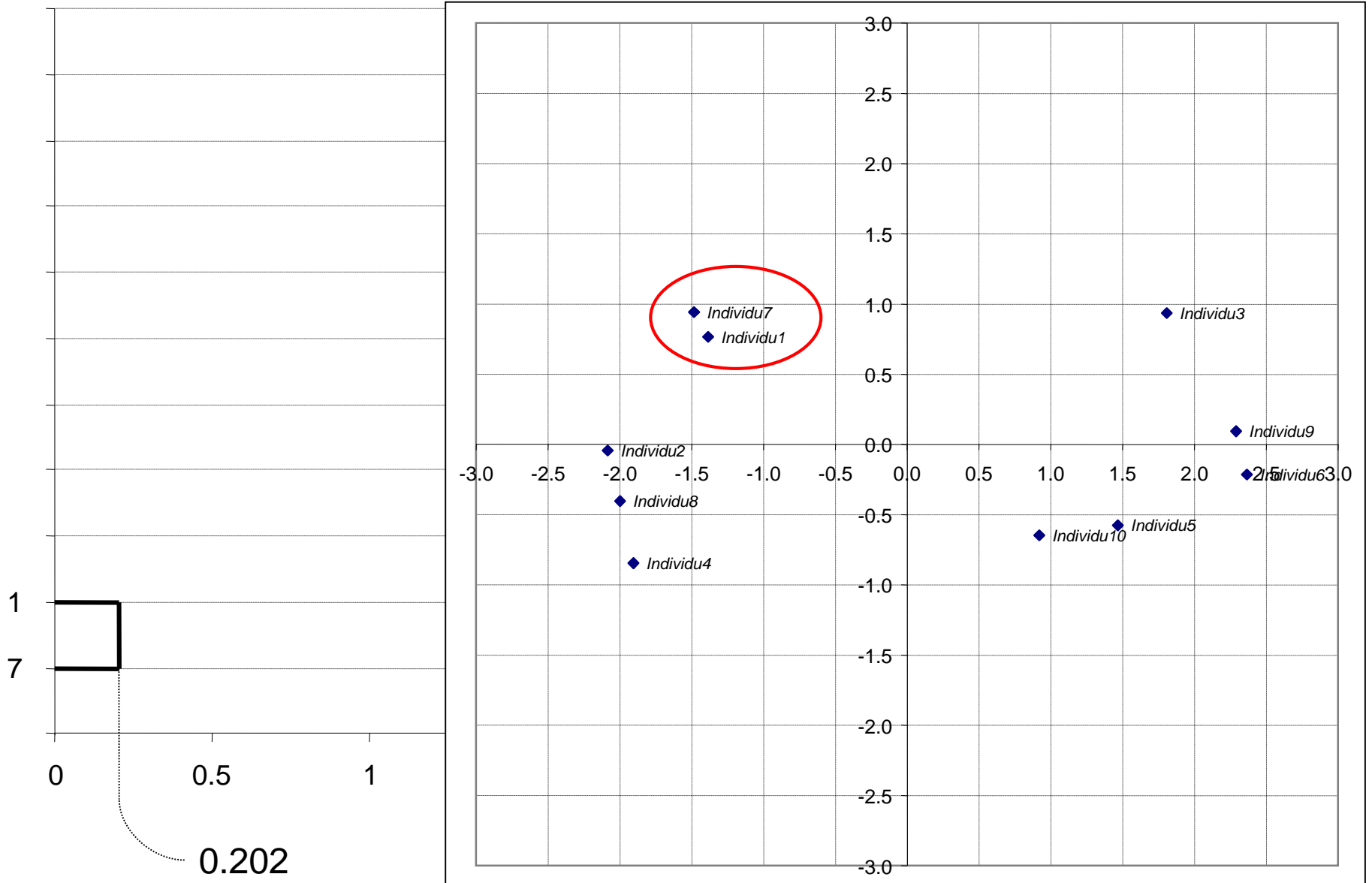
$$d(I_3, I_4) = \sqrt{(1.8071 - (-1.9049))^2 + (0.9340 - (-0.8467))^2} = 4.117$$

Classifications hiérarchiques – 2.2 Exemple pédagogique

	1	2	3	4	5	6	7	8	9	10
1										
2	1.069									
3	3.196	4.011								
4	1.694	0.822	4.117							
5	3.153	3.591	1.547	3.384						
6	3.877	4.453	1.278	4.318	0.968					
7	0.202	1.154	3.290	1.838	3.318	4.019				
8	1.320	0.369	4.033	0.453	3.471	4.368	1.440			
9	3.736	4.376	0.970	4.299	1.059	0.317	3.867	4.317		
10	2.704	3.064	1.815	2.832	0.553	1.510	2.882	2.928	1.558	

$$d(I_3, I_4) = \sqrt{(1.8071 - (-1.9049))^2 + (0.9340 - (-0.8467))^2} = 4.117$$

Classifications hiérarchiques - Dendrogramme

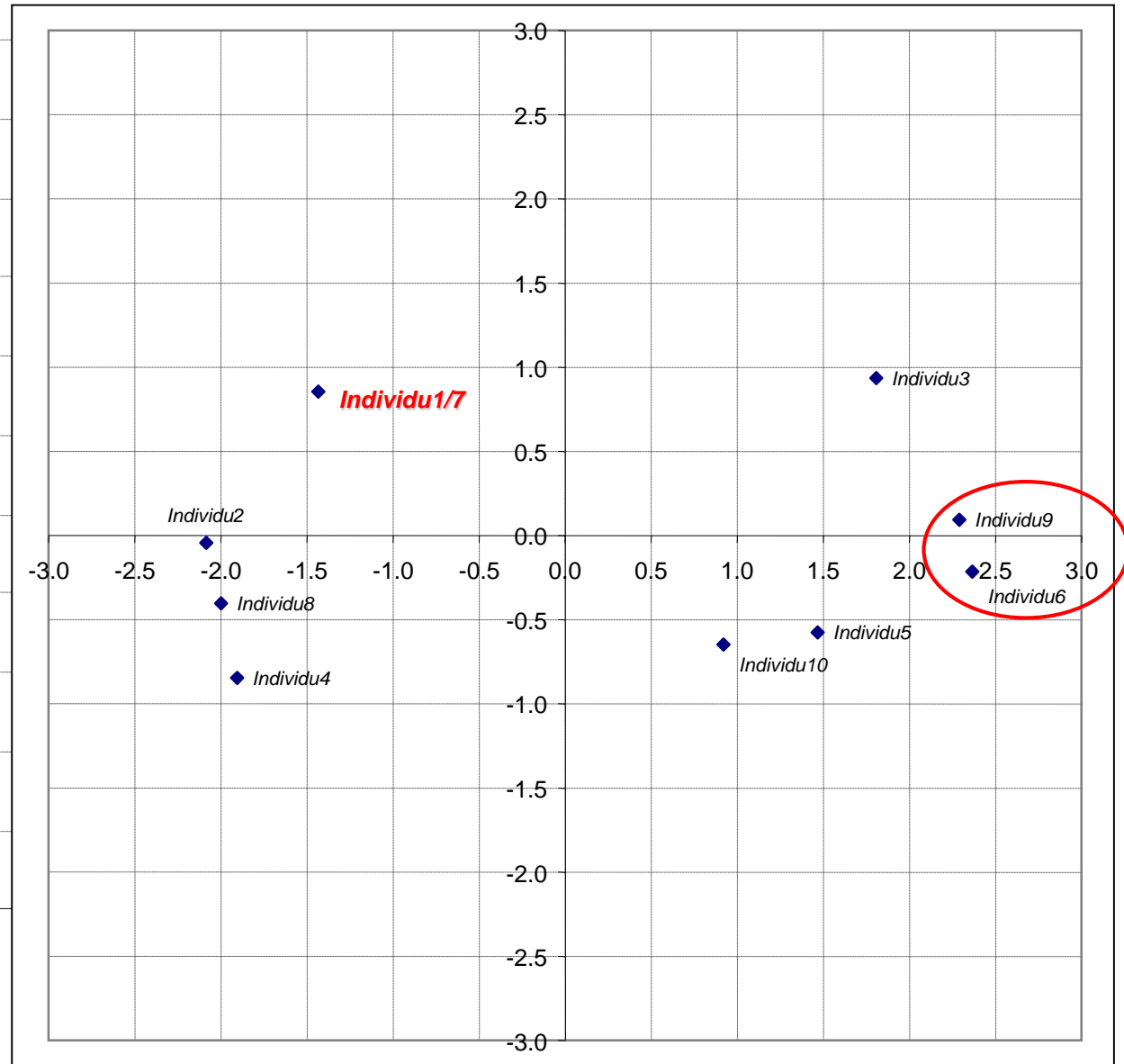
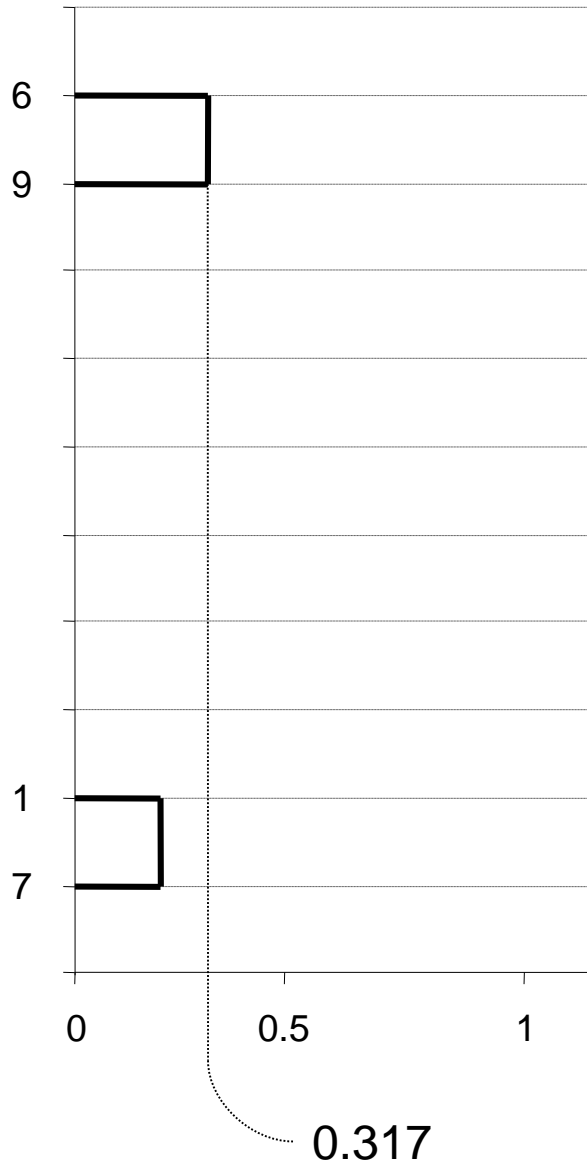


