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1. *Introductory*

Classification is a fundamental method of science, and seeks to introduce simplicity and order into the bewildering multiplicity of things that confront the human mind by formulating a scheme of mutually exclusive and collectively exhaustive categories based on the important characteristics of the things concerned and on the actual relations between them. The first attempt at any systematic classification of map projections appears to have been that of Tissot, in his "Mémoire sur la Représentation des Surfaces et les Projections des Cartes Géographiques", 1881, but this side of the subject has been generally neglected by English writers. Many have, in fact, commented upon the impossibility of classifying the known projections into mutually exclusive groups, and Close ("Text-Book of Topographical and Geographical Surveying", 1905), in listing seven descriptive terms, states that "they are not all mutually exclusive", . . . and to treat them as classes would be to fall into his error who divided the human race into Frenchmen, red-haired people and cannibals".

In reality, the position is not quite so hopeless as these remarks would have us believe. Most of the difficulty comes from the failure to emphasize the fact that the descriptive terms in use are based on two independent systems of classification; the groups of one system *are* mutually exclusive and, although the groups of the other system overlap to some extent, the resulting classification is much more satisfactory than is generally realized. In the classification table here given, the two systems have been separated, the groups of one system being the vertical columns and those of the other system the horizontal divisions, and the classification is illustrated by a selection of the better-known projections. Very little of this table is new, but the writer has not previously seen it assembled in precisely this form.

Not only is the classification of projections unsatisfactory in English writings, but the nomenclature employed, both of the classification groups and of the individual projections, is in a state little short of chaotic. It is the purpose of this paper to comment on some of the more serious features, and to offer some suggestions by means of which they can be improved. Further opinions and discussion on the various points raised would be welcomed, in the hope that some of them at least can be finalized.

2. *The Representation Groups*

Projections fall readily into three mutually exclusive groups according to their properties of representation. These may defined, by considering the scale relations at any point, as:

Conformal: Projections in which, at any point, the scales in any two orthogonal directions are equal.
Authalic: Projections in which, at any point, the scales in two orthogonal directions are inversely proportional.
Aphylactic: Projections that are neither conformal or authalic.

In conformal projections, the scale at any point is equal in all directions around that point, so that angles and the shapes of elementary areas are preserved. Three terms have been proposed to describe these projections: *conformal* (Gauss, 1825), *orthomorphic* (Germain, 1865), and *autogonal* (Tissot, 1881). "Orthomorphic" (ὀρθός, straight right; μορφή, form) has until recently been preferred by British writers, but "conformal" is steadily gaining favor, and is already firmly established in the United States. "Orthomorphic", with its implication of correct shapes, is open to objection because the shapes of large areas are not preserved, and the value of the projections lies in their preservation of angles. Tissot's term, "autogonal" (αὶτός, same; γωνίος, angled), has more to commend it, but it has not gained currency. "Conformal" is the simplest as well as the earliest of the three terms, but the main argument in favor is that it is a general term used by mathematicians to describe the representation of on surface upon another in such a way that the angles between corresponding lines on both surfaces are equal.

CONICAL PROJECTIONS

	CONFORMAL	AUTHALIC	APHYLACTIC
CYLINDRIC	Mercator	Authalic Cylindric	Equidistant Cylindric Rectangular Cylindric Central Cylindric Gall
PSEUDOCYLINDRIC	..	Collignon Sinusoidal Mollweide Authalic Parabolic Prépétit-Foucault Eumorphic	Trapezoidal Apianus Loritz Orthographic Fournier II Arago
CONIC	Conformal conic with one standard parallel Conformal conic with two standard parallels (Lambert)	Authalic conic with one standard parallel Authalic conic with two standard parallels (Albers)	Equidistant conic with one standard parallel Equidistant conic with two standard parallels Murdoch I, II, III
PSEUDOCONIC	..	Bonne Sinusoidal Werner	..
POLYCONIC	Lagrange Stereographic	Authalic Polyconic	Equidistant Polyconic Rectangular Polyconic Fournier I Nicolosi Van der Grinten
AZIMUTHAL Perspective	Stereographic (Sphere)	..	Orthographic Gnomonic Clarke James La Hire Parent Lowry
Non-Perspective	Stereographic (Spheroid)	Authalic Azimuthal	Equidistant Azimuthal Airy Breusing

