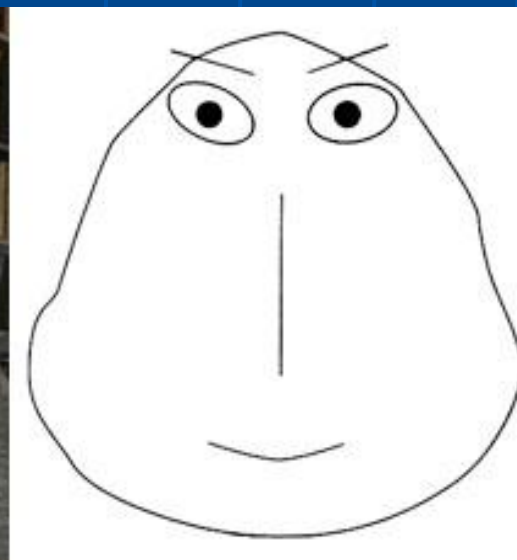
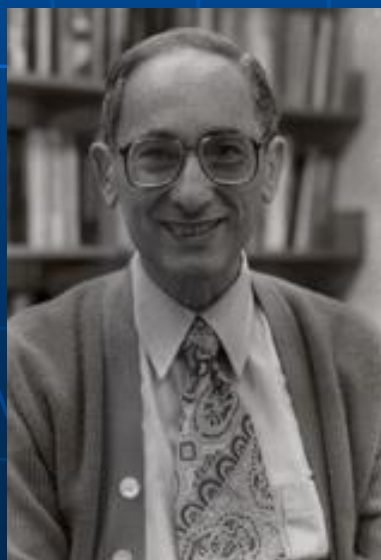




Short Introduction

What are the Chernoff faces? → Iconographic representation (glyph)

- The Chernoff faces are a graphic method for the visualisation of multidimensional data
- Author: Hermann Chernoff (at present Professor Emeritus of Applied Mathematics, Department of Statistics at Harvard University)
- Published in 1973 („The use of faces to represent points in k-dimensional space graphically”, *Journal of the American Statistical Association*)





Short Introduction



What are the Chernoff faces? → Features of a human face (eyes, nose, mouth, etc) can be used to represent different data

According to Chernoff up to 18 features can be used for data representation



Map made using SYSTAT software

SYSTAT 12
More Statistics, More Graphs, Less Effort



Table 1: Description of facial features of Chernoff face

Dimension	Facial Feature
1	Face width
2	Ear level
3	Half face height
4	Eccentricity of upper ellipse of face
5	Eccentricity of lower ellipse of face
6	Length of nose
7	Position of centre of mouth
8	Curvature of mouth
9	Length of mouth
10	Height of centre of eyes
11	Separation of eyes
12	Slant of eyes
13	Eccentricity of eyes
14	Half length of eye
15	Position of pupil
16	Height of eyebrow
17	Angle of brow
18	Length of brow
19	Radius of ear
20	Nose width



First experiences using Chernoff faces on maps



During the last 20 years the Chernoff faces were used for the representation of data in thematic maps

A classic example:

The first thematic map drawn using Chernoff faces (1977)

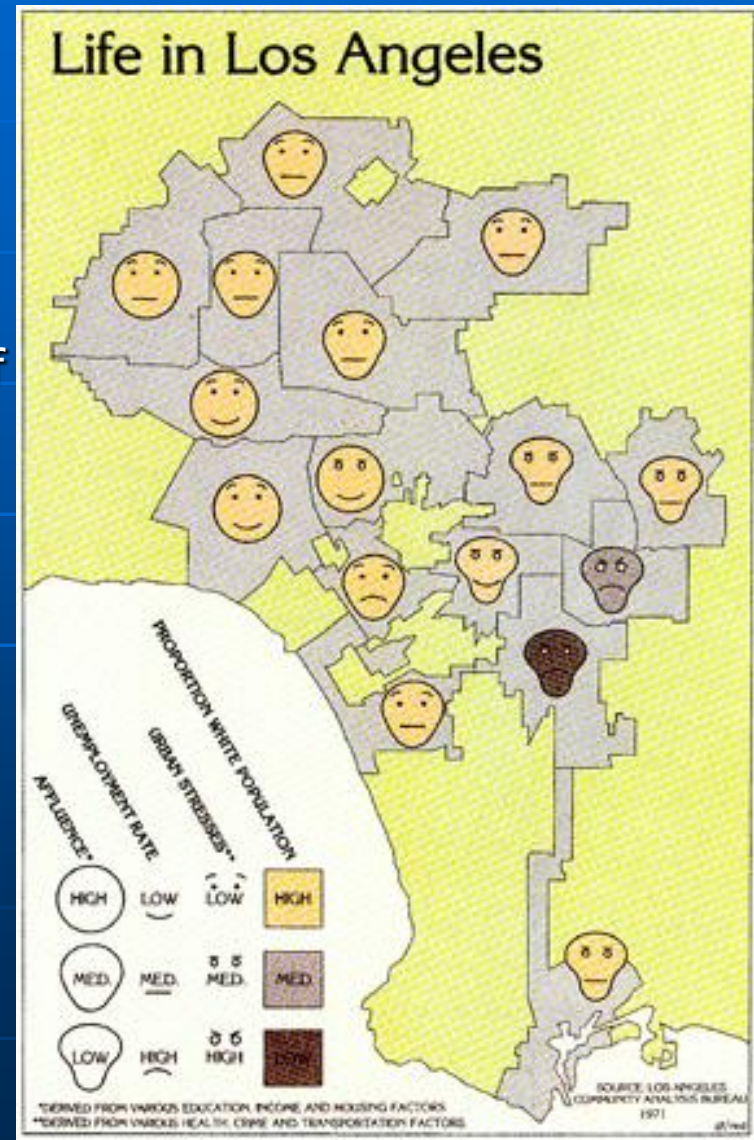
Title: „Life in LA, 1970”

Author: Eugene Turner, Geography Dept. at California State University (drafted by Richard Doss)



“It is probably one of the most interesting maps I've created because the expressions evoke an emotional association with the data. Some people don't like that.”

