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# ABSTRACTS *of* PAPERS

EDITED BY

F. E. Ian Hamilton

NELSON

## Preface

This volume contains the Abstracts of Papers submitted to the 20th International Geographical Congress held in the United Kingdom in the summer of 1964. The Abstracts are presented systematically, grouped according to their appropriate subject content, e.g. geomorphology, regional geography, settlement, etc. Fourteen groups have been drawn up. These do not correspond necessarily with the nine Sections specified in the second Congress circular. A new classification has been devised, which also takes into account Abstracts submitted to certain Commissions and Symposia of the Congress. Thus the *Geography of Population and Settlement* has been divided into two groups according to these two broad topics. The groups *Political Geography* and the *Teaching of Geography* have been added to bring together Abstracts submitted for Symposia on these subjects which are not covered by the Sections of the Congress. A small miscellaneous group on *Methodology and Bibliography* has also been included.

Where a group is particularly broad in coverage (e.g. *Economic Geography*), or where a large number of Abstracts was submitted for a particular branch of geography (e.g. *Settlement*), a topical sub-division in the grouping of Abstracts was considered desirable for easier reference. Thus *Economic Geography* is subdivided into general economic geography, agriculture, land use, industry and, lastly, transport, communications, and tourism. The *Geography of Settlement* is subdivided into rural settlement and urban geography.

Within each division all Abstracts are arranged alphabetically according to the author's name. Where two or more authors have written one Abstract, that Abstract is placed according to the name of the author whose name appears first. Authors may find that their Abstracts are not grouped necessarily in the section for which they were submitted. In all cases the editor takes responsibility for placing Abstracts into the most appropriate group or sub-division for presentation in this volume.

At the left side of each abstract title, readers will find the Congress registration number(s) of the author(s) of that Abstract. It will be understood that it has been necessary to edit the Abstracts in order to meet the requirements of the Congress rules and the necessity to avoid inordinate length. In view of the very short time between the arrival of the Abstracts and the despatch of material to the printers some imperfections must doubtless remain. The Congress rules prescribed that Abstracts should be submitted by the *1st November 1963*. All Abstracts received by this date are included, as also are those received between *1st November 1963* and *1st February 1964*. It has not been found possible to publish in this volume Abstracts received after *1st February 1964*. If possible, abstracts received later than *1st February 1964* will be included in a supplement.

F. E. Ian Hamilton: Editor  
LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

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# Cartography

## GENERAL CARTOGRAPHY

### 1066 Production Control of Cartography

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The U.S.A.F. Aeronautical Chart and Information Centre (U.S.A.F./A.C.I.C.) is developing an Automated Production Management System which will incorporate advanced scientific management techniques for the planning, analysis, and control of production programmes. The U.S.A.F./A.C.I.C. is responsible to provide the Air Force with aeronautical and astronomical charts, astronomic, astrophysical, and geophysical data and related technical materials for aerospace navigation, air target materials, geodetic missile data, flight information publications, and documents, terrain models, maps, evaluated intelligence on aerospace facilities, and related services. A.C.I.C. maintains complete cartographic production facilities and supplements its capability by contracting some phases of production. Objectives of the system include the ability to solve problems and provide data for production development and analysis, production scheduling, quality control, cost accounting, manpower status, inventory and product distribution control. It is expected that a system of this type will provide management with the ability to maximize the use of available resources and to be more responsive to essential programme changes through decision making based on integrated machine developed information. The accurate recording of daily production activities in the system for subsequent data reduction will provide for exception reporting, timely job status, and manpower status information for management's use, and the up-dating of production yardsticks/analysis, leading to the preparation of the Programme, and the distribution of skills. Reports from this integrated system will be

designed for use by A.C.I.C. staff and line activities, other U.S.A.F. elements, quality control management, and should result in improved analysis, planning, control of products, qualities, and costs.

### 1469/1470/1471 Problems of Methodology in Detailed Geomorphological Mapping

BŘETISLAV BALATKA, JAROSLAVA LOUČKOVÁ AND JAROSLAV SLÁDEK  
*Academy of Sciences, Prague,  
Czechoslovakia*

In contrast to geological maps there is no tradition in compiling geomorphological maps. In Bohemia and Moravia systematic geomorphological mapping has been carried out only over the last ten years. Therefore, till now there has been no definitive, stabilized, and generally reputable key to a detailed geomorphological map. Existing detailed geomorphological maps often reflect the individual conception of the authors and the specific conditions of the areas mapped. We construct detailed geomorphological maps using the genetic classification of surface forms. Three main complexes of forms have been distinguished: 1. Forms due to the rock structure. 2. Erosion-denudation forms. 3. Accumulation forms. Anthropomorphologous forms belong to a special group of forms. The differentiation of forms due to rock structure (i.e. forms due to volcanic rocks, to karst rocks, to sediments deposited horizontally, to resistance of rocks to denudation), to a certain extent permits a demonstration of the geological situation. In the complex of erosion-denudation and accumulation forms several groups are distinguished according to their origin: fluvial, gravity, glacial, glacio-fluvial, frost and nival, sea and lake, and aeolian forms. The age of surface forms is shown only on plateaux of various origins, while age of the

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slopes is not indicated, for the slopes are the most progressive elements of the relief and are subject to continuous modifications. Therefore it is not possible to determine definitely the limits of individual phases of development. River terraces form the basis for determining age. The classification of their age is the most detailed one. Allied genetic forms are represented by a similar colour, the horizontal hachure on the base colour demonstrates age of the forms. The use of colour and hachure is subordinated to a good legibility of the geomorphological map.

