SI for Chapter 6.Regions.

Regions are spatial clusters.
SI 6.1. Dendrogram, map and table for all camp locations. spatial
SI 6.2. Dendrogram, map and table for camp locations in 1985 **spatial1985**
SI 6.3. Dendrogram, map and table for camp locations in 1999 **spatial1999**

Regions are clusters of kin.
SI 6.4. Regions and kinship in 1985. kinship
SI 6.5. Region x kinship in 1999. related1999

Kinship x distance.
SI 6.6. Kinship x distance fitskindist

Long term region to region movement.
SI 6.7. Measures for region of origin. longterm
SI 6.8. Region of origin of parents of children born 1985-2000. parentsregion

Regions are spatial clusters.

SI 6.1. Regions as spatial clusters. 1985-2000.

Map of 243 camps visited between 1985 and 2000, with spatial cluster membership denoted by symbols. The spatial clusters correspond closely with Hadza identification of the region of their camp. Cluster observations, linkage method average, distance measure Euclidean, 4 clusters. From late 1985 camps were mapped by UTM coordinates.
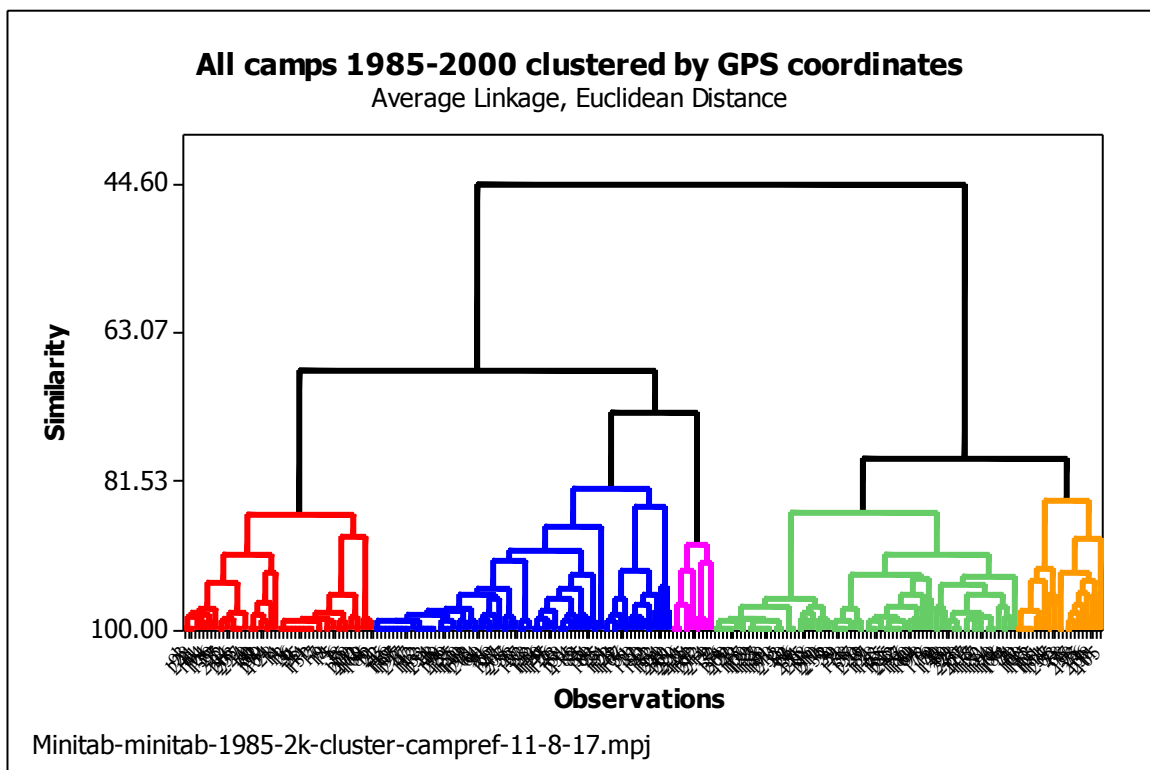
Color version of 5 cluster version of Figure 6.1

