

Possibilities of Automatic Labeling and Label Placement in GIS Software

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Summary

Creating of digital maps is supported by geographical information systems nowadays. Such software automatically places labels into a map. Labels are very important part of maps. Content, form and position of labels should comply with several cartographic rules. The texts of labels are stored as attribute data in a database table of a layer in GIS.

The aim of the article is description of several problems and results of labeling with software ArcGIS with special extension Maplex and experiences with Autodesk Map during creation of labels in thematic maps. Extension Maplex is extension for better labeling in a map. This extension helps very much with automatic labeling, but beside that it is necessary final manual editing to meet all cartographic rules and get good readability of a map.

In the article it is described how to use character spacing, set font type and font face according to attribute, mask background under the text, using abbreviation dictionary in Maplex extension and other topics.

1 Introduction

Utilization of two types of GIS software is described in this article. The first is ArcGIS v 9.1 and the second is Autodesk Map 3D 2006. Labeling in ArcGIS is performed in two steps. The first step is automatic dynamic labeling by setting several options. The second is converting labels into annotations and follow-up manual correction of annotations for better quality. Annotations are stored in a geodatabase or directly in a map. Automatic labeling and manual editing of labels is set according to user's knowledge of cartographic rules. In Autodesk Map labeling is set in Display manager by Text stylization. This is only one step on the contrary to ArcGIS. The labels are not dynamic. There is no conversion of text. The term annotation is used in a different meaning. That means final manual editing of labels is limited only to adjustment of new positions of labels by command ADTEXTLOC.

It is possible to put the text into a map by two ways in general. The first way is to use Text tool and put the text manually into a map in suitable font and place. But this way is slow. The second way is automatic labeling feature by values stored in database. Beside own text information it is possible to store other attributes, which serve for setting of parameters for text (size, font), orientation of text, color etc. Another attributes can also express meaning of a feature (a capital city in point layer of towns), age of a feature. It is possible to set SQL query based on value of an attribute for different appearance of text in the same layer. It is utilized in software ArcGIS. In Autodesk Map it is possible to set orientation and color of labels according to attributes, but it is not possible to set two or more ways for labeling and positioning in the same layer.

2 Character spacing

Character spacing is used to spread a label across an area or a long line feature. Character spacing increases the distance between each two neighbouring letters in label. Spread label can indicate district or mountain range. It is common to increase character spacing slightly for map labels to improve their legibility at small sizes (Brewer, 2005). The units for character spacing are expressed as percentage of the text element's point size in ArcGIS (application ArcMap). 100 percent character spacing means approximately one letter will fit in the spaces between letters. It depends on size and font.

Character spacing is possible to set for certain text creating by Text tool. But when labeling feature from attribute in database is used and setting of text style character spacing is done, all text labels are spread.

The example below shows a label of a long street with spread text (300 percent). When it is set for all streets in layer, some of labels are not placed. Spreading is suitable only for the long street. The solution is to add a new attribute into the table with indication Y/N for spread. Author of the map chooses street label to be spread (according to his sense) and sets this attribute. After that it is possible to build two classes for labeling based on SQL query for indicator of spreading.

