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Digital tools concerning the analysis of maps representing Hungary and Transylvania (1683–1711)

Keywords: Gábor Hevenesi, Giovanni Morando Visconti, Johann Christoph Müller, Nicolaus Visscher, Frederik de Wit.

Summary: As a result of the war between the Holy League and the Ottoman Empire, Hungary and Transylvania became part of the Habsburg Empire. During and shortly after the war important maps of these newly acquired territories were drawn by members of the Habsburg army and of the Society of Jesus.

Among these early works is the manuscript map series of the Hungarian and Transylvanian counties (*Mappae Comitatum Regnum Hungariae*), kept in the collection of the Jesuit scholar Gábor Hevenesi. The maps delineated the Hungarian counties surprisingly differ from the printed pocket atlas of Hungary supervised by Hevenesi (*Parvus Atlas Hungariae*, 1689), but they are similar to the well-known Dutch maps of Hungary by De Wit and by Visscher. The maps delineated the Transylvanian counties are similar to the manuscript and printed maps versions of Transylvania (*Mappa della Transilvania*, 1699) by Giovanni Morando Visconti and to one of the manuscript map of Johann Christoph Müller (*Mappa Geographica Transylvaniae*). Almost all of these above maps are undated; the authorship of some maps is unclear.

The author of the present paper has analyzed the maps using the following digital tools: rectification of the maps (in Global Mapper), their accuracy analysis (in MapAnalyst) and the compilations of geo-referenced gazetteers (in Microsoft Excel). These methods has been used to distinguish the source maps and the copied ones; to fix the years when these undated maps were drawn; to clarify the roles of the authors; to understand the correlation between these maps.

Historical background

The territory of Hungary in the Middle Ages was torn in three parts: the Kingdom of Hungary had Habsburg kings; the Principality of Transylvania survived by paying taxes to the Turks; the occupied territory by the Ottoman Empire was stuck between them. In 1684, the Holy League started the reconquering war. At the beginning of 1699, the representatives of the Holy League and of the Ottoman Empire made peace at Karlowitz (Sremski Karlovci). The High Porte gave up all its previously conquered territories in Hungary, except for Temesköz (Banat) and Szerémség (Syrmia), by which the Habsburgs grew in size. Subjugation by the Ottomans was succeeded by Habsburg oppression, which led to the Kuruc War of Independence in 1703. Without any outside help, the uprising lost in 1711. After another war, in 1718, the remaining part of medieval Hungary also became part of the Habsburg Empire. (Köpeczi 1990: 359–379)

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Materials: maps of Hungary (1683–1699)

During the war between the Holy League and the Ottoman Empire (1683–1699) the demand for maps of the Carpathian Basin grew. Instead of country maps published abroad (De Wit 1685, De Wit 1688, Visscher 1690, Coronelli 1688), several local maps were prepared (e.g. in Vienna). The most important of them was a small atlas of Hungary printed in Vienna and connected to the name of the Hungarian Jesuit scholar, Gábor Hevenesi (Colloredo–Hevenesi 1689). Beyond this, it is known an anonymous and dateless manuscript map series representing the counties of Hungary and Transylvania (MCRH s.a.), which is part of the collection of the previously mentioned Jesuit scholar, Gábor Hevenesi. What is the connection between Hevenesi's atlas and the county maps of his collection? Of the works produced at almost the same time, but mostly dateless ones, which were the sources and which were the copies?

Materials: maps of Transylvania (1691–1711)

After 1691, when Transylvania seceded from Turkish suzerainty and was placed under Habsburg rule, the Habsburg mapping of the province started off. Only one work was published: the map of Transylvania (Morando Visconti 1699), the first product of the Habsburg mapping of this province. This printed map named three times as many settlements as the previous Transylvania maps, showing a few hundred settlements that had not been marked before. Beyond this, there are several other undated maps linked to this one drawn by the members of the Habsburg army or by the Jesuits, but being manuscript maps, they are less known. Such is an anonymous manuscript map in Italian (Transylvania s.a.) kept in War Archives in Vienna, which is very similar to Visconti's map. Another one is the anonymous manuscript map series representing all the counties of Hungary and Transylvania (MCRH s.a.) kept in the Jesuit Hevenesi Collection. The cartographic content of its Transylvania sheets bears a close similarity to Visconti's map. The manuscript maps of Transylvania made by the imperial cartographer, Müller (Müller s.a.) also deserve attention. These manuscript maps bear no date, only one has an author, but they show a close correspondence to Morando Visconti's map. What is the relationship between the printed map and the manuscript maps, what were their sources, of what are they copies? What can we find out about the authors and the date of the manuscript maps? How did the Habsburg mapping of a new province begin? To position these manuscript maps, it is worth examining them all.

