MAKING MAPS IN POWERPOINT AND WORD
WHY DO REGIONAL SCIENTISTS NOT MAP THEIR RESULTS?

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Abstract

Cartography has commonly been used in regional science and Exploratory Spatial Data Analysis is regularly applied to visualise the distribution of the variable of interest in space. Articles often contain several maps of administrative areas showing the values of a certain variable. However, and despite the benefits of such maps, they are nothing more than spatial catalogues of data. Their usefulness for regional scientist is beyond questioning, but the communicative value is limited. The rise of GIS has rightly been welcomed by many scientists, however, critical cartographers often pose the question if 'GIS has killed cartography?'. Moreover, this discussion about maps in regional science can be more than a trivial item since it can reveal the fear of scientists to *draw* a conclusion. The chorematics approach, as developed by Brunet, considers maps as 'vitrines', and not as catalogues. In this paper we show that such an approach can enrich regional science by delivering a methodology to visualise spatial structures and dynamics using geometric figures. Finally, we argue that powerpoint and word are better cartographic tools than common GIS packages.

50th Anniversary European Congress of the Regional Science Association International (ERSA)

'Sustainable Regional Growth and Development in the Creative Knowledge Economy'

19th – 23rd August 2010, Jönköping, Sweden

Introduction

In the last few years, regional scientists reflect on their discipline as a result of anniversaries of journals, like the thirty-fifth birthday of Regional Science and Urban Economics (RSUE; (Ottaviano and Minerva 2007) and the Golden Issue of the Journal of Regional Science (Duranton 2010). Two statements attract our attention since they deal with cartography. First, while looking back at 35 years of RSUE, Ottaviano and Minerva (2007, p.448) state that,

> '*it is remarkable that, in a journal that claims to be exclusively concerned with spatial economic phenomena, practically none of the papers employ maps. This trend will probably change, now that mapping software is becoming more sophisticated and easier to use.*'

In the Golden Issue of the Journal of Regional Science, Murray (2010, p.147) indicates that the trend has changed.

> '*Display in GIS has proven to add the wow factor to this method, enabling map-based graphics to be easily generated for evaluation and inspection by humans. This is where knowledge is typically derived.'*

However, he also warns that making maps is rather complex,

> *'Interestingly, this is far more complicated and involved than one may realize, as substantial research continues to be devoted to display-oriented endeavors. From the human perception and cognition side, there are issues of appropriate communication in color selection, symbology, and so on. Even the most basic choropleth map displays, where polygons are color coded to represent some attribute interval, are involved, with the default natural breaks approach reflecting a class selection mathematical optimization problem.*'

We will use these observations as a starting point to explore the use of maps in regional science. In this essay, we illustrate which type of maps are mainly used in regional science. Next, we discuss the pros and cons of this kind of maps. Finally, we discuss alternative approaches and their advantages.

Maps in regional science

Figure 1 illustrates well which kind of maps are displayed in regional science journals. These are what Murray describes as '*the most basic choropleth map displays, where polygons are color coded to represent some attribute interval'*. He also indicates that these maps are applied to evaluate and inspect a variable (and to increase the wow factor of the research). Indeed, detecting spatial patterns (spatial autocorrelation) is one of the favourite games played by regional scientists. Traditionally, scholars apply statistical tests to measure the spatial effects, like the Moran's I (Legendre 1993), Lagrange Multiplier tests (Anselin et al. 1996), and Local indicators of Spatial Association (LISA, (Anselin 1995). Especially with the development of GIS-based statistical software like Geoda (Anselin 2005), exploratory spatial data analysis (ESDA) has become a rather easy exercise. Figure 2 shows the detection of spatial clusters and outliers using the LISA option in Geoda. It indicates that even with increasingly advanced quantitative tests, visual inspections of variables, model residuals, and other spatial data, have the advantage that a user can inspect the data at a glance.

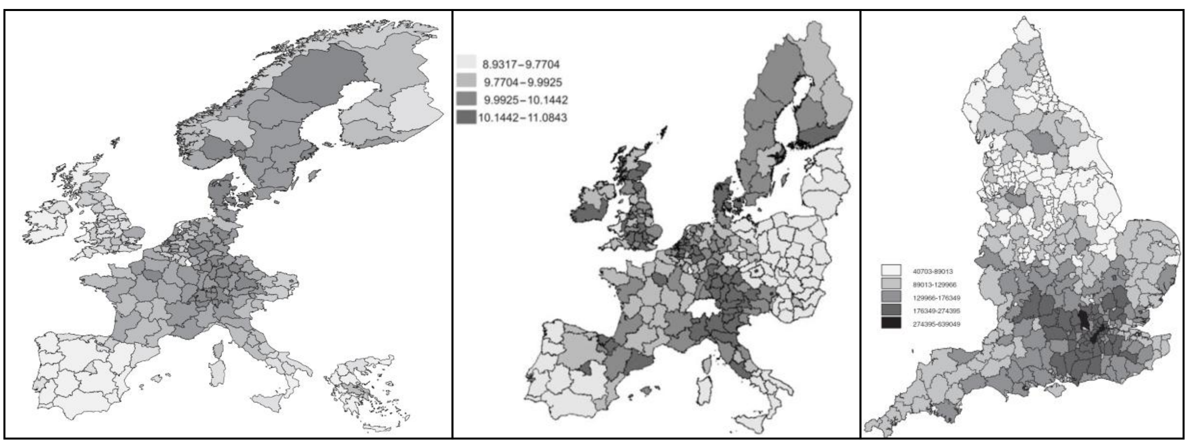

Figure 1: Some examples of maps in Papers in Regional Science
Source: Bosker (2009, p.11); Olejnik (2008, p.376); and Fingleton (2006, p.342)

