MAKING THE ANAGLYPH MAP

Krešimir Keresteš
Geodetski zavod Slovenije d.d.
Zemljemerska 12, Ljubljana

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ABSTRACT:

Representation of the relief on the maps requires some knowledge of the map users to understand it. Different cartographical techniques and methods are used to represent the third dimension – relief on two-dimensional maps. Binocular viewing enables a spatial perception (stereo-effect), that could be used for cartographical purposes as well. This was tested on an example, where a classical two-dimensional map was converted into "three-dimensional" by using an anaglyph.

1. INTRODUCTION

Colour percepction of the visible light and binocular viewing gives us possibility of viewing our surrounding in natural way. In this way we recognise our surrounding and because of that we feel in the space domestic, orientated and even safe.

In cartography different techniques were developed to represent the relief on two-dimensional maps and to show them in appointed scale. Many of this techniques, specialy contouring, hill-shading with hachuring of rocks and layer tinting, or even digital elevation model (DEM) gives us at least some three-dimensional feeling of shown area. For understanding of real world shown with this techniques we should first learn, how to use this maps. Cartographers are still looking for more appropriate way to represent terrain for easier spatial perception to all users of two-dimensional maps.

I made a test in making the map in a way, which give users better feeling of third dimension. Used technique is more known in photogrammetry for appointing a position of point in space with binocular viewing.

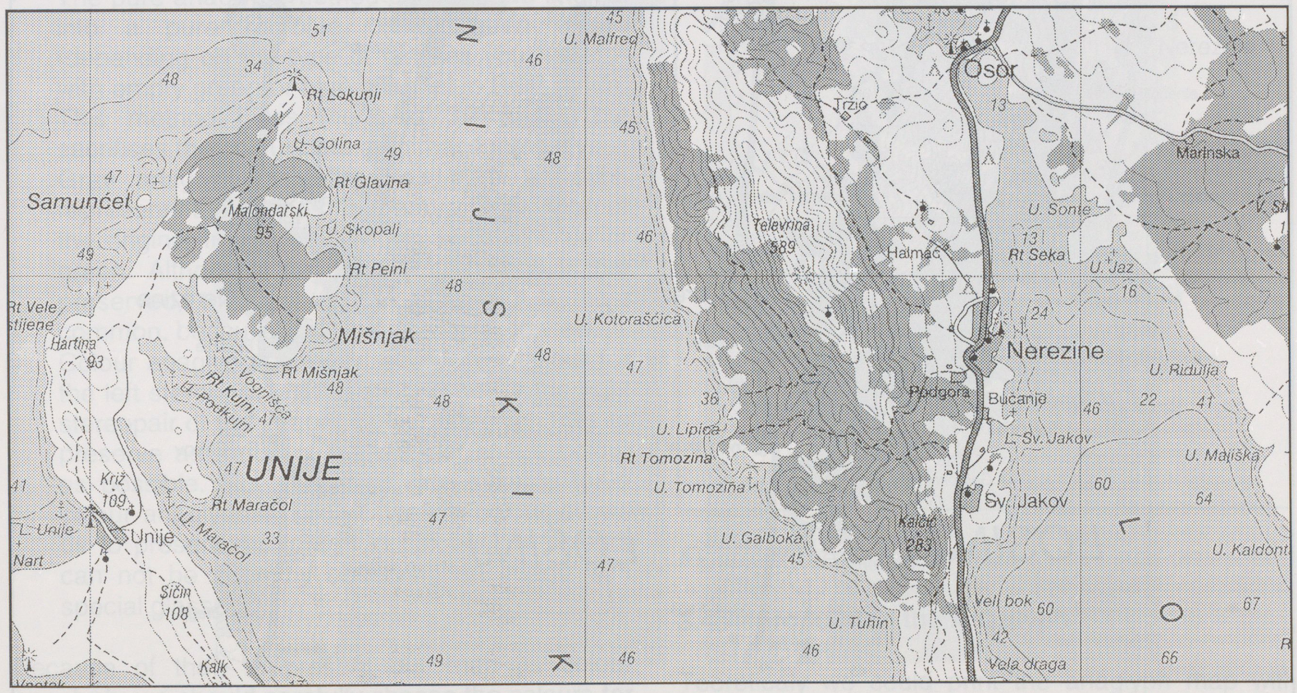

Figure 1: The map in vector's form.