### 1395 Simplified Arithmetic Geographical Analysis

E.D. BALDOCK

*Department of Mines and Technical Surveys, Ottawa, Canada*

This paper will show the development and implementation procedures of a capacity system based on statistical data. The system embodies the use of personnel output, geographical designations, and map scales to provide a simplified tool for formulation of managerial mapping policy. To establish a basis for comparison, data was assembled from records dealing with previous years of map production, time histories collected through the use of data processing systems and the study of individual components of the plant staff. It was established that Canada could be divided into three general areas, based on population and cultural density forming east-west strips across the country. The area demanding the heaviest output was designated area "A", its boundaries being the Canada-U.S.A. border and running to North Latitude 52°. The intermediate category (area "B") ran north of the "A" Boundary to North Latitude 56° swinging north into British Columbia to include Latitude 60°. Area "C" consisted of those areas north of area "B". Standard, provisional, and Arctic maps were designed to provide coverage of the type required for these areas. These three types could be classified in the same manner as the geographical-culture system. The factors of personnel availability (output) and the classification of maps into new editions, or other edition types are the last factors

relevant to the problem. Assignment of values to each of these factors was made and an evaluation produced for a map sheet or portions of a mapping programme.

### 1395 Vignette for Air Overprints

E.D. BALDOCK

*Department of Mines and Technical Surveys, Ottawa, Canada*

Currently in Canada controlled airspace (airways and controlled area extensions) are portrayed on visual pilotage charts by means of a dark blue stipple. The rapid extension of controlled airspace has resulted in an over-abundance of blue stipple which materially affects the use of the charts for visual air navigation. The vignette technique permits adequate portrayal of controlled airspace while reducing the cluttered effect produced by overprinting with an air blue stipple. The photo-mechanical production of a halftone vignette involves several exacting stages. The problem of speed and ease of producing necessary vignette patterns was of primary importance due to continuous revision of current flight information. The paper explains a method of producing positive halftone strip film vignette patterns in lines or circles, which are easily applied to the air information overlay.

### 1074 Cartographie Thématique d'Illustration: Problèmes de Documentation, de Conception, et d'Expression Graphique

JEAN BARBIER

*Société Française d'Editions Cartographiques, Paris, France*

Le definition: Il s'agit de cartes de synthèse qui tentent de rassembler dans une surface restreinte tous les éléments géographiques, déterminants, nécessaires à l'expression "totale" de la réalité. Ces cartes ne doivent pas être confondues avec des cartes de manuels scolaires ou des schémas de localisation qui accompagnent un texte. Les cartes présentées, qui illustrent en majeure partie le "Grand LAROUSSE Encyclopédique" en dix volumes (1960-65), sont un exemple—bon ou mauvais—de cartographie géographique découlant de l'enseignement donné depuis 1934 par

l'Institut de Géographie de Paris. Nous exposons ce que nous avons voulu faire, les difficultés rencontrées, et les problèmes que nous n'avons pu résoudre.

Les objectifs: Ces cartes sont conçues comme un *document* donnant au lecteur des possibilités de mesures directes et de comparaisons entre les différents éléments de la description carto-géographique; elles impliquent la nécessité de recourir à une documentation statistique détaillée et de rechercher une expression graphique particulière. Elles doivent traduire aussi fidèlement que possible la réalité géographique, c'est-à-dire: 1. Montrer la distribution générale des phénomènes. 2. Permettre l'analyse de chaque facteur déterminant, dans son extension, sa valeur et sa structure. 3. Montrer les variations régionales.

C'est nécessaire pour examiner des difficultés rencontrées dans: 1. La documentation statistique. 2. La documentation géographique. 3. La conservation de l'unité d'expression. 4. La généralisation au stade de la conception de la carte. 5. L'expression graphique. 6. La rédaction des légendes.

#### 1072 Cartographic Uses of the Model E-51 Co-ordinatograph System

ROBERT J. BEATON

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The importance of automation to ocean charting is briefly described with emphasis on developing data collection systems that are compatible with digital computers and plotter systems. A description of components comprising the Model E-51 Co-ordinatograph System is only briefly presented by illustrated slides, for earlier papers have already dealt in detail with the equipment's design and performance characteristics. The substantive content of the paper is chiefly concerned with discussion of applications of the plotter in normal operations, both from work accomplished and work potential perspectives. Typical projects will be displayed, accompanied by discussion of problems encountered with low density magnetic tape, dust effects, etc., and compromises made between computer and plotting systems. Examples of plotting

versatility will include the following: 1. Hyperbolic and circular curves for electronic navigation systems like Loran and Lambda Decca. 2. Grid and geographic intersections for Mercator and Transverse Mercator. 3. Various projections, such as azimuthal equidistant, point plotted, and annotated. 4. Hydrographic sounding data plotted by photo projection and developed on film base. 5. Experimental shoreline and depth contour plotting and scribing.

#### 1092 Techniques and Topographical Cartography

WILLI BECK

*German Hydrographic Institute, Hamburg, German Federal Republic*

This paper considers: 1. Plan representation and map representation. 2. Techniques and plan production, scale and plan quality. 3. Fundamental plan and plans. 4. Techniques in processing and producing topographical maps.