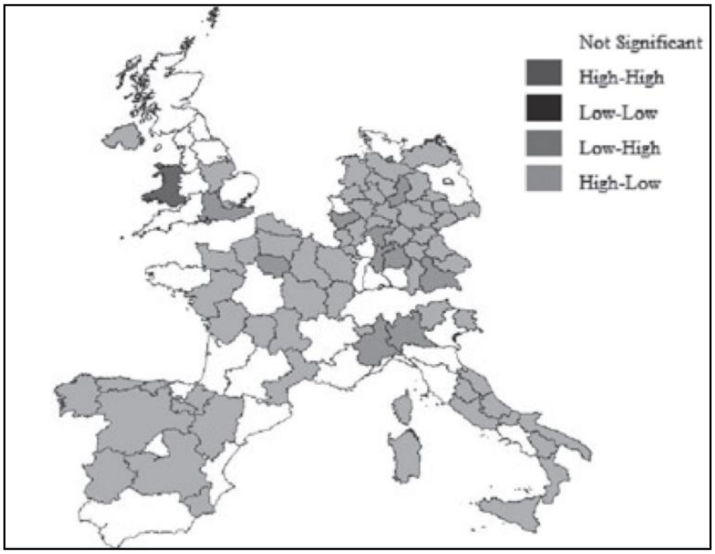

Figure 2: Exploratory spatial data analysis using LISA (Source: (Maggioni et al. 2007, p.485)

With the introduction of software tools, one can literally carry out a spatial data analysis within one minute. Inevitably, the risk of careless analyses turns up. Murray already indicated that there are algorithms and assumptions behind the default natural breaks button. Choropleth maps heavily rely on the method to classify the, often continuous, variable in a distinct number of classes. The title of the cartographic bestseller 'How to lie with maps' (Monmonier 1996), indicates that changing the (default) settings, can lead to misinterpretations of spatial patterns. However, trying some different options, and combining both cartographic and econometric tests, avoids wrong interpretations.

In general, the quality of maps in regional science journals is sufficient for their purpose, i.e. data inspection and showing spatial patterns to other scientists. However, an exploration of the maps used in articles in volumes 85-86 of Papers in Regional Science, reveals that only two of the 13 papers (15%) that contain choropleth maps, draw a scale bar, and none of them a north arrow. Only two other (non-choropleth) maps are accompagnied with a north arrow. The resolution is sufficient in only 13 papers out of 23 (57%) (the 23 papers which contain cartographic images). Seventeen papers show cartographic images with text on it. However, in 7 cases (41%) the text was illegible. Furthermore, in 5 out of 13 papers (39%), there are difficulties to distinguish the different categories in the legend.

Although there is room to improve the cartographic quality of maps in regional science, in most cases, they allow readers to detect a spatial pattern. Moreover, cartographic quality is not higher in other disciplines. We illustrate this by showing a map taken from the main report of the prestigious Stiglitz-commission (Stiglitz et al. 2009). Figure 3 shows that parts of Africa and the Middle-East are missing, just as a north arrow and scale bar. Furthermore, the up to seven significant digits in the legend does not look professional either.