<http://www.csun.edu/~hfgeg005/eturner/gallery/gallery.htm>



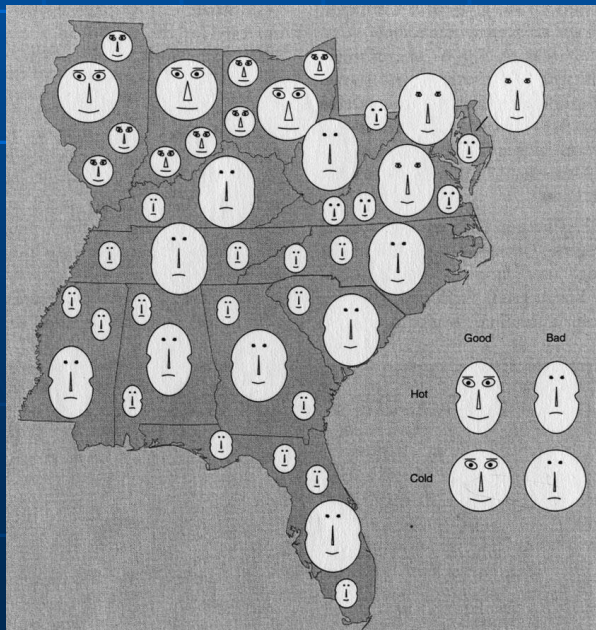


First experiences using Chernoff faces on maps



Other research related to Chernoff faces on maps:

- Howard Wainer (1979, University of Pennsylvania) – Regional differences in USA, map using Chernoff faces to represent nine variables
- Daniel Dorling (1991, University of Newcastle upon Tyne) – PhD thesis
- Elizabeth S. Nelson (1997-2007, University of North Carolina, Greensboro) – Cartographic potential of the face symbol
- Sarah I. Fabrikant (2004, University of Zurich) – USA map of Presidential Elections





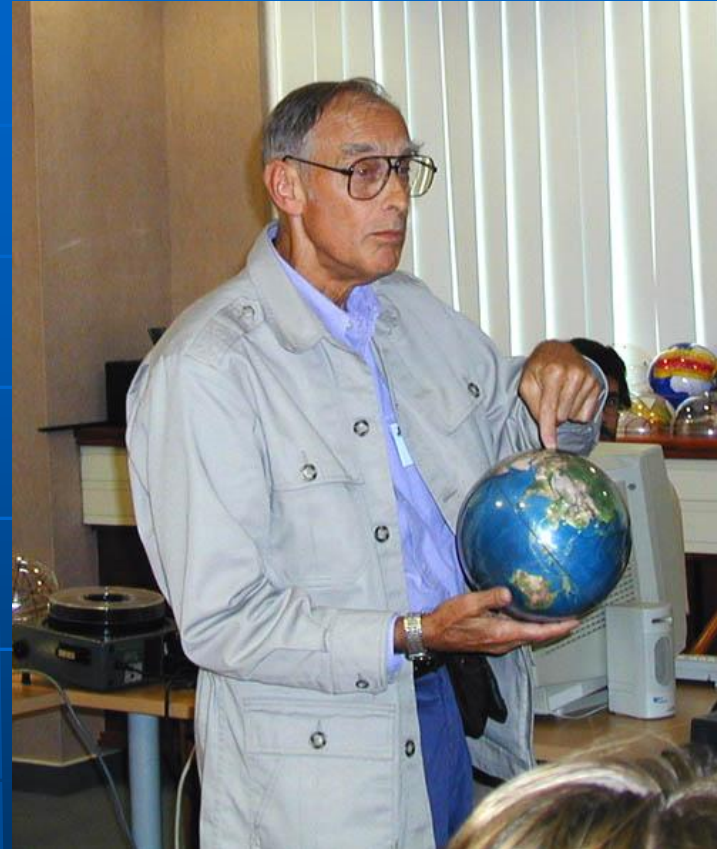
Experiences teaching Chernoff on maps



My first experience



1998, ICA Joint Seminar
(Wroclaw, Poland)
Chernoff workshop
by Prof. Henry Castner
(Greensboro, USA)



From 2005 → MSc on Cartography, Practical lessons within the subject
entitled „Thematic Cartography III”

Positive and negative experiences discussed with students –
Psychological (Nelson, 2007) and editing factors using Chernoff faces



Experiences teaching Chernoff on maps



Psychological and editing questions

Psychological questions:

Dorling (1991)



Nelson (1997,2007)



After Nelson (2007):
Reading of a face determined by two factors



Natural correspondence

Face as a whole expressing a human feeling (happiness, sadness)

Feature salience

Role of a feature transmitting the psychological message of a face as a whole



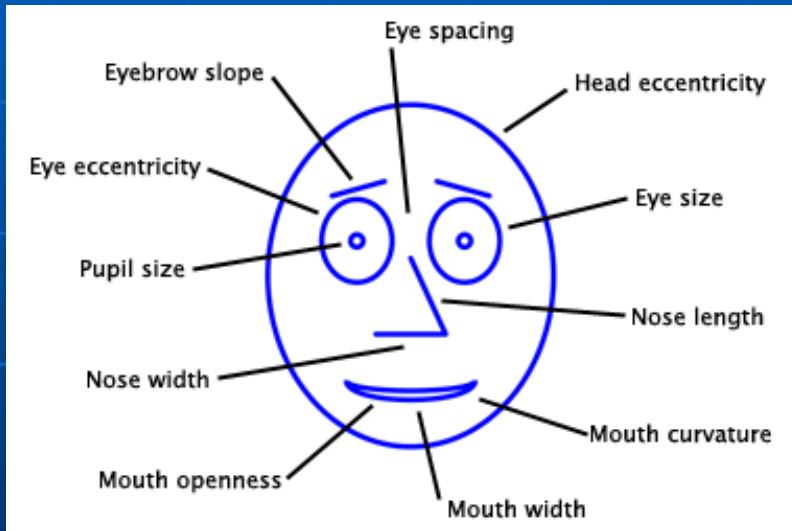
„Individual” expression – can provoke a contradiction between features („angry” eyebrow – smiling mouth)