#### 1101/1102 An Automatic System of Cartography

D. P. BICKMORE

*Clarendon Press, Oxford, England*

A. R. BOYLE

*Dobbie McInnes (Electronics) Ltd., Glasgow, Scotland*

1. *Scope*—The system under review is concerned with translating completed map compilations into series of final reproduction negatives through the medium of magnetic tape. It is, therefore, at present distinct from various automatic processes currently being developed in surveying and photogrammetry. 2. The *Context* for automation in cartography is to provide accuracy, plus effective "communication": (a) The definition of accuracy in relation to current printing processes, and to current methods of using maps. (b) The need for colour in order to be able to "stack" different types of fact relating to the same place and with maximum legibility. (c) The need for subtlety in symbols to cover

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variations in the "hardness" of the facts mapped. 3. To achieve this necessary co-ordination of precision and elegance by contemporary cartographic methods still involves much slow manual effort. Cartography needs greater speed, but this cannot be at the expense of precision and elegance. Greater speed is also desirable to give cartographic editors the opportunity of trial shots at correlating different types of information: much scientifically interesting experimental work cannot now be adequately tried out before production is started. 4. *Details of equipment involved in the new system:* (a) The "Reading" Unit. (b) The Magnetic Tape Deck. (c) The Line Drawing or "Writing" Unit. (d) Name Placement Unit. (e) Coloured areas. 5. *Some effects of the system:* (a) Once information has been read from a compilation on to the tape it can be written at the same or any smaller scale, and in any line thickness, etc. or colour desired. Change in projection requires that the tape be simply processed through a computer. (b) The process of "reading" the compilation on the tape, though "manual", is many times faster than normal cartographic drawing, since the reader is concerned only with accuracy and not with quality of line. (c) Since lines will be written with an electrically operated light spot projector as opposed to by a human hand, it is possible to introduce variations in cartographic symbol. (d) Accuracy of writing is better than 0.07 mm. over a plotting table 1 x 1.4 metres, and hence offers very high register automatically.

### 1601 Applications of Photo-interpretation to Geographical Research

H. L. CAMERON

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Sequential air-photography of Sable Island (off Nova Scotia) was used to construct maps of the island at approximately three-year intervals. Comparison with maps prepared by ground surveys over the period 1766-1899 indicate that the reports of continual wastage are correct, with the west end losing some eight miles while the east bar has been elongated by some eleven miles. The causes of these movements are

currents and storms. It is suggested that high altitude photography could be used to determine the system of currents in the island's vicinity. The measurement of current speeds from high altitude air photos and satellite photos has been done elsewhere. The possible applications of these methods to ocean currents on a world-wide basis is briefly discussed.

### 1073 Inventaire Méthodique par Sujets des Cartes et Documents Cartographiques

Comité Français de Cartographie, Paris, France

La recherche rapide et complète de la documentation préexistante est l'un des premiers problèmes posés par l'entreprise d'un nouveau travail cartographique. Pour faciliter cette tâche il paraît souhaitable que tous les organismes de documentation cartographique puissent disposer d'un inventaire identique de *classification des sujets* cartographiques pour unifier le classement des documents et des fiches d'analyse. C'est pourquoi le Comité Français de Cartographie a constitué une commission spécialisée dont cette communication résume les travaux (susceptibles d'un intérêt international).

En premier lieu, on a dû préciser certaines *définitions techniques* essentielles; car un même terme n'a pas toujours la même acception dans les divers établissements d'une même nation, voire dans les différents services d'un même organisme. Par ailleurs, les définitions figurant dans les ouvrages généraux ne correspondent pas toujours rigoureusement à la nature exacte des documents ou à l'évolution des techniques. *L'inventaire méthodique* des sujets a ensuite été étudié point par point. L'ensemble du projet comprend donc: 1. Une liste de *définitions* des cartes et documents cartographiques essentiels et de quelques phases opératoires (accompagnée de quelques conventions concernant l'identification chronologique des cartes: actuelles, prévisionnelles, historiques, anciennes). 2. Un *inventaire méthodique*: (a) des natures de cartes et documents *topographiques*; (b) des *SUJETS* de cartes et graphismes *thématiques* (physiques, biogéographiques, humains, économiques, et



synthèses régionales). 3. Un *répertoire alphabétique*, d'ordre pratique, des données précédentes.

**1073 Projets de Normalisation des Symboles de Cartes Thématiques**

*Comité Français de Cartographie, Paris, France*

De nombreuses raisons ont conduit les principaux services officiels de grandes nations à adopter une normalisation des *signes conventionnels* utilisés pour les cartes topographiques. Le développement des relations internationales a étendu le domaine de cette normalisation, d'importantes conférences ont considéré les problèmes posés par les cartes aéronautiques, les cartes hydrographiques, la carte internationale du monde à 1:1 000 000. Les bénéfices d'une telle normalisation intéressent également les *symboles* employés pour des *cartes thématiques*, notamment des cartes d'inventaire (géologie, végétation, etc.), qui ont été l'objet d'efforts analogues. Le Comité Français de Cartographie a estimé nécessaire de former une commission chargée d'étudier les symboles de certaines cartes économiques, concernant surtout les *activités industrielles et touristiques*. L'exposé qui résulte de ces travaux présente: 1. Un *répertoire des principales activités industrielles et touristiques*, classées en chapitres et en rubriques. 2. Pour chaque chapitre: une "*enveloppe géométrique*" générale, autorisant éventuellement une représentation *quantitative*. 3. Pour chaque rubrique: un *symbole figuratif* destiné à la représentation *qualitative* de l'activité considérée (dont le dessin peut être réduit à de faibles dimensions). 4. Ainsi que les *références officielles* de l'Institut de la Statistique et des Etudes Economiques, permettant de retrouver la documentation chiffrée correspondante. Il est d'un intérêt évident de pouvoir retrouver ainsi les mêmes symboles sur un atlas, un livre scolaire, une étude économique. Toutefois, une telle normalisation, pour être valable, ne peut considérer que les activités essentielles; et le choix de figurations plus détaillées, s'appliquant à des buts particuliers, doit être laissé à chaque auteur.