Scatterplot of KmNorth vs KmEast
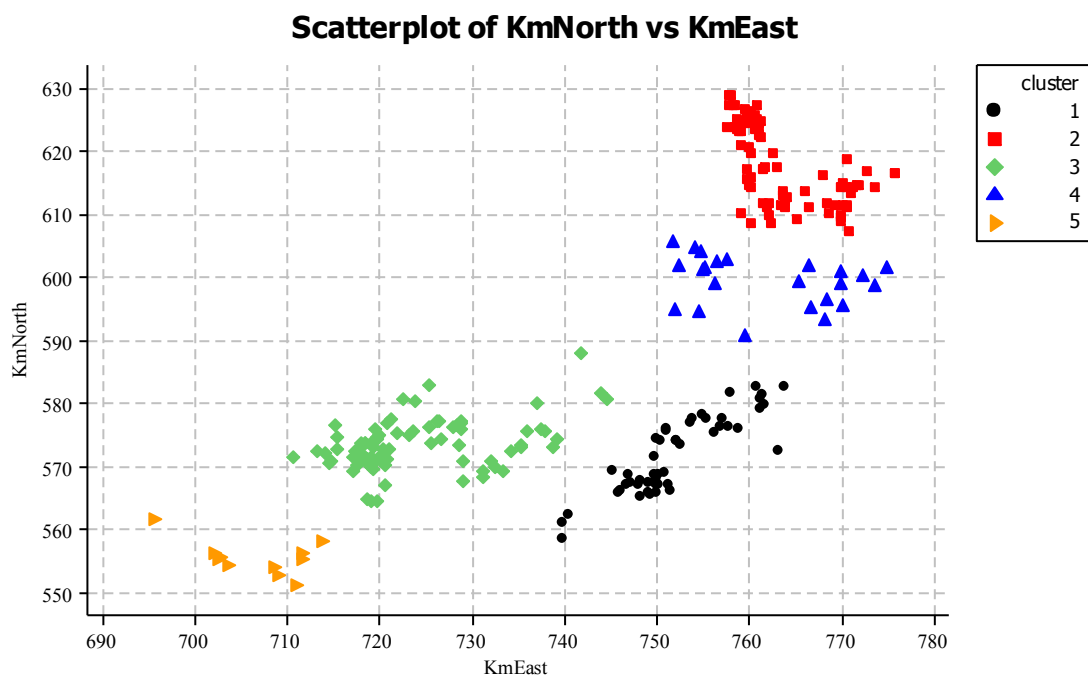
Minitab-1985-2k-cluster-campref-11-8-17.mpj

Dendrogram of all camps located 1985- 2000, clustered by GPS coordinates. The illegible labels on the x – axis are the camp ID numbers. When table is split and displayed full size the record numbers (on X axis) can be read and camps and their regions identified, leading to the following labels. Left, in red: Siponga. Blue: Mangola, Mauve: Ma south, Ma mountains, northern Han!abe. Green: Tliika. Orange: Tliika south, Munguli and Singida villages.

A cluster analysis could have been run using each individual in the camps as an observation. This seemed redundant. It would only be useful if there were many individuals living alone or outside Hadza camps, or if many people changed location during a census.

All camps 1985-2000 clustered by GPS coordinates
Average Linkage, Euclidean Distance

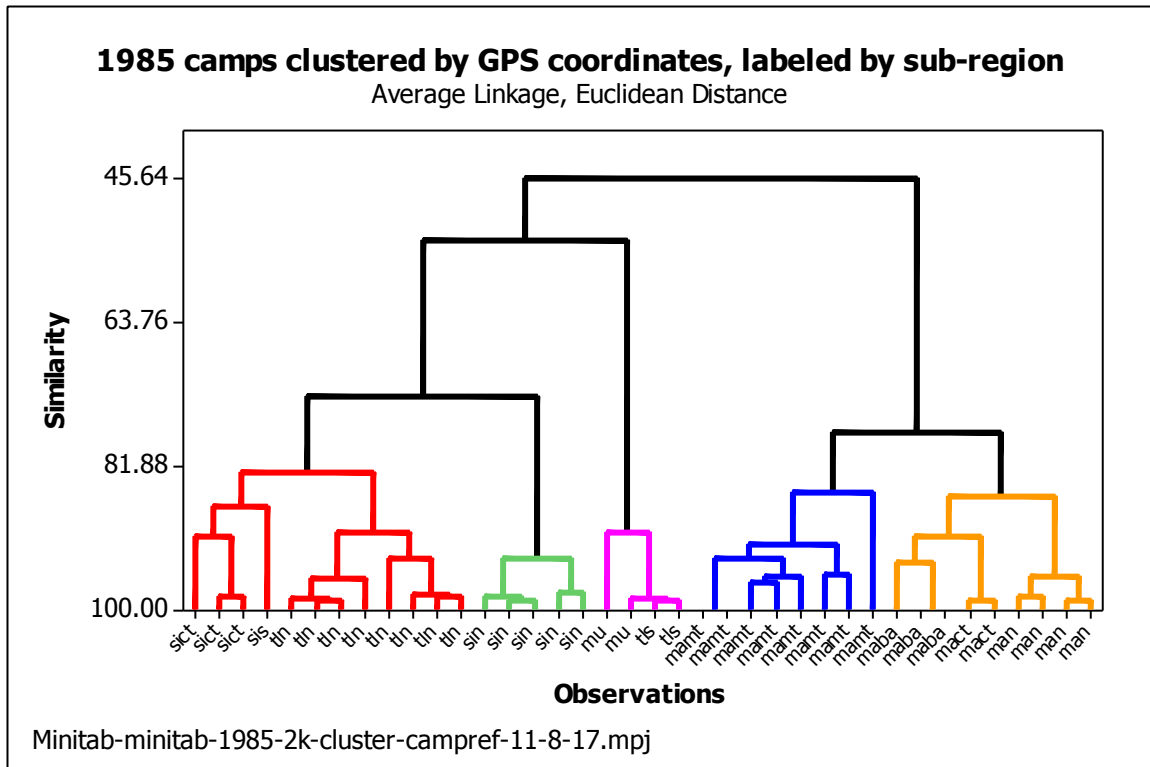Minitab-minitab-1985-2k-cluster-campref-11-8-17.mpj

