3D methods in cartography

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Abstract

The 3D technology has developed significantly in the last few years, having more and more technical devices as well. The 3D is also important in cartography, because it is a new way of development. Maps can be made in a new way, representing more information by using the new 3D based technologies.

The adaptation of traditional thematic methods in 3D is an unmined area in cartography. Cartographers have a lot of opportunities to represent data with the new 3D methods and they can also use animation to show e.g. the progress of time.

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1 Research theme

My research theme is the use of 3D based methods in cartography. At present my main task is to work out the 3D version of each traditional thematic method. I analyze and develop how we can use the 3D based thematic methods of representation in digital maps.

First I analyze these methods one by one and also together, combing each other, studying the possible solutions to combine the various methods keeping a map readable. My final aim is to draw the inference of the adopted 3D thematic methods, suggesting how the methods can be used or how they can be avoided in maps.

2 Experimenting 3D thematic methods

I will review five thematic methods adopted in 3D. I won't perspective all traditional thematic methods, only the ones I researched.

2.1 Symbols

A specific example of traditional symbol was tested in 3D: I used pictograms to present the type and amount of the objects and also their place. The digital technology allows us to use these symbols in a static way when we show one specific moment in our map, or dynamic when it shows the progress of time (Figure 1, Figure 2).

Figure 1: Changes in the poultry stock in Hungary between 2001 and 2007, dynamic map. The height of chickens are growing and decreasing.

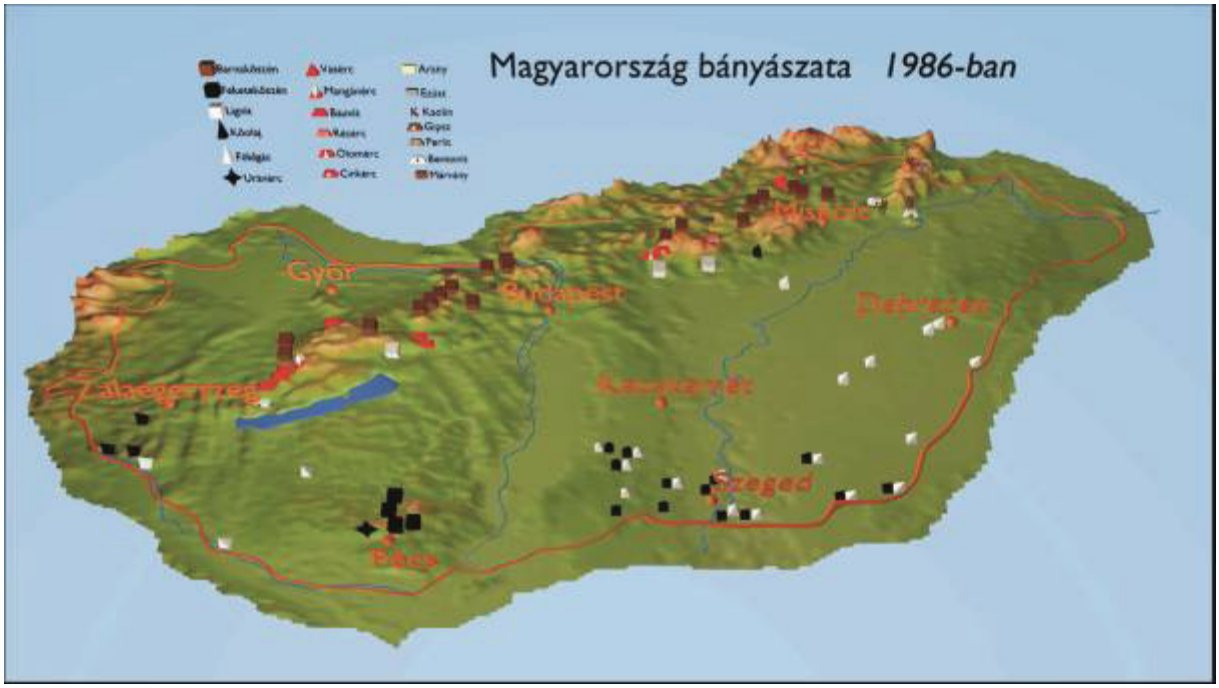

Figure 2: Mining in Hungary, dynamic map. The map shows three dates: 1962, 1986, and 2007. Between these dates the 3D pictograms appear and disappear (changing by the transparency) as the mines close or open.