**1075 Mise au Point d'une Charte des Couleurs Applicables aux Surcharges Thématiques Imprimées en Offset**

JACQUES DEJEUMONT

*Institut Géographique National, Paris, France*

Une charte des couleurs est un catalogue de teintes susceptibles d'être reproduites avec un nombre réduit de planches de tirage. L'intérêt de l'utilisation d'un tel procédé réside essentiellement dans l'économie réalisée lors de l'impression. La mise en application présente toutefois des difficultés quant à la tenue des teintes et aux corrections éventuelles des planches de tirage. A condition de tirer le meilleur parti de ses possibilités, une charte utilisant trois encres primaires permet de réaliser une gamme de tonalités très variées. La mise au point d'une telle charte consiste à définir les encres primaires et les pourcentages imprimants à utiliser pour chacune des encres. L'utilisation des caractéristiques colorimétriques de certaines couleurs obtenues à l'impression permet de définir le domaine de reproductibilité des trois encres ainsi que des séries de valeurs d'écarts sensoriels correspondant à certains "trajets" colorés obtenus en faisant varier de quantités égales le pourcentage d'une encre primaire.

Cette étude permet de définir au moyen d'une solution de compromis les pourcentages des trames à utiliser pour chacune des encres, dans le cas de trois gradations (2 trames), et de quatre gradations (3 trames).

**1440 Méthode de Représentation des Formations Superficielles**

YVETTE DEWOLF

*Université de Caen, France*

Le problème très actuel de l'inventaire des possibilités physiques d'une région, d'un pays, d'une nation, demande la réalisation d'un document nouveau d'une carte qui exprime le plus clairement et le plus simplement possible les facteurs constituant "l'épiderme de la terre". Les *formations superficielles* provenant de la désagrégation mécanique et physique et de l'altération

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chimique des roches apparaissent comme l'élément fondamental d'une telle cartographie, puisqu'elles conditionnent toute la vie agricole et une grande partie de l'économie du monde. Elles seront cartographiées en relation avec les roches substrats qui leur servent de support. Le classement des formations superficielles se fera selon leur granulométrie, que l'on représentera à la fois qualitativement et quantitativement. Celle des roches substrats sera basée sur leurs propriétés physiques les plus importantes: 1. Degré de cohésion (roches cohérentes, plastiques, meubles). 2. Massivité (schistosité). 3. Architecture (texture et structure). Le mode et le degré d'altération des roches seront suggérés par des signes particuliers. La couleur sera accordée aux roches substrats, les couleurs chaudes du spectre étant données aux roches carbonatées, les couleurs froides aux non carbonatées. Des variations d'intensité de la couleur permettront de préciser la profondeur d'apparition de la roche—substrat, c'est à dire l'épaisseur de la formation superficielle. Ainsi seront représentés les principaux éléments conditionnant la valeur et l'occupation du sol: 1. Nature et texture des formations superficielles. 2. Épaisseur des formations superficielles. 3. Nature de la roche substrat. 4. Mode et degré d'altération de cette roche. Des extraits de cartes destinées à l'aménagement du territoire et réalisées selon cette méthode accompagneront la communication.

### 1071 Maps and Aerial Photographs for Natural Resource Management in Forests

LAMONT G. ENGLE

*U.S. Forest Service, Milwaukee, Wisconsin, U.S.A.*

The National Forests of the United States contain 181 million acres of wild land which is managed on the principle of multiple use of all the natural resources for the greatest common benefit of the people. Involved are timber, water, wildlife, recreation, and grazing. Because of the extensive areas under management, the variety of functional needs, and the heterogeneity of land and vegetation, a variety of maps is needed. The basic maps which are required by the

land manager for planning, co-ordinating, and controlling operations are: 1. A topographic map. 2. Soil map. 3. Land ownership map. 4. Vegetation-type map. 5. Transportation map. This paper treats only those maps prepared from Forest Service source material. An example is the vegetation type map. Production of a vegetation type map to meet the needs for co-ordinated resource management is a continuing problem. It involves systems of vegetative classifications, minimum size of area to be delineated, the use of aerial photography, the method of presenting the information on a map, and keeping the map up to date. In order to provide the land managers with an integrated picture of conditions for any given unit of land, we have developed the "multiple use" atlas in which data from the various functional maps are combined. As management intensifies, the atlas will contain greater detail. A system of map overlays is our answer to adequately present and up-date the data. The atlas will be a concise repository of management information.

### 1580 Cartographic Criticism

LAWRENCE FAHEY

*New York, U.S.A.*

The tempo of cartographic activity has been increasing during the last decade. New topographic series have been started in various countries, numerous new atlases have been published, new cartographic societies have been formed and, in general, popular interest in cartography has been growing. A result of this increased activity has been a greater need for appraisals of cartographic works. The public wants more guidance in the purchase of cartographic materials, map librarians require more information on how they can best augment their collections and professional map users need to know more about the reliability of the cartographic materials that they require.