Results of cluster analysis of 243 camp locations 1985-2000. Clustered by GPS coordinates. Association of region label with cluster. Program saves cluster membership for each record. Upper panel rows: region noted in camp record. Lower panel rows: are sub-regions recorded in camp record, and cell entries denote number of camps emerging as members of the cluster denoted in the column heading.

Cluster:	1	2	3	4	5	total
MA	0	80	0	20	0	100
SI	50	0	0	0	0	50
TL	0	0	79	3	3	85
MU	0	0	0	0	8	8

	1	2	3	4	5	Total
Maba		22				22
Mact		16				16
Mamt				12		12
Man		40				40
Maw		2		8		10
MU					8	8
Sict	26					26
Sin	21					21
Sis	3					3
Tlct			42			42
Tlhn			2	2		4
Tln			34	1		35
Tls			1		3	4
Total	50	80	79	23	11	243

SI 6.2. Spatial 1985. Dendrogram, and table for camp locations in 1985.

Dendrogram for 1985 camps clustered by GPS coordinates.

1985 camps clustered by GPS coordinates, labeled by sub-region
Average Linkage, Euclidean Distance

Minitab-minitab-1985-2k-cluster-campref-11-8-17.mpj
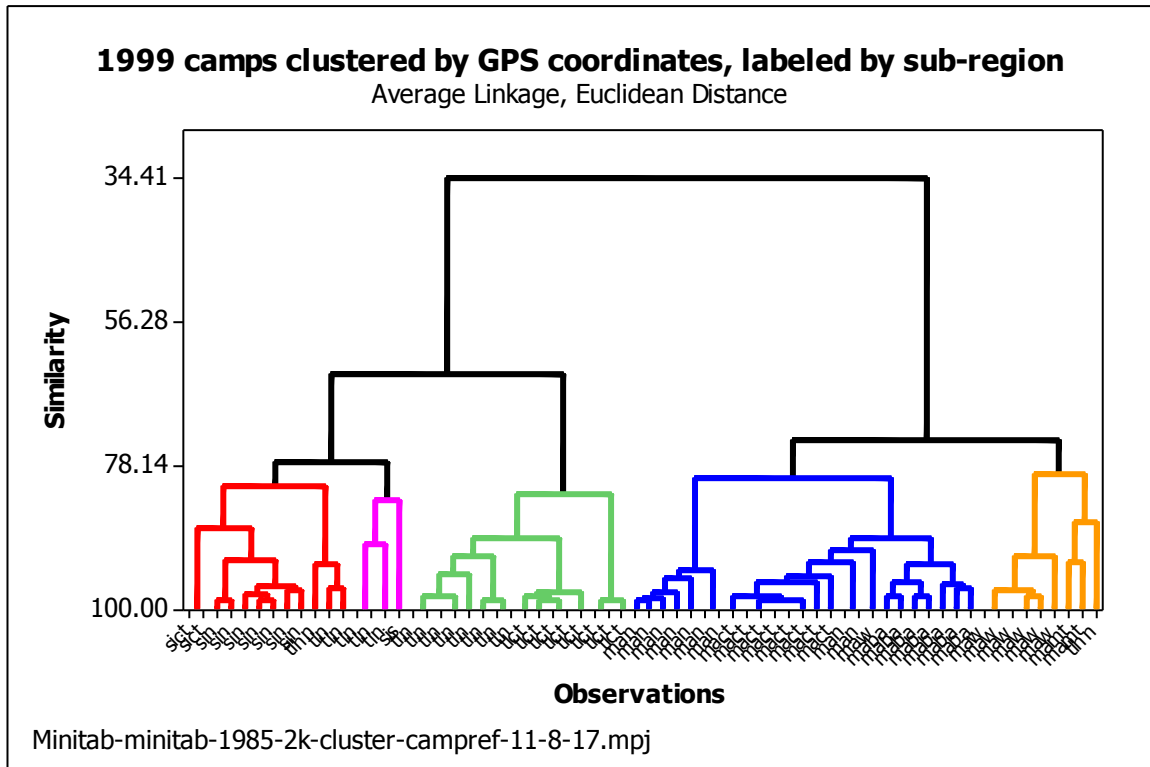
SI 6.2. Locations of camps in 1985.

