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ADVANTAGES AND SHORTCOMINGS OF MIGRATING CARTOGRAPHY FROM ArcView™ TO ArcGIS™. CONCLUSIONS AND PRACTICAL RECOMMENDATIONS

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RESUMEN

En este artículo se exponen de un modo práctico las ventajas e inconvenientes de la migración de la cartografía de ArcView™ 3.x a ArcGIS™ 8.x y se incluyen recomendaciones y sugerencias basadas en la experiencia práctica de los autores, para hacer esta tarea más sencilla. Los usuarios SIG se encontrarán con un nuevo sistema y nuevos conceptos, más allá de un simple cambio de versión. Diseñar un nuevo SIG en lugar de adaptar el existente puede ser incluso la solución más sencilla, puesto que tratar de mantener la misma apariencia en la cartografía puede convertirse en una tarea tediosa. La migración ha sido considerada por los autores como una oportunidad para revisar la estructura del SIG existente. El experto en SIG debe informar al responsable de la toma de decisiones de las ventajas e inconvenientes del nuevo sistema de modo que se satisfagan todos los requerimientos y emerjan otros nuevos.

Palabras clave: SIG, migración, ArcView™ 3.x, ArcGIS™ 8.x

ABSTRACT

Advantages and drawbacks of cartography migration from ArcView™ 3.x to ArcGIS™ 8.x are expounded in this paper in a practical way, including recommendations and tips based on praxis to make it a less distressing experience. A new system and new concepts have been introduced for GIS users. Starting with a new work instead of migrating an existing one can be not so exhausting, but when trying to keep more or less the same appearance as in the previous project this task becomes an authentic painful experience. Migration has been considered by the authors as an opportunity for reviewing the organization and structure of the previous GIS: views, layers, layouts... have to be re-organized and re-located. The GIS-expert should inform the decision-maker

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about the advantages and shortcomings of the new system, so that all the requirements can be satisfied and new ones can arise, due to the new capabilities.

Keywords: GIS, migration, ArcView™ 3.x, ArcGIS™ 8.x

1. Introduction

Maybe it can look only a change in language, but migrating from ArcView™ 3.x to ArcGIS™ 8.x involves more than that, it is a change of mindset. Until now information was presented as a group of layers, but can we in fact represent the world as a set of polygons, lines and points? It is said that modelling objects in the space will let (PETERSON and PLATT, 1993) get intelligent special entities, increase the power to model relations between entities and using dynamic special models.

The conceptual model developed is closer to the real world events. The applied method tries to preserve the characteristics of the objects and their relations with the others. It does not involve forgetting about lines and polygons but these entities have to be more "conscious" of their actual status. Their appearance should be also improved, so that the user can immediately realise of what they represent. In praxis it means that entities are not abstract concepts, but real objects where much more information than geometry, topology or a few attributes can be stored.

This paper is the result of the experience of the authors migrating the cartography of an existing ArcView™ 3.x project, called Ref-Project, to ArcGIS™ 8.x. In first place main changes in the system structure are expounded, and then consequences in praxis are set, to finish with a set of recommendations and tips to make less distressing this change.

2. Main changes in theory

In ArcGIS™ the multiple document interface we were used to see in ArcView™ (Tables, Views, Layouts, Charts and Scripts) are replaced by a single interface document (ESRI, 2002). In ArcGIS™ the attributes are more than a feature property. The other components (graphs, tables and VBA) are stored as elements of a map rather than as separate components of a project. So the real world is tried to be represented in a more complete way, instead of an overlay of layers with different kinds of information (called Views, Tables, Charts, etc...).

ArcMap™ is the core application of the new ArcGIS™ family, used for working with spatial data and creating cartographic output (ESRI, 2001), so it is essential that ArcMap™ works effectively for all users from the novice to the professional. ArcGIS™ tries to be an integrated working group, which means that you can search for a map document in Catalogue utility

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(ArcCatalogTM), and once found, it can be opened in the mapping utility (ArcMapTM) just clicking on it in the catalogue. Anyway data can be drop in ArcMapTM without using specifically ArcCatalogTM.

[Table 1](#) presents the main differences in language between ArcViewTM and ArcGISTM. As it has been pointed out before, these changes show a change in the way of thinking and in workflow.