Experiences teaching Chernoff on maps

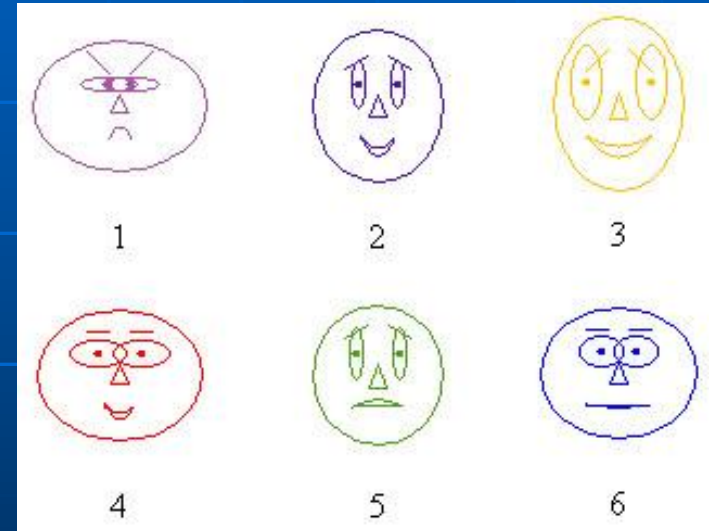
Editing questions
Number of variables to be represented



Chernoff (1973) – up to 18 variables can be represented on a face



Bradley Mohr (1995-2003) –
11 features



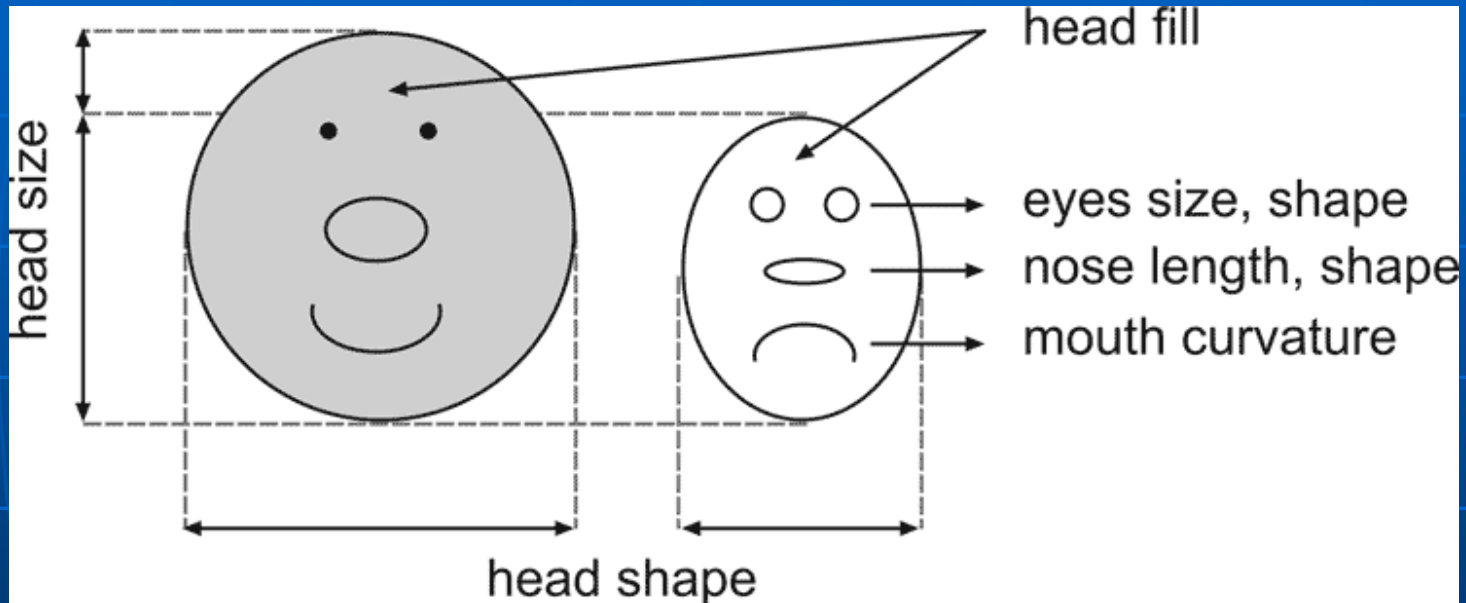
John Wiseman (1998) –
10 features

Too much!!!

Experiences teaching Chernoff on maps

Number of variables that can be represented on a face:

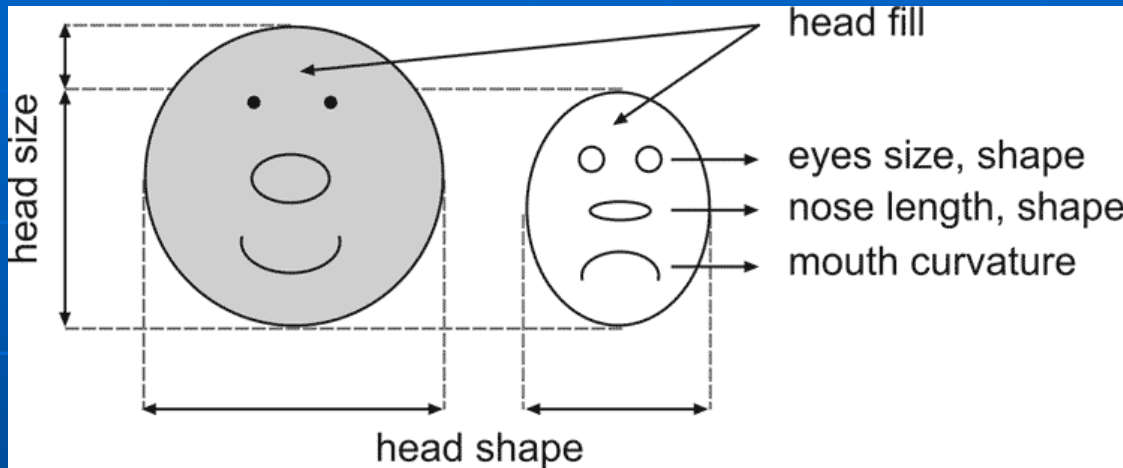
MAX. SIX!!!