Clustering of the 1985 camps by GPS coordinates. Columns are clusters. Rows are region and sub-regions. Each cell shows the number of camps in the sub-region that fell into the cluster. For example, in column 4, three camps were in Siponga central, 1 in Siponga south and 8 were in Tliika north.

	Cluster 1	2	3	4	5
MA	9	8	8		
SI			5	4	
TL				8	2
MU					2

1985	1	2	3	4	5
Maba	3				
Mact	2				
Mamt		8	8		
Man	4				
MU					2
Sict				3	
Sin			5		
Sis				1	
Tln				8	
Tls					2
Total	9	8	5	12	4

SI 6.3. Spatial 1999. Dendrogram, and table for camp locations in 1999.

Dendrogram for 1999 camps clustered by GPS coordinates. Labelled by Region and sub region. Left in orange: Siponga, and 3 Tliika north camps, Mauve: Tliika north and one Siponga camp. Green: Tliika. Blue: Mangola. Yellow: Mangola west and mountains.

SI 6.3. Locations of camps in 1999.

Clustering of the 1999 camps by GPS coordinates. Columns are clusters. Rows are region and sub-regions. Each cell shows the number of camps in the sub-region that fell into the cluster. In column 1, one camp was in Siponga central, 4 were in Siponga north. In cluster 2 there were 5 camps in Tliika central and 3 in Tliika north.

|	Cluster 1	2	3	4	5
MA			10	4	5
SI	5				
TL		8		1	2
MU					

| 1999	1	2	3	4	5
Maba			2		
Mact			3		
Man			5		
Maw				4	
Sict	1				
Sin	4				
Tlct		5			
Tlhn				1	1
Tln		3			1
Total	5	8	10	5	2

Regions are clusters of kin.

SI 6.4. Regions x kinship 1985.

Dendrogram of camps clustered by relatedness (r). Input to the cluster analysis is a matrix of average of relatedness of members of one camp to members of each other camp. The example here is for camps visited in 1985. Cluster analysis used average linkage, and correlation coefficient distance. The camp numbers shown on x -axis run roughly from north (Endamagha) to south (Munguli). Their numbers and geographic region affiliations are given in Table SI 6.4. The camp locations are plotted, and their kin cluster membership shown by symbols in figure 6.4. The clustering by kinship shows much structure. This is not a geneological tree but a clustering by average relatedness between members of camps. People tend to have close relatives in camps in their region, and sometimes these are in the camps spatially nearest to them.

1985 camp relatedness clustered by r
Average Linkage, Correlation Coefficient Distance