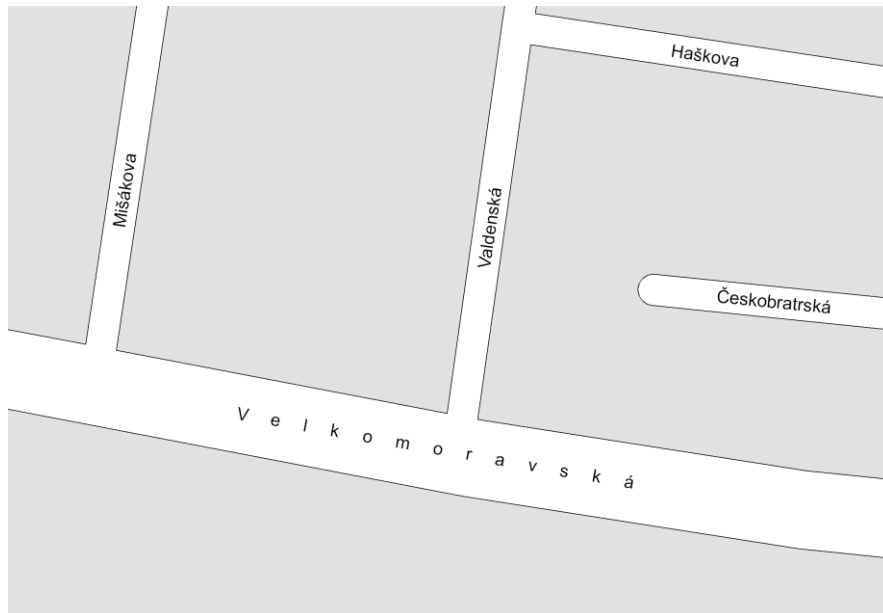


Fig. 1: Street label with character spacing

A function for setting of character spacing is not available in Autodesk Map.

3 Setting font type and font face

Font face can express meaning of feature. There is a small cut from the map of trees in Smetana's park in Olomouc in example below. Gardener needs a map with new planted trees and with cut down trees for service in the park. Number identifiers of new trees are in bold face. The SQL query tests the YearOfPlant > 2000. Number identifiers of cut trees are crossed.



Fig. 2: Labeling trees in the park

4 Overlapping geometry and labels

In Fig. 2 the position of labels is set to upper right position according to cartographic recommendation (Vozenilek, 1997, Capek, 1992). There are some overlaps with line geometry of pavement (ID 332, ID 343). It would be better to move these labels from default position upper right to a better position. In ArcGIS it is possible to utilize setting weight of the pavement feature. Setting of weight concerns geometry or a label of a layer. Without extension Maplex it is possible to set only four levels of weight – high, medium, low and none. After switching extension Maplex on it is possible to set weight by number from 0 to 1000. The priority of layer is set more fine especially if there are more displayed layers in the map.

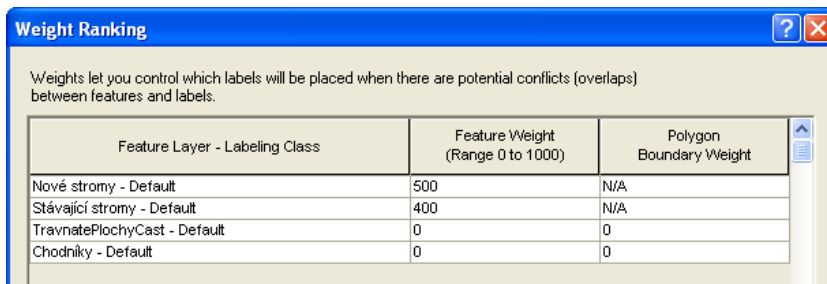


Fig. 3: Setting weight of feature

Next example shows overlapping labels from two layers. This is map of plant bed in botanical garden. Point layer contains herbs. Herbs are represented by point symbols and by ID numbers. Every plant bed is labeled by number Zx (x=1, 2,...39,..). Numbers Zx are automatically placed in the centre of the plant bed.

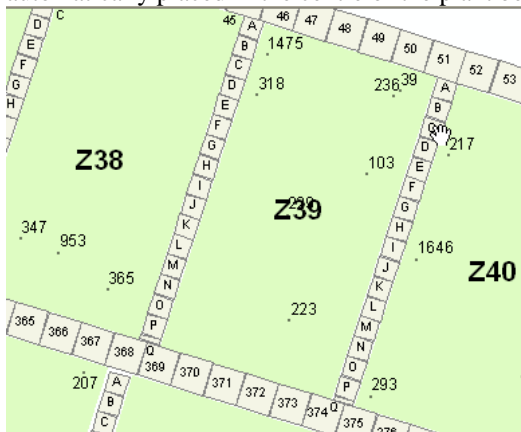


Fig. 4: Overlapping plant bed labels Z39 with herb ID 229

The solution is to set higher priority for point layer of herbs than priority of polygon layer of plant beds.