Classifications hiérarchiques

Individu1			F1	F2	Individu7	
-1.3844	0.7654	Individu1/7	-1.4335	0.8537	-1.4825	0.9420
		Individu2	-2.0832	-0.0437		
		Individu3	1.8071	0.9340		
		Individu4	-1.9049	-0.8467		
		Individu5	1.4685	-0.5759		
		Individu6	2.3667	-0.2153		
		Individu8	-1.9978	-0.4031		
		Individu9	2.2904	0.0925		
		Individu10	0.9201	-0.6492		

	1/7	2	3	4	5	6	8	9	10
1/7									
2	1.108								
3	3.242	4.011							
4	1.765	0.822	4.117						
5	3.235	3.591	1.547	3.384					
6	3.948	4.453	1.278	4.318	0.968				
8	1.378	0.369	4.033	0.453	3.471	4.368			
9	3.801	4.376	0.970	4.299	1.059	0.317	4.317		
10	2.792	3.064	1.815	2.832	0.553	1.510	2.928	1.558	

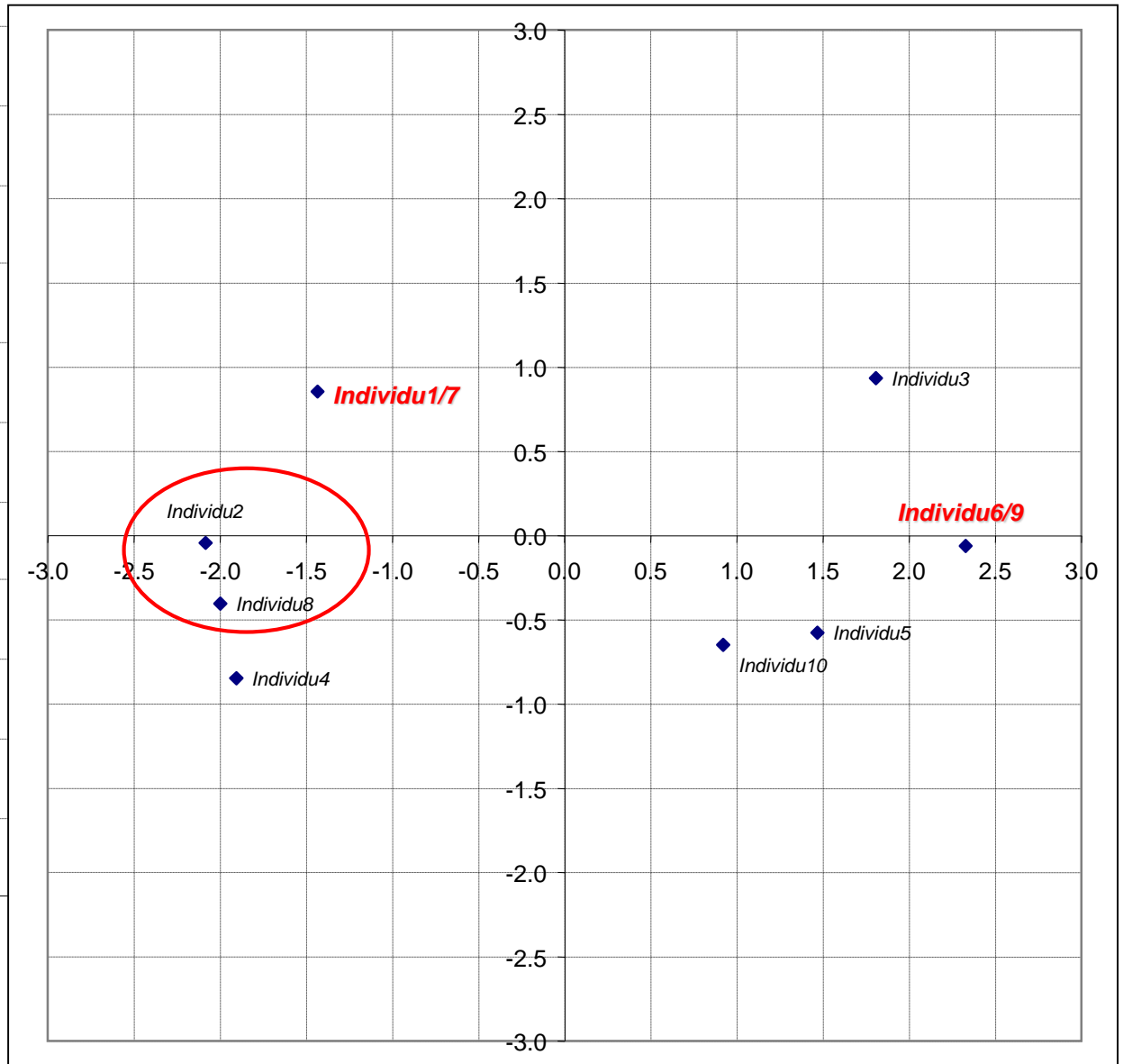
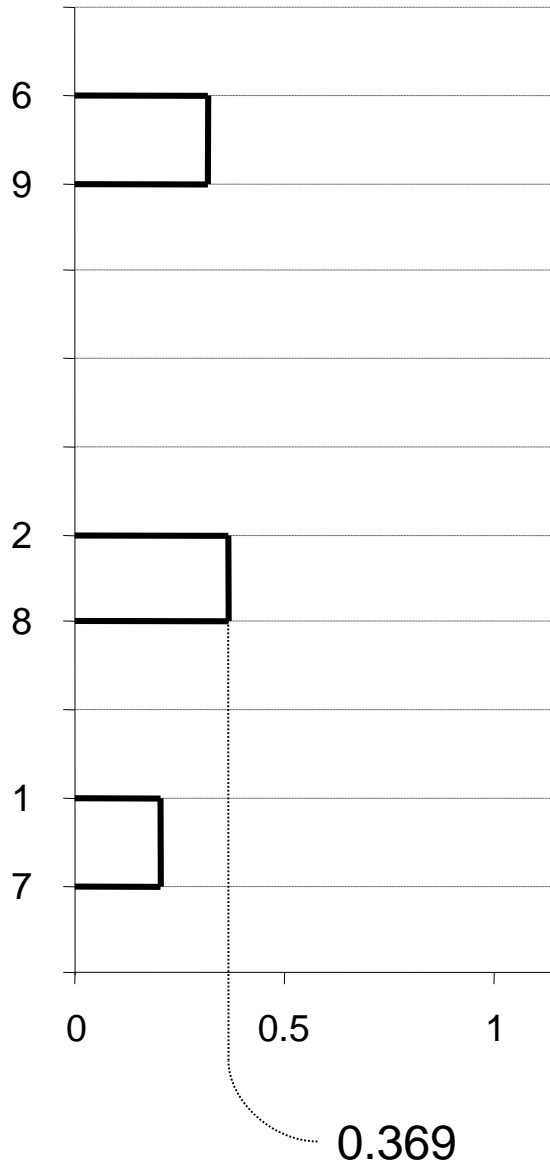
Classifications hiérarchiques - Dendrogramme



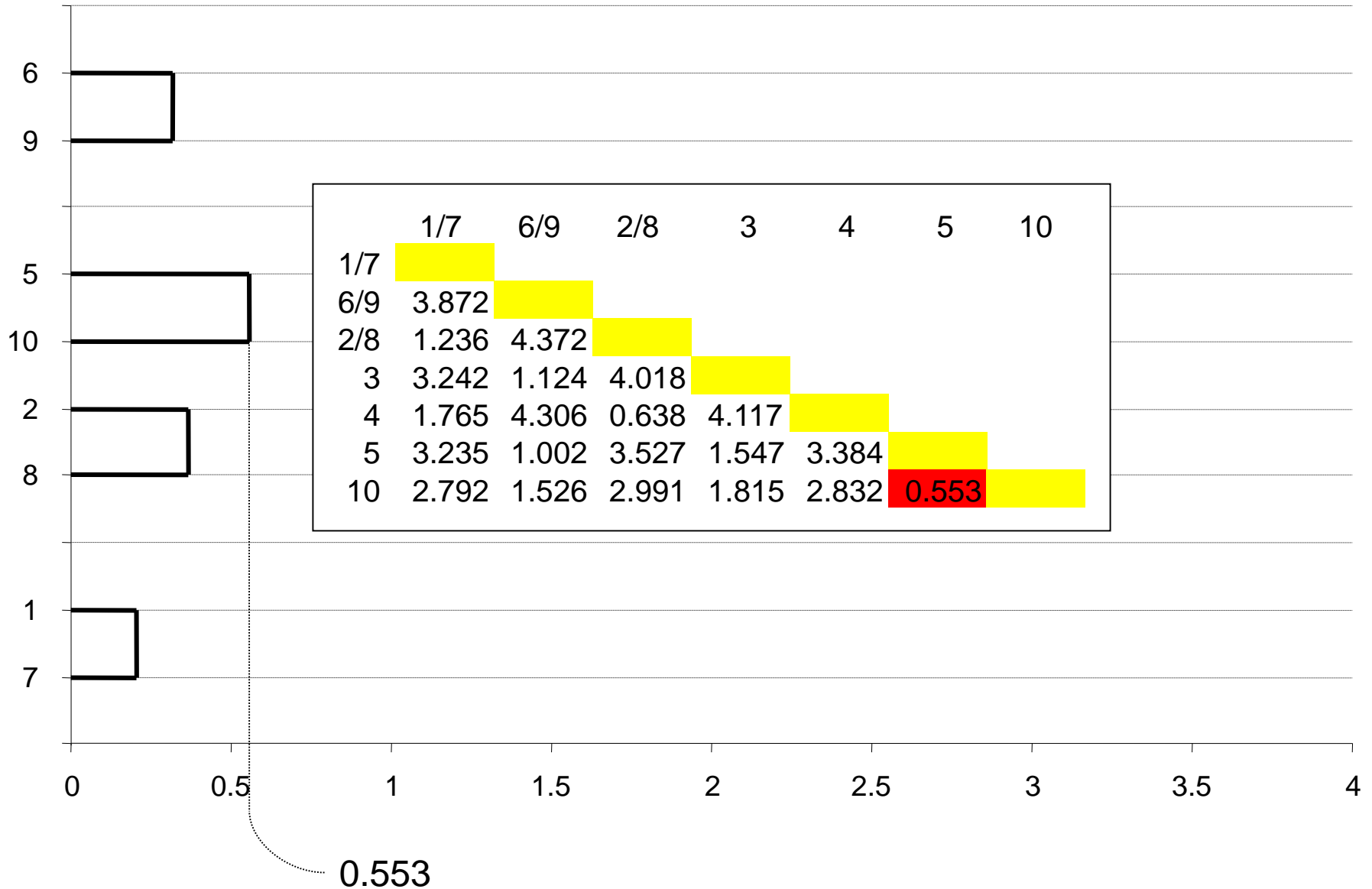
Classifications hiérarchiques

	1/7	6/9	2	3	4	5	8	10
1/7								
6/9	3.872							
2	1.108	4.412						
3	3.242	1.124	4.011					
4	1.765	4.306	0.822	4.117				
5	3.235	1.002	3.591	1.547	3.384			
8	1.378	4.340	0.369	4.033	0.453	3.471		
10	2.792	1.526	3.064	1.815	2.832	0.553	2.928	