To be accepted, cartographic critiques must be written by technically qualified individuals who are unbiased. The most important problem in the evaluation of the merits of cartographic works is establishing

standards of accuracy, legibility, utility, and graphic appeal, which are scientifically and aesthetically sound. Comparison with other works of similar nature is a traditional technique of criticism but empirical testing and the application of evaluation criteria from other disciplines should be considered. Cartographic criticism exists today, in a limited form, in certain geographic and cartographic journals, consumer reports, and the public press. However, only a small fraction of the material which is published throughout the world each year is reviewed. Cartographers and geographers should develop a keener sense of cartographic discrimination, a greater proportion of the world's cartographic output should be critically reviewed, and more effort should be devoted to developing sound criteria for cartographic evaluation.

**1659 The Optical Weight of Symbols on Thematic Maps**

KONRAD FRENZEL

*University of Frankfurt-on-Main, German Federal Republic*

In preparing complex thematic maps it is necessary to apply a method of representation which makes possible the immediate perception of the main facts, of highlights, of inter-relationships of facts, and of trends, even before studying the explanatory notes intensively. Only shapes and colours are applicable for determining and constructing cartographical symbols. Some tradition and rules already exist in order to show different values by the use of colours. Physical and psychological investigations have been performed to solve that problem. No similar results of investigations however are available with regard to the form of symbols. It is therefore attempted, partly using slides, to combine colour and shape in creating systems of symbols in such a way as to show clearly successions of values by their optical weight. The logical application of such a method makes it possible to differentiate clearly and instantaneously the mass of possible symbols on complex, quantitative, and qualitative maps of special subjects. The attempt may be a contribution to a vital system in thematic mapping.

**1193 Photogrammetry and Cartography: An Inseparable Unit**

EDWIN GIGAS

*Institute for Applied Geodesy, Frankfurt-on-Main, German Federal Republic*

One of the most important and most urgent demands of cartography nowadays is the quick revision of maps. Here photogrammetry furnishes very valuable help. Modern instruments make it possible to transform vertical aerial photographs (taken during regular flights), at intervals of a few years, into orthogonal aerial photographs called orthophotocopies. The Orthophotoscope and the Orthoprojector fulfil this task and—connected to the stereomat—they fulfil this task even almost fully automatically. If the information data is stored on a punched tape, as is the case with the Orthoprojector, the same tape can be used during repeated flights. Thus repeated scanning of the model, line by line, can be eliminated. The orthophotoscopic plan can be copied onto the negative of the original engraving plate and serve immediately as original for the engraving of the supplements. The orthophotoscopic plan, i.e., the aerial photograph true to a map, has in the meantime proved to be highly suitable for other tasks, too. It is possible to use the orthophotoscopic plans as basic maps for a topographic cadastre, and in the United States orthophotoscopic plans have been used already as topographic maps 1:24 000. The maps are printed in a photolithographic procedure without the use of a screen. The new map of the moon in the scale of 1:250 000 is developed from photographs taken from satellites. The photographs were transferred by television to the earth. No topographic measurements were available. The photogrammetric information was the only basic material for the cartographic production of the map. This shows that photogrammetry and cartography belong together and will prove in the future to be inseparable.

**1358 The Evaluation of Historical Evidence on British County Maps**

J. B. HARLEY

*University of Liverpool, England*

Methods of evaluating topographical data depicted upon the county maps of the

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period 1750–1850 are discussed. Particular attention is paid to the important group of privately-produced surveys published at the one-inch scale or larger just prior to, and contemporaneous with the first Ordnance Survey maps in the period 1750–1850, and which are a valuable and, in some respects, unique source, of British historical geography.

The date of the topographical information (as opposed to that of a map's publication) has usually to be established. Dates of survey imprinted on the map cannot always be accepted *prima facie*, and the evidence of newspaper advertisements, prospectuses, and occasionally surveyor's correspondence, reveal discrepancies between them and the actual dates of survey. These may be confirmed by internal evidence on a map in particular that obtained through the distributional analysis of its industrial sites and communication patterns. Different areas of a map, or different topographical features, can bear different dates.

There is no consistent evolution towards a standard accuracy or reliability amongst private cartographers in the century under discussion. The key to evaluation often lies in the surveying practices, compilation habits and commercial associations of individual map-makers. Cross-checking with map and other contemporary sources reveals the different standards of publishing houses and a variable reliability between different topographical items on a map. Printed maps are composite documents whose critical assessment reveals the measure of caution necessary for their use in social and economic studies.

### 1069 Technical Problems on Thematic Mapping

WILLIS R. HEATH

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The infinite variety of purpose and use served by small-scale thematic maps is equalled by the variety of cartographic problems involved in their preparation. For maps of this order, functional effectiveness is a primary requirement, in terms of content and visual quality. Limitations on size and on use of colour compound the difficulties of obtaining visual clarity. Solution of graphic technical problems

under such difficult space conditions leads to simplification of map content problems, and can guide map preparation at larger scales and in multiple colour. Restricted map areas intensify the problem of contrast control, a composite involving: sensitivity of the human eye in distinguishing value differences; limits of effective visual perception of symbols and patterns; and variations in size, shape, and location of map elements. The key to contrast control lies in avoiding marginal areas of visual acuity by establishing perception levels recognizable under varying mapping conditions; limiting patterns to reduced levels of visual perception; and in reducing the importance of areal or surficial extent of symbols in relation to background surfaces. Lowered contrast within the physical area of symbols can be obtained, permitting placement of more information in a unit area of the map. The effect of outside variables is minimized when map elements are internally related and controlled. The establishment of effective procedures is functionally essential to obtain desired relationships and integration of the map elements.