Minitab-matrix-1985-over15s-09-1-13.mpj
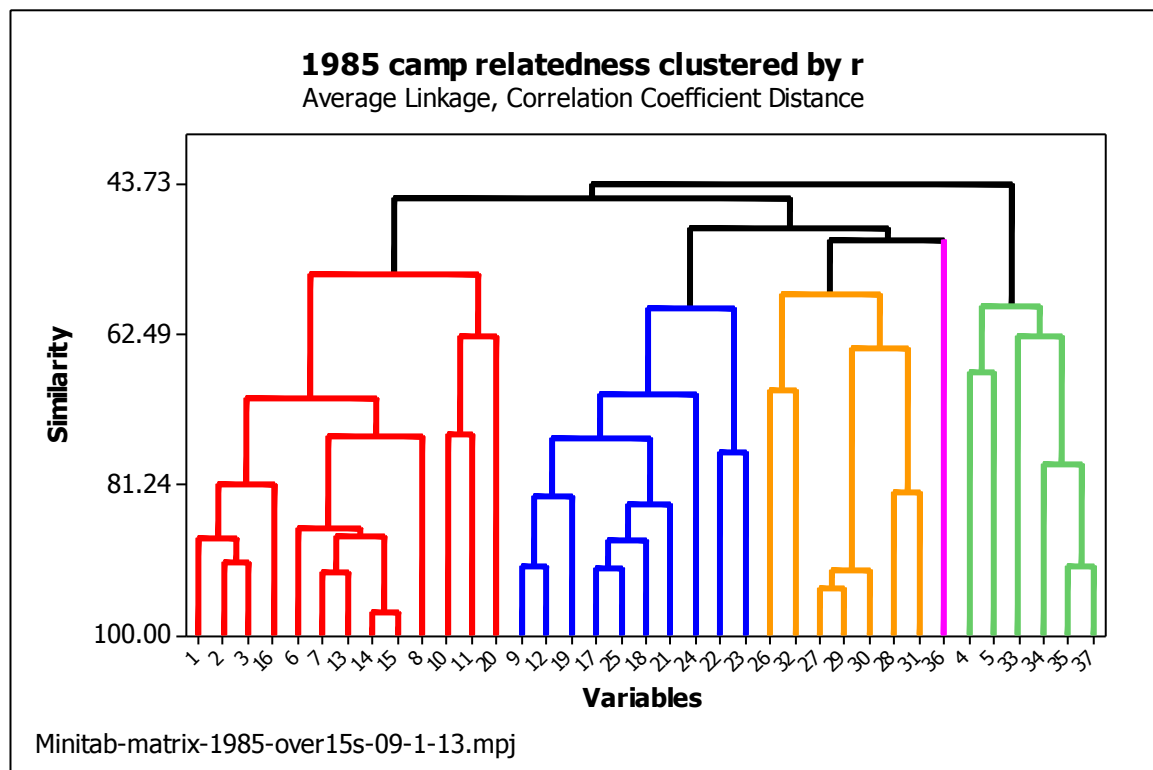
SI figure 6.4. Map plotting camps visited in 1985. Symbols denote cluster by relatedness.
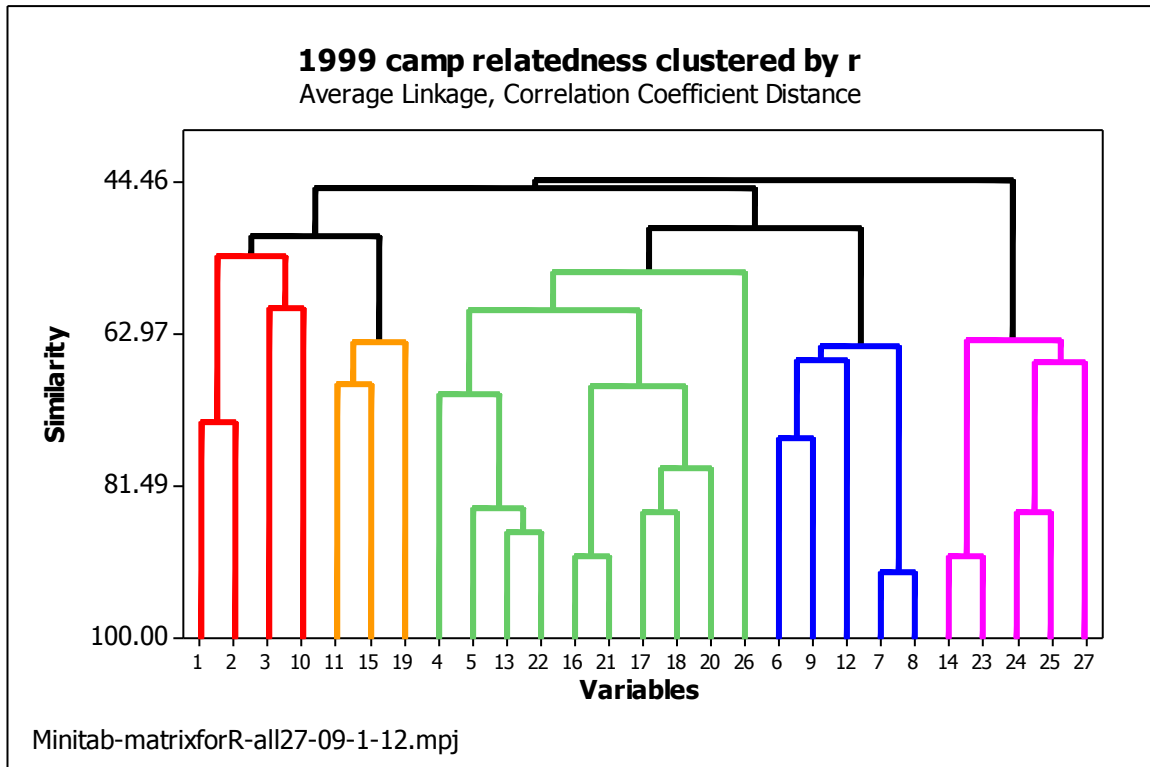
Scatterplot of kmnor vs kmeast
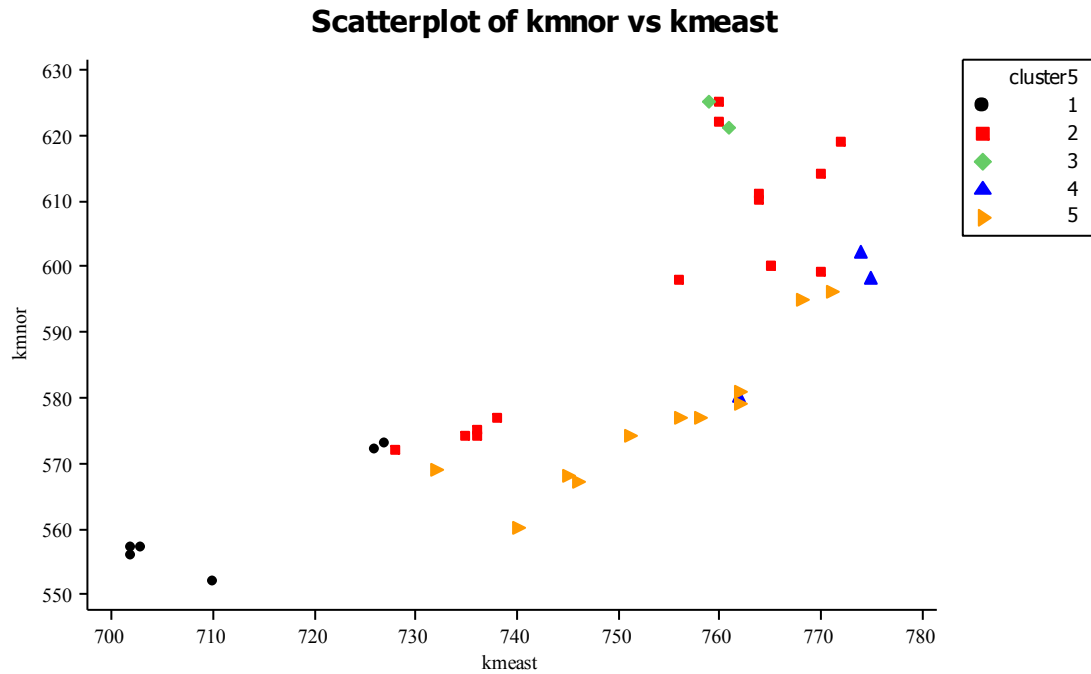
Minitab-combocamps1985cmplist-kin-clusters-13-6-13.mpj