NON-CONICAL PROJECTIONS

	CONFORMAL	AUTHALIC	APHYLACTIC
RETROAZIMUTHAL	..	..	Equidistant Retroazimuthal
ORTHOAPSIDAL	..	Authalic Orthoapsidal pp.	Orthoapsidal pp.
MISCELLANEOUS	Littrow August Peirce Guyou Adams pp. Laborde pp.	Aitoff	Schmidt Petermann Two-point Azimuthal (Orthodromic) Two-point Equidistant

Lenox-Conyngham (E.S.R., iii, 19, 309) discusses the question whether "orthomorphic" should not perhaps be "orthomorphous" or even "orthomorphotic", but he decides on the original form. "Orthomorphotic" would describe, not the projection, but the process of obtaining one. The present writer cannot agree with the view that words derived from classical or foreign sources should be made to obey the syntax of the language of origin. Once a word has been incorporated into the English language it becomes English property, and however much grammarians may deplore the fact, the English treat it as they will, and a dictionary can do no more than record the usage. Even if there is no Greek termination -μορφικός, that is no reason why there should not be an English termination -morphic, and the O.E.D., as Lenox-Conyngham points out, has been forced to admit both "amorphous" and "metamorphic".

The property of a conformal projection is termed *conformality*, or, if the term "orthomorphic" is preferred, *orthomorphism*.

Authalic projections are those which preserve a constant area scale and four terms have been proposed to describe them. They are usually known in English as *equal-area*, or more rarely as *equivalent*. The view that "equal-area" is an unsatisfactory term has been expressed by several writers, who nevertheless are reluctant to part with it. The term *authalic* (αὐτός, same; ἅλως, area) was due to Tissot, and provides a neat and satisfactory word to replace "equal-area", but it has so far been used by English writers merely as an alternative, except when applied to an auxiliary latitude (see 7 below). The corresponding noun to signify correctness of areas could be *authalicity*. Lenox-Conyngham (E.S.R., vi, 45, 435) has suggested *orthembadic* (ὀρθός, right; ἐμβάδόν, area) and *orthembadism* which, although etymologically sound, appear superfluous when a satisfactory term already exists.

Projections which are neither conformal nor authalic are not usually given a collective name by English authors, but the present writer considers that one is needed. Tissot called such projections *aphylactic* (α-, not; φὑλακτικός, preserving), and his term has been adopted in the table given here.

Aphylactic projections comprise all those in which the scales in two orthogonal directions at any point are neither equal nor inversely proportional, and they are consequently almost unlimited in variety. Further subdivision of the class is difficult, but, as the majority of the projections included in it are of little value, the matter is not of importance. One group, perhaps, could be distinguished: those in which the sum of the squares of the errors of scale in two specified orthogonal directions is a minimum over the whole area mapped. They are sometimes called projections by *balance of errors*, but are more generally known as *minimum error* projections.

3. *The Graticule Groups*

The horizontal groups in the classification table are based on a consideration of the pattern formed by the meridians and parallels and they may be defined as follows:

Cylindric: Projections in which the meridians are represented by a system of equidistant parallel straight lines, and the parallels by a system of parallel straight lines at right angles to the meridians.

Pseudocylindric: Projections in which the parallels are represented by a system of parallel straight lines, and the meridians by concurrent curves.

Conic: Projections in which the meridians are represented by a system of equally inclined concurrent straight lines, and the parallels by concentric circular arcs, the angle between any two meridians being less than their true difference of longitude.

Pseudoconic: Projections in which the parallels are represented by concentric circular arcs, and the meridians by concurrent curves.

Polyconic: Projections in which the parallels are represented by a system of non-concentric circular arcs with their centres lying on the straight line representing the central meridian.

Azimuthal: Projections in which the meridians are represented by a system of concurrent straight lines inclined to each other at their true difference of longitude, and the parallels by a system of concentric circles with their common center at the point of concurrency of the meridians.

These definitions strictly apply to the normal or direct aspect, but may be extended to the transverse and oblique aspects by changing the wording to "Projections in which, in the direct aspect . . ." The definitions could also be made to cover all aspects, though somewhat awkwardly, by replacing "meridians" and "parallels" by "great circles through a chosen point" and "small circles having that point as a pole", respectively.

Nothing is new in this classification except the term *pseudoconic*, which, so far as the writer is aware, has not previously been applied in this connexion. It is derived from the analogy of *pseudocylindric*, since the pseudoconic projections bear much the same relation to the true conic projections as the pseudocylindric do to the cylindric. Pseudoconic projections are at present known as *modified conic* projections.