### 1099 Colour and Mapping

OLOF HEDBOM

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A rather simple and handy system is given for studying colour and different colour combinations, thanks to two scientists, Ewald Hering, a German, and Tryggve Johansson, a Swede. The system is based on colour impressions as received with our eyes and interpreted by our brain, and thus a psychological rather than a technical system. The paper will give a short presentation of the system and show some examples of its application in mapping and modern printing technique in Sweden. Intensity scales and colour combinations for population and climatic maps are discussed and map examples are given.

### 1352 Interprétation des Photographies Aériennes

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Les problèmes d'interprétation des photographies aériennes, qui se posent pour

l'établissement d'une carte à grande échelle par photogrammétrie, et les problèmes d'interprétation géographique: études de morphologie, d'agglomérations, etc., présentent de nombreux points communs. L'auteur étudie d'abord comment s'effectue à l'Institut Géographique National l'interprétation des photographies aériennes lors des trois principales phases de l'établissement d'une carte de base par photogrammétrie: restitution, mise au net, complétement. Le sujet étant limité à la carte de base à 1:20 000 de la France.

L'expérience acquise sur le terrain par les compléteurs (en comparant constamment les détails topographiques et leurs images sur les photographies aériennes) joue un rôle prépondérant dans la formation du personnel; mais on peut accélérer l'instruction des dessinateurs de mise au net et des compléteurs en utilisant d'abord des collections de stéréogrammes, puis des couples de photographies aériennes commentés. La collection de stéréogrammes présente les détails topographiques selon des extraits de couples de surface réduite, dans un ordre logique, celui du tableau des signes conventionnels de la carte de base à 1:20 000. Dans l'autre méthode on choisit un certain nombre de couples témoins, intéressant des paysages variés, et on commente pour chaque couple les moindres détails de photographies. Au couple proprement dit (échelle des photographies 1:25 000) sont plusieurs extraits de cartes agrandies avec des numéros en surcharge; chaque numéro renvoie à un commentaire.

#### 1034 Cartographic Communication

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The paper will attempt to examine the fundamental processes of cartographic communication. The main structure of Information Theory will be explored to demonstrate how cartography can be examined in terms of the gathering and coding (symbolizing) of data, its transmission by several means, and the final "decoding" process which remains largely subjective. The points at which it is possible for "noise" to affect the communication system is also studied. From this general

analysis it will be shown that present technical developments will tend to magnify the distinction between the two primary classes of cartographic information, locational data, and geographical concept. The paper will conclude with an estimate of the types of maps which may be produced in the future, and the purpose which they may serve.

#### 1032 Transformation of Photo-tone into Line

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This paper deals with the photo-mechanical transformation of the photo-tone of vertical aerial photographs into line without manual operations. The process consists in the camera-exposure of an aerial photo-negative, with the Klimsch "Variomat" as a shifting device, and a positive mask of the original on the negative side of the camera. On account of the function of the Variomat the picture of the negative moves in all directions along a short distance, producing small openings between those areas that possess sufficient differences in density. After careful development of the light-sensitive film behind the positive mask, black lines are shown of a size as dictated by the angle of oscillation of the "Variomat". So the aerial photograph has been transformed into an outline map of the scale of the mask. Thanks to the very minute and careful laboratory experiments executed by Messrs. Klimsch, Frankfurt/M., on the author's initiative, the first positive results of this process can be shown. These experiments and their results prove that, given a certain minimum of difference in density between bordering areas on aerial photos, a dividing-line between areas of different tone can be restituted automatically. This can be of importance for any application of vertical aerial photographs where the object is to reconstitute the planimetric details of topography on a certain scale. Every discontinuity in the tone on an aerial photo marks an "object". Provided discontinuity is large enough, the camera-Variomat exposure of the negative through its positive mask produces such an object as a line. Consequently, shadows also give

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their contours and there are more imperfections in this method, the results of which should be considered to be first proofs. Like all applications of automation in "reading" aerial photos this "automatic edge isolation" technique also eliminates personal interpretation, but it adds unwanted details to the line-drawing produced.

### 1089 Problems in Mapping and Classifying the Vegetation of the U.S.A.

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The problems in mapping and classifying the vegetation of the United States may be arranged in three groups: 1. Problems arising from the area's size and the scale of map. 2. Problems arising from heterogeneous source materials. 3. Problems arising from dissimilar interpretations of vegetation. Each of these groups contain both the general kinds of problems characteristic of vegetation mapping everywhere, and those peculiar to the regions mapped. The new vegetation map of the United States is presented as a solution to these problems. Its more significant features are discussed, especially the manner of establishing the vegetational units it portrays, the organization of its content and the legend with its elaboration. The new vegetation map is printed in colour at a scale of 1:3 168 000 or 50 miles to the inch. It shows 116 types of vegetation, each of which is identified both physiognomically and floristically. An illustrated book accompanies the map. It contains comments on the map and an expansion of the legend. It is published by the American Geographical Society, New York.