3. Changes in praxis. Practical recommendations

This is the theory, but what does it involve in praxis? How does it affect the workflow for generating cartography in this project? When designing a map it is not only necessary to know what contents should be displayed (as it has been done when the "old" project (Ref-Project) was designed), but also how it should be done, so the next aspects have to be taken into account:

- Coordinate system (Cartographic Projection)
- Visualization scale
- Measurement units
- Legends (categories, colours, symbols...)
- Identification of the entities (labelling)
- Images displaying (raster, satellite images, aerial photographs)
- Repairing links
- Layouts

All these aspects have been already set in the Ref-Project, but this is a good chance to review some of them and try to improve them. However, the main aim is to maintain a similar appearance in the layouts.

The status-quo is a single project in ArcViewTM 3.2 (*.apr) where different views are used to represent different maps. Migration to ArcGISTM involves only one map in each map document (*.mxd); that map can include different data frames and layers. You can explore, display, edit, and query your data in a data view or in a layout view so, first of all, forget about different layouts in the same document.

Each view of the Ref-Project was treated as a new map document, so several documents were created. Each map document can contain different data frames. Only one data frame can be active in each map document, with the same name as the view, and therefore, as the map document.

The first step is defining the properties of the new map document, which are going to be common for all the data frames in the document. The main and most important novelty is the possibility of storing data with relative paths instead of absolute paths. It has been an aim for all ArcViewTM 3.x old users, and it avoids redirecting each data file when changing the file directory.

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Each data frame contains a set of features called *layers* which are shown together. "Layers" are similar to "Themes" in ArcView; the main difference is that layers exist independent of a data frame or map layout; therefore they are not linked or dependent on a concrete project. This means that layers can be drop onto maps and used by other users.

3.1. Coordinate system

The coordinate system is a data frame property: when a layer is added to an empty data frame this layer sets the coordinate system for the data frame by default. Only one coordinate system is possible in each data frame in order to display all the layers in the same way, but changing this system does not mean a change in the coordinate system of the layers displayed on it. If there is not enough information about that layer it is necessary to define the parameters of the coordinate system or to choose among the existing ones. The dialog-box is very easy to understand and the customisation and review of the parameters very easy to do.

This way of representing data concerns the fact that data represent actually the real world, more than being only features: features represented together (in the same data frame) should have the same references, because they belong to the same piece of reality. This is a practical application of the new conception of reality developed in ArcGIS™.

3.2. Visualization scale

When the map contains quite a lot of information stored in different layers, some features should be shown only at a certain scale, if not they could be too difficult to distinguish (small scales) or the information provided can be not suitable or not accurate enough (big scales). As an example, let us take cartographic information: in this project contour lines each 50 m, 10 m and 5 m are available, so depending on the map scale the most suitable data should be displayed. This is possible setting the maximum and the minimum scale for each layer. This is the easiest way to control how the map looks at different scales, and it is very useful when this map is going to be used for others. In this case the visualization scale range of each of the Ref-Project themes was checked in ArcView™, because when a layer is loaded in ArcMap™ is shown at all scales by default, and assigned to the respective layer.

The layers displayed at a certain scale are stood out with a dark cross in the layer's check box in the table of contents, while those which are out of their range of visualization scale have a grey scale bar under its check box. This is a clear improvement of ArcGIS™, a very useful tool for the user to notice at once which layers the displayed data belong to and to check if the current scale is possible for a certain datum.

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3.3. Measurement units

When measuring features or locating places by their coordinates it is necessary to set the units for distances and also for the map (they can be different). This is a data frame property and can be customized easily. Therefore it is unnecessary to define it for each layer.

3.4. Legends (categories, colours, symbols)

How you represent a map determines what your map communicates (MINAMI *et al.*, 1999), so choosing how to represent data on a map could be the most important decision in mapmaking. Each layer can represent its data in the most suitable way. Depending on data type may be more suitable to use single symbols (e.g. inventory plots, tourist information points, lakes), draw features based on an attribute value (e.g. tree species) or to use series of symbols whose colours change according to the values of a certain attribute using a graduated colour ramp (e.g. mortality levels in the forest). Dealing with continuous surfaces like temperature or precipitation gradients, the colour-shaded relief maps are highly informative and easy to interpret.

All these kinds of maps are used in the Ref-Project, depending on, as said before, the data type. Each legend (*.avl) is saved with the same names as the theme it belongs to, so the first possibility to achieve a similar map in ArcGIS™ is importing the legend from ArcView™, because the layers are loaded with no legend. New colours, colour-ramps, symbols can be created and stored in the Style Manager.