Head size and fill – two „purely” cartographic parameters

More important parameters:

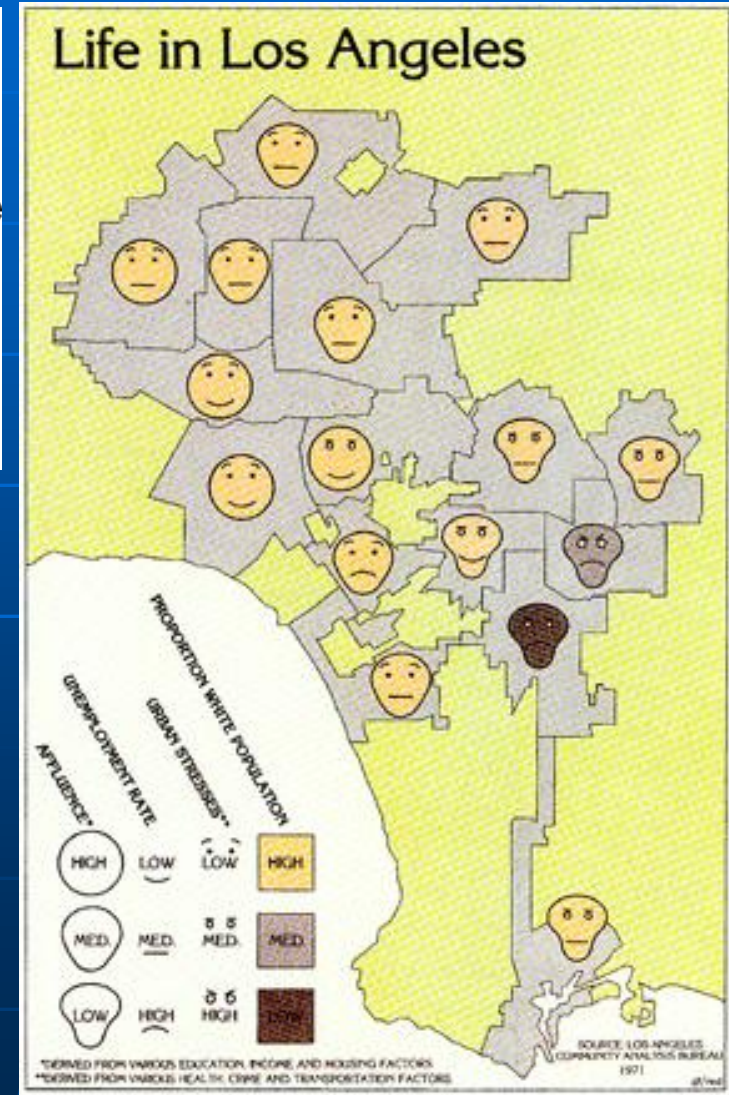
- Curvature of mouth: essential parameter to determine the expression of a face
- Head size/shape and fill: easily recognizable



- Curvature of mouth: essential parameter to determine the expression of a face
- Head size/shape and fill: easily recognizable

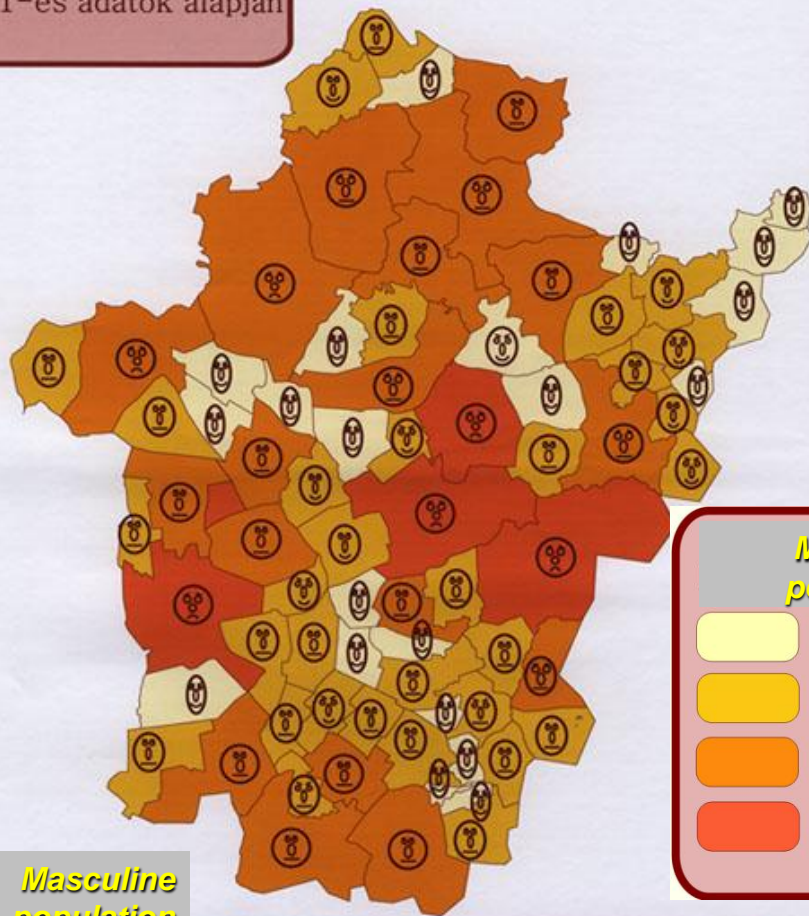


Eugene Turner,
„Life in LA, 1970”



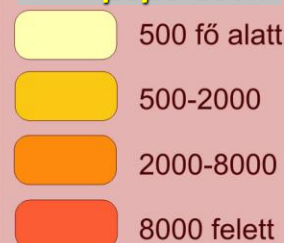
Experiences teaching Chernoff on maps

A 15 év feletti férfiak családi állapota Békés megyében 2001-es adatok alapján



Masculine population

Masculine population



Jelmagyarázat:



Készült az ELTE Térképtudományi és Geoinformatikai Tanszékén
Szerkesztette: Sztrapkóvics Gyöngyvér
Budapest, 2005.