Comparison of maps

The county maps in the Hevenesi Collection (MCRH s.a.) mentioned at the maps of Hungary and Transylvania as well, was reviewed first by Ferenc Fodor (Fodor 1952: 65–73), who considered the work homogenous. However, he did not realize that the map series was merged out of two different materials: namely, the county maps of Hungary and Transylvania. According to Fallenbüchl (1958: 170), the basis of the Hungarian maps is De Wit's (1688) map of Hungary. In addition to this, it is worth mentioning that the Dutch-made Hungary maps (De Wit 1685, 1688; Visscher 1690) published around 1683–1695 has almost identical content. Their content is reflected in the sheets of the manuscript county maps of Hungary (MCRH s.a.).

Later, Bartha (1983: 6) discovered a map that resembles closely the small atlas (Colloredo–Hevenesi 1689) as far as its extract, projection and content is concerned. It appears that they copied one of the best western maps published after 1683. Colloredo trusted the work of the Venetian Coronelli, therefore the content of his four-page map of Hungary (Coronelli 1688) can be recognized on the atlas sheets.

Katalin Plihál published the reproduction of the Transylvania map of Visconti with an accompanying study (Plihál 1999), where she observed that Morando Visconti's map (1699) was the source of the Transylvanian county maps. The other two manuscript maps of Transylvania are less-known: Müller's map (Müller, s.a.) was reviewed by Bartos-Elekes (2020: 106–116) for the first time, while no one analyzed the Italian manuscript map (Transilvania, s.a.) so far.

Works by different authors are almost identical. Regarding maps of Hungary, the Dutch maps and the Jesuit maps of the Hungarian counties (De Wit 1685, De Wit 1689, Visscher 1690, MCRH s.a.), or the Venetian map and the small atlas (Coronelli 1688, Colloredo–Hevenesi 1689) are very similar, as they basically copied the source maps without mentioning the source, and signed it with their own names. Regarding maps of Transylvania, the content of Morando Visconti's map published in 1699 is shown on three manuscript maps: on the anonymous Italian map (Transilvania, s.a.), on county maps (MCRH s.a.) and on the map of Müller (Müller s.a.) as well.

On the other hand, if we check maps by the same author, we come across surprisingly different maps. The small atlas probably made by Hevenesi as a co-author seems to have nothing in common with the county maps of his collection, as if he had not used his previous work (Colloredo–Hevenesi 1689, MCRH s.a.). The Hungary and the Transylvania sheets of the county maps also differ significantly, as if they were not part of the same map series (MCRH s.a.).