3.4.1. Symbols

Concerning symbols, a very important fact should be pointed out: if their size should change depending on the scale they are displayed or not. If the symbol is scaled its size depends on the current scale, so it becomes bigger when the scale does, and smaller when the scale does, too. In the Ref-Project many themes contain scaled symbols, such as inventory points, grid 1x1 km with cartographical data, rivers, etc. To get this change in size is necessary to set a reference scale. In ArcView™ each theme could have a different reference scale, so that each scaled symbol can be defined at a certain scale, but in ArcGIS™ only one reference scale per data frame is possible. Therefore, all the layers in the same data frame must have the same reference scale. This aspect enables the possibility of maintaining the same characteristics in the new map in ArcGIS™, so two suggestions are settled:

1. In most cases it would be appropriate to discuss if it is suitable or not to display scaled symbols. As shown in [Figure 1](#) in ArcView™ (Ref-Project) inventory plots were displayed as scaled symbols, and at big scales (e.g. 1:1.500) not scaled symbols look more suitable (ArcGIS™ map), because the interest it is focused on location, and its "visual" accuracy decreases when the size of the symbol increases.

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So before trying to scale symbols a review of its suitability in each case should be done.

2. If scaled symbols are the most adequate option, a new reference scale for the data frame should be agreed, what means searching for a suitable scale for all the layers in the data frame. It is not necessary that the reference scale is in the range of visualization of all the layers. Working with a unique reference scale looks more functional and practical than having more than one, and it deepens in the idea of integrity in each data frame. Once established the common reference scale the type and size of each symbol is fixed for each layer.

3.4.2. Simple symbols or colours

When the legend includes simple symbols or colours, sometimes it is only necessary to readjust the border line (if exists), or load the line type, because only the colour is available after the import (not the symbol) (e.g. one line). When not even the colours are loaded it is difficult finding exactly the same colour because the new available palettes (RGB,...) do not include the colour definitions employed in ArcViewTM.

3.4.3. Complex symbols

When symbols are complex (usually user-defined symbols) sometimes are easily loaded (if they had been saved previously in the Ref-Project), but some of them are not, so that it is necessary to design a new one or to choose it from the large ArcGISTM collection. Possibilities for designing new symbols are great, but often it is too complex to develop one similar to the old one. This is, in fact, a chance to review all the symbology utilized in the project and to update it, taking into account that the legend editor in ArcViewTM was not so powerful, and that a new set of possibilities is offered.

3.4.4. Ramp colours tool

The ramp colours tool improves a lot the legend and allows creating new and more attractive legends in a very simple way.

To sum up, migration concerning legends can cause some trouble due to not all the "old" legends can be loaded, so that quite a lot of time is spent trying to adjust the new ones. When a completely new legend is set this problem disappears and the user is introduced to an amazing world, full of tools for customizing colours and symbols (Style Manager). However the main difficult appears when working with scaled symbols, because in ArcViewTM the reference scale is set in each theme, while in ArcGISTM it has to be set for each data frame (so all its layers have the

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same one). The need of a scale symbol should be checked and when necessary a new one for the entire data frame should be chosen.

It should be pointed out that this step in migration is also a good indicator to check the design of the Ref-Project, because not only the access to the layer should be easy to understand, but also finding the corresponding legend should be fast and not time-consuming. The main conclusion about this point is that a good file-structure and organization let the user save a lot of time, even if the user is not familiar with the Ref-Project, because a workflow can be established.

3.5. Identification of the entities (labelling)

In a map one of the main facts is giving information about geographic features. Therefore displaying only features on a map is not always enough and it is necessary associating text to a map feature (label). Labelling is quite different in ArcGIS™ comparing to ArcView™ and what was a very simple and easy issue, has become a real nightmare for users. A new world of possibilities is promised by ArcGIS™, and in fact new and more advanced options allow improving labelling, but the most simple requirements (such as scaled labelling) are much more difficult to satisfy.

Typing the text label is only advisable when only a few features should be labelled, otherwise ArcMap™ can dynamically generate and place labels. This is the option chosen in this case, because of the huge amount of features and layers to label. ArcMap™ can also dynamically adjust the labels to fit the available space, and what looks at first sight a clear advantage, it is sometimes more a problem, because there is no guarantee that you will get the labels you want be positioned where you want them (and in fact it is what happens most times!). This is warned in ArcMap™ help and a more precise (and, let's say, painful) process is required. This process implies converting the dynamic labels to *annotation*, what allows manually controlling the labelling of features. Once labels are converted, these new text graphics can be moved and the size, font and text changed. But that is not all, if the user wants scaled labels, there is no way unless using annotation, so, forget about fast and dynamic labelling!!