2.2 Diagrams

Data can be represented traditionally by bar graphs and circle diagrams. Using the 3D we have more possibilities. We can use static 3D columns (Figure 3), or representing them in a dynamic way if the variation of data is represented also in time. I tried to combine the changes of width, depth and height of the columns to show three different data (Figure 4). The result was negative, because changes of the columns are interpreted with difficulty by the readers.

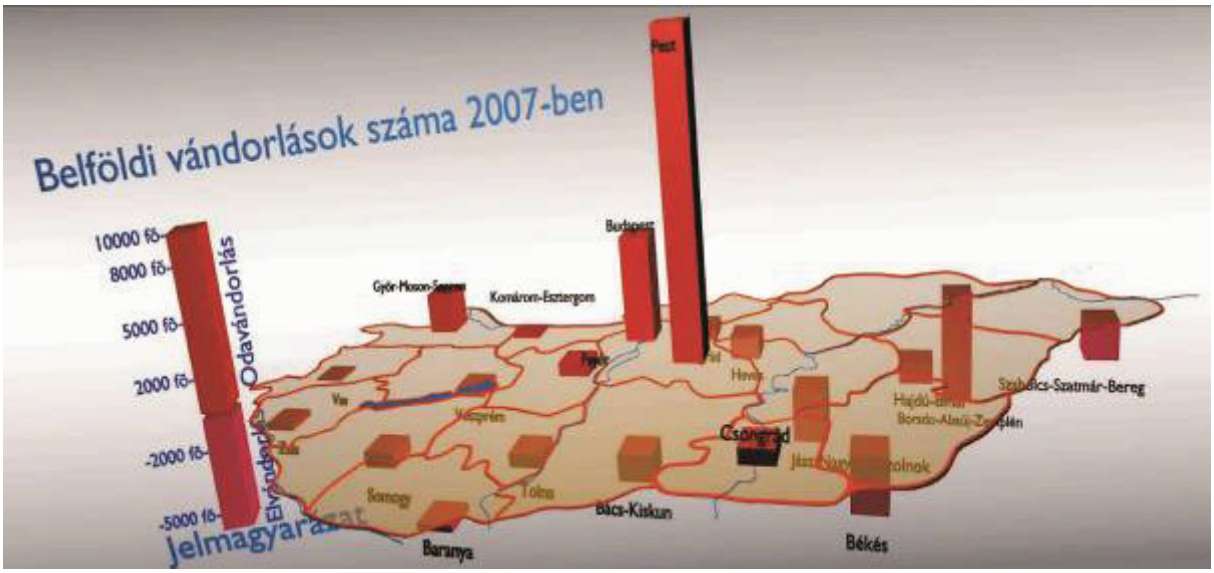

Figure 3: Interior migration in Hungary, static map. The height of columns shows the number of migrated people. If the columns are under the plane of the country, the migration is negative, if they are above, they are positive. The map is animated, the viewpoint sight is moving above and below the horizon.

