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On the Terminology of Cartographic Generalisation

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It seems, that the efforts for the introduction of automatic resp. electronic data processing into cartography are already worthwhile up to this time. In some processes of the preparation of source material and of the fair draught and map reproduction as well, automated methods have contributed towards improving the production of maps and reducing total production time.

But there is no doubt, that the break through to the computer-assisted cartography, to a real automated cartographic system has not succeeded, before the processes of compilation and editing were included. This means the achievement of cartographic generalisation by rote or at least for the present semi-automatic. That needs the research of the rules governing the cartographic generalisation, and their expression by algorithms, suitable for use in computers.

In this way the analysis of the cartographic generalisation has become the main task of cartographic research. Cartographers are engaged worldwide in finding the solutions to the problems. It is obvious, that the tremendous task of the scientific penetration of the generalisation problems can be done only by international discussion and cooperation. But this makes a minimum of terms necessary, which should have a clear meaning. So that these terms are suitable for the international exchange of ideas.

It is the duty of Commission II - Definition, Classification and Standardisation of Technical Terms in Cartography - to take care of this minimum in the next edition of the Multilingual Dictionary of Technical Terms in Cartography, as the few terms concerning generalisation included in the first edition are not sufficient for the actual demands. However, there are difficulties. Most terms of the Multilingual Dictionary reflect a long tradition of the various branches of Cartography, e.g. topographical cartography. In the course of time a terminological system was established with clarified meanings, making possible the expression of one and the same object in using distinct words in various languages. Thus the great majority of the terms included in the Multilingual Dictionary in five definition-languages and in *nine* languages without definition are "equivalents" indeed.

However, the terminology of generalisation is relatively young and by no means clarified, with the exception of the term "Generalisation" itself. Meanings for existing words have been developed on a daily basis. They are influenced by certain schools, a lot of them are adequate to the very individual concept of one author.

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Pars pro toto a few summarizing articles and basic papers are mentioned:

In 1967 L. Ratajski published in the International Yearbook of Cartography "Phénomènes des points de généralisation", in which the concepts of quantitative generalisation and qualitative generalisation have been developed. In a similar way J. Bertin proceeded in 1967/68, when he explained the terms généralisation structurelle et généralisation conceptuelle in his famous book "Sémiologie graphique" and in the contribution "La Généralisation Cartographique" in the Bulletin of the Comité Français de Cartographie.

In 1972 in volume 5 of the series КАРТОГРАФИЯ under the title ГЕНЕРАЛИЗАЦИЯ В ЕЕ ИСТОРИИ И СОВРЕМЕННОМ РАЗВИТИИ.

K. A. Salischtschew summarized the development up to the beginning of this decade and emphasized the results of the Soviet activities. That is very important for readers in western countries. His statement, that linguistic difficulties have delayed the knowledge of Soviet researches to the foreign cartographers, is unfortunately much to true. It seems, that especially the book of A. F. Aslanikaschwili: "Kartografijskaja. Woprosi teorii" published in 1968 in grusinic language is worthwhile to be read worldwide.

In 1974 in the monography "Cartographic Generalisation. Some Concepts and Explanation" H.J. Steward reviewed comprehensively the relevant discussion especially in the anglo-saxon countries.

Also in 1974 F. Töpfer presented in his book "Kartographische Generalisierung" the detailed concepts on statutory generalisation, which have been developed by him since 1962, especially the principles of selection. The book comprises an abundance of terms corresponding to the views of the author.

In the Federal republic of Germany, especially at the University-Institutes for Cartography in Bonn and Hannover and at the Federal Institute for Applied Geodesy in Frankfurt on Main, numerous papers - often in the Nachrichten aus dem Karten- und Vermessungswesen - have been published, which use terms of cartographic generalisation in a manifold manner.

This small selection shows, that there are a lot of important publications, relevant to the terminology of generalisation. What has to be done? Certainly it is impossible and also not necessary to take over all terms in the aforesaid publications, but the most important terms should be selected. However, where is the guideline to say, which terms are important now and in ten years and which are not? We

cannot wait for some decades as in the case of topographical cartography mentioned above, as the scientific community expects the support of the Multilingual Dictionary hic et nunc. Commission II accepted the challenge. It started, to the best of its ability, with some terms of supposed long standing importance in order to reduce the danger of including ephemeral terms and to exclude terms, of which a broad availability will be obvious in five or ten years.

The following terms are under consideration, partly reseeded from the first edition:

• Generalisation. That means reducing the minor peculiarities and rendering the typical characteristics of features and phenomena, retention of their essential elements. According to the fields of application we may distinguish between two aspects:

- generalisation of the objects themselves by surveying and mapping them, that is constructing a map from raw data;
- cartographic generalisation in a narrower sense by derivation of a map from an already existing map or maps, keeping the perceptibility, usually for a topographic map at a smaller scale than the reference base.

These two aspects of generalisation are penetrated by two other categories - explained in the Glossaire Français de Cartographie - according to the degree of deindividualisation, so to speak:



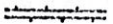
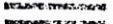

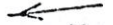











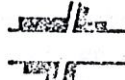

- généralisation structurelle qui conserve le mode de représentation et l'implantation d'un phénomène, tout en schématisant sa structure originale;
- généralisation conceptuelle qui transforme le mode de représentation d'un phénomène pour répondre à un nouveau concept et/ou à un changement du niveau d'observation.