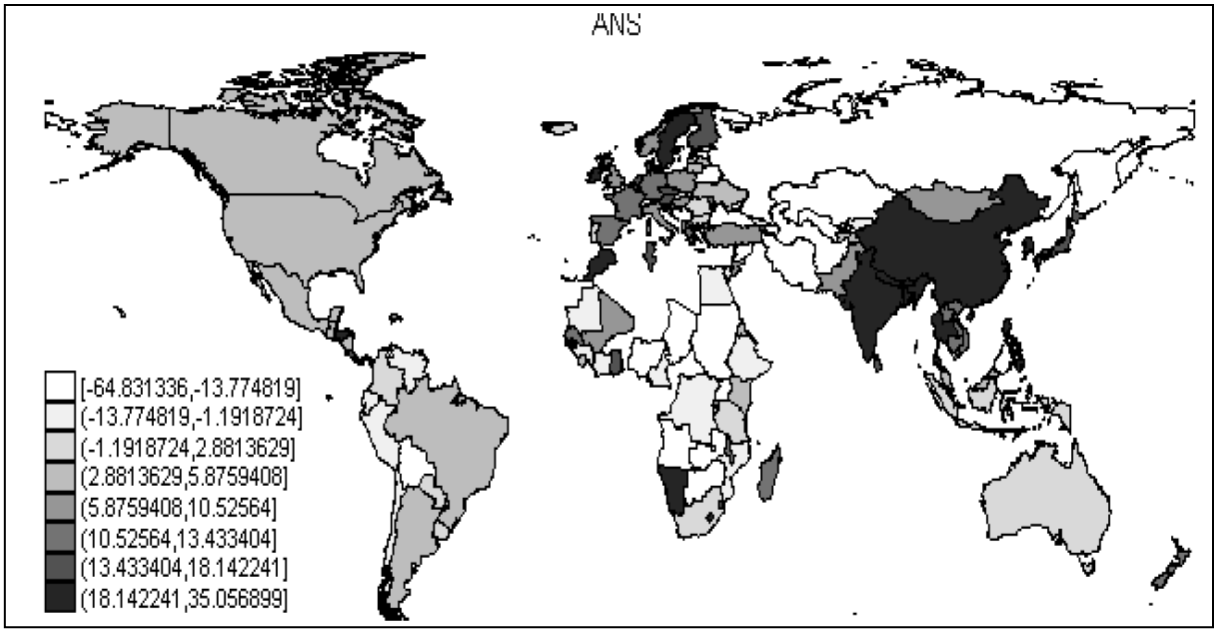

Figure 3: Map showing the Geographical distribution for Adjusted Net Savings in the raport of the Stiglitz-commision (Stiglitz et al. 2009, p.68)

Has GIS killed cartography?

Several cartographic tools are available on websites of organisations like ESPON, the OECD, and Eurostat. Furthermore, several software packages allow to quickly generate maps. With these interactive cartographic tools, users can make choropleth and other maps using the large databases of the aforementioned organisations. We do not doubt the educational value of these tools; however, according to Monmonier, the author of a map is as important as the author of a book. As a consequence, if a less experienced person quickly generates a map using an online tool, the quality is not guaranteed.

As indicated by Murray, most maps are made in GIS. The basic cartographic tools in this kind of software allow to make maps that meet the basic standards of choropleth maps. However, there is critique on this kind of maps. Some scholars raise the question whether ‘GIS has killed cartography’. Sui (2004) refers to a discussion on this topic in 1996, and lists following answers, (i) ‘No, GIS has not killed cartography; cartography committed suicide instead!’ ‘(answer cartographers), (ii) ‘No, GIS has not killed cartography; they got married!’ (answer GIS practitioners), and (iii) ‘Yes, GIS may have killed cartography—but the jury will never convict!’ (answer Social theorists). He himself concludes that ‘GIS and cartography are still having a honeymoon’ (Sui 2004, p.68).

Model maps

Apart from their use in GIS, choropleth maps are also criticised. Already in the 1980s, Brunet (1987; 1990) stated that these maps are catalogues of data and not ‘vitrines’. Indeed, choropleth maps just represent a table in a spatial way. These maps are made for analytic purposes, but are not the result of a thorough analysis. The communicative aspect is thus less important. In contrast with ‘data inspection choropleth maps’, the main function of model maps is clear communication. With this, a model map is defined as, a cartographic synthesis map which gives an analytical view of space, and represent a number of essential functions or relations in a graphical way using a custom symbology (De Maeyer 2008).

To map the spatial structure of an area in a more attractive way, a wide variety of model maps is available. The most extreme counterparts of technical GIS-based maps, are hand-drawn schemes, like the spatial strategy diagram in Figure 4. This model map visualises the future spatial structure as defined in the Spatial Structure Plan for the region of Flanders (Belgium) (Ministerie Vlaamse Gemeenschap 1998; Albrechts 2001). However, the picture is quite chaotic and the choice of colours and symbols is not in line with the ‘standard’ symbols in classical maps. Furthermore, a noted disadvantage is that making changes to a hand-drawn map is complicated. Figure 5 illustrates that making changes after a public consultation procedure, requires ‘photoshopping’. There is thus a need for a method that allows to make simple model maps. To start this search for an alternative cartography, we discuss chorematics as a structured way to draw model maps that visualise the essence of a region.