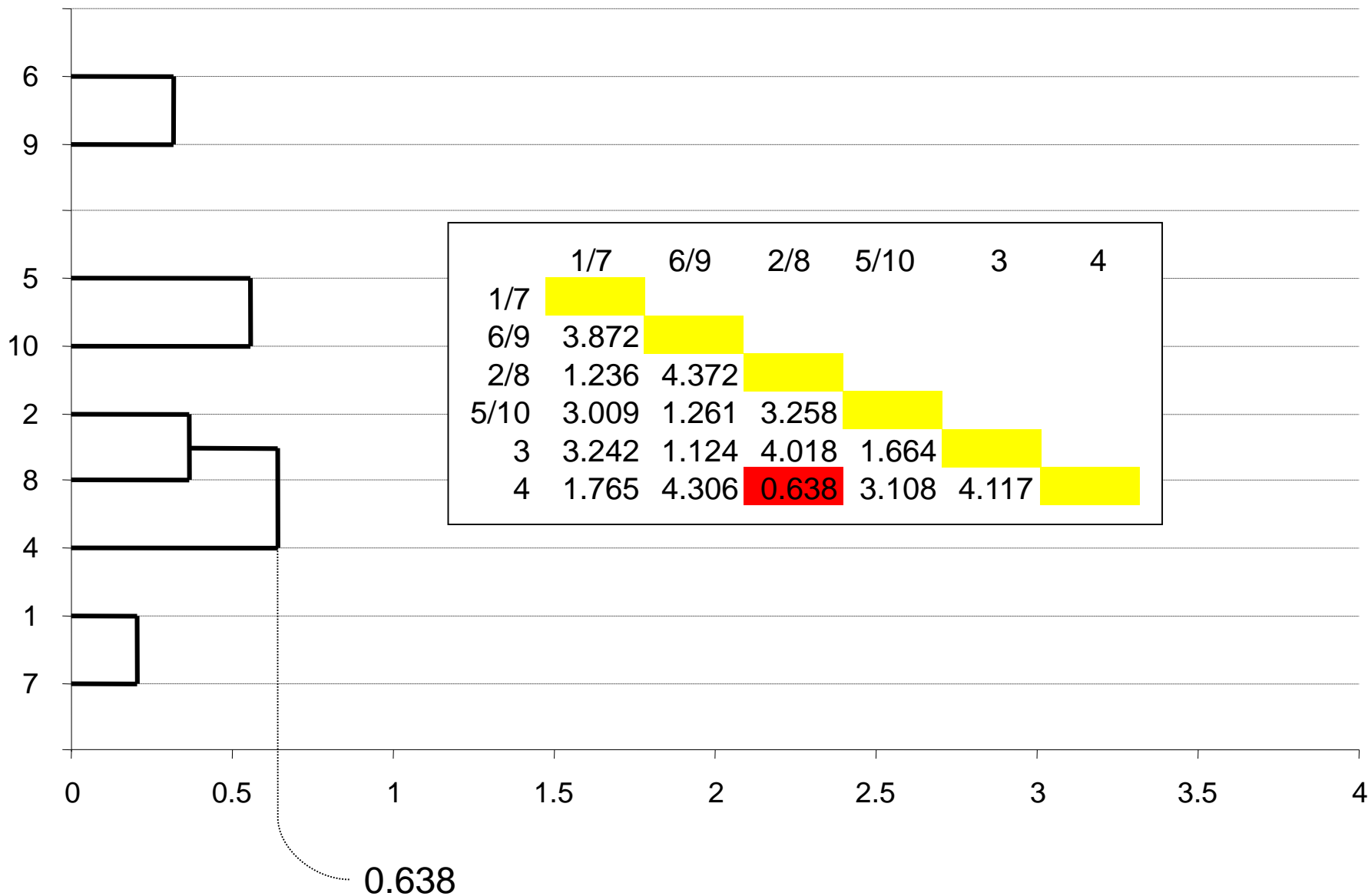
Classifications hiérarchiques - Dendrogramme



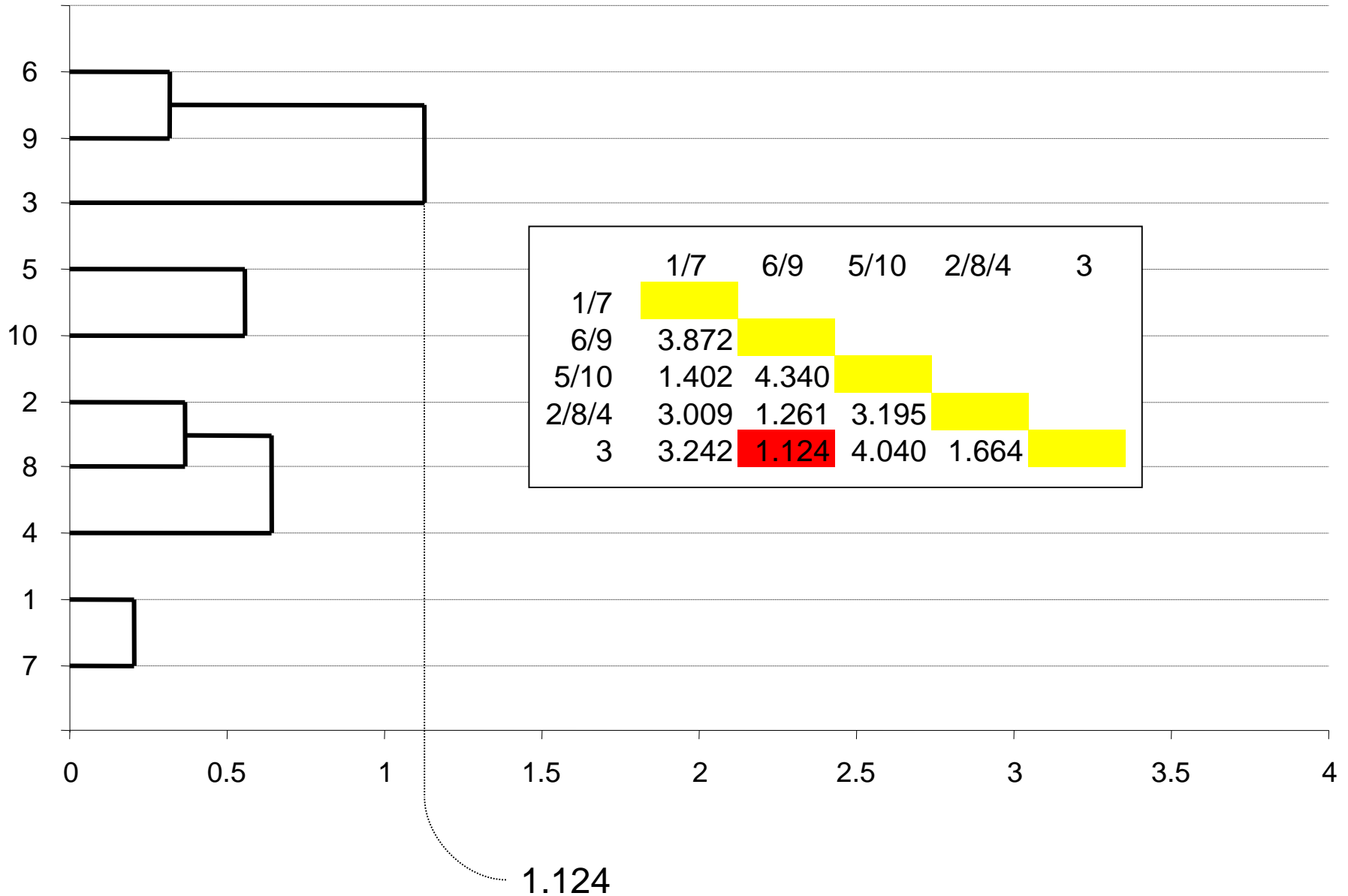
Classifications hiérarchiques - Dendrogramme



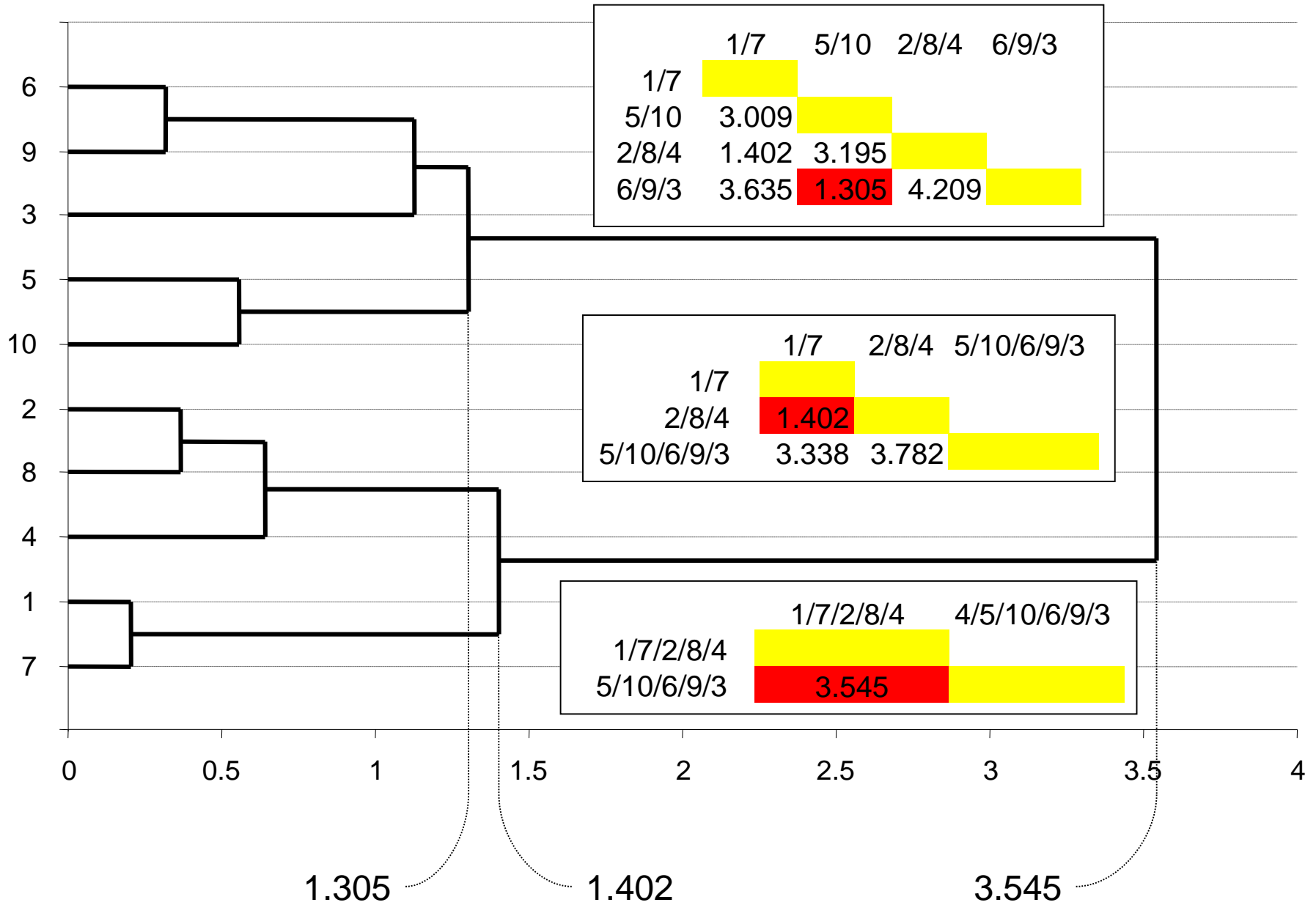
Classifications hiérarchiques - Dendrogramme