Forrás: www.nepszamlalas.hu/hun/kotetek06/04/data/taabhun/4/load01_6_0.ht

Jelmagyarázat:



Forrás: www.nepszamlalas.hu/hun/kotetek06/04/data/taabhun/4/load01_6_0.ht

MSc on Cartography, Practical subject entitled „Thematic Cartography III”: Different solutions for the use of Chernoff faces on choropleth maps



Chernoff principle on school cartography



Professional discussions about Chernoff faces

↓
Positive

↓
Negative

↓
„Unusual” pictorial method of representation

↓
Can or not arouse the children’s attention better than a traditional method of thematic representation?

↓
Simplified version of Chernoff faces
(representing only 3-4 themes)
on easy thematic maps for school atlases

↓
Why should only faces to be used???



Chernoff principle on school cartography



Adaptation of the principle followed by Hermann Chernoff
for cartographic symbols



Improving the traditional use of symbols:
A cartographic (pictorial or geometric) symbol can be divided into its more
relevant and graphically better recognizable elements (features)



Different data (variables) related to a specific theme can be represented
using each of these components



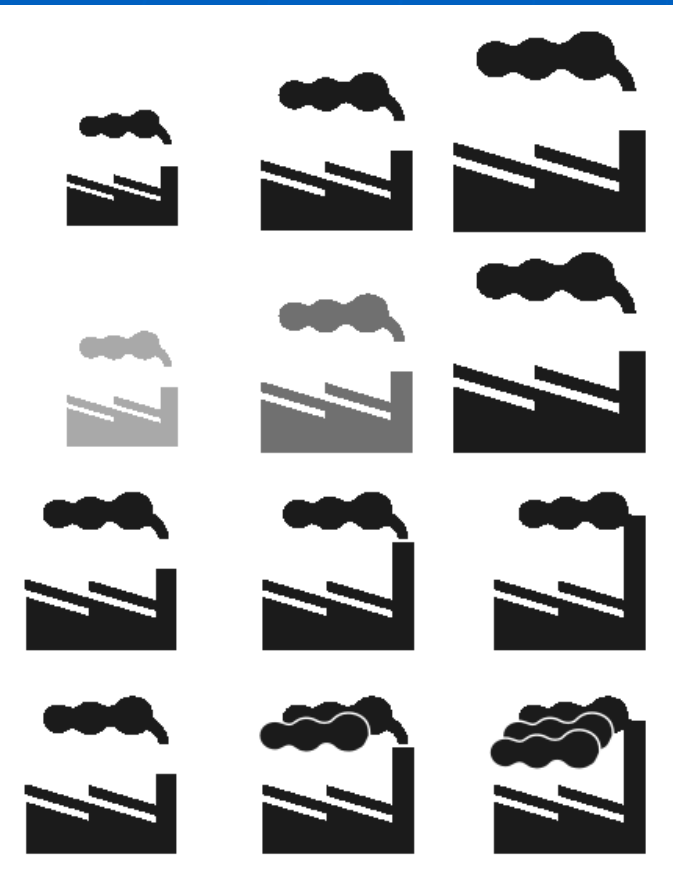
Max. 4-6 variables, considering which are the more important features within
the selected (pictorial) symbol



Chernoff principle on school cartography



factory symbol



size

Parameters changed in traditional cartography

colour

Nothing new...

height of the chimney stack

Parameters not changed while using a traditional symbol

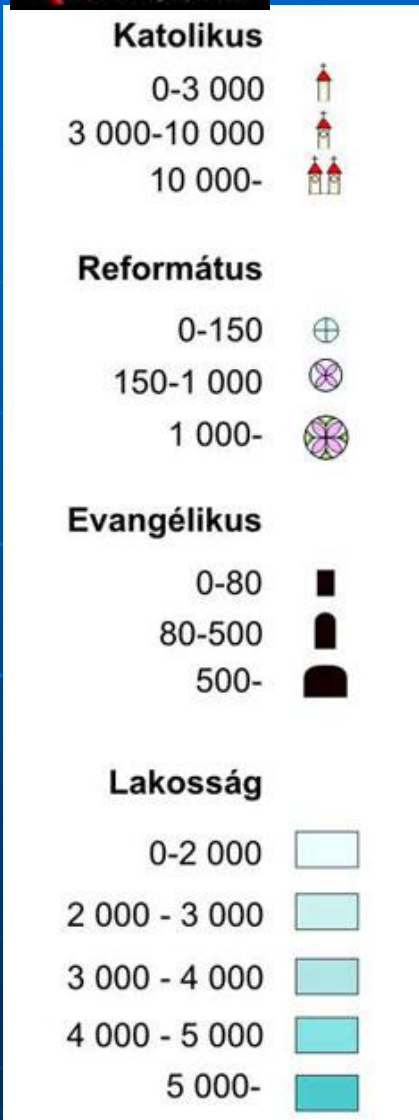
number of clouds of smoke

Applying the Chernoff's principle...