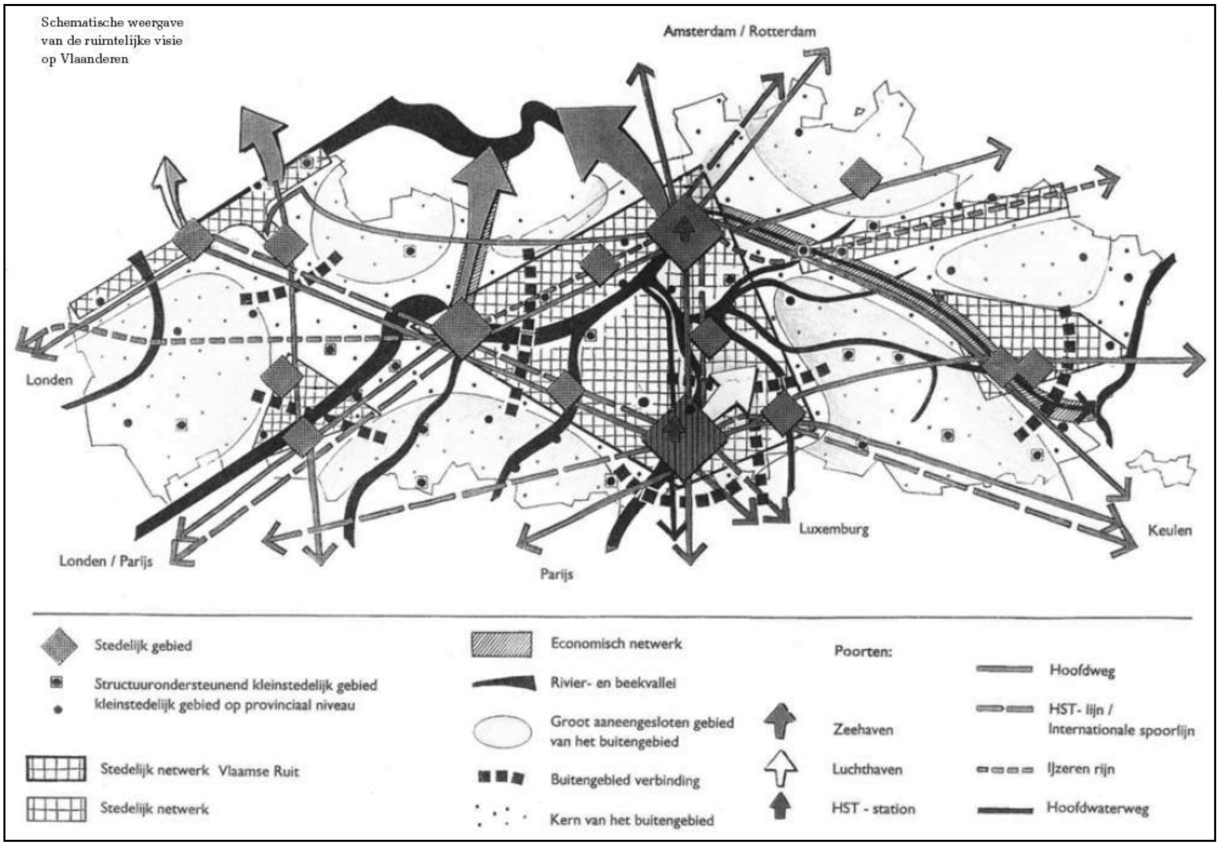

Figure 4: Spatial strategy diagram of the region of Flanders (Belgium)
Source: Ministerie Vlaamse Gemeenschap 1998, p.326 (originally in colour)

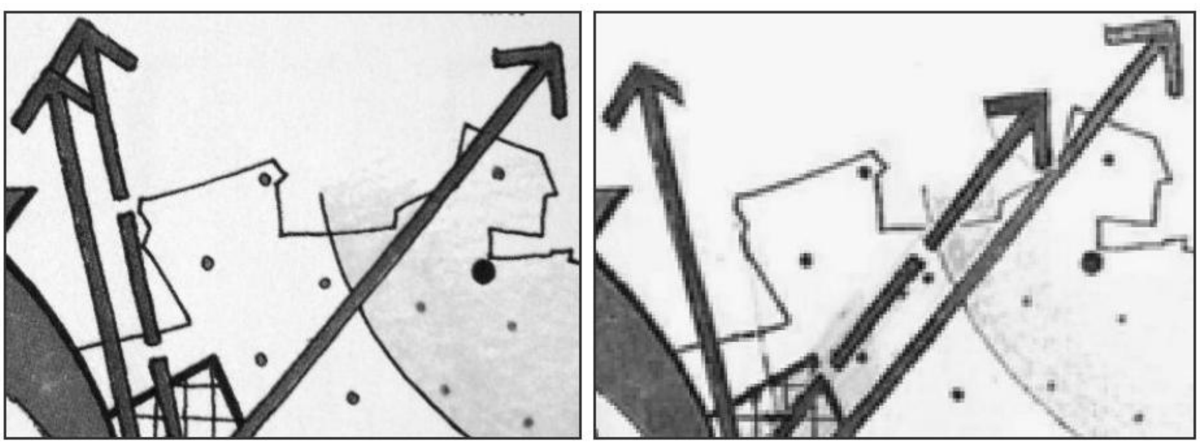

Figure 5: Example of a difference between the spatial strategy diagram of the Spatial Structure Plan for Flanders used during the public consultation (left) and the final document (right)

A structured approach: chorematics

A specific type of model maps are the choreme maps, which are cited as a potential method to use in e.g. spatial planning . Indeed, the choreme methodology emphasises the identification of trends, relationships and networks (Dühr 2007). Chorematics is the brainchild of Roger Brunet.

This method challenges the purely descriptive maps of traditional geography, which are nothing more than catalogues of spatial data. Chorematics aims to show the essence, and to fully apply the communicative function of maps, instead of displaying an abundance of spatial data. A choreme map is more than a vague sketch or scheme for two reasons. First, chorematics takes into account the visual variables underlying cartographic theory. Using this theory, Brunet proposes 28 basic figures based on seven categories of choremes (mesh, pattern, attraction, contact, tropism, territorial dynamics and hierarchy) which are manifested in the form of points, lines, polygons and networks. A second reason why choremes are more than a vague scheme is the fact that they show the organisational principles of space, its structure and dynamics, instead of giving a summary of spatial information. The most famous example of a choreme map is the European 'blue banana' (Figure 6) (Brunet 1987; 2002; Dühr 2004; Laurini et al. 2006; Del Fatto et al. 2007).