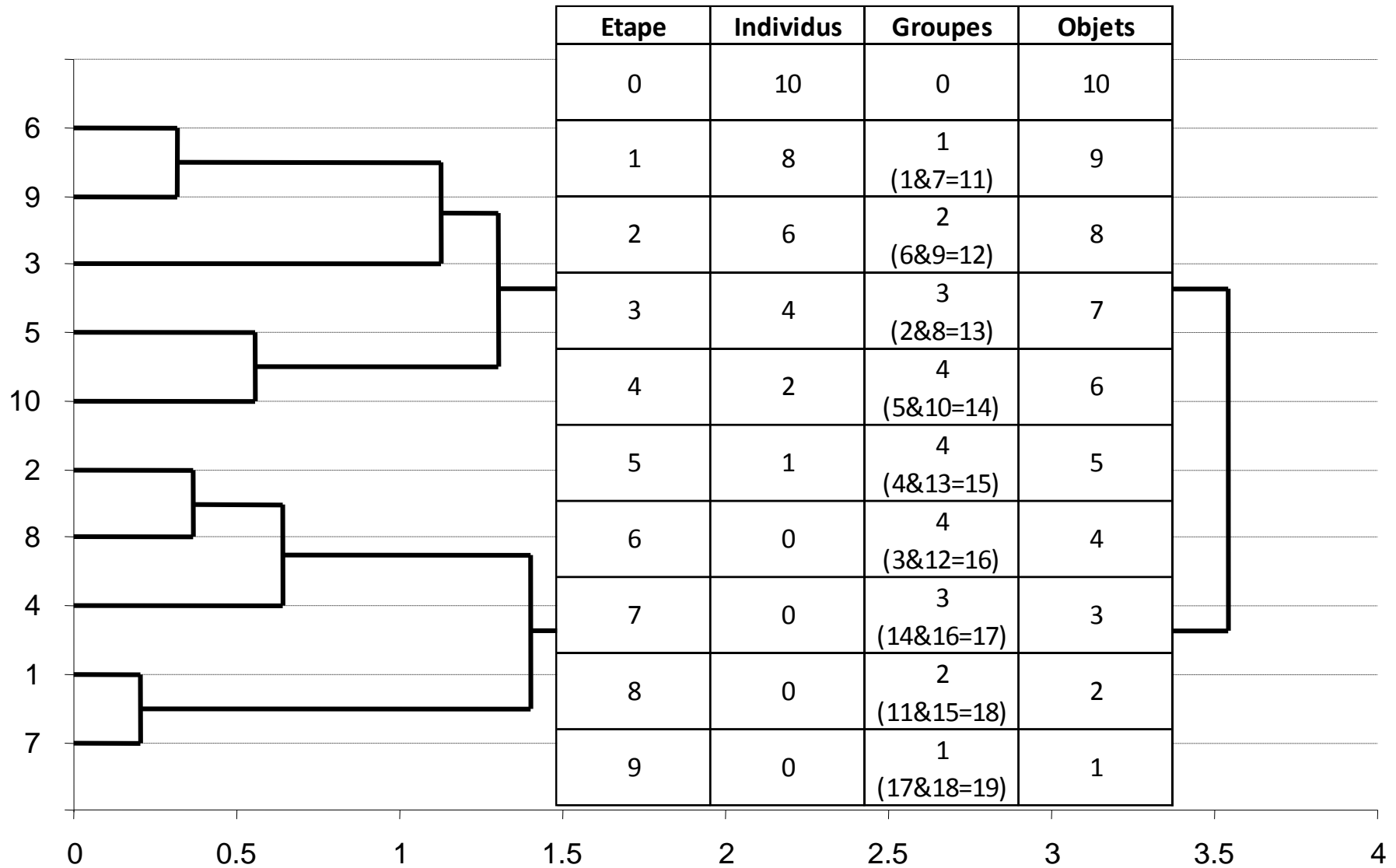
Classifications hiérarchiques - Dendrogramme



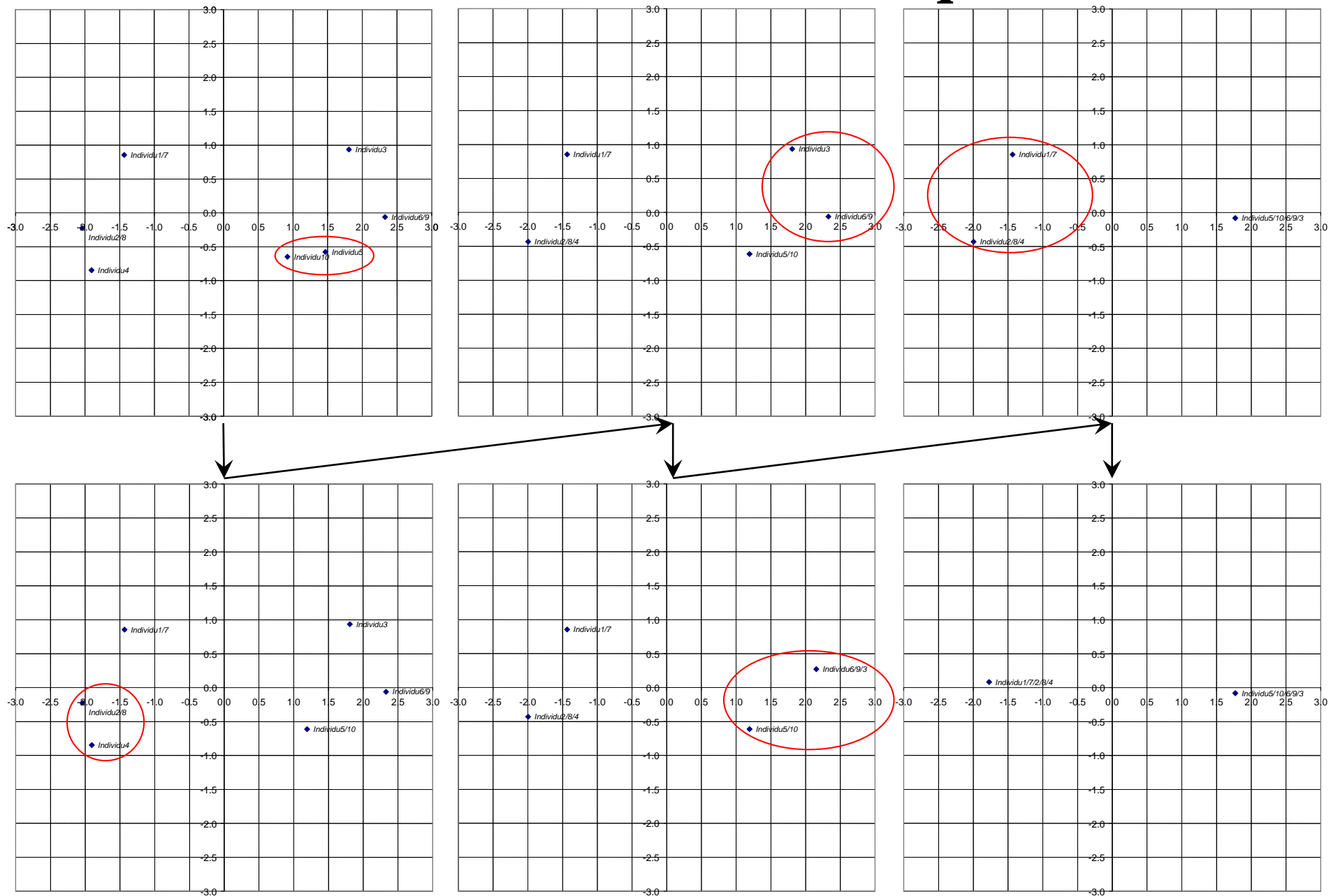
Classifications hiérarchiques - Dendrogramme