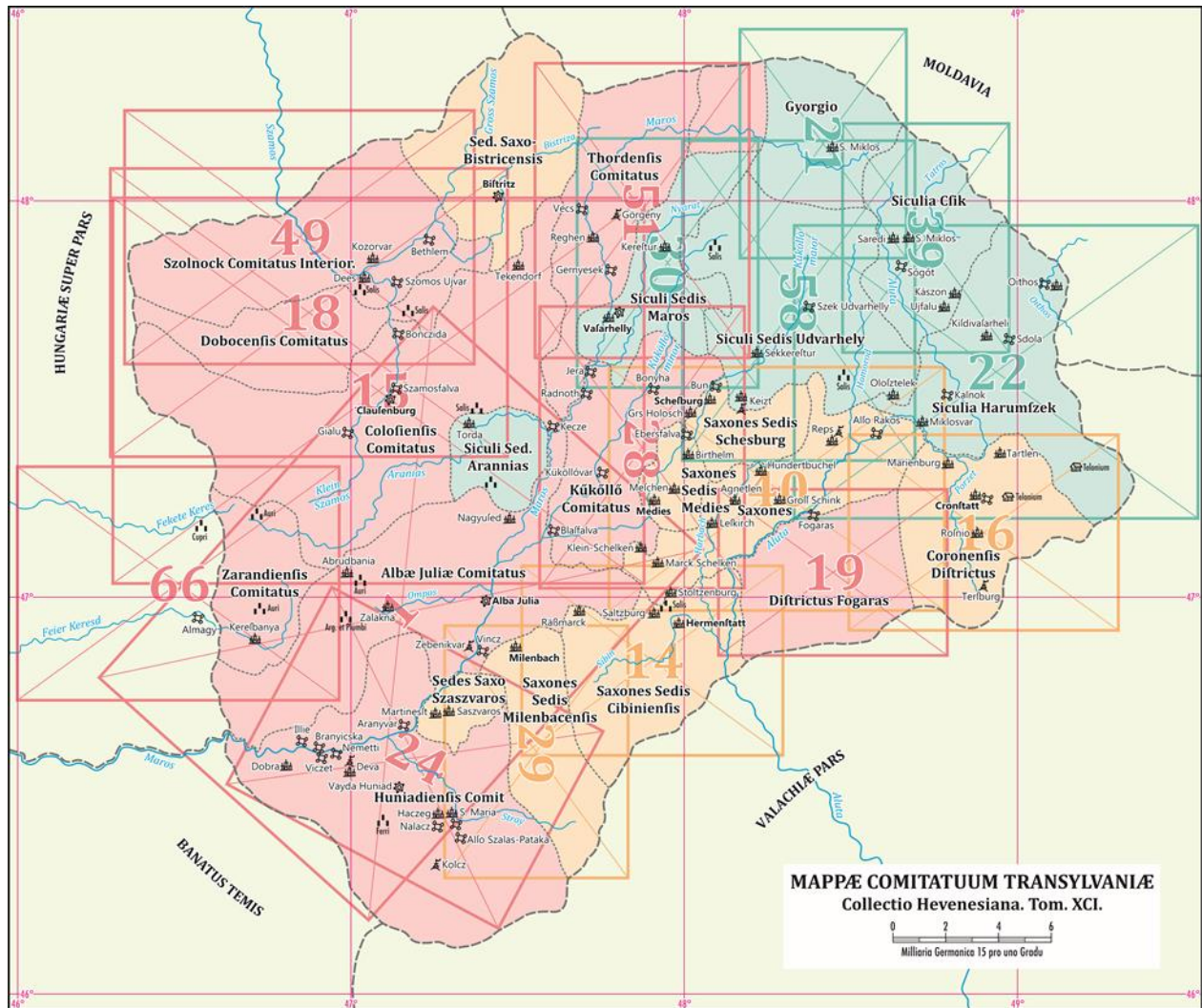


Figure 1: Overview of the Transylvanian sheets of county maps (MCRH s.a.). Designed by: Zs. Bartos-Elekes.