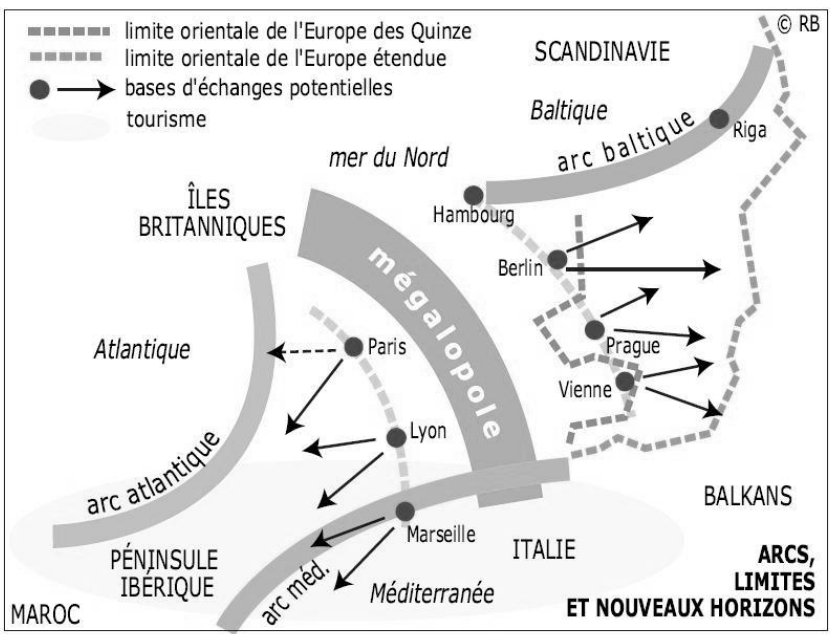

Figure 6: A version of the European Blue Banana
Source: Brunet 2002, original version in colour

Figure 7 shows an alternative mapping of the spatial strategy diagram in Figure 4. This alternative is based on four restrictions (Vanoutrive and De Maeyer 2009). First, it was attempted to obtain a less chaotic picture, inspired by the chorematics approach. Second, the map represents the same information as in the original map and can be used on the same scale (ca.

A4). Avoiding colour is the third condition and, finally, the map is made in a widely distributed software package, i.e. microsoft powerpoint.

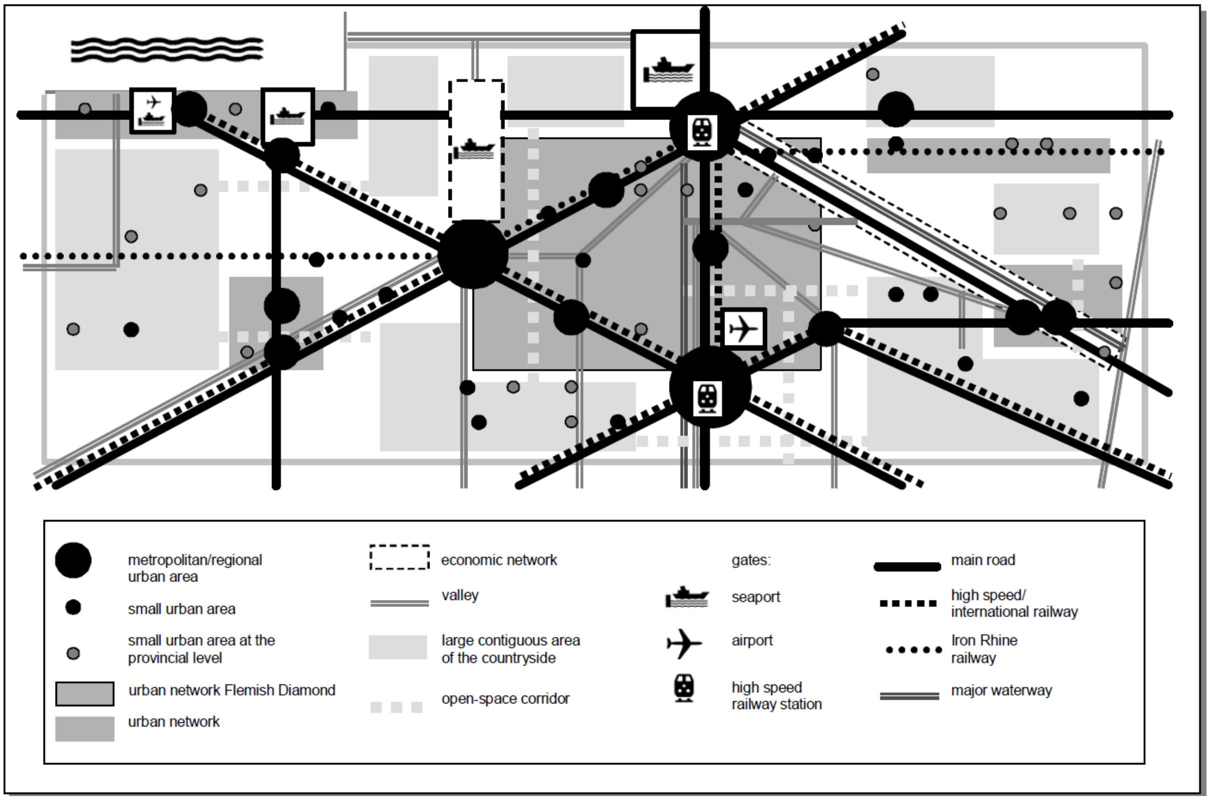

Figure 7: Alternative mapping of the spatial strategy diagram of the spatial structure plan for Flanders (Adapted from Vanoutrive and De Maeyer 2009)