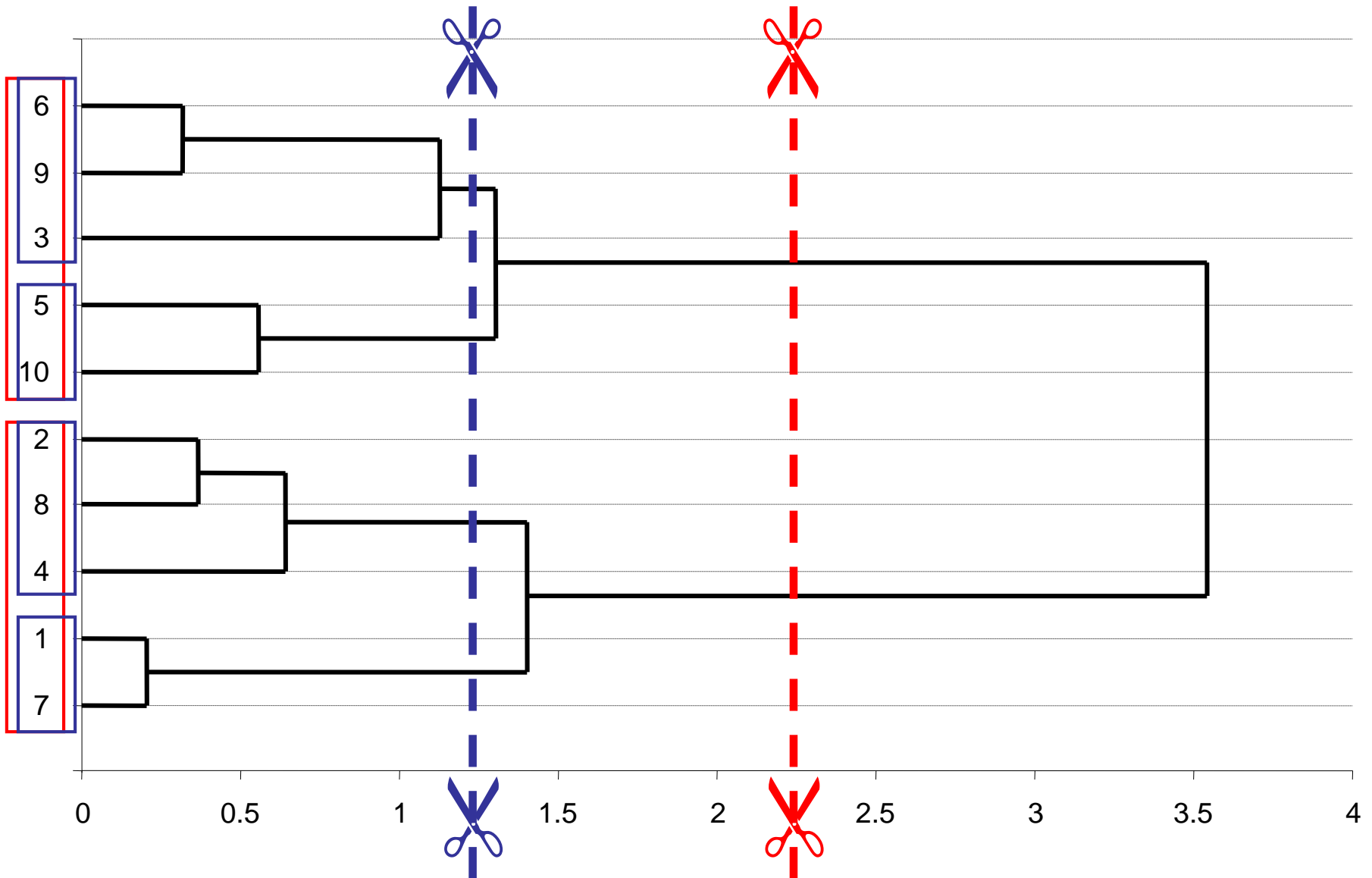
Classifications hiérarchiques - Dendrogramme