At first the writer thought it possible to separate as *polyconic* those projections in which the radii of the parallels are derived by regarding each one as the standard parallel of a simple conic, and as *pseudopolyconic* those in which the radii of the parallels are not so derived. However, the mathematics of these projections are very similar, and no real advantage would be gained by the separation. The term "polyconic" was applied to the first group by Hunt (Appendix 39, Report for 1853, U.S. Coast and Geodetic Survey), and was extended to cover the remainder by Tissot.

A note might perhaps be added on the use of "cylindric" rather than "cylindrical". The shorter form was used by Craig ("A Treatise on Projections", 1882), and is in harmony with "polyconic", which has well-nigh displaced "polyconical", and "conic", which seems to be winning the day over "conical".

The projections here described as *azimuthal* are more often known as *zenithal*. The relative merits of the two terms have often been discussed, but the issue is really clear: "zenithal" is correct applied to a map of the celestial sphere, but it is inappropriate applied to a terrestrial map; while "azimuthal" describes with equal justification both terrestrial and celestial maps, and implies an important property of these projections, the correct representation of azimuths from the central point. Hinks ("Map Projections", 1912) states clearly that "it is unfortunate that *zenithal*, which has no very clear meaning, should replace *azimuthal*, whose meaning is precise", but he continues to use the term to which he objects. "Azimuthal" has, however, been used more frequently since that date, particularly in the United States, and its use should be encouraged. The *perspective* projections are those azimuthal projections which can be derived by a geometrical projection of the sphere on to a tangent or secant plane by means of rays drawn from a fixed point.

No reference has been made in the above definitions to cylinders, cones or planes. The projections are termed cylindric or conic because they can be regarded as developed on a cylinder or a cone, as the case may be, but it is as well to dispense with picturing cylinders and cones, since they have given rise to much misunderstanding. Particularly is this so with regard to the conic projections with two standard parallels: they may be regarded as developed on cones, but they are cones which bear no simple relationship to the sphere. In reality, cylinders and cones provide us with convenient descriptive terms, but little else.

The major divisions, *conical* and *non-conical*, in the above table have, however, been derived from considerations of cones. A cone with the apex removed to infinity becomes a cylinder, while a cone with the apex depressed to the plane of the base becomes a plane, so that cylinder and plane are limiting cases of the cone. Hence, cylindric and azimuthal projections are limiting cases of the conics, or, put in another way, cylindric projections are conic projections in which the central parallel is the equator and Azimuthals are conic projections in which the standard parallel is the pole. Thus, cylindric, conic and azimuthal projections can be classified as conical *sensu lato* (to borrow the biologist's convenient term). As stated by Hinks (Glazebrook's "Dictionary of Applied Physics", *vol.* iii, 1923), there has been no general agreement as to whether a term such as "conic" should include or exclude the modified forms, the "pseudoconic" and "polyconic". In the classification recommended here, "conic" is reserved for the conic projections *sensu* *stricto*, but these and the modified forms are all included under the general heading of *conical* as opposed to *non-conical*.

The graticule groups, as previously mentioned, are not mutually exclusive. The orthographic projection, for example, appears as a cylindric and also as a perspective azimuthal; the stereographic as a polyconic and as an azimuthal; The sinusoidal as a pseudocylindric and as a pseudoconic. Actually, the sinusoidal does not quite fit the definition given for pseudoconic projections, but it is included there for convenience as one limiting case of the Bonne. Many more examples of overlapping could be found if the inquiry is pushed to extremes; the Mercator projection, for instance, can be derived as a limiting case of the Lagrange, although it is not a polyconic in the accepted sense.

The projections listed as non-conical are a heterogeneous assemblage. It is possible to separate the *retroazimuthal*, those in which azumuths to the central point are correctly represented, and the o*rthoapsidal*, a new class described recently by Raisz (*Geographical Review*, 1943). The latter offer almost unbounded possibilities and it would be unwise to attempt any further refinements of classification at this stage. The writer has been unable to do anything satisfactory with the further subdivision of the projections described as *miscellaneous*.

4. *Descriptive Terms*

Even as "Frenchmen", "red-haired persons" and "cannibals" are convenient as descriptive terms, although they are unsuitable for anthropological classification, so there are many useful terms other than those already given which can be applied to projections. There are, for instance, "right-angled" and "oblique-angled", "geometric", and "non-geometric", "general purpose" and "special purpose", and many others. Tissot proposed a wealth of terms descriptive of particular features of projections, and all of them have their uses. Since they are not used as a basis of classification, however, they need not concern us here.