Fig. 5: Dynamic labels after setting priorities

Automatic labeling with setting weight of priority for geometry of pavements (big and small tiles) and setting weight for labels from layers is very helpful because there are 56 plant beds and 450 herbal. Number of manual corrections of label placement is reduced significantly.

A function for overlapping geometry and labels is not available in Autodesk Map.

4 Abbreviation dictionary in Maplex extension

When extension Maplex is switch on, function Abbreviation dictionary is accessible. Extension Maplex first puts a whole word into a map. If there is not enough space for the whole word, extension Maplex substitutes the word with an abbreviation from abbreviation dictionary. It is possible to create own definitions of abbreviations. Dictionary is stored in a text file with suffix .dic. There is an example for word Avenue - abbreviation Ave. - for English language in the manual. In German language it is used abbreviation Str. for word Strasse. I have created a dictionary for Czech words for labeling feature in a town. The same dictionary is possible to use for different maps of towns.

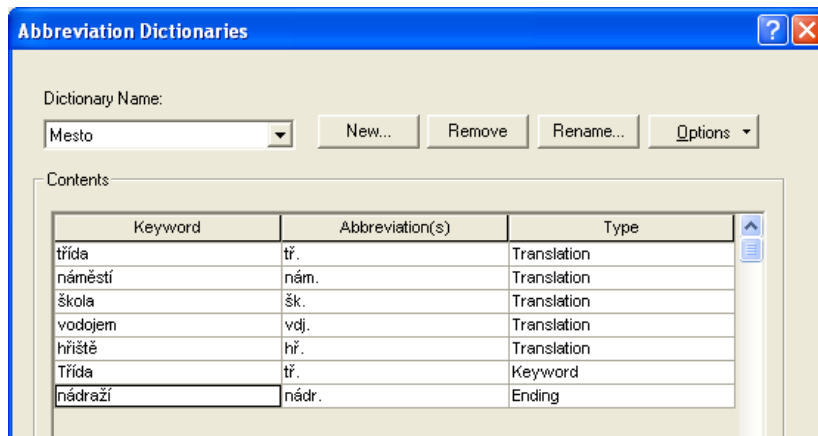


Fig. 6: Dictionary of abbreviation in town plan for Czech language

5 Text orientation

Orientation of the text label is automatically set according to the direction of line in GIS software. In Autodesk Map the angle is calculated from half start and end edge. The angle is not correct. There is a small difference in angle of the label and the bus line in Fig.7. The solution is to put angle to attribute data and set the orientation of labels according to attribute data.