Classifications hiérarchiques

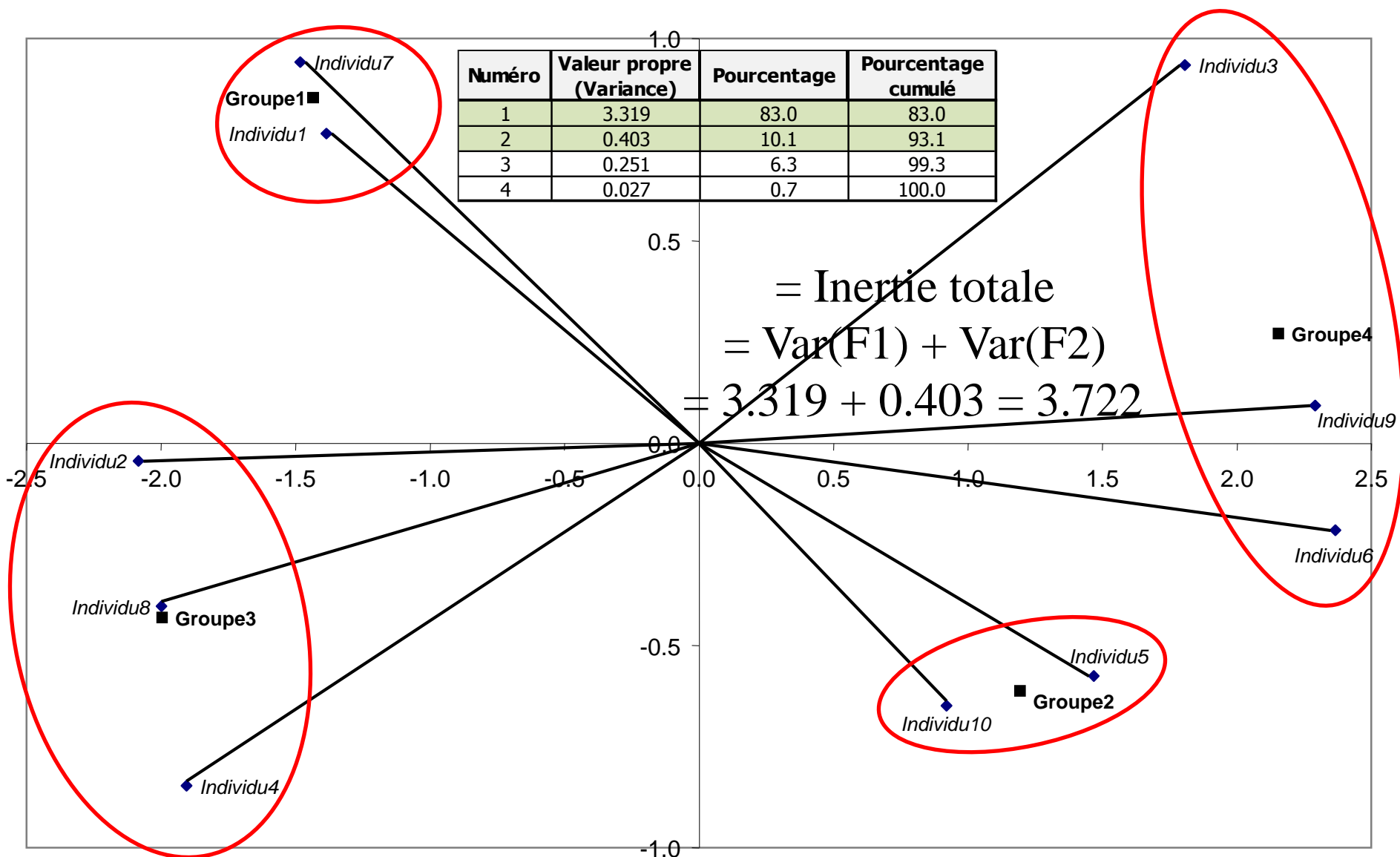


Classifications hiérarchiques - Dendrogramme



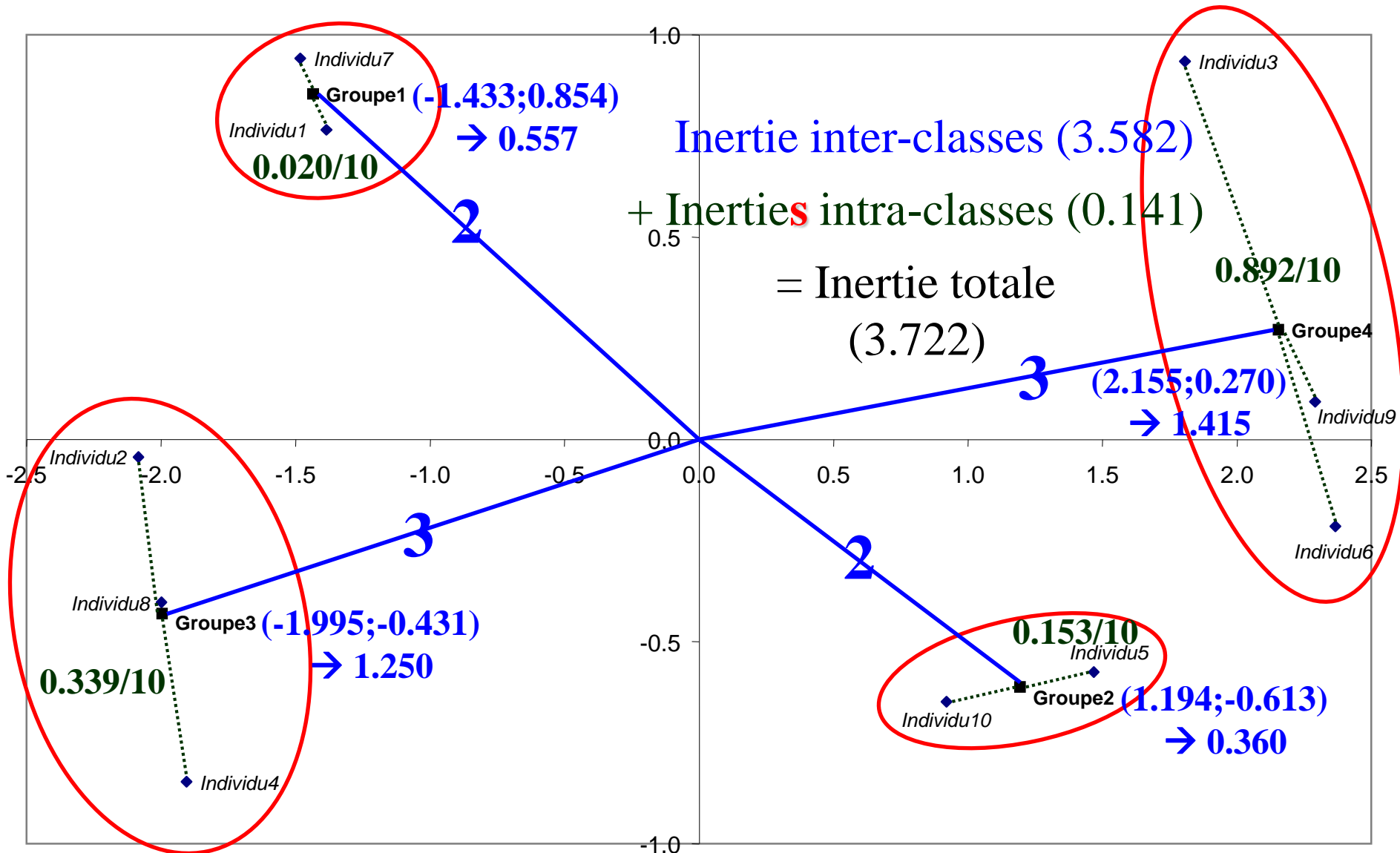
Classifications hiérarchiques

2.2.2. Indice de niveau avec 4 groupes



Classifications hiérarchiques

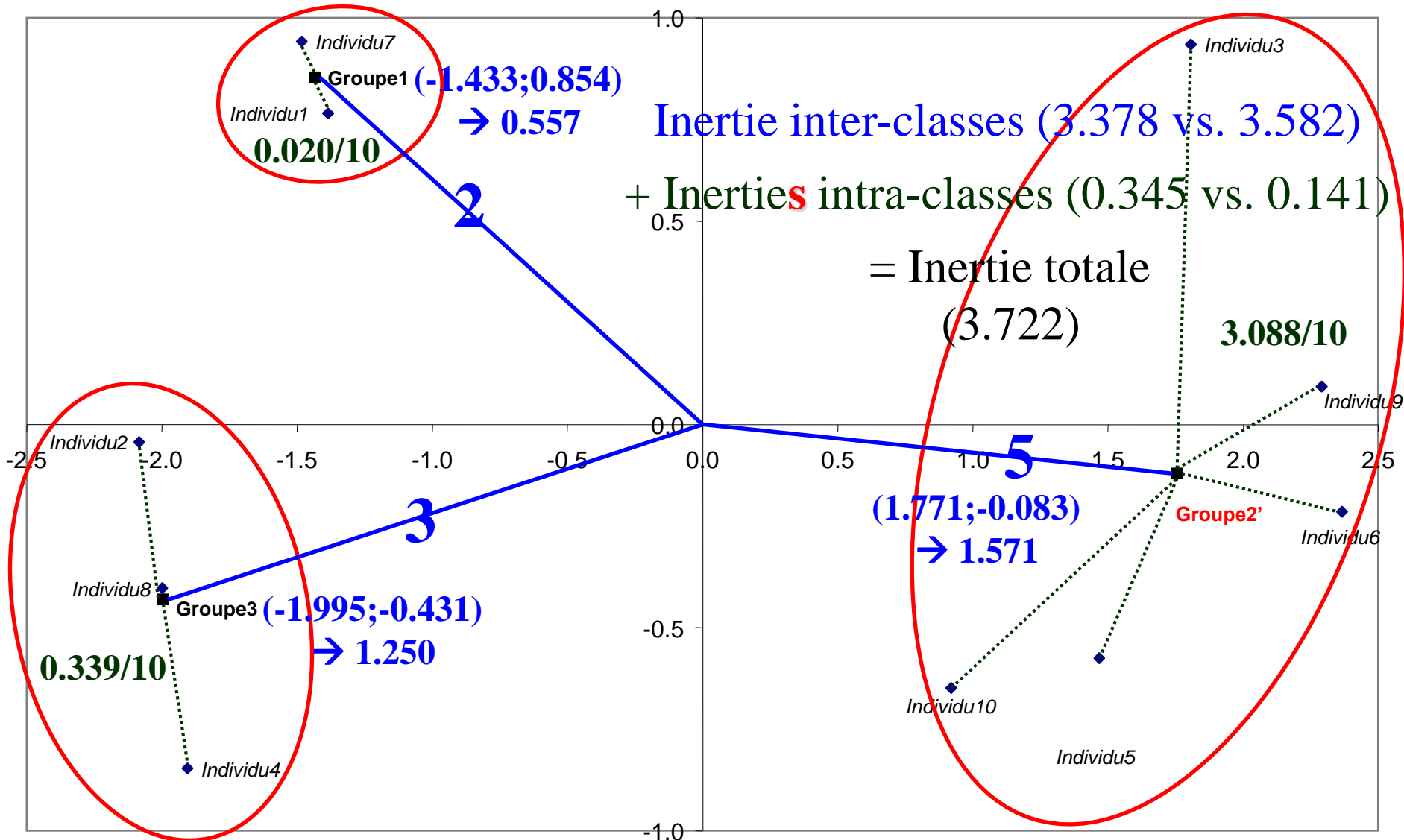
2.2.2. Indice de niveau avec 4 groupes



Classifications hiérarchiques

Perte In. Inter
3.582 - 3.378
= **0.204**

2.2.2. Indice de niveau avec 3 groupes



Classifications hiérarchiques

2.2.2. Indices de niveau

Méthode de Ward

Lorsqu'on remplace deux classes A et B par leur réunion, on montre que la diminution de l'inertie interclasse (et donc l'augmentation de la somme des inerties intraclasse) est égale à :

$$\frac{n_A \cdot n_B}{n \cdot [n_A + n_B]} \cdot d^2[g_A, g_B]$$

Classifications hiérarchiques

2.2.2. Indices de niveau

Méthode de Ward

	1	2	3	4	5	6	7	8	9	10
1										
2	1.069									
3	3.196	4.011								
4	1.694	0.822	4.117							
5	3.153	3.591	1.547	3.384						
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10	2.704	3.064	1.815	2.832	0.553	1.510	2.882	2.928	1.558	

$$\frac{n_A \cdot n_B}{n \cdot [n_A + n_B]} \cdot d^2[g_A, g_B]$$

$$\frac{n_1 \cdot n_7}{n \cdot [n_1 + n_7]} \cdot d^2[g_1, g_7] = \frac{1 \cdot 1}{10 \cdot [1 + 1]} \cdot 0.202^2 = 0.00204$$

Classifications hiérarchiques

2.2.2. Indices de niveau

Méthode de Ward

	1/7	6/9	2/8	5/10	3	4
1/7						
6/9	3.872					
2/8	1.236	4.372				
5/10	3.009	1.261	3.258			
3	3.242	1.124	4.018	1.664		
4	1.765	4.306	0.638	3.108	4.117	

$$\frac{n_4 \cdot n_{2/8}}{n \cdot [n_4 + n_{2/8}]} \cdot d^2[g_4, g_{2/8}] = \frac{1 \cdot 2}{10 \cdot [1 + 2]} \cdot 0.638^2 = 0.02712$$

Classifications hiérarchiques

2.2.2. Indices de niveau

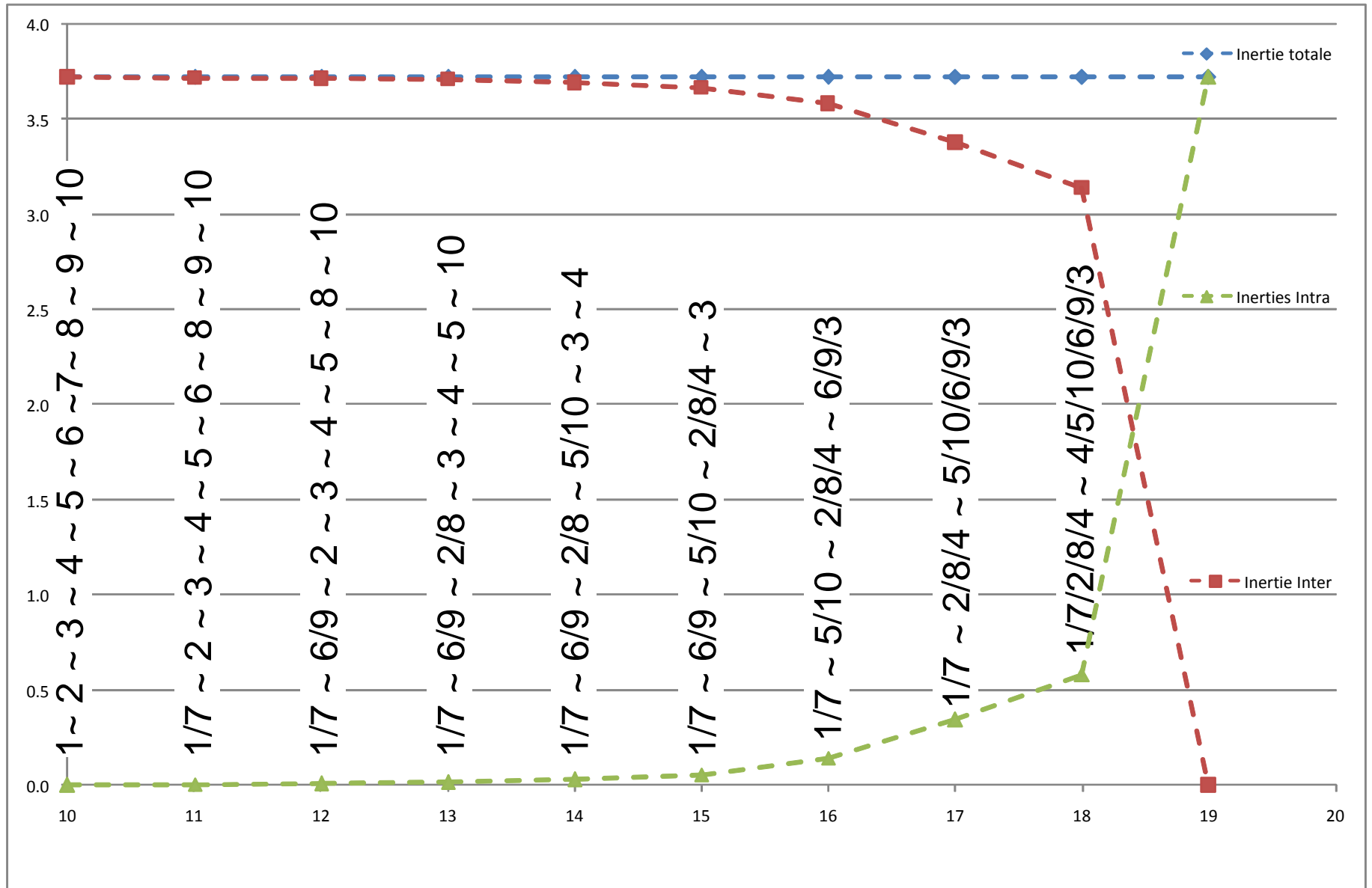
Résultats SPAD

NUM.	AINE	BENJ	EFF	POIDS	INDICE
11	7	1	2	2	0.00204
12	6	9	2	2	0.00503
13	8	2	2	2	0.00682
14	5	10	2	2	0.01530
15	4	13	3	3	0.02712
16	12	3	3	3	0.08419
17	16	14	5	5	0.20424
18	15	11	5	5	0.23599
19	17	18	10	10	3.14170