Choremes in regional science

Although choremes aim to visualise spatial processes, trends, relationships and networks, they are not regularly applied in regional science. Figure 8 shows an example of how an analysis of a economic geographical phenomenon can be summarised in a choreme map. In the title of this paper, we asked the *tendentious* question why regional scientists not map their results. Regional scientists has started to apply cartography, but mainly for data inspection. Therefore, we raise the question why the main findings of the analyses, are not mapped using a choreme-like style. The blue banana is a well-known concept, but scholars seem not ready to draw their own banana on the basis of their findings. Note that drawing a basic scheme, forces a scientist to clearly communicate the conclusions. Probably, the absence of model maps hides the uncertainty of authors. Or are model maps just seen as childlike drawings? With this essay, we just want to raise the question.

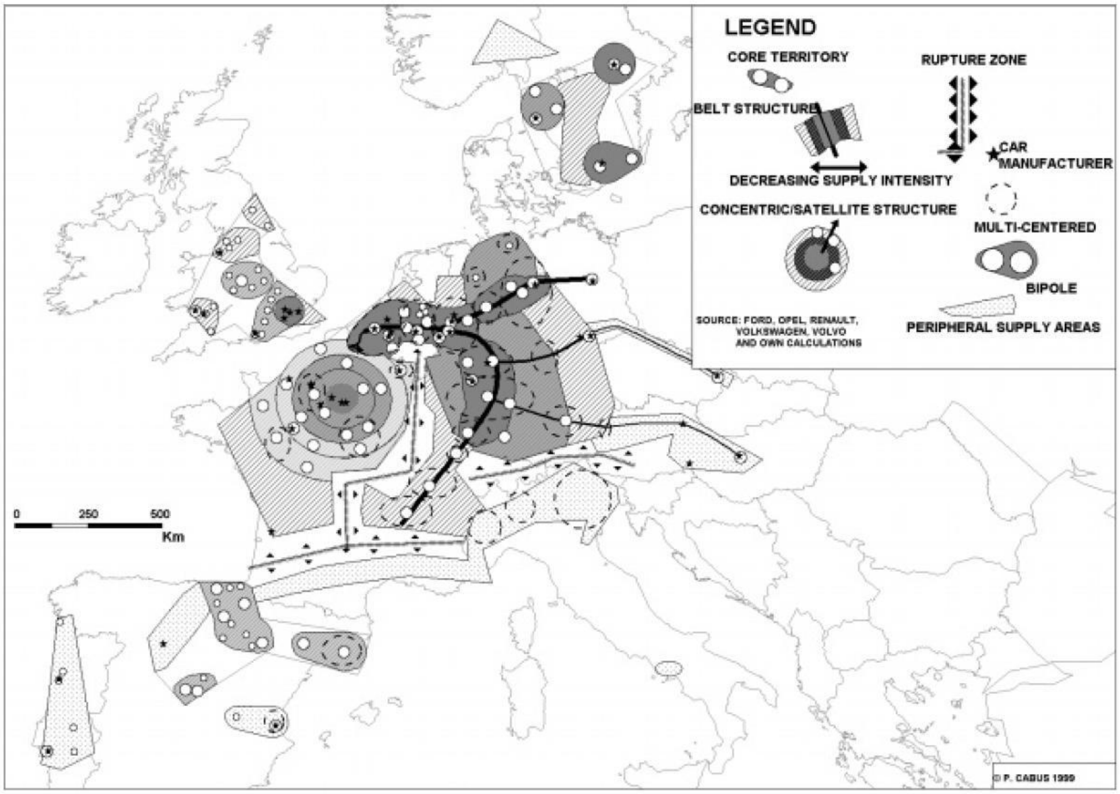

Figure 8: Example of a choreme map in regional science (Source: Cabus 2000)

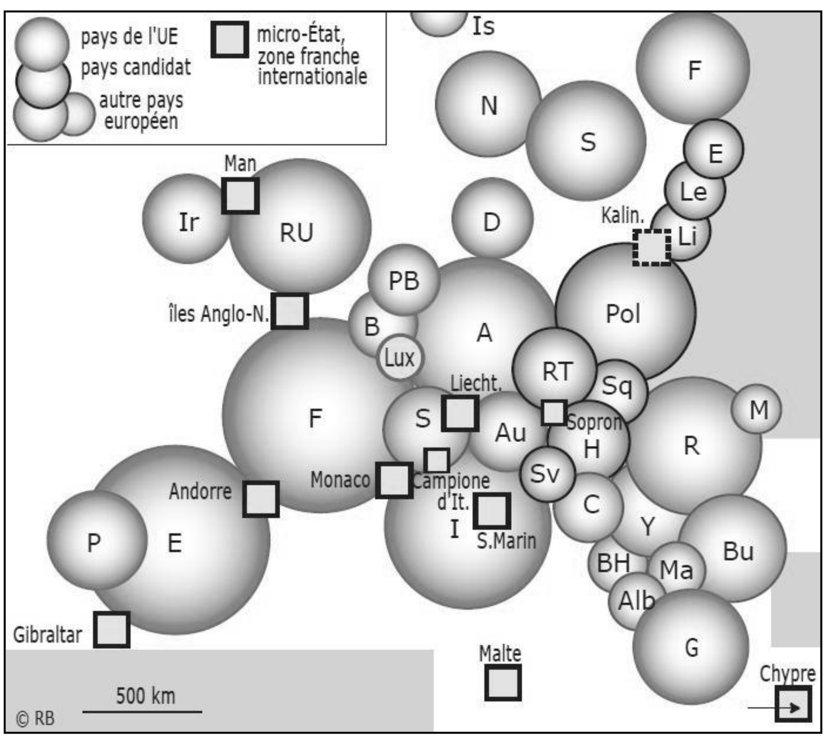

Figure 9: Alternative mapping of Europe (Source: Brunet 2002, original in colour)