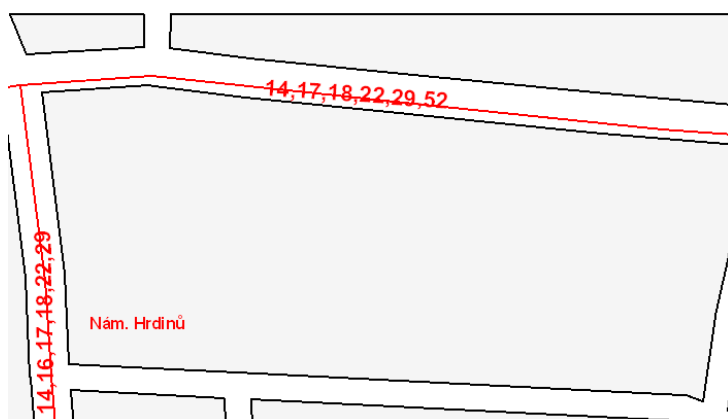


Fig. 6: Labeling of bus lines in Autodesk Map with a wrong small twist

6 Background Mask

Map labels sometimes need to mask background or subtly improve contrast with background. Halo function in ArcGIS serves this purpose. Labels on hatching fill of polygon need to mask the filling. In the bottom example on figure 7 is a 2-point halo on 8-point type. Density of population in Olomouc city district is expressed by hatching. Halo does not mask too much of the area around the text, but small pieces of line remain on cross-hatching area (Olomouc-mesto). It might make legibility worse. The solution is to select a bigger halo size to mask small pieces of line. The second solution is to create a layer with a mask polygon. The fill color and outline of masking polygon is the same as color of the background. The second solution is used in Autodesk Map because there is no halo function. There are manually created mask polygons in the map. Polygons consume more space than halo.

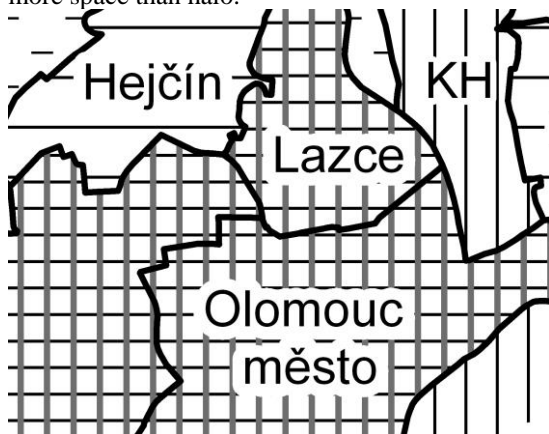


Fig. 7: Halos around labels on hatch fill of polygon in ArcGIS

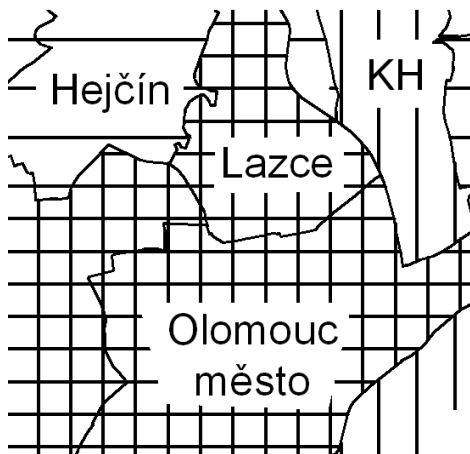


Fig. 8: Polygon mask created in Autodesk Map

In ArcGIS there is also Mask Tool – Feature Outline Masks in Tool Set Cartography. After conversion of a dynamic label to annotation stored in a geodatabase it is possible to generate mask polygons automatically. There are three types of masking geometry: BOX, CONVEX_HULL and EXACT. Usage of masking geometry is on fig 9. There are labels on tram and bus lines. Position of labels is straight and centered on lines. When halo is used small pieces of tram line or bus line remain between numbers of lines. On the left figure the mask polygons can be seen right after generation. On the right figure the color of outline and fill is set to white color.



Fig. 9: Polygon mask created by Cartography Mask Tool in ArcGIS

The contrast of labels on the orthophotomap needs to be improved on places where parcel numbers are placed on various colors of the photo. Various colors of background make difficult to select color of labels that remain readable. Black color is not suitable for labels on othofotomaps (Belka, 2007). Suitable colors are yellow, orange, violet and red. White and black halos of labels solved readability on dark and light background in the figure 10.



Fig. 10: Labels with black and white halos on orthophotomap

There are also some problems with compound labels with subscript and superscript. These labels have to create by program code. It is not solve with Maplex extension. Labels are not to put automatically to automatically created legend. Author of map have to arrange legend manually. Number of herb, number of flowerbed, number of big and small tile is created with text tool in the legend.

. 1206	herb
Z16	flowerbed
390	big floor tile
A	small floor tile

Fig. 11: Legend of map of Botanical garden (Fig.4 , Fig.5) supplemented with labels

7 References

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