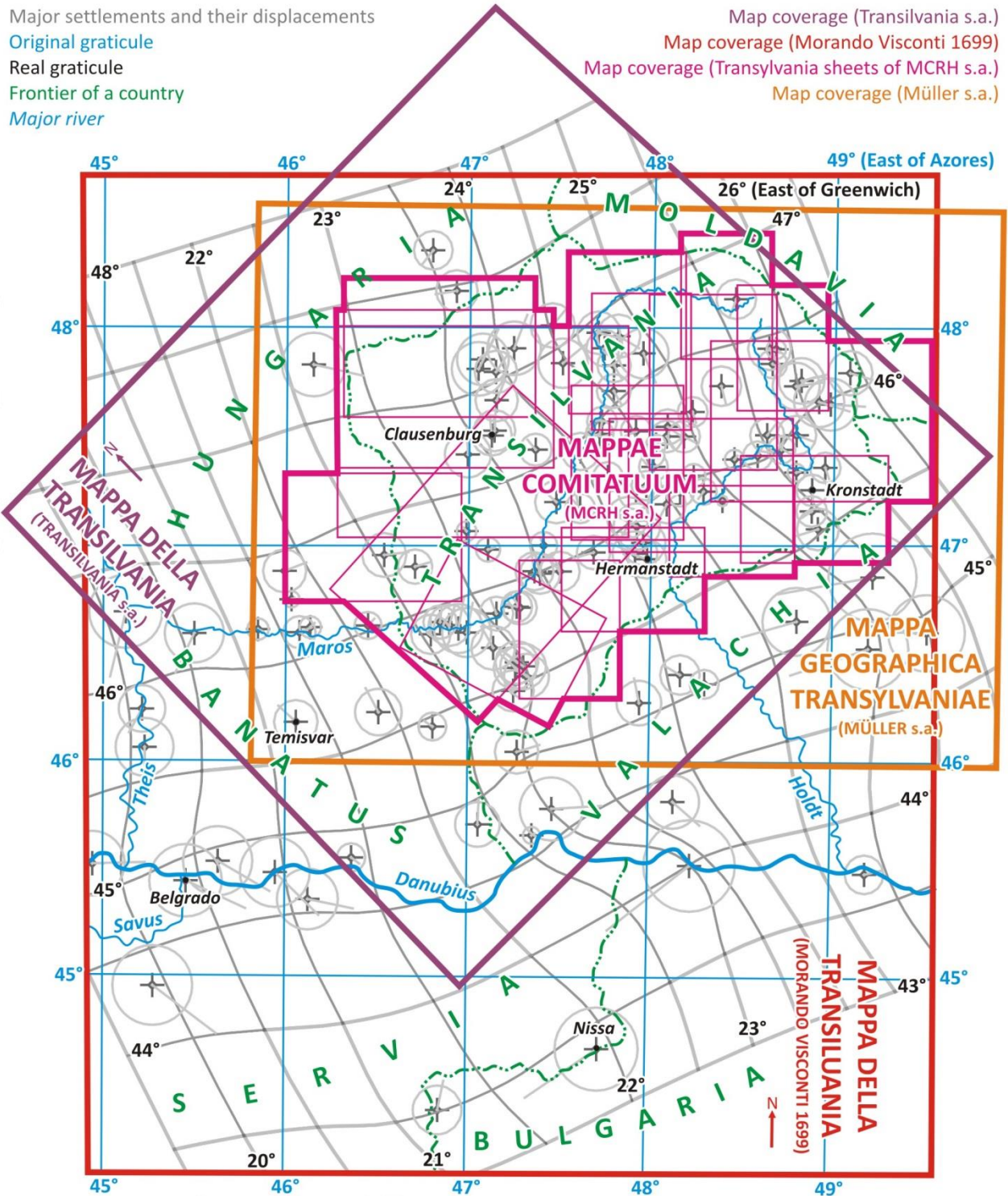


Figure 2: The analyzed maps of Transylvania projected onto each other; the original and the real graticules; the displacement vectors on the basis of measured points. Designed by: Zs. Bartos-Elekes.

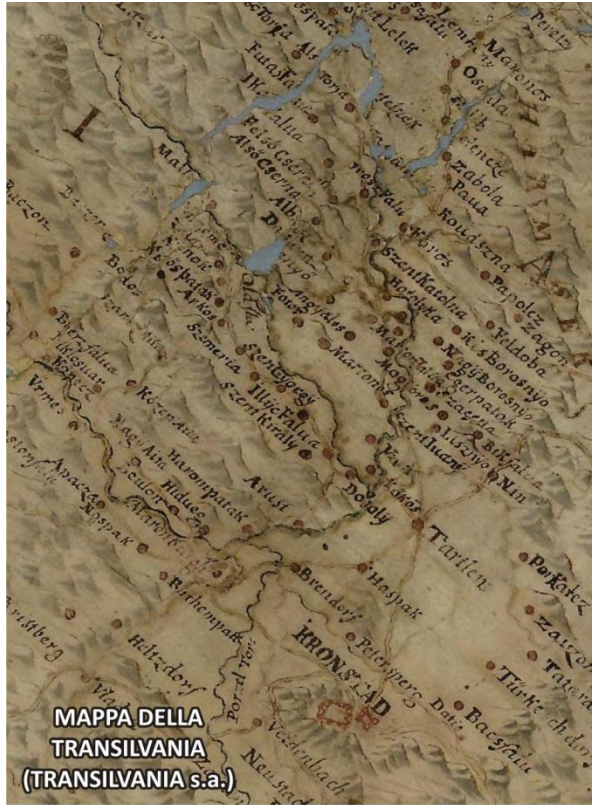


Figure 3: Details from the analyzed maps of Transilvania: extracts between identical map coordinates. A section of the Olt River: on one side the Saxon Kronstädter District, on the other the Székely Seat of Háromszék. Designed by: Zs. Bartos-Elekes.