2. MAKING THE STEREO-MAP

With transformation of two-dimensional map into the shape, as it could be seen from two points of viewing for each eye, we actually seperate the map into two stereo-pairs. To make a set of two stereopairs we have to calculate parallax distance for each node of elements on the map. First we have to add height component to the topographical data. For the map made in digital vector format we use DEM, which can be also height extended. If DEM does not exist, we can generate it from contours and other height points. Then we drape topographical data of the map on the DEM – each node gets its height coordinate. If we know the height of all nodes of the elements and if we appoint a base distance and height of our observation, we could calculate and move each node for a value of parallax difference – we get the right stereo-pair of the map. Set of the left and the right stereo-pair creates stereogram of the map – stereo-map.

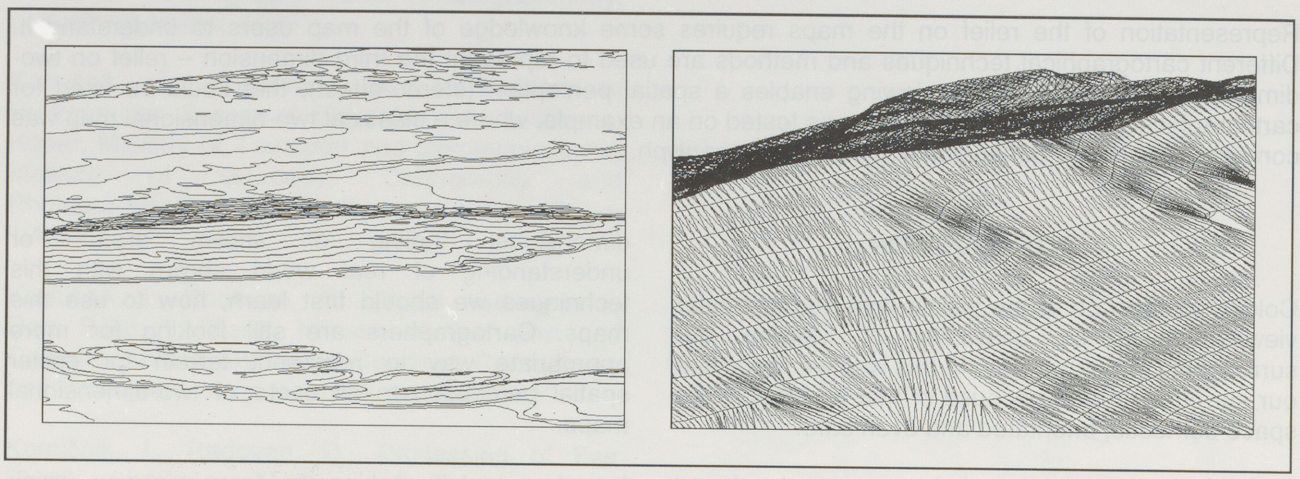

Figure 2: Making the digital elevation model (from contours and height points with added high component generated triangular irregular network – TIN)