Frequently projections are described as being "arbitrary" or "conventional", by which is meant that they are constructed by arbitrary methods for convenience of drawing and not for any special properties they may possess. The definition is a loose one. The terms are not coextensive with "aphylactic", which is capable of precise definition, even though it is a negative one, and it appears to be more or less a matter of personal opinion which projections are arbitrary or conventional and which are not. They are terms which could well be done without.

5. *Aspects of Projections*

The writer has felt the want of a term to describe the direct, transverse and oblique forms in which every projection may be used. The overworked word "case" hardly answers the requirements, and the term *aspect* is here suggested. In the case of the general conical projections, the *direct aspect* is that in which the axis of the cylinder, cone or plane coincides with the polar axis of the sphere; the *transverse aspect* that in which the axis of the cylinder, cone or plane lies in the plane of the equator; and the *oblique aspect* that in which the axis has any other position. It is difficult to extend the definitions to cover the non-conical projections, but a simple convenient test is that the direct aspect is always the simplest mathematically.

A rather curious position arises in the case of some of those projections which fall into more than one of the graticule groups given above. When the stereographic, for example, is considered as an azimuthal projection, the direct aspect is that in which the point of tangency is the pole, and the transverse aspect that in which the point of tangency is at the equator; but when the projection is considered as a polyconic, the direct aspect is that in which the point of tangency is at the equator, and the transverse aspect that in which the point of tangency is the pole. Similar remarks apply to the orthographic. The difficulty could be overcome if it were agreed that the terms, direct and transverse, applied to these projections should refer to them as perspectives, as they are more generally regarded. This would make them conform to the test that the direct aspect is the simplest mathematically.

The aspects of the azimuthal projections have received other names, but unfortunately confusion has arisen in regard to their use. According to whether the origin of the projection is a pole, a point on the equator or some other point, they have been called *polar*, *equatorial*, and *oblique*; while according to whether the plane of projection is (or is parallel to) the equator, a meridian or the horizon of some point, they have been called *equatorial*, *meridian*, and *horizon*. Thus "equatorial" is used in two conflicting senses. Since the terms direct, transverse and oblique can be applied to these projections as to all others, it would seem advisable to abandon the use of terms about which there is no general agreement.

The oblique aspect is the general case of every projection, and the direct and transverse aspects are limiting cases of the oblique aspect. Many text-books of projections go to the length of investigating each aspect independently, but labour and space can often be saved by investigating the oblique aspect completely, and deriving the direct and transverse aspects by making simple substitutions in the formulæ for the oblique aspect. This method is particularly useful in the case of the perspective projections of the sphere, but is not perhaps so readily applicable in other instances. The problem is, of course, not so simple in the case of a spheroid.

6. *Nomenclature of Projections*

The ideal nomenclature is a binomial system indicating in which of the representation and graticule groups a particular projection falls. In this way there are derived the names conformal cylindric, conformal conic, authalic cylindric, authalic conic, and so on. Unfortunately, relatively few projections can be designated in this manner, for quite often such a description could apply to a series of projections. In some cases the addition of a third descriptive term or phrase will satisfy the requirements, as conformal conic with one standard parallel, conformal conic with two standard parallels.

The aphylactic projections present a problem of their own, for the term "aphylactic" is in itself too vague to be used as part of the name of a particular projection. These projections seem to have been named according to the whims of individual writers, and we find the descriptions *simple cylindrical*, *equidistant cylindrical*, *square projection* and *plate carrée* all applied to the one projection. Of these, "equidistant" seems perhaps the least unsatisfactory term. This projection is unusual in that it is known by a distinctive name, the *Cassini*, in its transverse aspect. The description *projection by rectangular co-ordinates*, which is also applied to it, is possibly the most ambiguous of all.

