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Cartography: Facts, Figures, Fiction, Fake – or: 170 Years of Cartography at ETH Zurich

Lorenz Hurni[a,*]

[a] *Institute of Cartography and Geoinformation, ETH Zurich – Lhurni@ethz.ch*

* Corresponding author

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Abstract:

Cartography deals with the interference-free transfer of spatial information from the real world to the map user by means of graphic visualisation methods. The article begins by looking at cartographic modelling and the associated methods, challenges and possible misuses. The Institute of Cartography and Geoinformation (IKG) at ETH Zurich which will celebrate its 100th anniversary in 2025, deals with such questions for a long time, even in its predecessor chairs before the institute was founded by Professor Eduard Imhof in 1925. In the second part, many examples of the institute's map projects which underpin this search for the ideal map will be presented. The history of the institute is currently being researched by a group of members of the institute. A commemorative volume will be published in 2025, and a scientific colloquium will be held in Zurich in June 2025 to present the results and current work. This summary therefore also provides a brief overview of the history, key people and projects of ETH Cartography.

Cartography is concerned with the symbolic, graphic representation of spatial data and information on suitable output media such as paper or electronic devices. The starting point is our real environment, which is initially recorded using surveying equipment, sensors and the like. This can result in direct images such as satellite images, but these are not yet interpreted. As a rule, geo-objects are defined into which the initial image (or, if surveying equipment is used, directly in the field) is then segmented, either automatically or manually. This results in modelling; not every detail is reproduced on a map, but only that which is relevant for the purpose of the map and is also adapted to the selected scale. When modelling, the content of the real world is deliberately selected and simplified, and the geo-objects are represented by clear graphic symbols. With further cartographic generalisation, these effects and measures become even more obvious.

Modelling therefore means simplification, but also alienation of the original content in the final representation. Eduard Imhof commented on this in 1981: "...maps are artificially produced worlds and therefore actually illusory worlds." The reason for this alienation in cartography lies in the endeavour to convey the geographical situation as vividly and user-friendly as possible, while avoiding disturbing or confusing details or irrelevant content. The greatest possible objectivity should still be maintained in the presentation of spatial information. The first part of this article will therefore use examples to illustrate how this is done in cartography. However, examples of fictional maps that have nothing to do with the real world and misuse of these visualisation methods will also be shown.

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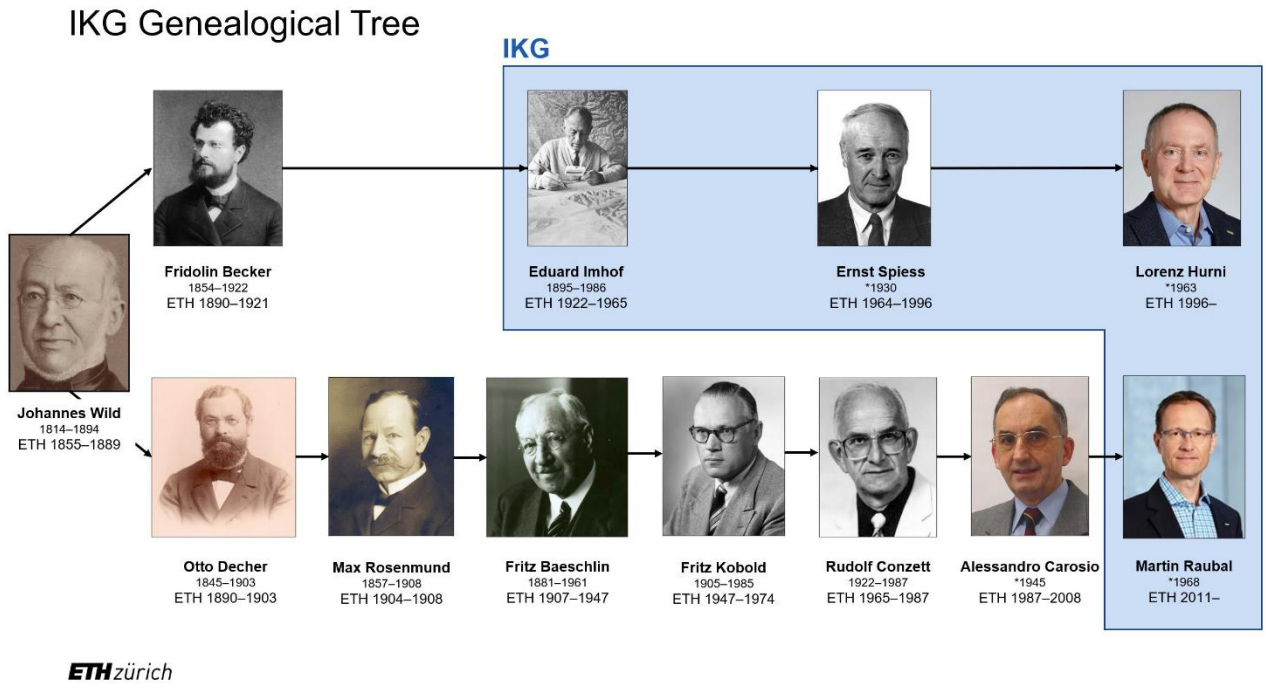