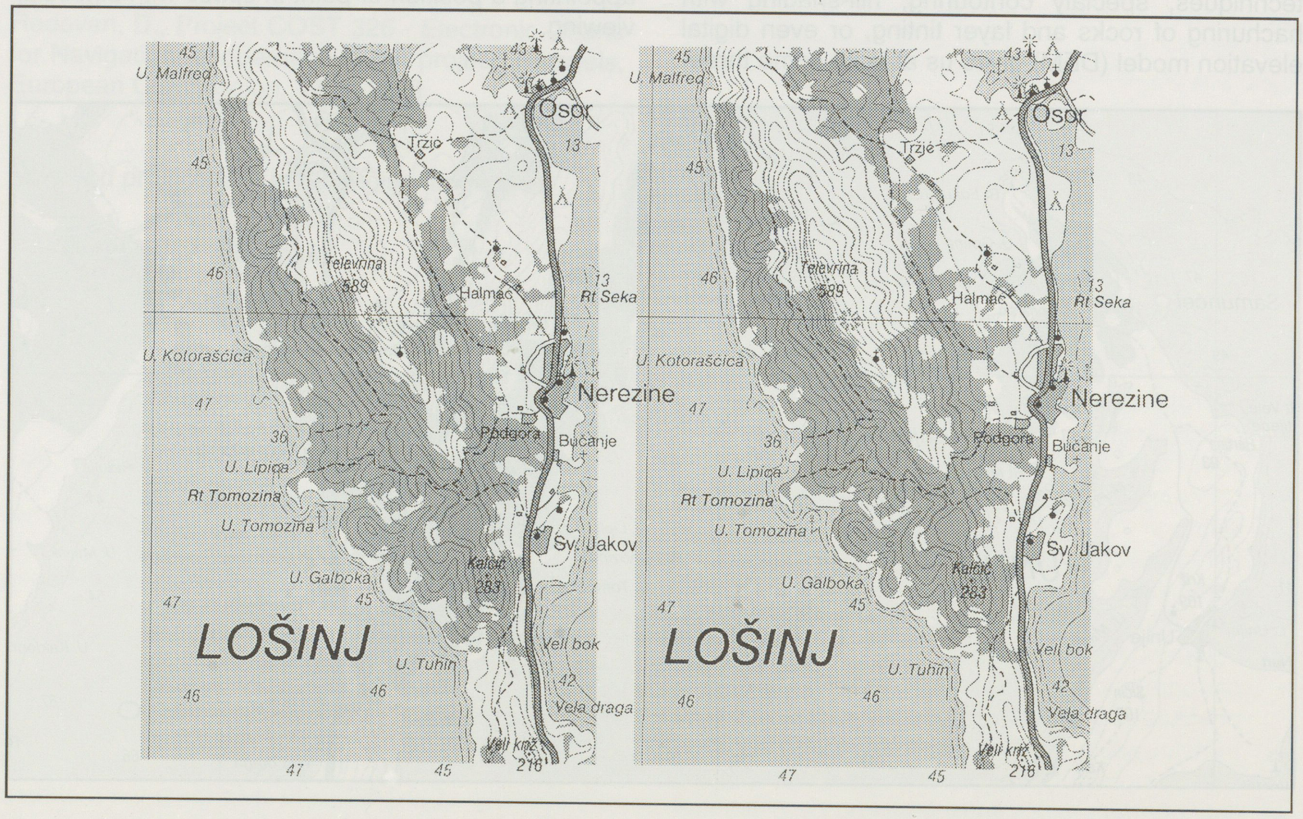

Figure 3: With moving the map elements for calculated value of the parallax difference we get the stereo-map.

3. MAKING THE ANAGLYPH MAP

Such stereo-map is possible to be observed in all its original colours but only with stereoscope. Smaller part can be observed with special viewing methods (parallel view method, cross-eye view method).

Merging of two stereo-pairs is possible, if they are represented as an anaglyph. This method was first used in 1858 from Spaniard d'Almeida. Later on Rollman has introduced a method for projection of diapositives of the stereogram, which was successfully used by Louis Lumière in his stereo-cinema projection (additive anaglyph method).

3.1 Anaglyph Method

The anaglyph method uses colour to encode the right and left image pairs. This method requires a wear of special glasses with colour filters over each eye. Best results we get, if used filters are of complementary colours. International Stereoscopic Union has chosen the red filter on left and the blue, cyan or green filter on right for standard disposal. It is also in coordination with the red used in international marking of ships, planes and politicians.

3.2 Anaglyph Types

The anaglyph image could be encode in three different ways: colour (colour anaglyph), gray (gray anaglyph*) and pure (pure anaglyph).

- The pure anaglyph method converts the original into a pure red/blue or red/green image (depending on the type of glasses you have) – with empty green or blue channel in RGB mode. This method gives the best 3D effect, but sacrifices the colour data and image intensity.
- Gray anaglyph as same as pure anaglyph represents the image but in grayscale version of the original image coloured in red and blue or green. Althought the colour information is not preserved, this type of an anaglyph is most common, because it is typically easier to view.
- Colour anaglyph uses red and yellow colour for the left stereopair and ussualy cyan for the right stereopair of the image. Colour anaglyph tries to preserve as much of the original image colour as possible. Not all images are suitable for a colour anaglyphs. Using of yellow colour allows us to present the image in colours. All colours can not be seen by observing an image with special glasses.