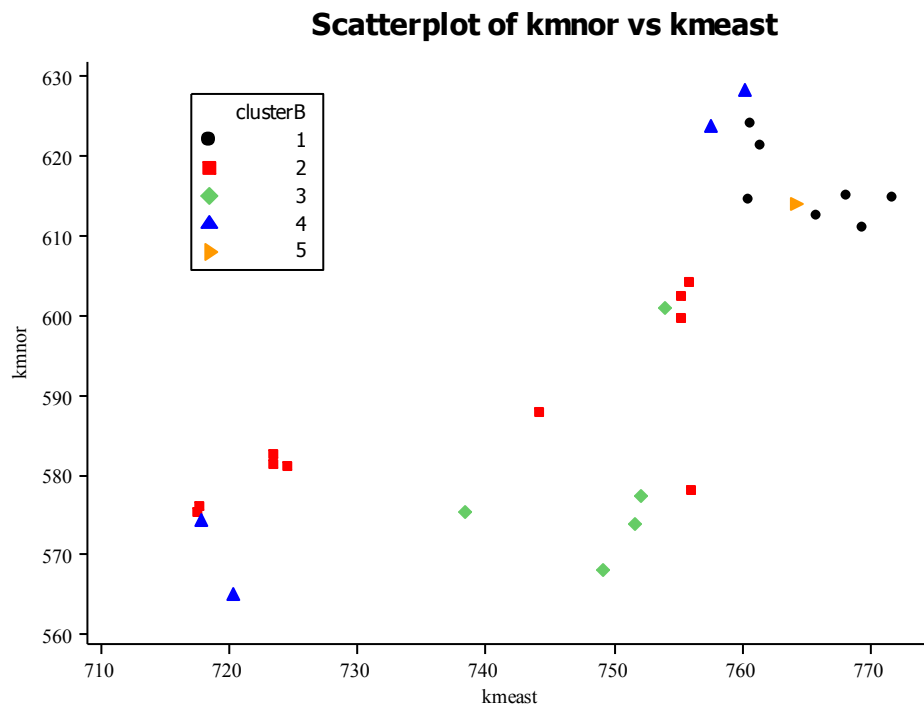SI 6.4. Clusters by relatedness 1985. Camps in 1985 clustered by relatedness.

Camp # Region Sub-region	1	2	3	4	5
1 MA n	1				
2 MA ct	1				
3 MA n	1				
4 MA n		2			
5 MA n		2			
6 MA ba	1				
7 MA ba	1				
8 MA ct	1				
9 MA mt			3		
10 MA mt	1				
11 MA mt	1				
12 MA mt			3		
13 MA mt	1				
14 MA mt	1				
15 MA mt	1				
16 MA mt	1				
17 SI n			3		
18 SI n			3		
19 SI ct			3		
20 SI n	1				
21 SI n			3		
22 SI n			3		
23 SI ct			3		
24 SI ct			3		
25 SI s			3		
26 TL n				4	
27 TL n				4	
28 TL n				4	
29 TL n				4	
30 TL n				4	
31 TL n				4	
32 TL n				4	
33TL n		2			
34 TL s		2			
35 TL s		2			
36 TL s					5
37 MU		2			

1999
Dendrogram of 1999 camps clustered by average relatedness of camp members to members of each other camp. "Variables" = camp number in my census record.