Studying the process of map making and making order between different versions is made difficult by the fact that there is rarely a date provided on the maps, and there is never a date on the manuscript maps. The author of the present paper used various GIS software to examine and interpret the structure and content of these maps. Methods were applied to the maps of Transylvania by the author (Bartos-Elekes 2020). Examination of the Hungary maps was primarily entrusted to the author's students: Magyari and Bálint 2022.

Methods: maps of Transylvania (1683–1711)

In Global Mapper the maps could be rectified using their original geographical coordinates written on the neat lines. In this way, the eighteen sheets of the Transylvanian county maps (MCRH s.a.) – that otherwise had different scales and orientations – could be combined as one single digital map mosaic. So the author could edit an overview map of the map sheets that did not exist or did not survive, thus allowing comparison with other maps (Figure 1).

Since the authorless map in Italian (Transilvania s.a.) has no coordinates, the author rectified it using common points with the printed map (Morando Visconti 1699). Thus, all the four Transylvania maps – though with different scales and orientations – could be placed on top of each other in the same reference system. After geo-referencing the maps, the author could compare the map positions and the real locations of the settlements. It can be surely stated on this basis, that the four works with absolute different scales and orientations has mainly common elements (settlements, waters, borders) which were marked under the same geographical coordinates in the same map projection (Figure 2 and Figure 3).

Using MapAnalyst software (Jenny–Hurni 2011) to examine the accuracy of the old maps, the author related the most important eighty-six Transylvanian settlements (all the represented towns, market-towns, castles and fortresses) on the old maps to their real geographical position as represented on Open Street Map. In this way, the author got the real scale, rotation and accuracy of the old map (Figure 4).

The authorless Italian map (Transilvania s.a.) marks north to the left, but in the author's measurements the north of the map is actually 17° NNW. Morando Visconti's map (1699) shows north also to the left, but the content has been rotated by 45° compared to the previous map. The author's measurements of Transylvanian settlements show that there the north of the map is actually 28° NNE. The discrepancy between the unchanged compass rose and the rotated content did not bother the makers. Mapping these major settlements, the average mistake (and, for the period, this is very good) is 9 km with a 6 km deviation. The error is four times greater abroad: the average error of the 125 major settlements of the whole map is 19 km with a 13 km standard deviation. The difference is striking: the map is more accurate in Transylvania, which has been under Habsburg control for many years, and less accurate in the foreign territories, which were only briefly acquired.

In the next step the author related these eighty-six settlements on the manuscript maps to their position on Visconti's printed map using the same software so that the author got the rotation between the maps and the accuracy of copying from one to the other.