These definitions reflect the ideas of J. Bertin; mode de représentation, implantation, niveau d'observation etc. are well defined key-terms in his theory of generalisation. Therefore the meanings of the two terms should be underlined by the following synonyms and examples: Structural generalisation is more or less geometric, numeric, graphic generalisation and concerns the form and configuration of map detail, its delimitations on the map face, size, shape and position of the graphic elements and cartographic symbols; conceptual generalisation (in German begriffliche Generalisierung) is generalisation by the representation of groups of phenomena as collective units, e.g. the absorption of coniferous and broad-leaved trees by trees and further of trees and shrubs by plants etc. or the representation of a group of houses by a village symbol, or by the inter-

pretation of groups of phenomena as parts of large structures (e.g. in synthetic maps).

The collective units may concern the kind and nature of phenomena, their number and values and their time. Accordingly we may distinguish between qualitative generalisation, quantitative generalisation and temporal generalisation.

The structural and the conceptual category of generalisation including the qualitative, quantitative and temporal aspects are more or less involved by the following elements resp. processes of generalisation:

	Representation on the		
	basic map	derived map	
	Scale of the		
	basic map	derived map	
• Smoothing			-
• Horizontal exaggeration			=
• Displacement			=
• Amalgamation			=
• Selection resp. elimination			
• Classification			
• Symbolizing			+
• Evaluation resp. emphasizing			

• Smoothing. There is a French definition given by the Glossaire Français de Cartographie: Lissage est élimination, conformément à une règle déterminée, de détails d'une ligne tracée sur une carte. This process means simplification, e.g. by reducing the manifoldness

or abundance of the shape, by curtailing the sinuosities of isolines, representing constant values within continuous phenomena, e.g. of a contour, or by curtailing the extrusions and intrusions, juttings and projections of the outline(s), bounding a discrete area on the face of a map.

• Horizontal exaggeration (by other words amplifying, enlarging, overdimensioning), mostly broadening and widening. That is the expansion and stretching of line weights, symbol sizes etc. to certain minimal dimensions, in order to prevent illegibility, caused by scale reduction falling below the "scale threshold" (sub limine mensurae).

• Displacement may be effected by horizontal exaggeration. The term is defined already in the Multilingual Dictionary (51.12). (Slightly altered) displacement is the horizontal shift of the plotted position of a feature from its original (in large scales true) position, caused by the required adherence to line weights and symbol sizes.

• Lessening, making fewer the number of represented features and phenomena either by elimination or by amalgamation.

• Elimination (deletion, dropping, leaving out, omission) may be a consequence of horizontal exaggeration. The representation of the original number of features of one group, exaggerated to the required minimal dimensions of line weights and symbol sizes, would exaggerate also the total area of this group and would consequently overemphasize this group. On the other hand, if a group of features has to be represented overemphasized, other groups have to be lessened.

• Selection is related to elimination and has a positive sense. Selected features are selected to be kept, not to be eliminated. Confer F. Toepfer's principles of selection.

• Amalgamation (combining, fusion, merging) also occurs by horizontal exaggeration. If displacement is not to be achieved, exaggeration is narrowing the blank between two or more neighbored features, at last becoming imperceptible, falling below the scale threshold. Therefore the blank cannot be kept and the features - necessary of the same nature - are joint graphically.

• Classification, emphasizing, evaluation are processes of conceptual generalisation. They take to symbolizing, that is representation of features and phenomena of the same nature by deindividualised symbols.

Obviously the term "minimal dimension" has a great part in generalisation. For three aspects of the least value, possible in given cases, e.g. the least perceptible impression or the smallest noticeable extent, namely

- Threshold of perception,
- threshold of separation and
- threshold of differentiation

the Glossaire Français de Cartographie offers the definitions:

- Seuil de perception est une dimension minimale d'un élément graphique permettant sa vision à l'œil nu dans les conditions normales d'observation.
- Seuil de séparation est une distance minimale entre deux éléments graphiques permettant de les distinguer à l'œil nu dans les conditions normales d'observation.
- Seuil de différenciation est un écart minimal permettant d'apprécier à l'œil nu, dans les conditions normales d'observation, les différences de valeur (forme, dimension, surface, teinte, etc.) d'éléments graphiques.

Because generalisation is influenced by scale variations, two further scale-concerning terms are considered to be included additionally in the Multilingual Dictionary, also prepared by the French Glossary:

- Echelle caractéristique est la échelle la plus appropriée pour rendre sensible un phénomène en fonction du niveau de son étude.
- Echelle limite est la échelle inférieure ou supérieure à l'échelle caractéristique, en deçà ou au delà de laquelle la représentation d'un phénomène perd sa signification.

For the representation of the planimetric shape of buildings within places and of the places themselves on a map according to the degree of generalisation four cases are to be distinguished:

- representation of individual buildings,
- representation of blocks,
- representation by place outlines and
- representation by place symbols



The Polish working group is considering the following terms:

- Generalisation threshold, the limit of map capacity appearing when a given method of cartographic representation is used in which point a partial or entire change of the representation method is needed to assure the map legibility, e.g. replacement of the areal outline of a settlement by the circle symbol
- Theory of generalisation
- Generalisation principle