1999 camp relatedness clustered by r
Average Linkage, Correlation Coefficient Distance

Minitab-matrixforR-all27-09-1-12.mpj

SI 6.5. Clusters by relatedness 1999

Scatterplot of kmnor vs kmeast

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Clustering 1999 camps by average relatedness. Rows are camps with their region and sub-regions labelled. Columns are clusters. Entries mark which cluster each camp fell into. Cluster 5 comprises a single camp, the most commonly visited by tourists coming to Mangola (the lowest price, least supervised destination). The implication is that people from many different families were assembled at this rather unusual camp, presumably attracted by the tourist cash and access to the nearby village.

Camp# Region, sub-region	1 MA-1	2 TL	3 MA-2	4 Exiles from MU?	5 - SI
1 MA ba	1				
2 MA n				1	
3 MA ct					1
4 TL hn		1			
5 MA s		1			
6 MA ct	1				
7 MA ba	1				
8 MA ba	1				
9 MA ct	1				
10 MA n	1				
11 MA n				1	
12 MA n	1				
13 MA s		1			
14 MA s			1		1
15 TL ct				1	
16 TL ct		1			
17 TL ct		1			
18 TL n		1			
19 TL ct				1	
20 TL ct		1			
21 TL ct		1			
22 MA s		1			
23 TL hn			1		
24 SI n			1		
25 SI n			1		
26 SI n		1			
27 SI ct			1		

Kinship x distance.

SI 6.6. Kinship x distance. Fit from regression equations of average relatedness (r) between members of each pair of camps x distance + distance^2 + distance ^3.

r x distance between camps 1985 and 1999
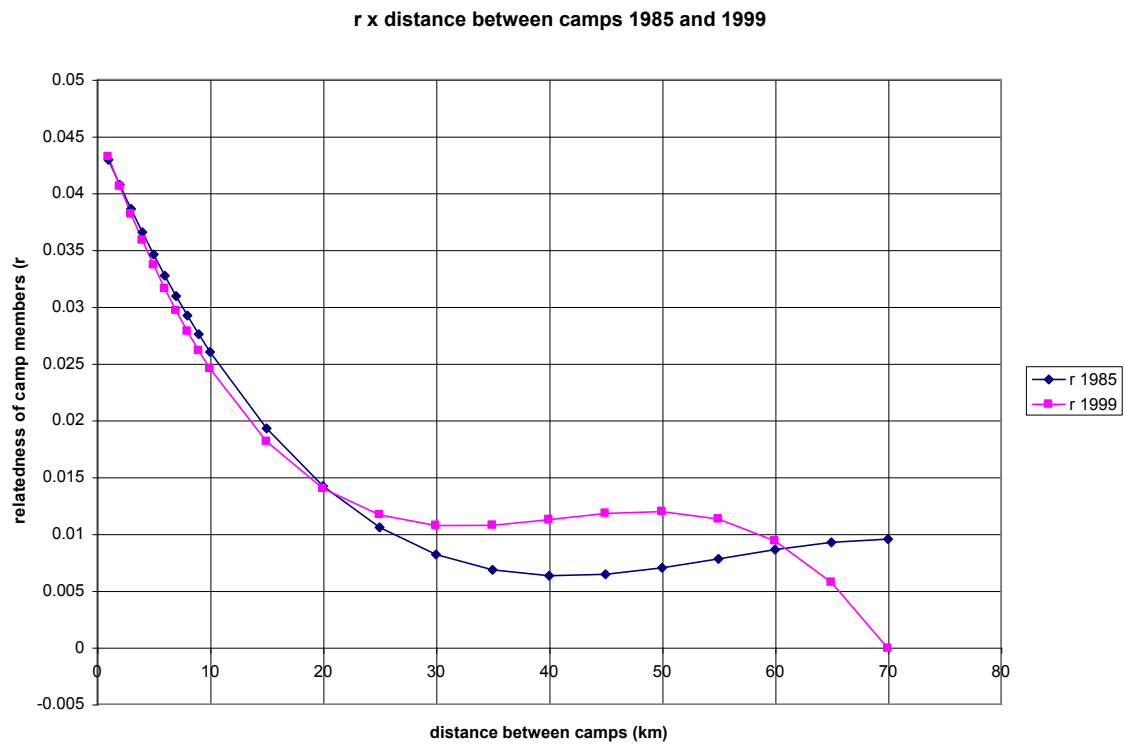
Long term region to region movements.

SI 6.7. Measures for region of origin.