Because of that, to present our map as colour anaglyph, we should carefully choose the colours for cartographical elements. With mixing the different values cyan, red and yellow and using the red/blue glasses a 3D impression of the map can be achieved in wanted colour tints. Pure red or cyan can not be used.

3.3 Making the Anaglyph

If we want to present a stereo-map as an anaglyph, both stereopairs should be merged. The easiest way to do it, is by help of computer:

1. Rasterise both stereo-pairs and present it in RGB mode;
2. Delete the red channel (contents) from the image of right stereo-pair;
3. Copy the red channel from the image of left stereo-pair;
4. Paste the red channel of the left image into red channel of the right image.

The result is an anaglyph map. Because of the RGB mode this map could be observed with special glasses only on the computer screen or projected with datascope to the screen.

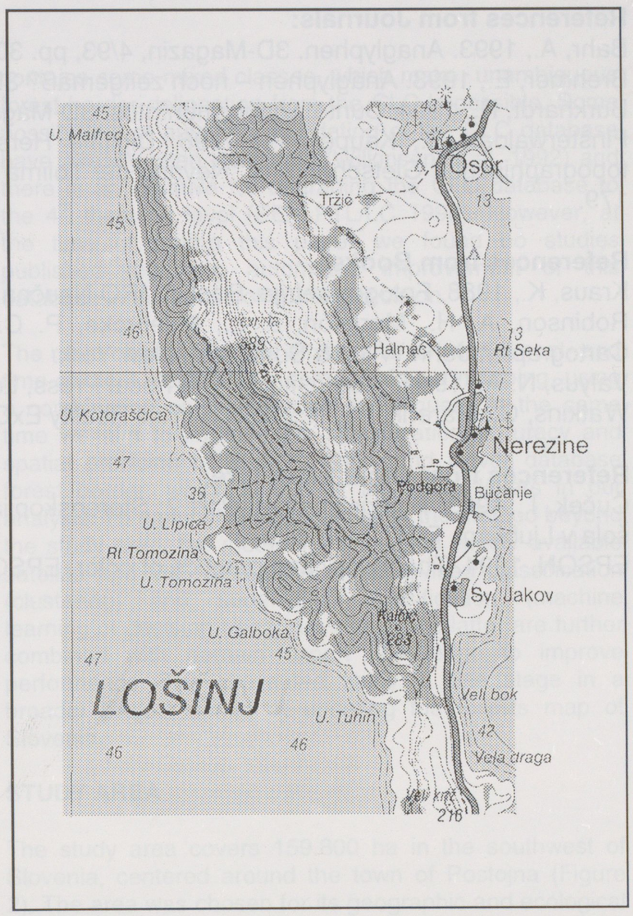

Figure 4: The anaglyph map

3.4 Reproduction the Anaglyph

Teoreticaly we could print the anaglyph map with transformation of the image into CMYK mode. In practice is better to print the anaglyph map in three colours (red, green-blue and yellow for colour anaglyph), because anaglyphs are very delicate on

the smallest differences – inclouding printing paper and light.

4. CONCLUSION

The anaglyph method is not ideal for use on all types of maps in general as contours can be used (map with contours on the anaglyph map gives even better 3D impression).
It is a fact that about 2% of otherwise normally-sighted are "stereo-blind". For unknown reasons they can not achive stereo fusion in artificial situations.
Binocular vision can be impaired by stress. In stress situation we can loose our stereo perception.

Because of that and because the anaglyph has colour limitations and we also need to wear special glasses, the anaglyph method is not perfect for all kind of images including viewing of some cartographical elements. Maybe is this a reason that 99,99% of our daily visual presentations are still tendered in two dimensions.
The anaglyph method is ideal for supplementing the anaglyphs of aerial photographs and satellite images with cartographical theme. Appropriate colour could made extraordinary and attractive image acceptable to its purpose.
Other techniques, which are as anaglyph on two-dimensional base enable a spatial perception, are unacceptable because of loosing intensity, colour, resolution, or they are, for now, to expensive.

* In older literature gray anaglyph is mentioned as coloured or even colour anaglyph, because one stereo-pair is red and other cyan or green. In that case the colour anaglyph is called three-colour anaglyph.

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