All these annotations should be stored somewhere, so the next step is deciding where! And, as usual, some options are available. But if we want them to be shown in the same range of scales as the corresponding layer it is only possible to store them as an annotation feature class in the geodatabase, and this annotation can be added as a layer to other maps. This annotation should be a feature-linked annotation, so that annotation is linked directly to the feature it annotates, and if the feature changes (it is deleted, moved, the attribute changes, etc) the annotation too. So the way to get labels in the right place, with the right size and style and also scaled, is not so easy as in ArcView™.

What does it imply in practice? Most themes in the Ref-Project include scaled labels, so when checked this option is the most suitable, the characteristics of the labels should be transferred to ArcMap™, because each layer has no labelling by default. So first dynamically labelling is enabled and the size and style of the text should be set. To know these data it is necessary comparing

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the text appearance displayed in ArcView™ and in ArcMap™, because it is not possible to check the text properties in ArcView™. Notice that in ArcView™ these aspects are defined considering the reference scale of each theme, while in ArcMap™ that scale is the same for the entire data frame, so a direct conversion is not possible. Adjusting the appearance of the labels is a boring and time-consuming task, too complicated when not advanced options are required. When labels are customized, they have to be converted into annotation, and this annotation converted into a new feature class linked to the main layer, so for each labelled layer we will have a new feature class in the geodatabase. And then it is time to check if all the labels are in the right place and with the right size. It is also important to make sure this annotation feature class is only displayed when the corresponding layer is.

The main conclusion about labelling is that this powerful tool looks great for advanced and detailed labelling (e.g. location conflicts, overlapping, labelling only the selected features, etc), but the basic requirements are too complex to get on. Starting with a new work instead of migrating to an existing one can be not so exhausting, but when trying to keep more or less the same appearance as in the previous project this task becomes an authentic painful experience. Which are our suggestions? Convert all your labels into annotation, and adjust the appearance taking into account the reference scale; it would take a lot of time but it seems to be the only way. It implies switching all the time between ArcView™ and ArcGIS™ to check the results.

3.6. Images displaying (raster, satellite images, aerial photographs)

Displaying raster (e.g. satellite images, aerial photographs, thematic data about temperatures, etc.) is not a problem with ArcGIS™; if a predefined colour scheme exists, it is displayed automatically by ArcMap™. It is remarkable that they are shown as images, not as layers.

3.7. Repairing links

When opening a map, ArcMap™ search for the data referenced by the layers on the map; if they cannot be found the corresponding layer is not displayed and a red exclamation mark is placed next to its name in the table of contents. The location of the data can be introduced after and the link restored. This option allows opening the map even when not all data are located; as an advantage it should be pointed out that when part of the data are damaged it does not mean that the project cannot be opened, as it was in ArcView™. On the other side it can be a dangerous improvement, because the structure of the GIS can become weaker and less consistent, as a result of being careless of data location and data integrity.

3.8. Layout view vs. data view

Data view is better for analysing data, because you avoid all the map elements, such as scale bars, north... In the layout view multiple data frames and all map elements can be displayed,

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like views in ArcView™ 3.x, and you can do almost everything you can in data view, plus design the map. All parts of the map layout are considered "live", so when different aspects of the same data frame should be shown in the same layout (e.g. location map at scale 1:50.000 and detailed map at 1:5.000) the data frame ought to be duplicated. Duplicating (once or more times) a data frame involves increasing the data volume and it contributes to decrease the integrity of the system.

On the other hand it is the benefit concerning selecting features, geoprocessing... in the layout view. Although all this operations are possible also in the data view, the possibility of doing them in the layout view goes deeper in the philosophy of only one reality and different ways to represent it, and in the need of interacting with the visualization of geodata. This viewpoint leads to the concept of interactive cartography, where the user can query with the maps without switching to data view, and where data/layout are only two dissimilar displays.

Regarding new symbols, templates, scales, precision to locate data frames or symbols, customizing legends or text, insert graphs, etc... the new possibilities for making maps are really numerous.

Although there were already layouts designed in the Ref-Project, the user should consider the possibility of redesigning of all of them, and taking advantage of the new tools. Maps are only one of the outputs of GIS, but in an organization it can be one of the most valuable, as a comprehensive way to show data. Old-fashioned maps can be considered as a sign of old-fashioned methods and technology, so a complete change should be considered. Although maps can change a lot depending only on the purpose of design and who are designed for, new designs should reflect changes in mindset.

4. Final comments about migration. Conclusions

Migration is an opportunity for reviewing the organization and structure of the Ref-Project: views, layers, layouts... have to be re-organized and re-located. It is a chance for a change in the organization and the "soul" of the project. The GIS-expert should inform the decision-maker about the advantages and shortcomings of the new system, so that all the requirements can be satisfied and new ones can arise, due to the new capabilities.