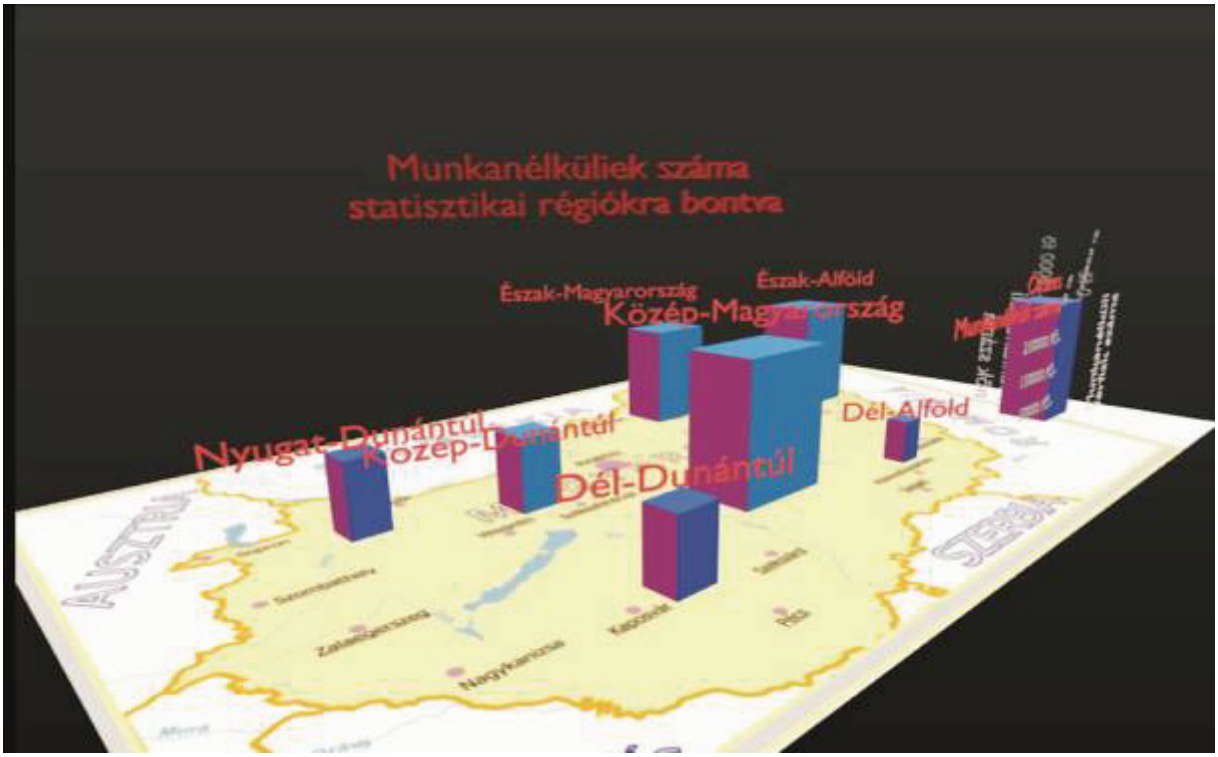

Figure 4: The number of jobless people in Hungary in statistic regions, static map. The height means the total number of jobless people, the width shows the men, the depth shows the women number.

2.3 Isolines

The isolines are lines that connect the same value points. This method is the most popular in meteorology. We can view these isolines as contourlines to illustrate e.g. precipitation or temperature data as relief (Figure 5). It can be also static or dynamic.