Data for "Origin" come from the various bits of historical interview, for example about Cooper's visit in 1945, Kohl-Larsen's photographs, and for most individuals from Lars Smith's census in 1977. For each individual the score is composed using the following rules: if there is historical information (i.e. before 1977), the region where the individual was reported during that period becomes his or her region of origin. If there are no data from this period, then the location in 1977 gives the "origin". If there are no data on the individual then we use the mother's location in the historical records, and if this is missing, her location in 1977. If we still have no "origin" for the individual we try its father's location in the historical period (1930 – 1970), and then its father's location in 1977. The measure was made for 1607 individuals ever noted, alive or dead.

Data for "Nowadays" come from the censuses and "where are they now" interview information gathered between 1985 and 2000. The region in which the individual was most often recorded in a census becomes its region for the "Nowadays" score. Ties were resolved by reference to the most recent "where are they now" data. The sample is restricted to 1451 individuals, those alive sometime between 1985 and 2000.

More results.

Among males 71.8% stayed in the same region, females 76%. If we take the "origin" measures as centered in 1977, and "nowadays" at the mid-point of my fieldwork, 1992, these data cover a 15 year period. The number changing regions can be converted to an annual migration rate. I excluded people who moved to Dunduwi (the West), and to Far Away (outside eastern Hadza country). On average, 10 men changed region each year, and 8 women. This is a much higher migration rate than to the west or far away. This rate contrasts with less than one woman a year leaving to live among Swahilis and about the same number moving to west of the lake. The rate of long term movement between regions is a little lower than found by following the 1977 and 1985 census cohorts. This is probably because in the follow up of the census cohort any single brief visit could score as a change in region whereas here in the "origin" to "nowadays" analysis the majority of later observations had to be in a different region in order to score a change in residence.

In Table SI 6.7 I have related the "original" and "nowadays" measures to each other, for males and females separately, for all available individuals, regardless of their age. For males, 478 out of 665 cases were "nowadays" in the same region as "Originally", this is 71.8%. Twenty-eight percent (28.2%) have moved to a different region. Those who go to a different region seem equally likely to go to each other region, except that Siponga people seem less likely to go to Dunduwi (the west) than others. Tliika people are the most likely to go to Dunduwi, they are nearest to that area. Siponga is furthest away from Dunduwi. For females the results are similar but slightly more stay

in the same region, 523 / 684 individuals 76.5% (23.5% have moved). Females who move are equally likely to go to each other main region. Tliikanabe are more likely to go to Dunduwi than are Sipongabe.

Table SI 6.7. Origin x nowadays. Top panel for women, lower panel for men. Columns represent "Nowadays", Rows "Origin". Thus of 179 men whose origin was in MA, 127 were there during the recent study period. 40 had moved to Tliika.

Women	MA	TL	MU	SI
MA	140	25	0	14
TL	14	122	6	15
MU	5	36	69	9
SI	28	19	1	171

Men	MA	TL	MU	SI
MA	127	40	3	9
TL	20	85	4	23
MU	8	26	54	9
SI	17	20	0	192

SI 6.8. Region of origin of parents of children born 1985-2000.

Table SI 6.8.1 shows regions of origin of parents of children born in the core area during 1985 – 2000. Father's region of origin is in columns, mother's in rows. Fathers' identities were reported by the mother, not based on who she was married to at the time of interview. The birthplaces of most of these children are known. For example, 33 children had a mother from Mangola, and a father from Mangola. 38 children had mother from Siponga and father from Tliika. For 399 children born 1985-2000, and for whom region of origin of both parents is known, 168 had parents from the same region as each other (42%).

Rows:Mother Cols: Father	MA	TL	MU	SI
MA	33	41	16	19
TL	13	60	15	23
MU	4	18	15	15
SI	10	38	19	60

Table SI 6.8.2 shows whether the child was growing up in its mother's region of origin. The child's region is in the columns, mother's in rows. So for example, 13 children were born in or growing up in Mangola whereas their mother had grown up in Tliika. Ten children were born in or growing up in Siponga while their mother had grown up in Mangola. Seven children were born in or growing up in Tliika whereas their mother had grown up in Mangola. 32 children were growing up in Mangola but their mother's region of origin was Siponga. Out of 399 children with data, 264 were growing up where their mother grew up (66 %).

	MA	TL	MU	SI	DU	FA
MA	92	7	0	10		
TL	13	69	7	21	1	
MU	6	20	14	11		
SI	32	4	1	89		2

A similar table (SI 6.8.3) shows whether the child was growing up where its father grew up. Child's region is in columns, father's in rows. Out of 399 children with data, 181 are growing up in the same region as their father grew up in (45 %). Child's region is in columns, father's in rows. Child is much less likely to be growing up where its father grew up. Comparing mother and father, although the actual difference is not great, it is highly statistically significant (chi-squared = 35.7 for a 2x2 table). A child is less likely to be growing up where his or her father grew up.

	MA	TL	MU	SI	DU	FA
MA	46	10	0	4		
TL	49	56	11	40		1
MU	23	17	8	16		1
SI	25	17	3	71		1