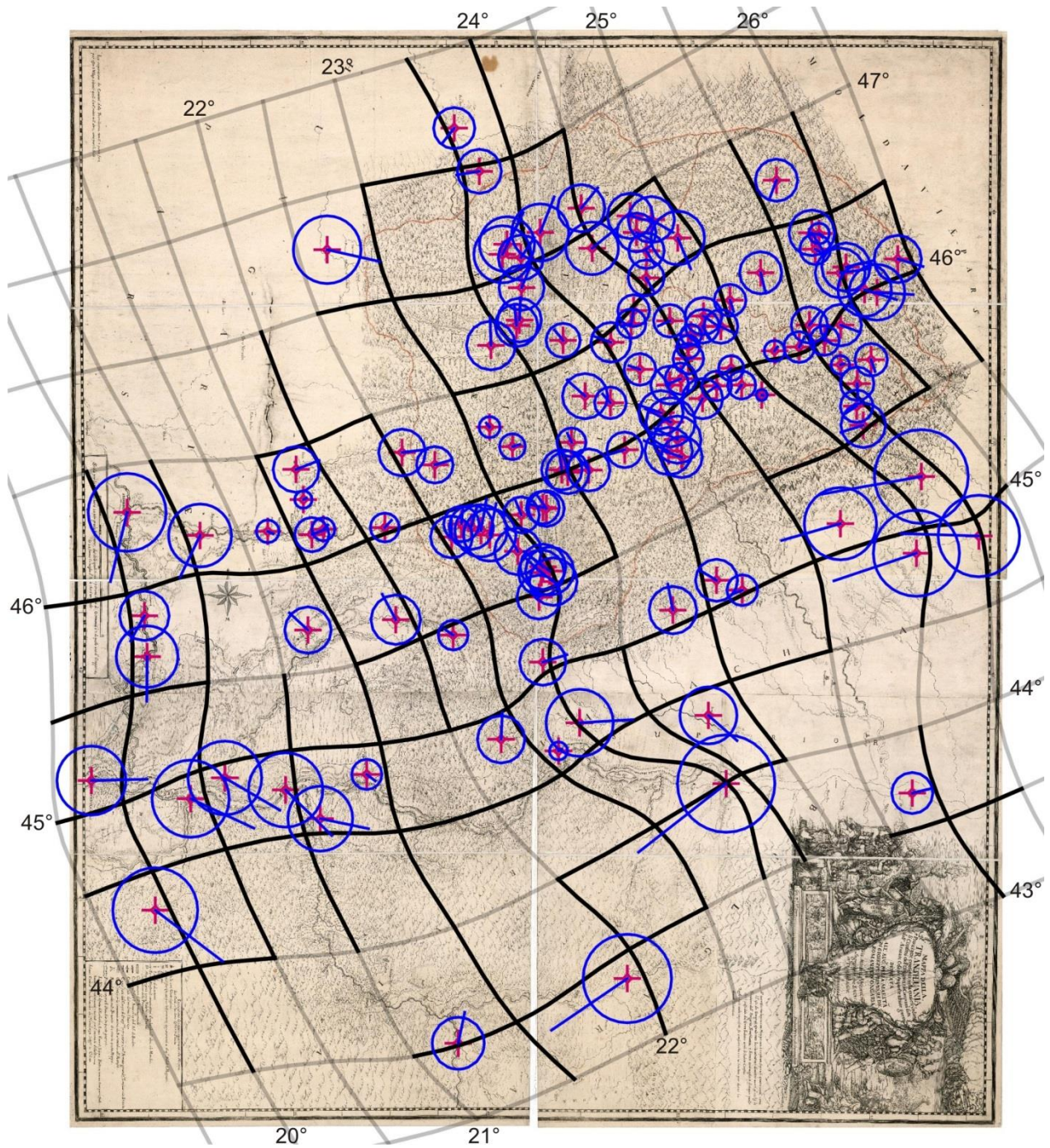


Figure 4: Map of Morando Visconti (1699) with the real graticule (black) and displacement vectors (blue) on the basis of measured points (red). Designed by: Zs. Bartos-Elekes.

All the toponyms of the Transylvania maps were entered into a spreadsheet (more than one thousand toponyms). Then, in further columns, their original map position (latitude and longitude), name type, the symbol that accompanied them and what they signified, their present-day equivalents, and their other contemporaneous forms were entered. During the research the author performed several arrangements and filters in this geo-referenced Microsoft Excel chart. E.g. it could be used to determine how many of the toponyms are the same between two maps or differ by at least one letter. This chart

was the basis of the webpage (<http://terkep.digiteka.ro/mct>), which contain the high-resolution images of the maps, and a searchable index that supports faster and more complex searches and filtering. Thanks to the coordinates, the program zooms in on the settlement being searched.



Figure 5. The map of the Great Hungarian Plain by De Wit (1688) in red and Visscher (1690) in blue projected onto each other: the common elements appear in black. Designed by: Zs. Bartos-Elekes.



Figure 6. The maps of the Great Hungarian Plain by Visscher projected onto each other: the one from around 1690 is in red, the one from around 1695 is in blue: the common elements appear in black. Designed by: Zs. Bartos-Elekes.