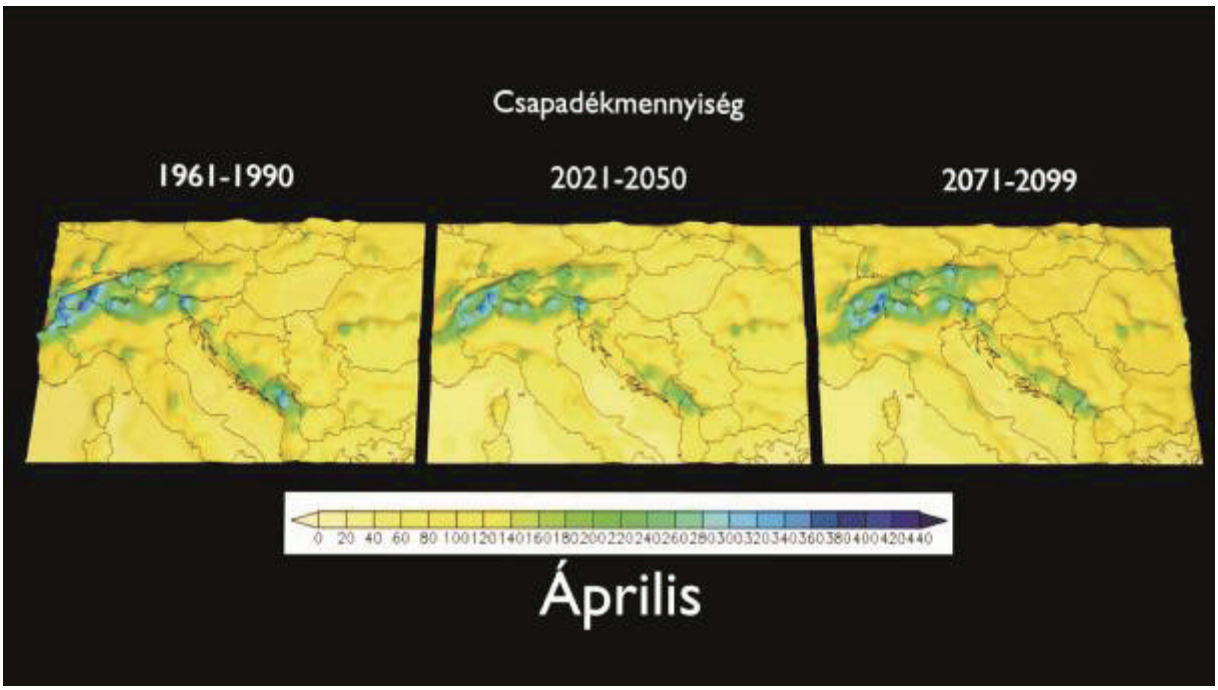

Figure 5: Average precipitation in three periods by meteorological models, dynamic map. The average precipitation in one month produces a 3D relief. This relief moves (up and down) as the monthly values change. We can see three periods together, so the rates can be compared.

2.4 Flow mapping

We use this method to represent the movement or transition of the objects with arrows or lines. Using the 3D we can draw these arrows in a spatial view and with the help of the digital technology it can be also animated by using a simple 3D object, e.g. a cube or a sphere, which follows a line. This movement can be interpreted as the progress of time or its direction (Figure 6).

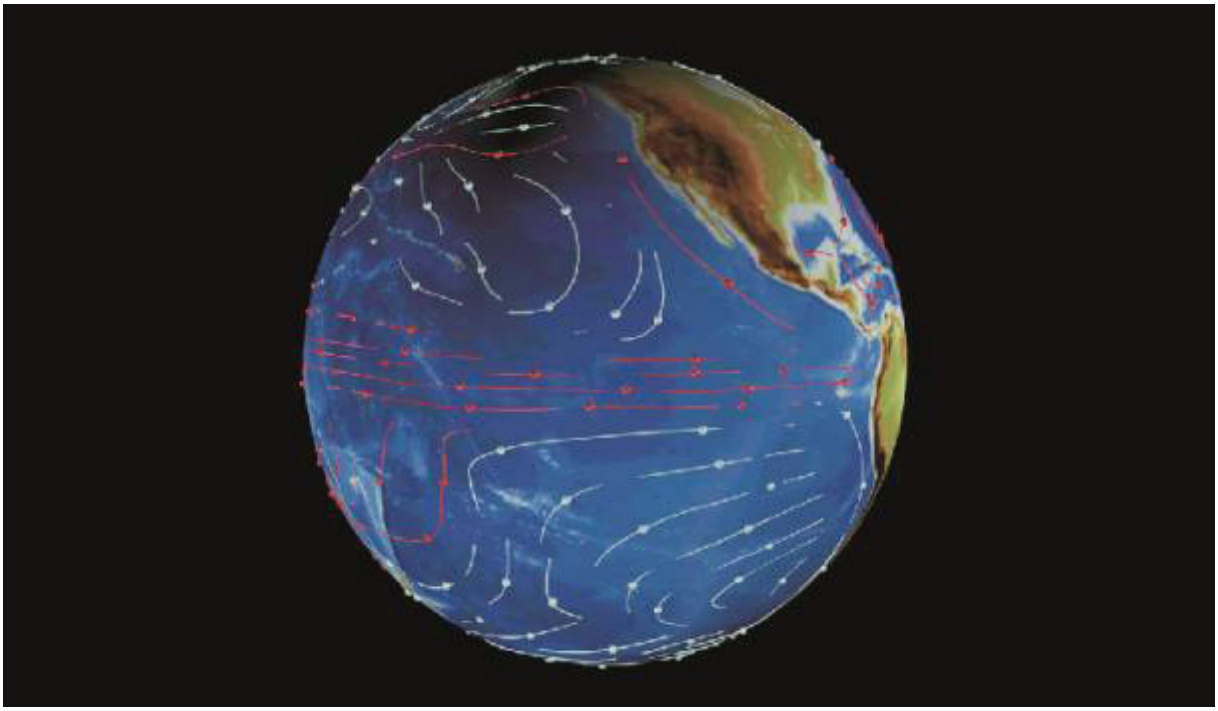

Figure 6: Ocean currents, dynamic map. The lines represent the way of flowing water, and the spheres follow them showing the direction. The map is animated, the earth rotates.

1.1 Dots

Thematic cartography uses small dots to represent density and scattering objects. By using 3D (Figure 7) we can show the same map horizontally and also vertically (Figure 8). The dots have height also, so the density and scattering has vertical values.

Figure 7: Burglaries in block of flats, static map. The spheres represent irrupted flats. The houses are transparent for better observation. The dates are fictitious.