Figure 1. Genealogical tree of cartography and GIS professors at ETH Zurich

The Institute of Cartography and Geoinformation (IKG) at ETH Zurich and its two predecessor professorships have long been involved in the search for the “ideal map”. This paper presents examples from the last 170 years of research, teaching and service activities in the context of the Institute's history.

ETH Zurich was founded in 1855 as one of the first major national projects of the Swiss Confederation, which was newly consolidated in 1848. The ETH was intended in particular to provide the specialists needed for the country's emerging industrialization and the major infrastructure projects such as the Gotthard Railway. Johannes Wild from Zurich was appointed as the first professor of geodesy at the School of Engineering (civil engineers). In 1840–1851, he drew up the map of the Canton of Zurich at a scale of 1:25,000 with groundbreaking contour lines. This subsequently served as the basis for the nationwide 1:100,000 Dufour Map and provided important design impulses for the following 1:25,000/1:50,000 Siegfried Map. Wild was above all a committed teacher at the ETH who, in addition to geodesy, also taught cartography. It seems that he was heavily absorbed by this teaching position and other mandates; in any case, apart from lecture notes and correspondence, there are hardly any products from his time at the ETH that could be described as research and development work from today's perspective.

Abstracts are intended to present very early or practical work. They provide a platform for artwork, demonstrations, or work of practitioners - work that would otherwise not be very well suited for a description in an extended scientific paper. Still, the publication of the abstract is very valuable both for the authors and for the participants of the meeting. Abstracts are reviewed based on quality and innovativeness, as well as on the practical relevance.

Significantly, Wild's teaching area was then covered by two professorships from 1890, one of which dealt exclusively with geodesy (Figure 1). Cartography was taken over by Wild's student Fridolin Becker, a native of Glarus, who initially worked as a private lecturer alongside his work at the Federal Topographical Office, later as a titular professor and from 1901 as a full professor. Becker was in active exchange with colleagues such as Xaver Imfeld and cartography made a real leap forward under him. The institute's archives contain, among other things, numerous hand-drawn attempts by Becker to depict the terrain in colour using shadows, a technique that he was able to use in numerous tourist maps and school maps and which was then perfected under Becker's successor Eduard Imhof. Figure 2 shows stylistic studies on coloured relief drawing with the first approaches to the height colour scale as it can still be found today in Swiss school atlases (left), a variant with cast shadows (centre) and a two-colour drawing (right).