### 2025 Prospects for Automatic Map Compilation, Preparation, and Reproduction

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One of the principal problems of modern cartography is the mechanization and automation of the processes of map compilation, preparation, and reproduction. Research into this problem is being carried out by Soviet cartographers. It is advisable to develop a series of instruments.

Each of these instruments should enable one to draw particular basic map elements—culture, relief, hydrography, etc. These instruments must be combined in future into the single aggregate. Technical solutions for a number of such instruments are developed. The electro-coordinatograph with programme control permits production of the standard map elements: grid, geodetic points, border lines. The programme is developed on the punched tape, places it into the line-to-code converter which distributes impulse signals to step-by-step electric motors connected with the scribing head. For reproduction of figure symbols and place-names, the photo-optical method is the most effective. However, the available designs of photo-setting machines do not allow reproduction of symbols and place-names within the limits of a highly accurate map sheet. Automatic scanning systems can be used for drawing the linear elements (contours, hydrography). The first experiments show they can ensure the scanning speed of 400–800 mm. per minute, and the accuracy of  $\pm 0.04$  mm.

### 1088 Production Control in Cartography

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Cartography consists mainly of intellectual and manual work. Control of such activity is very complicated but also most important.

Production control must deal both with quality and quantity, i.e. costs. It must be a running control and cannot be left until the proof reading. The most important check is that made by the cartographer himself. Foremen or special control officers must also keep a current control to assure the management responsible economically and in other ways that work is going according to plan. This paper will consider in further detail: 1. Quality control. 2. Cost control.

### 1351/1075 Utilisation de cartes Perforées en Toponymie Cartographique

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Le problème est traité au niveau de la carte de base, ce qui correspond pour la France

à l'échelle du 1:20 000. Le document fondamental est constitué par l'état des noms, dressé sur le terrain par le topographe. Chaque nom est accompagné des renseignements nécessaires à son identification: habitat, lieu-dit, détail naturel, à sa classification typographique: type de caractère à employer, et à sa localisation: coordonnées. Le nom est perforé grâce au système alphanumérique sur une carte où il apparaît également en clair. Les renseignements sont perforés sur cette même carte suivant un code pré-établi. La grande facilité des cartes perforées permet d'obtenir rapidement le classement correspondant au but recherché. Ce but peut être suivant les cas: 1. L'établissement des listes de noms figurant sur une ou plusieurs coupures de la carte de base, classées par type de caractère, d'ou meilleure planification de la composition typographique. Le classement peut également être fait suivant l'ordre rationnel de collage des noms sur les planches de rédaction. 2. L'établissement de répertoires toponymiques, par ordre alphabétique, soit dans le cadre d'une ou plusieurs cartes, soit dans un cadre administratif, ou dans celui d'un ouvrage, par exemple un atlas, comportant un index. 3. L'établissement de listes de noms en vue de l'édition de cartes dérivées de la carte de base et à échelles plus petites, par sélection suivant des normes fixées à l'avance.

#### **1068 Production Control of Cartographic Phases in a National Topographic Mapping Programme**

ROBERT O. MAXSON

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Map-making is an art and it is also a production operation. In order to turn out the product efficiently and economically, management needs reliable production data and reliable methods of analysing that data. In administering the National Topographic Mapping Programme, the U.S. Geological Survey uses carefully planned production control techniques to assure that the funds and manpower invested yield as favourable a return as possible. Production control is made up of such elements as plans, budgets, operating programmes, manpower utiliza-

tion, resource management, and improvement of procedures and tools. To achieve effective production control, thorough analysis must be made of costs, schedules, workloads, cycles, and productivity. These analyses are particularly valuable in managing production in the map-finishing phases. These phases—office completion, scribing, checking, and editing—are the bridges between topographic surveys and the printed map.

#### **1515 Quality and Quantity in Representing Vegetation on Topographic Maps**

GERALD MCGRATH

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The most cogent reason for showing vegetation on topographic maps is that vegetation comprises an element of land use, but the distinction between general and specialist information on maps is indefinite. Elements of vegetation that might be portrayed are reviewed. The significance of vegetation density is noted. Methods of representing vegetation are principally: 1. Point symbols. 2. Point symbols and colour patterns. 3. Colour patterns. Map scale is considered as the probable determinant, with the range of the vegetation spectrum as a secondary factor. Presentation by point symbols is based on the vertical or profile view of the feature, scale as the principal criterion sometimes being over-emphasized. The profile view is the most logical, for this is the conventional view of the earth-dweller. The symbol should have obvious relationship to the feature represented, be clear and unambiguous, and be capable of being identified correctly by the unskilled map-user. The individual symbol should be tested for effectiveness by skilled and unskilled map users before it is accepted. The oblique view has no place in vegetation symbolization.

The basis for standardization is discussed. A botanical classification is not necessarily suited to topographic map presentation of vegetation by point symbols, because of the likely complexity of the scheme and the reduction in interpretability of the symbols devised. Presentation by colour patterns

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and problems of legibility in relation to other physical and human data are examined.

