Who needs *Mitteleuropa* old maps? Present-day applications of Habsburgic cartographic heritage

Marco Mastronunzio, Elena Dai Prà

Department of Humanities, University of Trento, Italy

Extended Abstract

The Cassini triangulation method from 18th cent. provided a mapped-Europe and, in a number of cases, "connected" through a triangle chain-network: a geometrical skeleton rather than a really map. Firstly, large basis triangulations (state survey for "national" geographies, to provide a meridian triangulation) were executed to furnish reference points for following detailed triangulation for mapmaking at large scale, earlier (after French) in Austrian Empire (Edney 1993). This was carried out, for French and Austria, at the same scale factor: the well-known 1:86.400 and its enlargements/reductions.

Historical habsburgic region of Tyrol (nowadays *Land* Tirol and, in Italy, Trentino-Südtirol Region) was extensively mapped from late 18th to early 20th cent., since it represented the "south of Mitteleuropa". These historical maps have their main *foci* on southern boundaries (security and fortifications) and rivers network (resources, transports). French scale for habsburgic mapping: measuring the Empires as a practical geopolitics throughout the direct state "sponsorship".

Our research group in historical geography at University of Trento are currently involved in two research projects on Trentino historical boundary line(s) and on Adige/*Etsch* river historical change detection (both funded by Trentino-Südtirol Region), dealing with a very large data-set of habsburgic cartographic heritage as a source for present-day issues (boundary disputes and river restoration).

In this paper, mainly methodological, we consider a part of data-set and cartographic time-series, that starts after the habsburgic First Military Survey (not including Tyrol): from *Kriegskarte* by von Zach (1798-1805, survey of venetian territories, but sharing commons boundary lines with Trentino);

ICA European Symposium on CARTOGRAPHY
VIENNA, 10–12 NOVEMBER 2015

Published in "Proceedings of the 1st ICA European Symposium on Cartography", edited by Georg Gartner and Haosheng Huang, EuroCarto 2015, 10-12 November 2015, Vienna, Austria

then with the Lutz map of Tyrol (1806) and its *Reambulierung* (updating) of Reininger-Geppert (1816-21), both included in the Second Military Survey (1806-69); toward the Third (1869-87) and the Fourth Military Survey (1896-1914, considering only the imperial period). Besides such a scales (1:28.800-25.000) there are hydrotopographical maps (1803-48) at very large scale (1:3.456). All maps are recovered from Vienna and Innsbruck archives and digitized in multi-resolution format; thus we are facing with cartographies composed by hundreds of map-sheets, with a good positional accuracy (after a planimetric analysis on sample sheets; and in general, Zentai 2013) and mainly (except specific case-studies, Dai Prà & Mastronunzio 2014) not georeferenced. But we need them with a common reference system (ETRF89), in order to compare with present-day reference maps (Google Map, Open Street Map and official topographic basemaps) for geospatial analysis and dissemination purposes. In other terms we need each of map-sheets "localizable", avoiding a massive previously georeferencing/mosaicking processing onto the whole data-set.

Thus, we are developing a multi-source, multi-scale and multi-temporal (but in progress) methodology for regional purposes, using map-sheets overview (index-map sheet; *Übersichtblatt, Skelett*) and, if present, overview triangulation sheet, provided along the maps and often neglected in a GIS-framework. Merging these data with archival documents and contemporary literature (e.g. von Zach 1803) we have investigated upon the original reference systems.

Although since the Second Survey a geodetic basis was used – Zach 1809 or Bessel 1841 ellipsoids[1], Vienna 1806 or Hermannskogel 1871 datums, Cassini or Gauss-Krüger projections (Mugnier 2004, Molnár & Timár 2009, Timár 2004) – other maps (*Kriegskarte* and hydrotopographical) have no fundamental geodetic survey, produced only using triangulation with plane tables and theodolites, starting from a central meridian (crossing astronomical observatories) with latitude/longitude (from Ferro prime meridian) of the survey points astronomically determined. That is: a topographic survey like the First Survey, whereas this used the Liesganig triangulation, the Kriegskarte used the "von Zach triangulation" centered on *Paduaner Meridian* (Rossi 2005).

The 4-steps map-to-map workflow is: a) assign to index-maps the original reference system; b) shift from Ferro to Greenwich with longitude rotation; c) perform the geographic datum transformation to WGS84; if parameters

[1] Original Bessel ellipsoid is in *Klafter* ("toise", but which one, *Wiener* or *Pariser Klafter*?) and, as other historical anthropometric measures, also the Bessel-toise is uncertain (US Army Map Service Technical Manual, 1943).

are not provided, notably for earlier Datum, we have calculated the roto-translation parameters using pairs of control points derived from "comparable" maps, e.g. habsburgic cadastre; d) reproject in ETRF89 UTM system. The results is a georeferenced index-map that readily provides the 4-corner coordinates of each single map-sheet for following georeferencing, only assigning the corner coordinates (from index-map) to corresponding corner-points (onto single sheets) without identifying landmark/control points on old and reference map. The positional accuracy is considerably better for maps with a geodetic basis and in flatlands, with increasing inaccuracy in relief areas (and without geodetic survey) and we need from 1 to 3 additional control points to align (zero-order transformation) the old map to the target one. Despite the inaccuracy (fairly suitable for dissemination purposes), we could use less control points of a standard rectification: 6 corner-points for 2-sheets, 10 for 4 and so on, and apply few additional points.

Finally, such a method has to be refined, but could provide a useful map-as-tool for not GIS-oriented fields and could be considered suitable for further research in spatial humanities.

References

Dai Prà E, Mastronunzio M (2014) Rectify the river, rectify the map: geometry and geovisualization of Adige river hydro-topographic historical maps. *e*-Perimetron 9(3):113–128

Edney MH (1993) Cartography without Progress: reinterpreting the Nature and Historical Development of Mapmaking. Cartographica 30(2/3):54–68

Molnár G, Timár G (2009) Mosaicking of the 1:75 000 sheets of the Third Military Survey of the Habsburg Empire. Acta Geod. Geoph. Hung. 44(1):115–120

Mugnier CJ (2004) Grids & Datums: the Republic of Austria. PE&RS March:265–266

Rossi M (eds.) (2005) Kriegskarte 1798-1805: il Ducato di Venezia nella carta di Anton von Zach. Fondazione Benetton Studi Ricerche, Treviso-Pieve di Soligo

Timár G (2004) GIS integration of the Second Military Survey sections – A solution valid on the territory of Slovakia and Hungary. Kartografické Listy 12:119–126

US Army Map Service Technical Manual (1943) Coordinate Conversion Tables. https://www.loc.gov/rr/scitech/sci-ref-guides.html. Accessed 3 October 2015

von Zach A (1803) Uber die trigonometrische Vermessung der ehemahligen Venetianischen Staaten. Monatliche Correspondenz zur Beförderung der Erd- und Himmels- Kunde 7:49–56, 134–147, 210–220, 544–550

Zentai L (2013) The way to Cartography 2.0: the implementation of Digital Technologies in Cartographic Heritage in Cartography and in the ICA. Proceedings of 8th International Workshop on Digital Approaches to Cartographic Heritage, Rome, Italy, 19-20 September