Somme des indices de niveau = **3.72244**

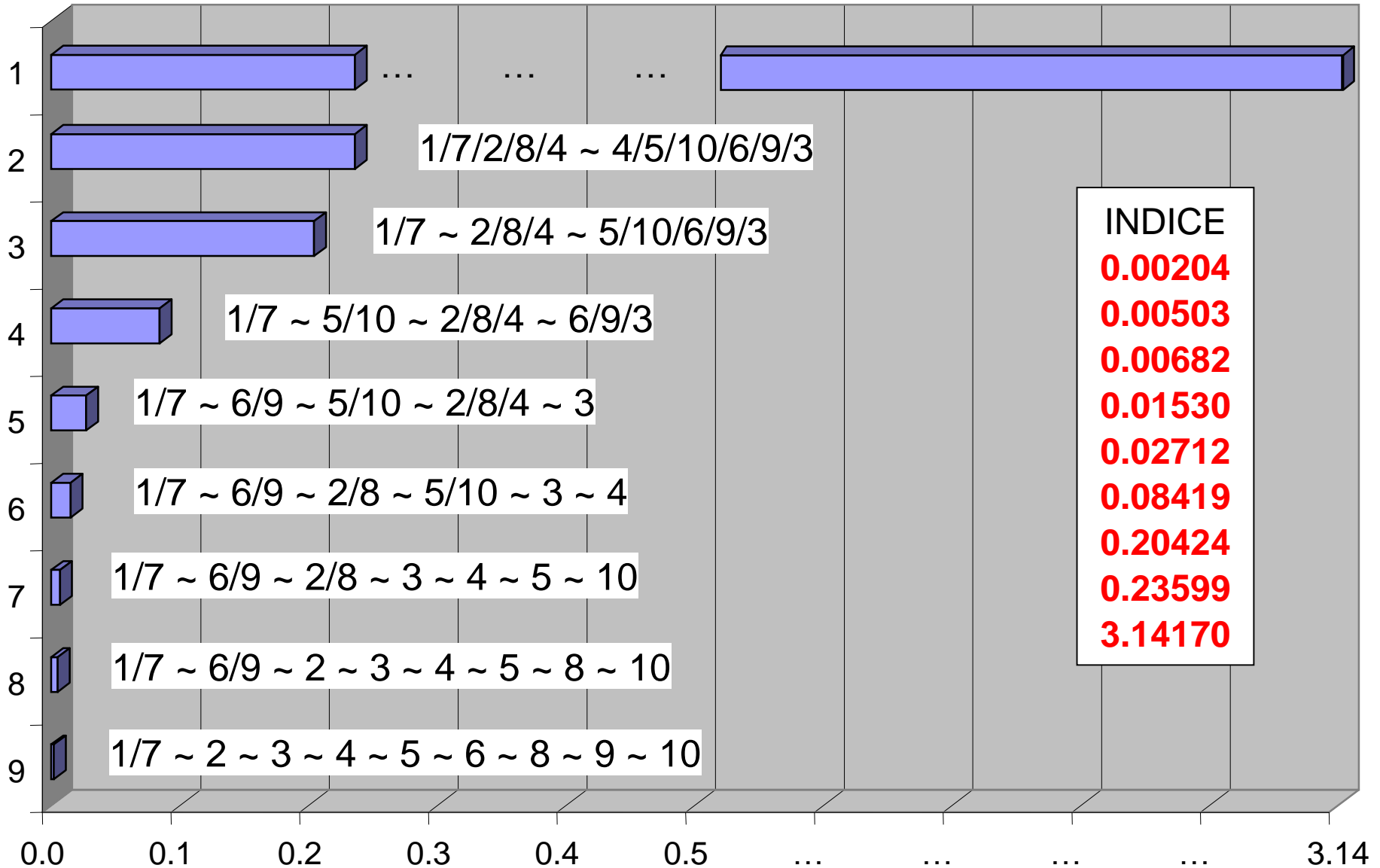
Classifications hiérarchiques

2.2.2. Indices de niveau



Classifications hiérarchiques

Résultats SPAD



Classifications hiérarchiques

2.2.2. Indices de niveau

Résultats SPAD

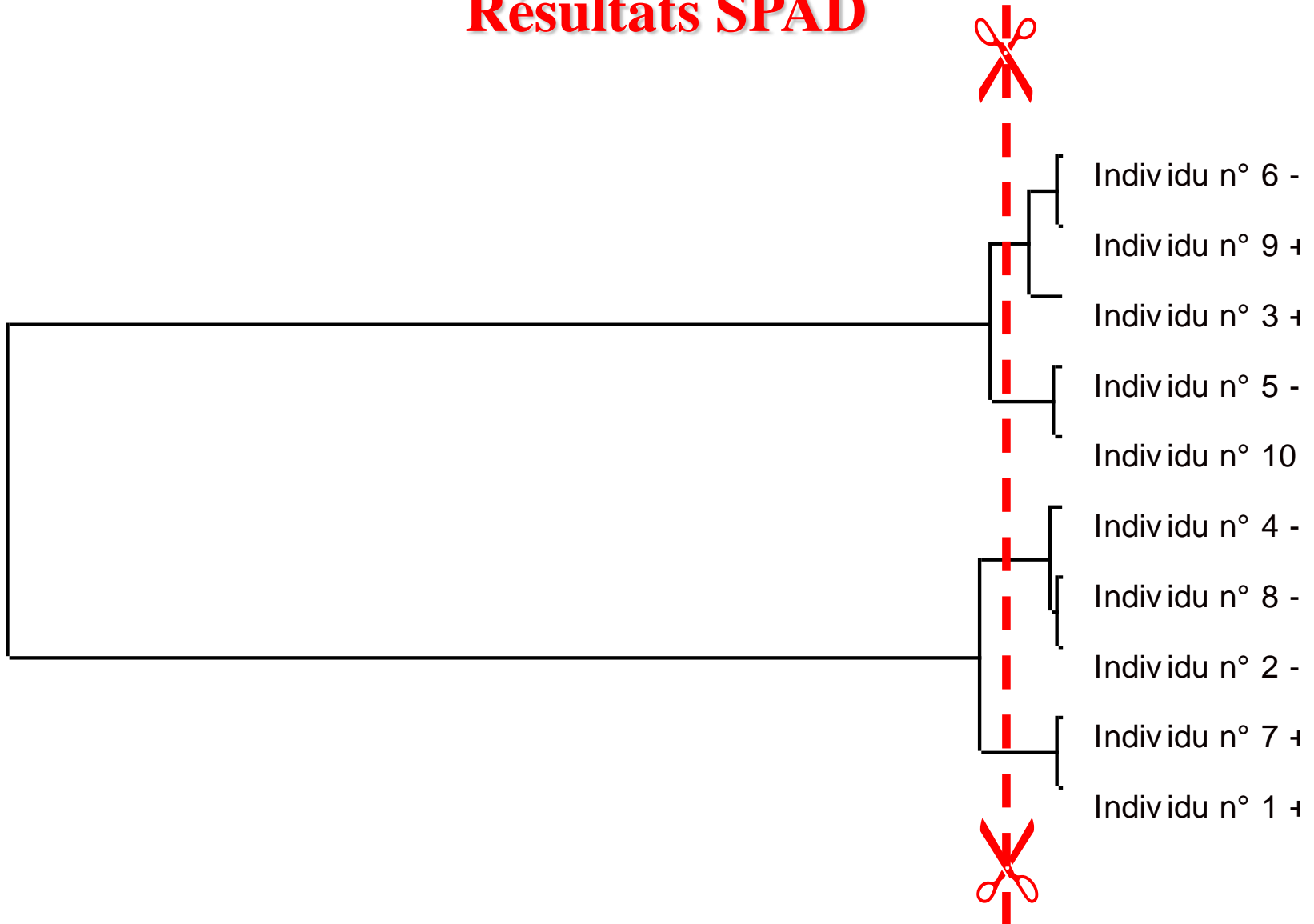
LISTE DES 3 MEILLEURE(S) PARTITION(S)
ENTRE 3 ET 7 CLASSES

- 1 - PARTITION EN 5 CLASSES
- 2 - PARTITION EN 4 CLASSES
- 3 - PARTITION EN 7 CLASSES

Classifications hiérarchiques

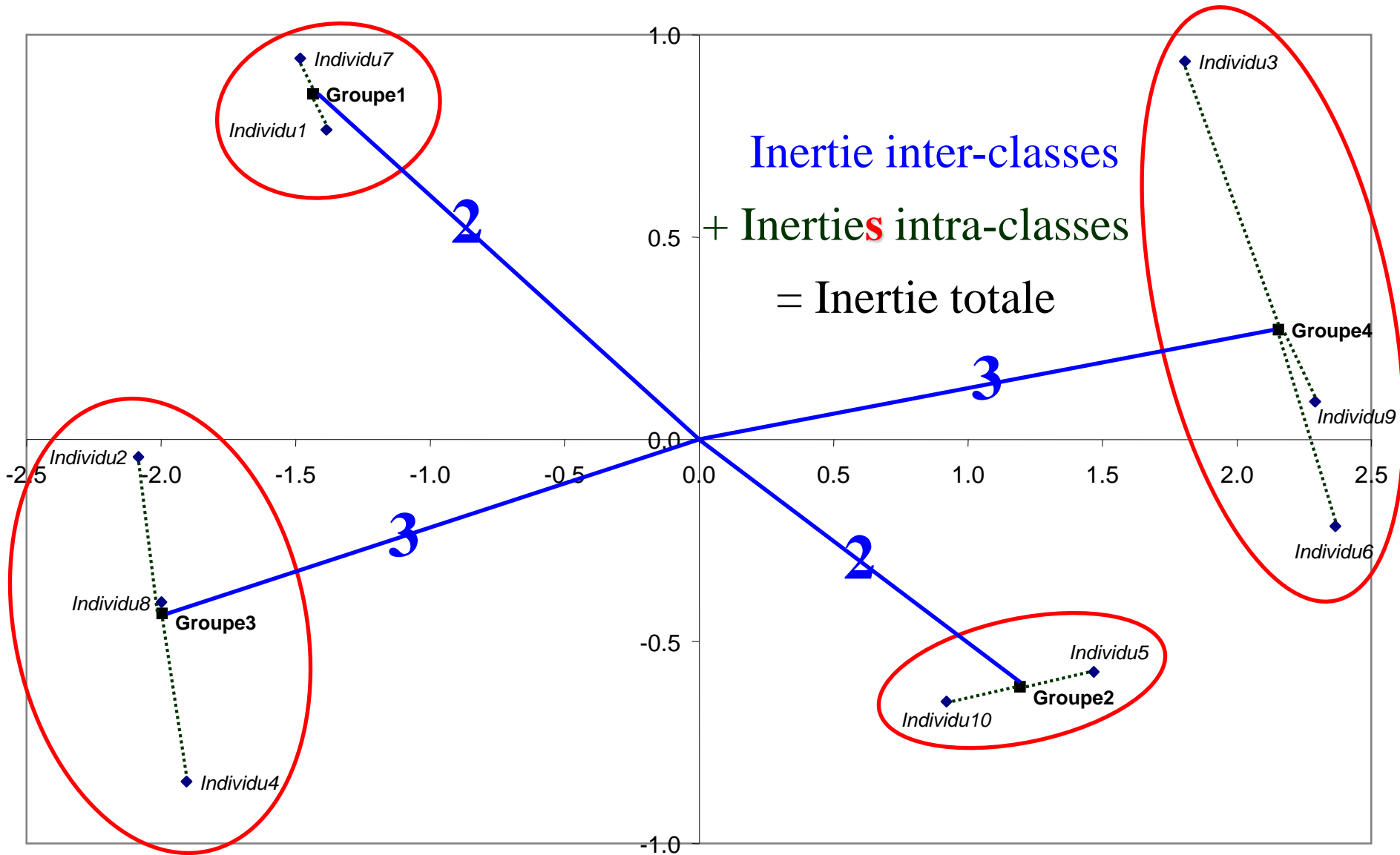
2.2.2. Indices de niveau

Résultats SPAD



Classifications hiérarchiques

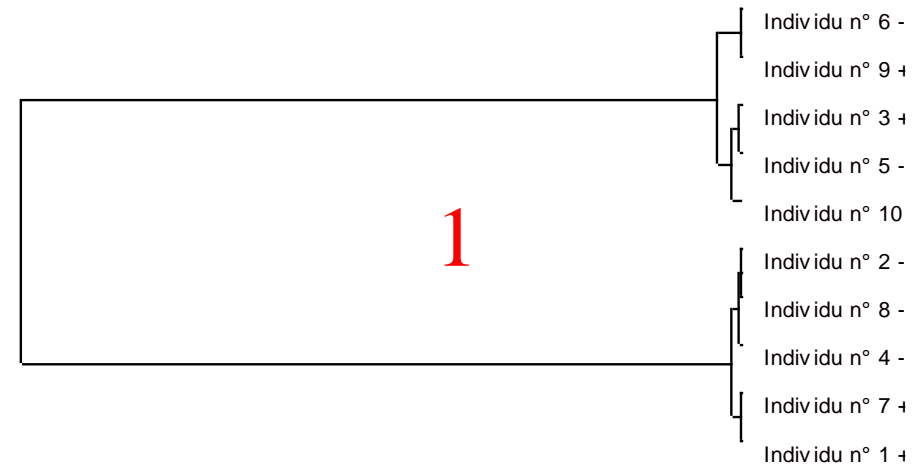
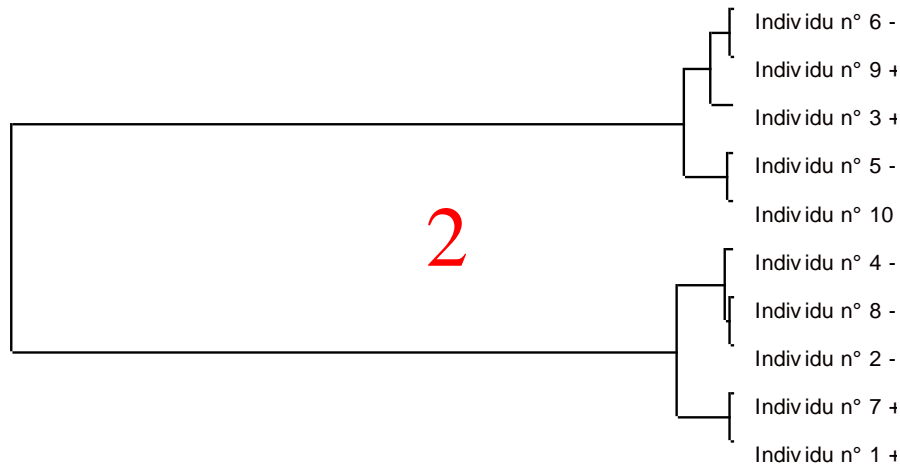