### 1170 Documentation in Cartography: An Aid in Map Design and Production

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This paper gives an empirical report on the results and publications of the Committee on the Bibliography of Cartographic Literature, founded in 1956 within the German Society for Cartography. However, the First General Assembly of the International Cartographic Association held in Paris, May 1961, gave special attention to the *Bibliotheca Cartographica*, as for instance, in the French *Bulletin* and the Spanish periodical *Cartografia*, and reported also at the annual German meeting of cartography in 1961 in Hanover. The author is chairman of the Working Group which includes scientific collaborators from 35 states of the world. The *Abstracts of Papers* of the last I.G.U. Congress, held in Stockholm, August 1960, gave a sketch of the published material. The paper was printed in full in *Bulletin* No. 42, Special Libraries Association Geography and Map Division, Dartmouth College, Hanover, New Hampshire, U.S.A., in 1960. On the other hand, documentation in cartography is an important aid in map design and reproduction, and also in the whole process of map production. It is very essential to know technical methods used in other countries. Furthermore, ideas and new statistical or other basic materials should be available as soon as possible to cartographic agencies. Compilation for design and production are nowadays more significant than in the past. Papers and technical reports relative to cartographical theory and practice must be read. But the time is not available and it is impossible for our staff to keep up to date with the cartographic literature. This requires specialized documentation with multilingual indices, detailed dispositions, a register of authors and periodicals. The value of such common basic work will help all discussions in cartography and

detailed examinations within our International Cartographic Association.

### 1056 The Conversion of Natural Signs<sup>1</sup> to Symbols in the Production of Substitute Maps from Aerial Photography

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Principles of design are discussed which have guided the compilation of an all black-and-white, one-press-plate, symbolized map, now under development at the Corps of Engineers, U.S. Army Map Service. This has been part of a map-design programme at the Army Map Service intended to resolve technical problems in the production of the best possible map in times of emergency. The chief feature of the design is the use of the linear pattern and granular texture of the aerial photographic image itself for map symbol formation. The main problem in effecting the graphic transformation from image to symbol has been in understanding in detail the difference between photographic imagery and map symbolism. The distinctive feature of the process is the achievement of several levels or steps of even over-all tonality, called photo-line or photo-tone screen separations. They are achieved by photo-masking techniques applied under quality control conditions to the original negative of the aerial mosaic. These separations are assigned symbol designations and are then composited together on a single film where they must be sufficiently distinctive to hold symbol designations. This composite is ready without further screening for making press plates or for Ozalid reproduction. The order in which graphic transformation is accomplished has been of particular importance and interest both for technical reasons, and reasons of understanding the peculiar nature of the map symbol in contrast to the "natural sign" character of the aerial image. The black-and-white map discussed can be printed in a single run through any one colour press. However, the principles of design utilized for the black-and-white map, would apply to all multi-colour

<sup>1</sup> The term "natural sign" as used in this paper, denotes a photo image identifying one object only, while "symbol" indicates a class of object.



printing. One-colour (black-and-white) map samples at large and medium scales are included in the text of the paper.

#### 1061 Map Publication and Distribution

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Maps of the land surface are vital to the scientific, engineering, industrial, and cultural elements of the general economy of the United States or any other country. The Geological Survey is the primary publishing agency of maps of this kind in the United States. It is the policy of this agency to carry out the publication and distribution of the various topographic, geologic, and similar maps in a manner which will best meet the needs of the many segments of users and potential users, insofar as available funds will permit. Although the users' needs are common in several ways they are different in other ways; accordingly, it is necessary to compromise the needs of some to fulfil the more important needs of others. These general considerations along with production management problems involving the interrelationship of available funds, technical skills, manpower, tradition, equipment, and imaginative capability are treated in this paper. In map production specific consideration is given to the control of colour, place name type (both selection of styles and methods of production involving newly developed equipment), multiple forms of editions, special printings, type of paper used, quantities of copies printed, reprinting cycles, night shifts, research in new methods, recruitment and training, and similar questions. The general considerations of the distribution of maps to officials and the public are within the same framework as those affecting map production. These considerations are involved in operations including automatic sendings to universities and officials, pricing and discounts of sales editions, stock controls, office procedures on accounting and billing, bulk stock warehousing, governmental retail outlets, commercial agents relations, bulk shipments, special customer service, and contact with the public and their problems.

#### 1494 Photography of the Earth from Space: Its Geographical Applications

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Photography of the earth from satellites and rockets constitutes a new source of geographic information. The use of existing space photography is compared with that of aerial photography. Apart from its illustrative value, space photography has possible or actual applications in mapping relatively: 1. Unchanging distributions—geology, landforms, vegetation. 2. Slowly changing distributions—land-use, the extent of glaciers. 3. Rapidly changing distributions—the extent of snow-cover, frozen lakes and rivers, forest-fire burns, ephemeral lakes and streams, ocean water masses, and sea-ice cover.

#### 1143 Revising and Maintaining Topographic Maps

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This paper considers the relationship between the aims and functions of the Directorate of Overseas Surveys and the design of its maps. Urgent mapping needs have had to be met by incomplete maps (e.g. the "Preliminary Plots" of the Directorate's first decade, and more recently by the production of compilations in a readily reproducible form.) The methods used for the collection and collation of place names and all other information not obtainable from air photographs are also analysed. Some consideration is made of the division of responsibility for the maintenance of map series between D.O.S. and local survey departments. The recording and incorporation of revision data is also an important element. Four categories are described: 1. New air photography. 2. Systematic field revision on the ground by staff of the survey department. 3. Information collected in the field by "amateurs". 4. Library sources, e.g. legal descriptions of new administrative boundaries, reports, and maps produced by other agencies.