When organizing the "new" GIS one single project can remain a single map document or distribute all its information in simpler map documents. When different layouts are required it is more suitable think about one map document for each layout, or for each view (using ArcView™ words). And each map document should be named as the view and enclose all its information, stored in layers which belong to the same data frame. This decision implies multiply the number of documents, and instead of working only with one project, data will be shared between as many maps as views there were. The idea of integrity in the GIS looks to decrease but actually the map document only store the information about data location, not data, so there is no change in data integrity.

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About legends some items to take into account: before starting it must be clarified if the main aim is maintaining the old appearance or a new one can be achieved using the capabilities of the new system. It looks clear that not in all cases is going to be possible to maintain the old symbology, the old colours, so deciding to keep the previous one involves always some changes. These changes can be minimized trying to import the old legends and when it is not possible (they cannot be loaded) a new symbol similar to the previous one can be designed. It takes time (searching for the legends to load, redesigning symbols, etc) but sometimes it is worth it.

But most times redesigning symbology and legends is more than a reasonable option, it is a way to get a bigger integration of the project in the new system, however a lot of hours of previous hard work seem to be wasted. Migration, as said before, is a great chance for checking a project and the right moment to become true all those stored ideas about improving some aspects in a project. For instance, a lack of symbols or options in the past could lead to use symbols with a very slow display or which require a huge amount of resources when loaded, so more "economic" symbols can be chosen from the new palette or just designed.

Actually migration involves exploring the new version, comparing with the old one and outweighing benefits and shortcomings. But not only, because you have to consider special circumstances which can condition the decision of migrate or not, such as the position of the organization concerning new changes, how difficult it is going to be to get used to the changes for the different levels of users, which is the estimated budget for training users in the new system, even if the project is developed by a public institution (e.g. university). Talking about ArcGIS™ the change is bigger than migrating to a new version, so the new conception of GIS should be soon integrated in public institutions, and of course in University or teaching centres.

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TABLES

Table 1. Main differences in language between ArcView™ and ArcGIS™

ArcView	ArcGIS
Project (.apr)	Map Document (.mxd)
View	Data Frame
Theme	Layer
Table of Contents	Table of Contents
Chart	Graph
Layout	Map in Layout View
Avenue Script	VBA Macro

FIGURES

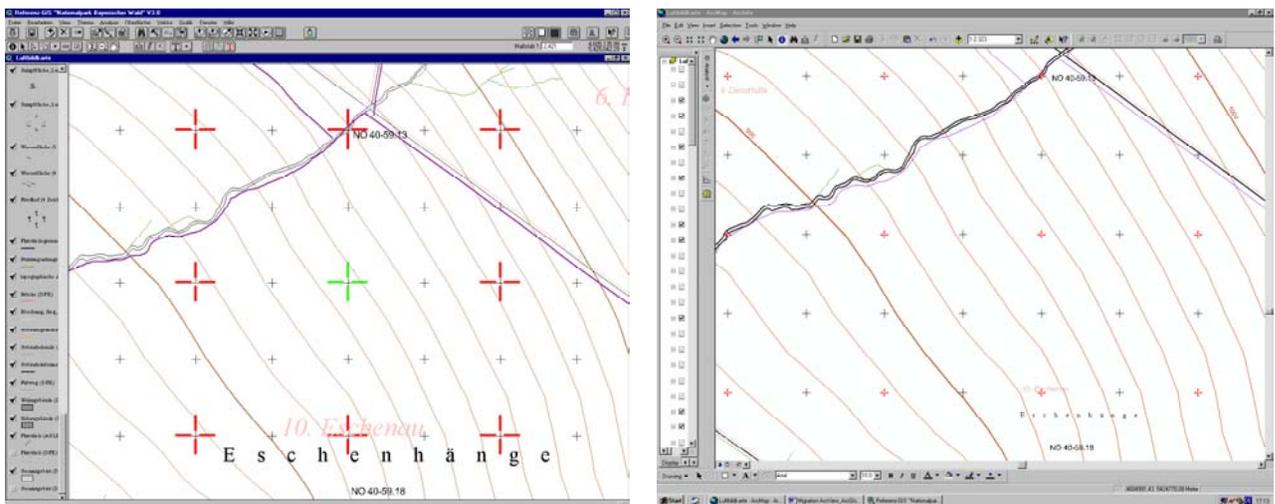


Figure 1. Inventory plots as scaled symbols in ArcView™ 3.x (Escale: 1:2.500) (left) and not scaled in ArcGIS™ 8.x (reference scale zero) (right).

Source: Authors.