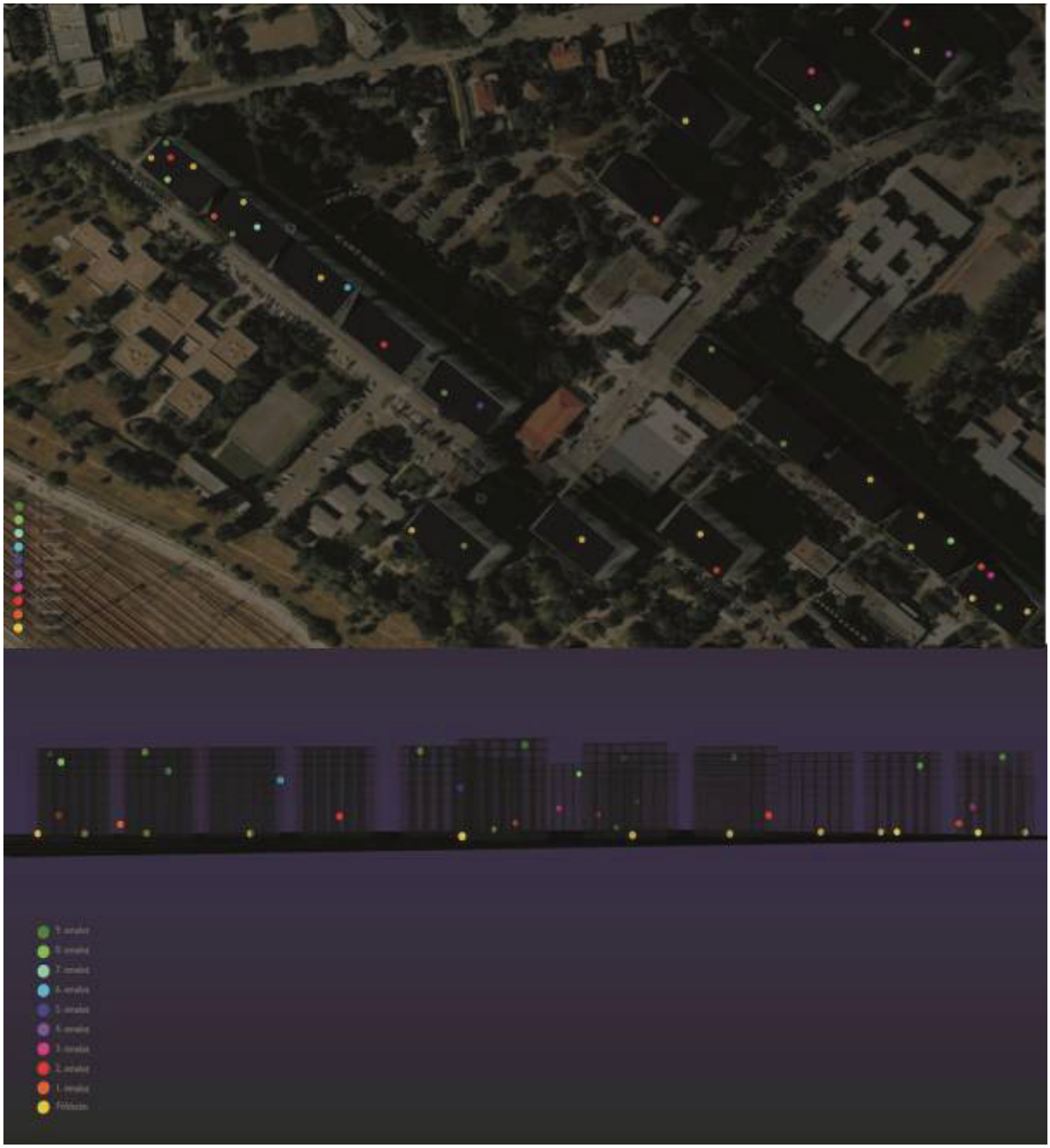

Figure 8: We can observe density and scattering (top view, above, and side view, below). The colours show the storeys.

3 Discussion and Outlook

So far I have improved five thematic methods adapted to three dimensions. There are several opportunities to transform our traditional methods in 3D using by the conventional rules. Using by 3D we can represent more information in a map, we can use new spectacular methods as I showed above. This work is the bottom line of my further research on more 3D methods.

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