Figure 7 shows that a model map can easily be drawn in ms powerpoint software. To end, we illustrate the cartographic possibilities of ms word, with a map (Figure 10) inspired by the representation of Europe in Figure 9 (Brunet 2002). This image shows that an attractive visual representation of space can be made with standard software. To our opinion, this kind of pictures is more attractive, and has thus a higher communicative value than common choropleth maps.

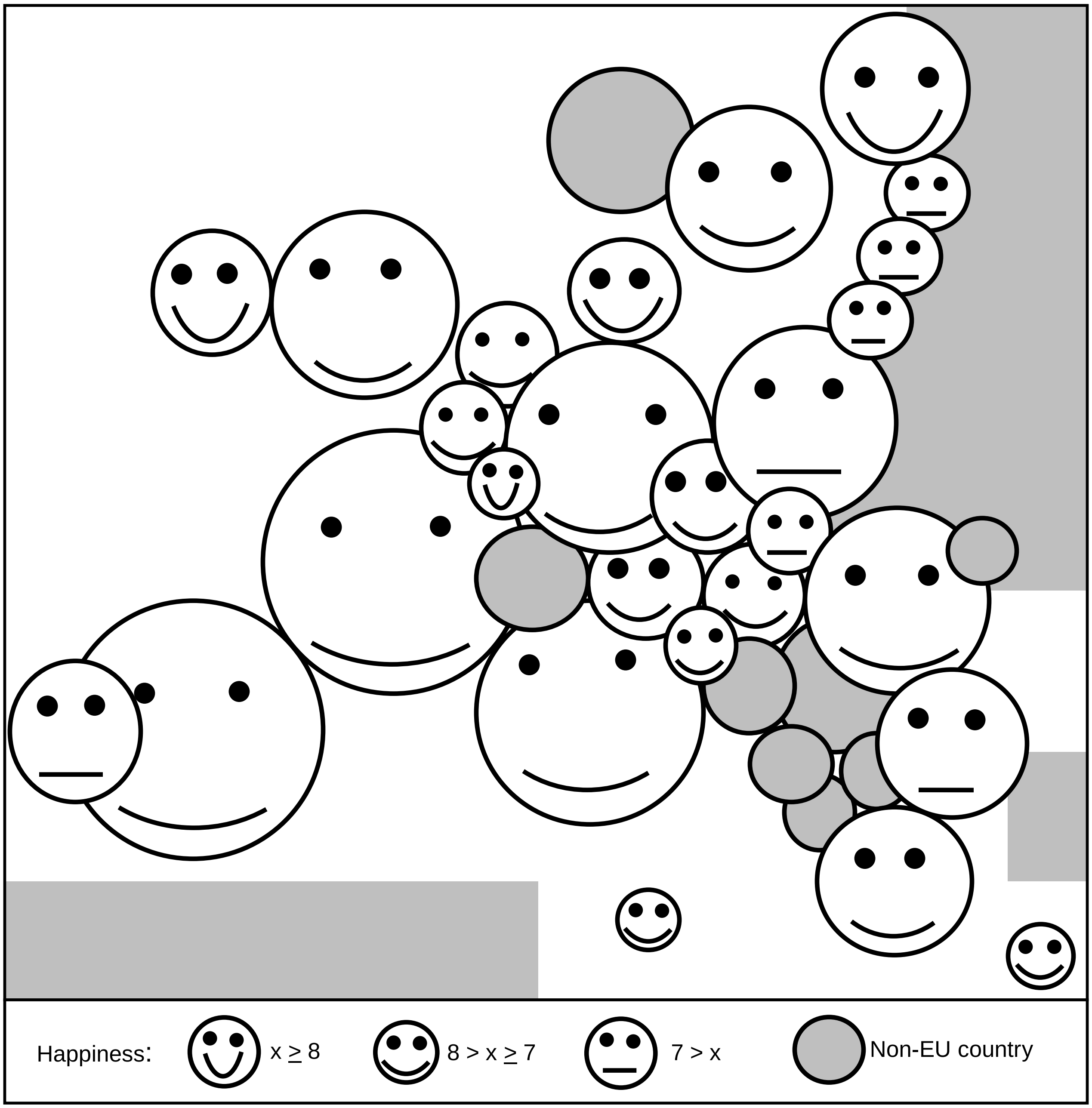

Figure 10: Happiness map of Europe
(Happiness data: http://www.dartmouth.edu/~blnchflr/papers/speeches/MA-DOCS_354864_1.pdf)

Conclusion

In general, cartography in regional science limits itself to technical choropleth maps. Although these maps generally fulfil the needs of the user, we argue in this essay that the quality of mapping can be improved. An appropriate resolution, the addition of a scale bar, and the use of distinguishable categories, all can improve cartographic quality. However, also more communication-oriented maps can be produced. We illustrate that standard software packages like ms word and powerpoint, enable researchers to literally draw their conclusions in an attractive way.