Certain projections have acquired particular names, and when the use of such names is well established and unambiguous, they should be adhered to. The principal perspective projections, stereographic, orthographic and gnomonic, are the most familiar examples of this case. Some such names, however, are ambiguous, and, in the absence of agreement as to their use, it is better to abandon them altogether. For example, the name *globular*, which in any case is meaningless when applied to a plane representation, has been used of three different projections, those of Fournier (1645), Nicolosi (1660) and La Hire (1701), and has also been used to mean any projection of the entire sphere. The name *orthodromic*, applied by Maurer (*Zeitschrift für Vermessungwesen*, 1922) to his two-point azimuthal projection, could with equal justification be applied to the gnomonic which is a particular case of it. Boggs (*Geographical Journal*, 1929) described a projection which he called *eumorphic*, but this term has since been used as a generic term for authalic projections which do not unduly distort shapes. Its use in this latter connexion cannot be governed by a rigid definition, but must be a matter of personal opinion, so that it is at once open to objection. Even the names of the well-known perspective projections have been loosely applied in other connexions, as, for example, the *equal-area stereographic* projection of Prépétit-Foucault and the *cylindrical stereographic* of Gall. Many more instances of ambiguity could be given, but the foregoing examples are sufficient to show that particular names should be used with reserve.

The majority of projections are named after their inventors, and this seems in general to be the most satisfactory method of designating them. It is recommended that the possessive termination be dropped, for, particularly when reference is made to a transverse or oblique aspect, this gives a neater and more logical description. Two difficulties arise with this method of nomenclature: several projections are sometimes due to the one man, and several rival claimants are sometimes found for the one projection.

In the first case, some writers adopt a numerical distinction between the various projections, and speak of *Murdoch's third* or the *Murdoch III* projection, *Lambert's fifth* or the *Lambert V*, and so on. The risk of ambiguity is still present, and names like these should be avoided if the difficulty can be overcome in another way. The four projections of Lambert (two of his "six" are transverse aspects of other projections) can all be designated by descriptive names, but his "second" projection, the conformal conic with two standard parallels, is now often known as the Lambert projection.

Where several personal names have become attached to the one projection, the biologist's "rule of priority" is logically the best test to apply -- that is, the projection should be known by the name of the man to whom it was originally due. Several examples can be given. The name of Gauss is associated with two projections which he investigated in 1825 and 1846, but both of which were first described by Lambert in 1772. One, the conformal conic with two standard parallels, is now often known simply as the *Lambert* projection; the other, sometimes called the Gauss conformal, is better known as the *transverse Mercator*. The projection sometimes called Lorgna's (1789) was also due to Lambert (1772), but the descriptive name, authalic azimuthal, is in this case better than a personal name. The equidistant azimuthal is sometimes called by the name of Postel (1581) and sometimes by that of Cagnoli (1799), but was used by Glareanus as early as 1510; in this case also the use of the descriptive name avoids the conflicting claims. The projection of Nicolosi (1660), previously referred to as one of those to which the term "globular" is applied, is sometimes credited to Arrowsmith (1793). The projection often known as the Sanson-Flamsteed appears to have been due to Mercator, and was used in the Mercator-Hondius atlases in 1606; it was used by Sanson in 1650 and by Flamsteed in 1729. Deetz and Adams ("Elements of Map projection") suggest the name *Mercator equal-area*. The projection is one of a series of authalic pseudocylindric projections, and descriptive names indicating the nature of the meridians may be given to them. In this case the meridians are sine curves, so that the name *sinusoidal*, used by d'Avezac (*Bulletin de la Société de Géographie*, 1863), appears the most suitable. Another projection of this series, that in which the meridians are ellipses, was described by Mollweide in 1805, and is correctly known by his name. It was used by Babinet in 1857, and is sometimes encountered under the name *Babinet's homolographic*.

Rigid application of the rule of priority, however, would sometimes have the effect of displacing a well-established name. For example, the projection known as the Bonne appears to have been first used by Le Testu in 1566, and was anticipated in a cruder form by Ptolemy as early as 150. Bonne did not use it till 1572, but, as it is universally known by his name, there would be no point in altering it. It is only when more than one name is in use for the one projection that the writer recommends the selection of one name and the suppression of the others.

7. *Auxiliary Latitudes*

The complexity of the mathematical formulæ for projections of the spheroid can be avoided to some extent by mapping the spheroid upon some sphere, thus giving rise to three kinds of auxiliary latitudes. As usually known, there are the *isometric* or *conformal* latitude, resulting from the mapping of the spheroid conformally upon a sphere, the *authalic* or *equal-area* latitude, resulting from the mapping of the spheroid authalically upon a sphere, and the *rectifying* latitude, which results from mapping the spheroid upon a sphere so that the lengths of the meridians remain unaltered. Here, again, alternative terms are in use, and it would be an advantage to associate conformal latitude with conformal projection and authalic latitude with authalic projection, and to dispense with the alternatives. Etymologically, "isometric" would have been more appropriately applied to the rectifying latitude. It is regrettable that the terms "orthomorphic", "autogonal" or Mercatorial" latitude (and the "latitude croissante" of the French) should have been applied to the ordinate of the Mercator projection, which, being a projection co-ordinate and not a latitude in any sense, has no right to any of the names. In addition, there is the danger of confusion with the isometric or conformal latitude described above.