Possible field of use: Atlases edited for first grades in Elementary Schools



Chernoff principle on school cartography



Catholic

Calvinistic

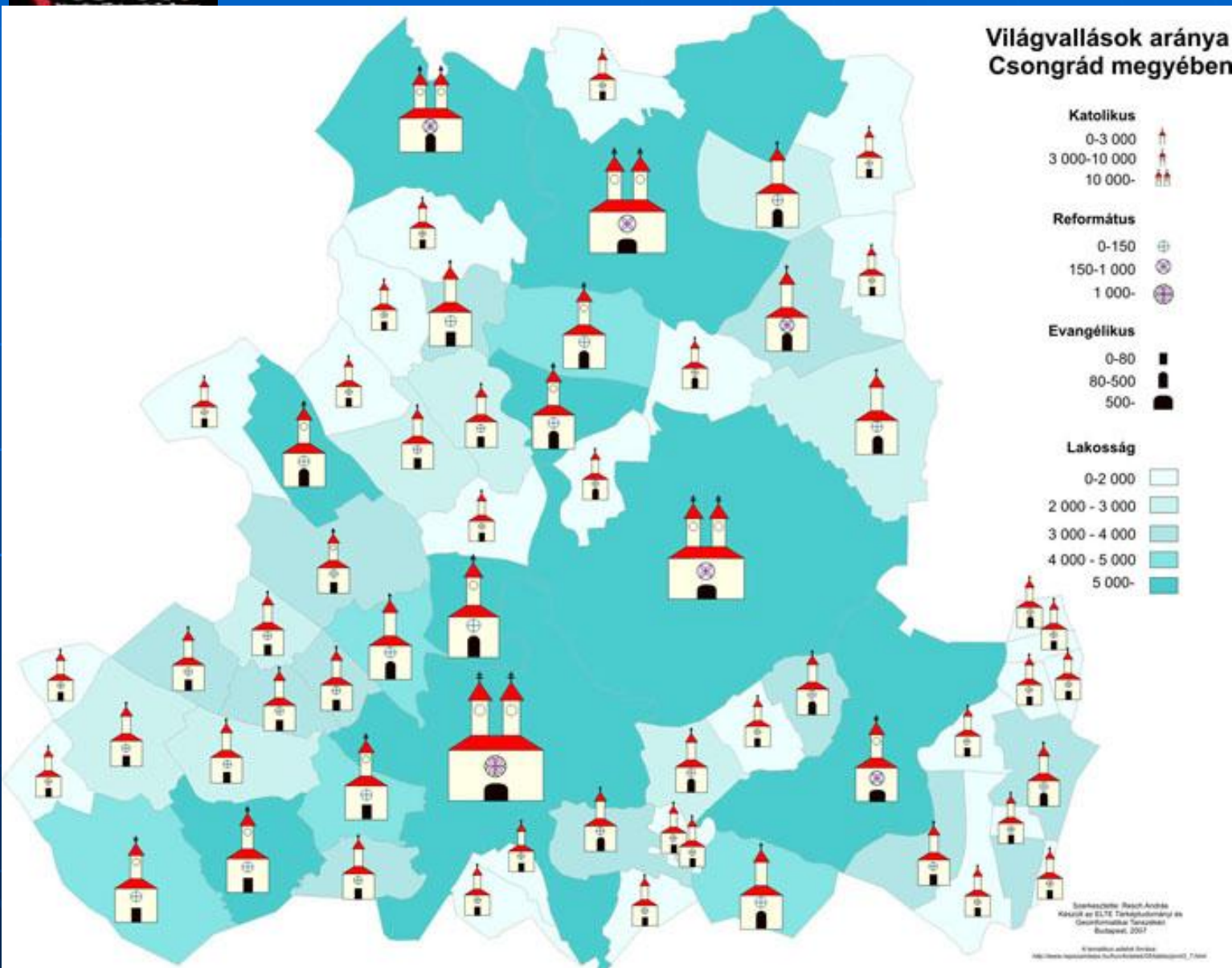
Evangelistic

Population





Chernoff principle on school cartography



World religions in Csongrád county (Hungary)
Catholic

Calvinistic

Evangelistic

Population

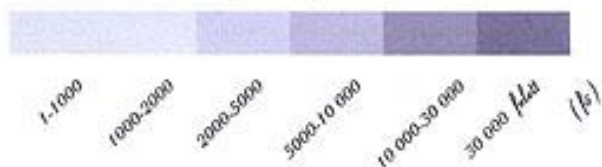


Chernoff principle on school cartography

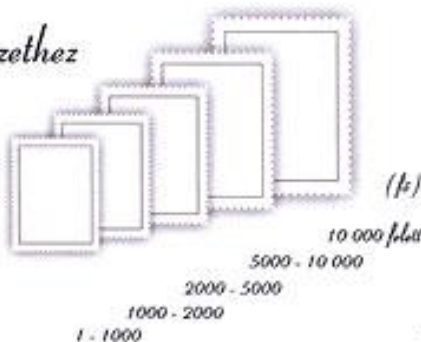


Jelmagyarázat:

Population
Települések népességszáma



Egyházhoz, felekezethez tartozók száma:
Believers



Katolikusok
Catholic



Tuzsányfő

1 - 500



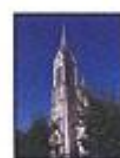
Dorok

500 - 1500



Ságvár

1500 - 3000



Makó

3000 - 5000



Szeged

5000 fölött (f)

Reformátusok
Calvinistic



1 - 50



50 - 150



150 - 1000



1000 fölött (f)

Evangélikusok
Evangelistic

1 Ft

/ 1 - 5

5 Ft

/ 5 - 10

10 Ft

/ 10 - 100

100 Ft

/ 100 fölött (f)

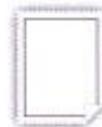
Más egyházhoz, felekezethez tartozók
Other religions



10 alatt



10 - 50



50 - 200



200 fölött (f)

Csongrád megye

vallási képe

2001



Készítette a L&L
Tervezés és Grafika Kft.
Szerkesztte: Torma Szabina
Budapest, 2009