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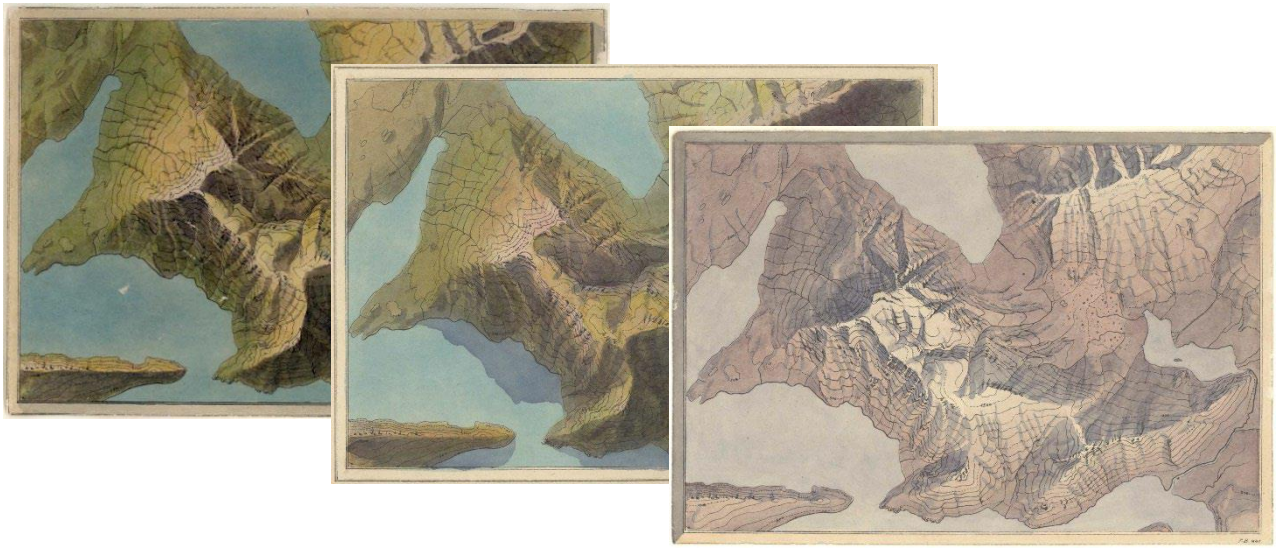

Figure 2. Study of various relief depictions (Detail of Mt. Rigi by F. Becker)

Under Eduard Imhof, who succeeded Becker in 1922, and now under the auspices of the Rural Engineering School, the cartographic representation of terrain was further advanced and reached a temporary high point with many of the atlases he designed, in particular the Swiss Secondary School Atlas (now the Swiss World Atlas). In later years, Imhof turned to thematic cartography, e.g. with the Atlas of Switzerland (National Atlas), wrote textbooks and was involved in the founding of the International Cartographic Association (ICA). Imhof founded the Institute of Cartography on his own initiative in 1925, which can probably be described as the oldest academic institute of its kind in the world.

The technological upheaval in cartographic production techniques took place under Imhof's student and successor Ernst Spiess. As early as the 1970s, a cartographic drawing system that was very advanced by the standards of the time was procured, which was used in particular to create reproduction templates for numerous thematic maps for the Atlas of Switzerland; a second system was introduced in 1990. Since 2011, the institute has had two professorships (Geoinformation Engineering, M. Raubal, and Cartography, L. Hurni).

In general, the influence of the engineering environment of a technical university can be recognised in the activities of the professorships over the 150 years. While Wild and Becker still held many engineering mandates for the creation of plans in the fields of hydraulic engineering and railway construction, Imhof's focus shifted to the refinement of production and visualisation techniques for specific school and atlas map projects. Under Ernst Spiess, the digital transformation took place, which brought major progress in the rational production of maps while maintaining and further developing cartographic design. Today, the handling of large amounts of spatial data takes centre stage. Research questions arise from current needs in the fields of energy and mobility, but application-oriented interaction and visualisation also facilitate the development of this often very heterogeneous geodata.

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