References

Albrechts, L. 2001. How to Proceed from Image and Discourse to Action: As Applied to the Flemish Diamond, *Urban Studies* 38: 733-745.

Anselin, L., Bera, A.K., Florax, R., and Yoon, M.J. 1996. Simple diagnostic tests for spatial dependence, *Regional Science and Urban Economics* 26: 77-104.

Anselin, L. 1995. Local Indicators of Spatial Association-LISA, *Geographical Analysis* 27: 93-115.

Anselin, L. 2005. *Exploring Spatial Data with GeoDa™ : A Workbook*, Center for Spatially Integrated Social Science, Urbana.

Bosker, M. 2009. The spatial evolution of regional GDP disparities in the 'old' and the 'new' Europe, *Papers in Regional Science* 88: 3-27.

Brunet, R. 1987. *La carte, mode d'emploi*, Fayard/Reclus, Paris.

Brunet, R. 1990. à quoi sert la chorématique, pp. 27-39. In Y. André, A. Bailly, M. Clary, R. Ferras, and J.-P. Guérin, editors, *Modèles graphiques et représentations spatiales.* Anthropos/GIP RECLUS, Paris/Montpellier.

Brunet, R. 2002. Lignes de Force de l'Espace Européen, *MappeMonde* 66: 14-19.

Cabus, P. 2000. Modelling Spatial Relationships between Belgian Car Manufacturers and their Suppliers Using Choremes, *Tijdschrift voor Economische en Sociale Geografie* 91: 3-19.

De Maeyer, Ph. 2008. *Cartografie*, Academia Press, Ghent.

Del Fatto, V., Laurini, R., Lopez, K., Loreto, R., Milleret-Raffort, F., Sebillo, M., Sol-Martinez, D., and Vitiello, G. 2007. Potentialities of Chorems as Visual Summaries of Geographic Databases Contents, pp. 537-548. In G. Qiu, C. Leung, X. Xue, and R. Laurini, editors, *Advances in Visual Information Systems.* Springer-Verlag, Berlin / Heidelberg.

Dühr, S. 2004. The form, style, and use of cartographic visualisations in European spatial planning: examples from England and Germany, *Environment and Planning A* 36: 1961-1989.

Dühr, S. 2007. *The Visual Language of Spatial Planning - Exploring Cartographic Representations for Spatial Planning in Europe*, Routledge, Abingdon, Oxon.

Duranton, G. 2010. Introduction: the Journal of Regional Science at 50: Looking Forward to the Next 50 Years, *Journal of Regional Science* 50: 1-3.

Fingleton, B. 2006. A cross-sectional analysis of residential property prices: the effects of income, commuting, schooling, the housing stock and spatial interaction in the English regions, *Papers in Regional Science* 85: 339-361.

Laurini, R., Milleret-Raffort, F., and Lopez, K. 2006. A Primer of Geographic Databases Based on Chorems, pp. 1693-1702. In R. Meersman, Z. Tari, and P. Herrero, editors, *On the Move to Meaningful Internet Systems 2006: OTM 2006 Workshops.* Springer-Verlag, Berlin / Heidelberg.

Legendre, P. 1993. Spatial Autocorrelation: Trouble or New Paradigm?, *Ecology* 74: 1659-1673.

Maggioni, M.A., Nosvelli, M., and Uberti, T.E. 2007. Space versus networks in the geography of innovation: A European analysis, *Papers in Regional Science* 86: 471-493.

Ministerie Vlaamse Gemeenschap 1998. *Ruimtelijk Structuurplan Vlaanderen (Spatial structure plan for Flanders)*, Ministerie Vlaamse Gemeenschap, Brussels.

Monmonier, M. 1996. *How to Lie with Maps*, University of Chicago Press.

Murray, A.T. 2010. Quantitative Geography, *Journal of Regional Science* 50: 143-163.

Olejnik, A. 2008. Using the spatial autoregressively distributed lag model in assessing the regional convergence of per-capita income in the EU25, *Papers in Regional Science* 87: 371-385.

Ottaviano, G.I.P. and Minerva, G.A. 2007. Thirty-five years of R(S)UE: A retrospective, *Regional Science and Urban Economics* 37: 434-449.

Stiglitz, J., Sen, A., and Fitoussi, J.P. Report of the commission on the measurement of economic performance et social progress. 2009.

Sui, D.Z. 2004. GIS, Cartography, and the "Third Culture": Geographic Imaginations in the Computer Age, *The Professional Geographer* 56: 62-72.

Vanoutrive, T. and De Maeyer, P. 2009. Over GeRSt en Patatten: de cartografische weergave van de gewenste ruimtelijke structuur in Vlaanderen (België). In G. Bouma, F. Filius, H. Leinfelder, and B. Waterhout, editors, *Plandag 2009: Tussen droom en werkelijkheid.* Stichting Planologische Discussiedagen, Brussels, pp. 387-397.