Jelmagyarázat:
Population

Jelölés méretarányos skála



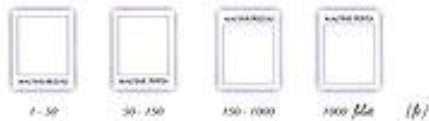
Egyházak, felekezetek
tartozói száma:
Believers



Katolikus
Catholic



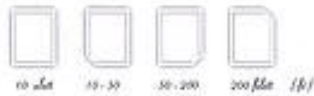
Református
Calvinistic



Evangelikus
Evangelistic



Más egyházak,
felekezetek tartozói
Other religions



Chernoff principle on school cartography

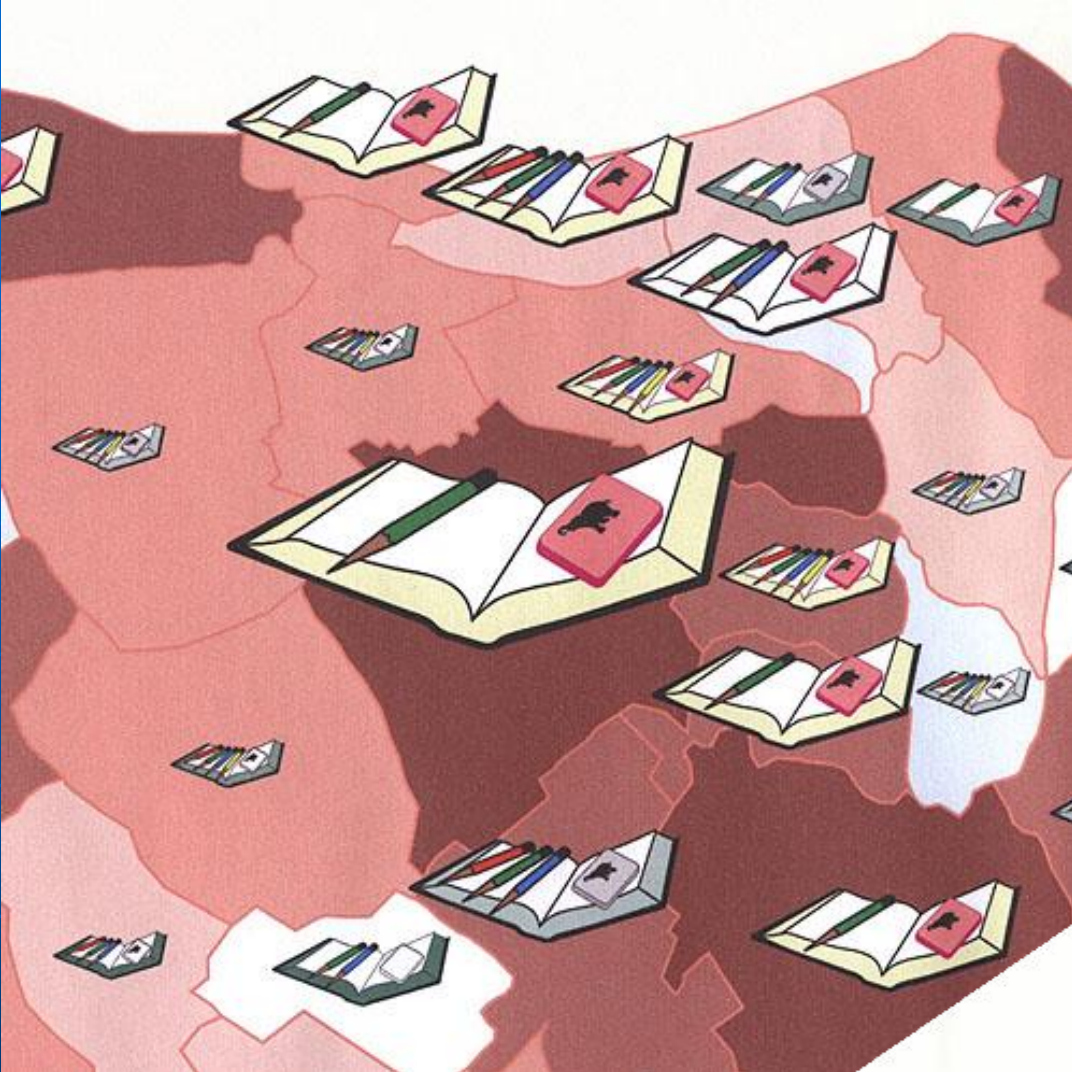


Made by Szabina Torma, 2009



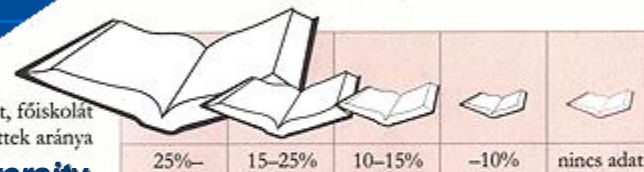


Chernoff principle on school cartography



Jelmagyarázat

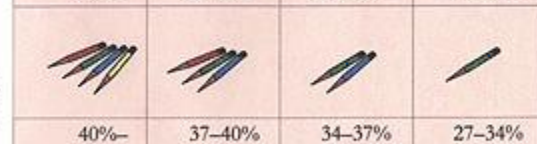
Egyetemet, főiskolát végzettek aránya
University



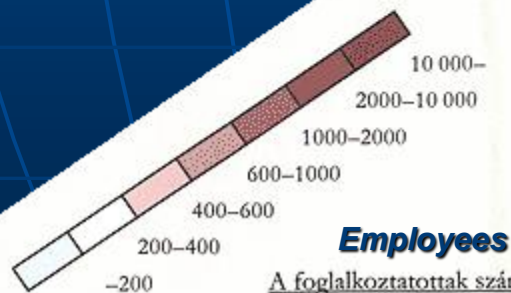
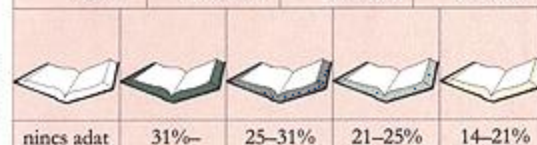
Középiskolai érettségivel rendelkezők aránya
High School