Methods: maps of Hungary (1683–1699)

Georeferencing the Hungary sheets of the county maps (MCRH s.a.) based on their own coordinates, we concluded that only Árva Comitatus is out of the system (see Magyarai and Bálint 2022). All the other map sheets match each other as if they were map sheets cut out from the same country map. The structure of this country map corresponds with the structure of the maps of the Dutch De Wit and Visscher and the content is also similar.

The works of the two Dutch authors are almost identical. Both maps have the same title, were published in the same place (Amsterdam), their extract, scale and sheet size are identical as well as their coordinates and projection. However, only Visscher drew the graticule, De Wit did not. Their content is also similar. They represented almost the same rivers, counties, and settlements at the same positions. The author georeferenced the Dutch map versions in their own coordinate systems, and then he colored the maps in red and blue and placed one on top of the other for comparison. If the content was identical, the combined colors showed dark (purple or black), while where the content was present only on one of the maps, the colors remained distinctly red or blue.

The most obvious difference in content is in the representation of the Great Hungarian Plain. While De Wit's representation was consistent, Visscher identified more settlements at the beginning, before later deleting most of the settlements and the relief. Newer editions of both maps were published later, mostly without a date. Therefore, only after careful examination does it become obvious if one is dealing with two different versions. Representation of the Great Hungarian Plain was more varied in Visscher's different editions. In earlier editions (Visscher 1690) he erroneously indicated mountains with mounds, and he identified a few dozen settlements of the Great Hungarian Plain that were represented only by him, and which were missing from De Wit's map. The new edition of the map (Visscher 1695) was corrected and the mountains were deleted, but new mistakes appeared as most of the settlements that had appeared only on the 1690 map were deleted together with the mountains, and the Ecsed Swamp was mapped as a lake south of Debrecen. (Figure 5 and Figure 6)

Árva Comitatus was missing from the Dutch maps. The coordinates of the Árva sheet are completely different with longitudes being almost 3° bigger on the map than on neighboring sheets. In order to examine this sheet, the author georeferenced the small atlas (Collredo–Hevenesi 1689), placing the Árva sheet on top of the small atlas, and determined that it had been copied from it.

Results

Above, the author has presented some examples of the methods used. The full text of the research is available in (Bartos-Elekes 2020). Here is a summary of the main findings.

Except for one sheet, the Hungary sheets of the county maps kept in Hevenesi Collection (MCRH s.a.) have no connection with Hevenesi's small atlas (Collredo–Hevenesi 1689). The maps of 49 counties of Hungary were made by copying one of the map versions of De Wit's Hungary maps dated after 1685. Most probably they used the 1685 version of De Wit's map (or possibly the 1688 one, but with a critical approach). These sheets were drawn before publishing the small atlas. Since Visscher's dateless maps (identified until now as made around 1690) were also used in designing the county maps of Hungary, which were most probably made before 1689, we may suppose that Visscher's

maps were made even before that, or that there was an earlier version of maps with similar content. The small atlas of Hungary (Colloredo–Hevenesi 1689) provides the source map only for Árva Comitat, which means that Árva was made after 1689.

The manuscript map in Italian (Transylvania s.a.) does not indicate the author, place or year; the author of the present paper considers that the estimation ‘17??’ by the map collection is incorrect, this is the earlier manuscript version of Morando Visconti’s printed map of Transylvania, so it was produced between 1691 and 1699. By comparing this manuscript and the printed map, we have more information about the process of making the map: it is clearer that the makers had no geometric knowledge (the work was made without a survey; the projection was only applied afterwards). The value of the work is not diminished: the manuscript and the printed map, the first results of Habsburg mapmaking of Transylvania, almost tripled the number of marked Transylvanian settlements compared with the earlier maps.

The author of the present paper managed to delimit the date of production of two manuscript maps and their relationship to the printed Transylvania map (1699). The earlier, that is the manuscript sheets of the Transylvanian counties in the Hevenesi Collection (MCRH s.a.) were produced immediately after 1699, a decade after the Hungarian sheets. The later, the manuscript map of Transylvania by Müller (Müller s.a.) was produced between 1705 and 1711 (and not in 1712, with this year is registered in the catalogue). Both are copies of the Visconti map (regarding the settlements and hydrography) and neither is coherent with the other works of the editors (Hevenesi, Müller); an important additional benefit of both is the much more complete marking of the Transylvanian county boundaries than ever before.

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