8. *Notation*

That a uniform notation for the quantities occurring in the mathematical development of map projections (as, indeed, in any mathematical science) would be an advantage is felt by anyone who studies the subject from several works in which the notations differ. The useful little book of Melluish ("Mathematics of Map Projections", 1931), for example, suffers from an unusual notation, and the use of no less than seven different symbols for colatitude, while the comprehensive treatise of Driencourt and Laborde ("Traité des Projections des Cartes Géographiques", 1932) employs a notation unfamiliar to English readers.

A uniform notation provides an international language of mathematics, and a scheme has already been proposed by the International Association of Geodesy (*Bulletin Géodésique*, 1939), but, as it has apparently not yet been finally approved, a few remarks may not be out of place. The symbols suggested for the axes, compression and eccentricity of the spheroid are those almost universally used at present, but the symbols M and N are suggested to replace our familiar ρ and ν for the radii of curvature. The argument advanced, that these are the initials of "meridian" and "normal" in all the widespread languages, is a cogent one, but the adoption of the new symbols would necessitate an alteration by those using the R.G.S. symbols, M, N, etc., for the geodetic factors. The symbols suggested for these latter, [I], [2], are at once open to criticism on the grounds that the use of numerals to represent quantities in mathematical formulæ is inviting confusion. The use of ϕ for latitude and λ for longitude, as in the suggested notation, is in accord with the majority of British and American text-books. Particular values should be indicated by subscripts, and not by the use of entirely different symbols. No symbol is suggested for colatitude, nor for the authalic and rectifying latitudes, and the list could well be amended to include these. Rectangular co-ordinates are to be represented by x and y, but no indication is given as to which is which, and this point could be clarified. The majority of the text-books which the writer has compared follow the usual mathematical practice of denoting the meridinal co-ordinate or northing by y, but many have adopted the older Ordinance Survey use of x. Sometimes the two systems are found even in the one book.

9. *Spheroid or Ellipsoid?*

A note may also be added on the use of these two terms as applied to the practical figure of the earth. The general mathematical usage appears to be that a *spheroid* is the figure generated by the revolution of an ellipse about one of its axes, the meridian section being an ellipse and the equatorial section a circle, while an *ellipsoid* is a figure in which both meridian and equatorial sections are ellipses, and may be conceived as generated by the parallel motion of a variable ellipse. The use of "ellipsoid" for the figure here defined as "spheroid" is logical in that it is in line with "paraboloid" and "hyperboloid", but it leaves us without a term to describe the figure here defined as "ellipsoid". Both figures are used in theoretical geodesy, although only the first is employed for practical computation, and a term for each is required. Prior to the recommending of the international figure in 1924, the term "spheroid" was almost exclusively used by British and American writers, but since then "spheroid" and "ellipsoid" have been used indiscriminately, so that a good deal of confusion has arisen. It is interesting to note that in several instances where matter in the *Bulletin Géodésique* has been published in both French and English, the term "ellipsoïde" in the French version has been rendered as "spheroid" in the English text. The writer's opinion is that "spheroid" should be retained, and in that he is following no less an authority than Archimedes.

10. *Conclusion*

The foregoing observations reveal that the terminology of map projections is in a state of confusion that would not be tolerated in any other modern science, and a systematization is long overdue. It is not contended that the recommendations are the best, but they should at least be regarded as suggestions for consideration. The writer is more concerned with drawing attention to an unsatisfactory state of affairs in the hope that others more competent than he may rectify it than with attempting to impose his views on others.

As a final question, which the writer leaves unanswered, is there a better term than *projection*, which has long outgrown its geometrical meaning? Several writers compare "projection" and "graticule", but the choice does not lie between these since they are not synonymous, and "graticule" has a distinct usage of its own. In view of the rate at which new technical terms are springing up in every other branch of science, does it reflect on the lack of inventiveness of geodesists and cartographers that they have not yet suggested a word to replace "projection"?