Középiskolai végzettségük aránya (érettségi nélkül, szakmai oklevéllel)
Secondary School



Általános iskola 8. vagy alacsonyabb évfolyamát végzettek aránya
Elementary School

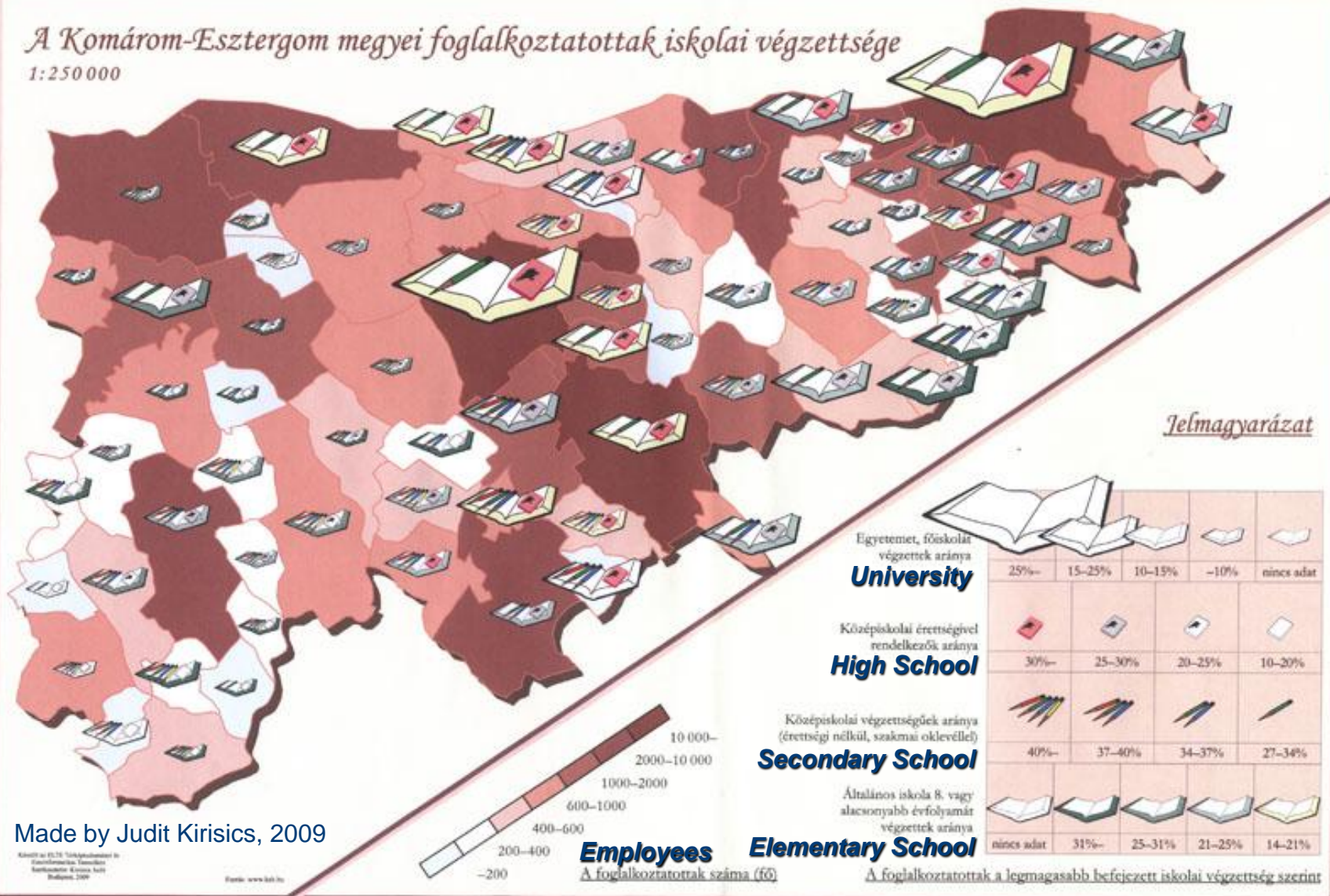


A foglalkoztatottak száma (fő)

A foglalkoztatottak a legmagasabb befejezett iskolai végzettség szerint

A Komárom-Esztergom megyei foglalkoztatottak iskolai végzettsége

1:250 000





Research project

Argentine-Hungarian project: The possible use of the Chernoff faces for data visualisation in school cartography

(2008/2009)



Testing the method in Argentine and Hungarian (Elementary, High?)
schools



- „Traditional” Chernoff faces on maps
- Chernoff principle using other pictorial symbols on maps

2008 – Theoretical research and exchange of experiences, first steps to
organize a survey

2009 – Making of the test and survey, analysis and presentation of results



If you became interested on this theme – we are very glad to welcome all
the contributions!

Please contact us!!!!





Mapa de Chile

Explicacion.

1. La Catedral	18. San Agustín
2. La Campana	19. San Agustín
3. 1 ^o Domingo	20. San Agustín
4. Iglesia de San Pedro	21. San Agustín
5. San Pablo	22. San Agustín
6. Iglesia de San Agustín	23. San Agustín
7. Santa Ana	24. San Agustín
8. Iglesia de San Agustín	25. San Agustín
9. San Agustín	26. San Agustín
10. Iglesia de la Victoria	27. San Agustín
11. La Merced	28. San Agustín
12. Carmen de la Victoria	29. San Agustín
13. San Agustín	30. San Agustín

A Plaza principal
 B Plaza de abasto
 C Plaza de la Victoria

THANK YOU MUCHAS GRACIAS

- José Jesús Reyes Nuñez
- Eötvös Loránd University
- Dept. of Cartography and Geoinformatics
- Budapest, Hungary