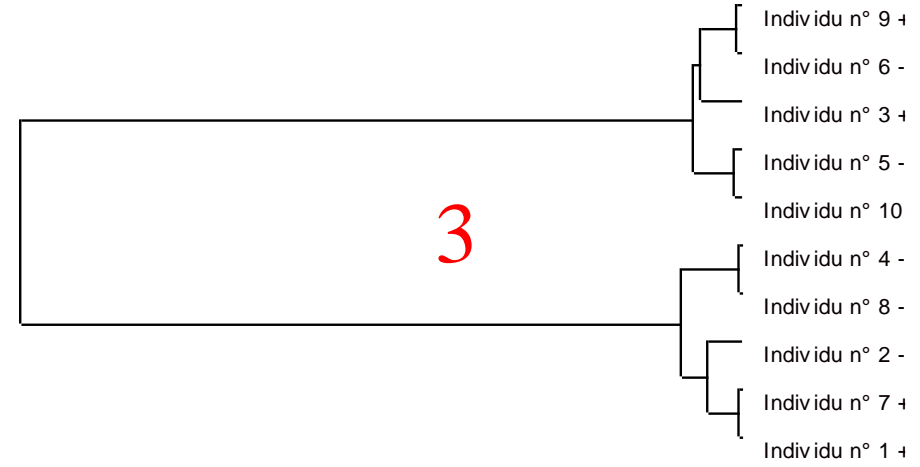
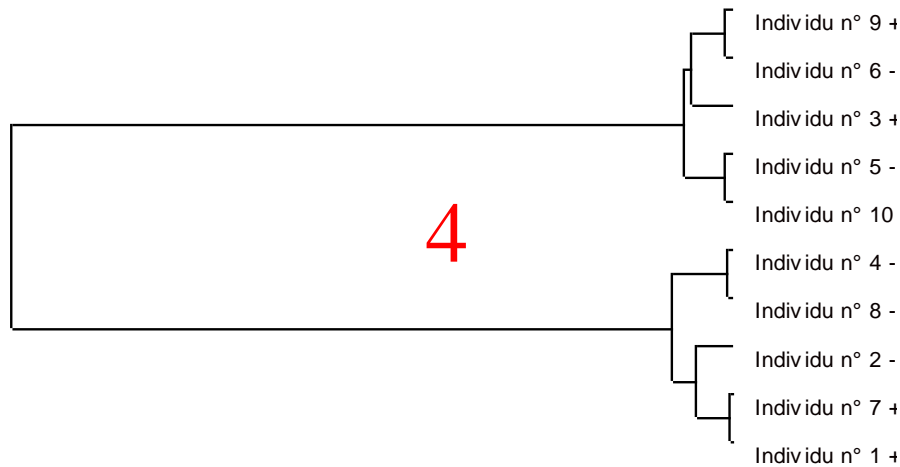
2.2.3. Consolidation de la partition.

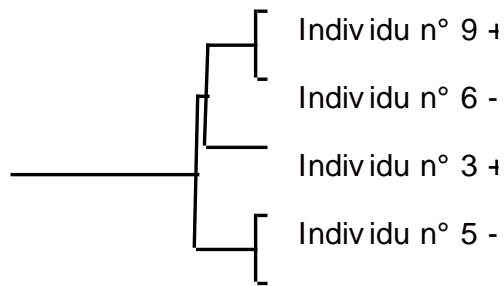


Classifications hiérarchiques - 2.3. Stabilité des classes.

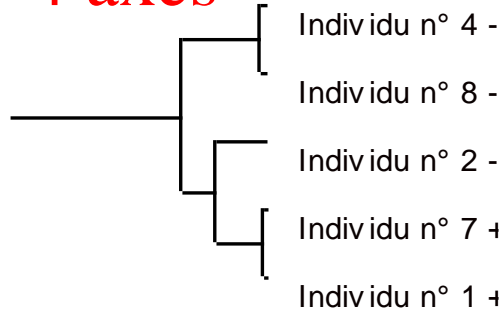
Exemples de DENDROGRAMME

suivant le nombre d'axes (coordonnées factorielles) retenus

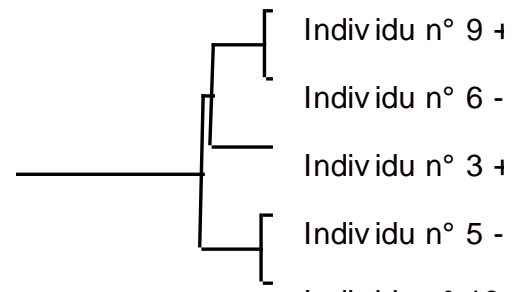
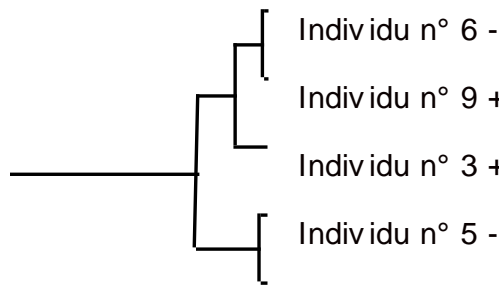




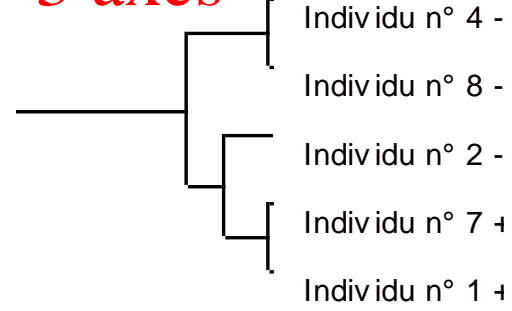
4 axes



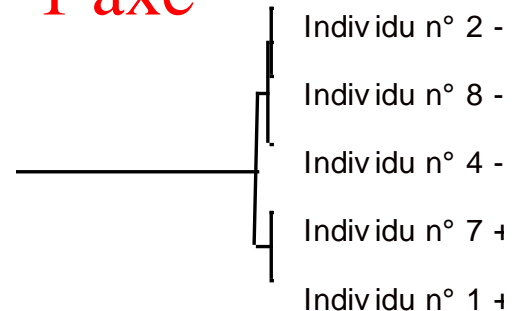
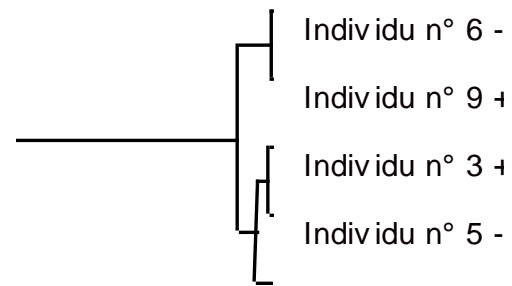
2 axes



3 axes



1 axe



Classifications hiérarchiques - 2.3. Qualification des classes.

Retour sur les données initiales