Ensembles and their modules as objects of cartosemiotic inquiry

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The structured set of signs in a map face − here called map-face aggregate or MFA − and the associated marginal notes make up an ensemble of modules or components (modular ensemble). Such ensembles are recognized where groups of entries are intuitively viewed as complex units, which includes the case that entries are consulted jointly and thus are involved in the same process of sign reception. Modular ensembles are amenable to semiotic study, just as are written or pictorial stories. Four kinds (one of them mentioned above) are discussed in detail, two involving single MFAs, the other two being assemblages of maps, such as atlases. In terms of their internal structure, two types are recognized: the combinate (or grouping), in which modules are directly linked by combinatorial relations (example above), and the cumulate (or collection (of documents)), in which modules are indirectly related through some conceptual commonality (example: series of geological maps). The discussion then turns to basic points concerning modular ensembles (identification of a module, internal organization of an ensemble, and characteristics which establish an ensemble as a unit) and further to a few general semiotic concepts as they relate to the present research. Since this paper originated as a reaction to several of A. Wolodtschenko's recent publications, it concludes with comments on some of his arguments which pertain to modular ensembles.

Keywords: module, modular ensemble, marginal note, adjunct, map, atlas

1. Problem, programme, and terminology

The central part of a map is the structured set of signs which are assembled within the map face. In this study, such a set is usually called a map-face aggregate or MFA; also, where no confusion is likely, we shall sometimes simply speak of a map (in a narrow sense of this term). An MFA combines with other entries, some of which, especially the legend, contribute part of the meanings conveyed within the map face. Items so combined are often consulted together and thus are involved in the same general process of sign reception. These combinations invite semiotic study, just as do the combinations of a picture and its caption or of several panels in a comic. Some examples follow (they will be referred to repeatedly):

1. A map-face aggregate is accompanied by a title, legend, and credit note, further by projection and scale statements.

2. The MFA of a highway map is complemented by a road-distance matrix.

3. Close to the MFA of a 16th-century map is placed an elaborate cartouche that contains a ruler's coat of arms.

4. The following items are presented together: a section of a large-scale topographic map with the map's title and, in addition, a textual comment.[1]

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[1] On the following pages, "text" and the derived "textual" refer to stretches of written (printed) language. In section 4.2.2, on the other hand, "text" refers to a complex of signs which is a coherent whole. In any case, the meaning will be clear from the context.

Each unit (map-face aggregate, credit note, etc.) is a document. The non-map entries in example 1 are marginal notes which accompany MFAs, and those in examples 2 and 3 are what will below be discussed as adjuncts. The documents mentioned in each of the above examples belong to ensembles within which they function as modules or components, therefore we also speak of modular ensembles. The constituent entries mentioned so far are the elementary units which can be set up in an analysis of modular ensembles. In example 4, a complex comprising an MFA and marginal notes is, in turn, treated like an individual document and enters as a module into a higher-order ensemble. In other words, a module may be elementary or complex. Finally, the constitutive characteristic of such ensembles lies in their internal organization: they consist of units which are unlike and are (directly) linked by combinatorial relations. For convenience we call them combinates or groupings.

A second and quite different kind of artifact is what – for want of a better term – will be called an assemblage of documents, or an assemblage for short:

5. A set of reference maps, each consisting of an MFA and corresponding marginal notes, are brought together in a world atlas.

6. Several combinations or groups of the kind mentioned in example 4 are joined in a regional collection of studies (Fehn et al., 1968).

By "assemblage of documents" we mean in the present context a set of maps and – where applicable – other documents which, under certain conditions, can be considered a modular ensemble (see s. 3). In terms of their internal organization, such ensembles either are combinates (example 6), or their modules are alike and (indirectly) related through a shared conceptual component or commonality (example 5). In the latter case, the constitutive process is one of cumulating, thus we speak of cumulates or collections of documents (or collections for short). Combined modules are frequently consulted jointly, while cumulated ones are often not treated this way.

The expression "module" comes from Wolodtschenko (2003; 2007) but has here been given a different sense.[2] In the present article, modules are visible documents that are linked by relations and thus are intuitively taken to belong together. For Wolodtschenko, in contrast, a module is apparently a subset of material found in a map or atlas, defined by one of various criteria.

As will have become clear, this study is not about map language (also called map symbolism), that is, the type of sign systems which are employed in mapping a territory, nor is it about the signs of map language which are instantiated in a given map face. At the level of the modular ensemble, the structured aggregate of these signs is not analyzed but taken for granted as a complex. This does not imply, however, that a marginal note or adjunct should invariably pertain to a map-face aggregate as a whole; it may instead relate to certain signs within it (ss. 2.1 and 2.2[3]). Legends, credit notes, etc., as well as adjuncts of various types are also treated as unanalyzed blocks.

This article is organized as follows. S. 2 deals with ensembles made up of map-face aggregates and additional modules, the latter being marginal notes and adjuncts. In either case, the resulting configuration is a combinate. In s. 3, the notion of modular ensemble is tentatively extended to assemblages of documents. Under this head, both combinates and cumulates are

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[2] A different and equally adequate term has not yet suggested itself, so that currently an ambiguity is inevitable.
[3] Hereafter "s." stands for "section" and "ss." for "sections".

presented. The topics of s. 4 are, first, basics concerning modular ensembles (the identification of modules, the structure of ensembles, and unifying characteristics of the latter) and, second, the semiotic concepts of sign system and text as they relate to the present research. Finally, since this paper originated as a reaction to some of A. Wolodtschenko's recent publications, s. 5 comments on a few of this author's arguments which are relevant to the study of modular ensembles. A summary follows in s. 6.

Finally, some general points must be clarified at the outset.

1. A modular ensemble, especially a collection of documents, may display various presentation forms, such as maps, photographs, cartoons, advertisements, written text, etc. Often, but certainly not always, one component, representing a specific presentation form, carries the core of the intended complex information and is therefore considered thematically dominant, while information conveyed by other components is auxiliary and subordinate. As a consequence, we can say, for example, that a given ensemble is a collection of maps (containing also some written text), or a handbook (a printed text, perhaps complemented by maps and photographs), or a booklet or sheet of advertisements (accompanied by an urban street map). For simplicity, this article concentrates on artifacts which are maps or in which maps can be considered thematically dominant components. In s. 3, we shall return to this point.

2. When dealing with signs and other semiotic phenomena, one may face terminological difficulties. Two clarifications may be helpful. First, wherever there is a sign, there is a conceptual item or sense (content, meaning in a narrow sense) associated with a perceivable item or sign vehicle (expression, form). Some scholars – among them the present author – view a sign as composed of a content and an expression. Others apply the word "sign" to the perceivable item and take the meaning which it conveys to be external to but associated with it; this view will be mentioned again in s. 5. For simplicity, other sign conceptions are left aside. Second, whether a modular ensemble is viewed as a composite sign (also called integral sign or super-sign) or as a complex of signs, at any rate it has a content (meaning) and a visible form which serves as its expression, and both are built up of parts.

3. The structure of an ensemble and also any unifying trait – a trait which defines the ensemble as a unit – are characteristics of its content. Thus, when reference is made to characteristics and structure of an ensemble, it must be understood that actually the ensemble's content is at issue.

4. Within an ensemble, the visible entries (expressions) are presented and arranged in various ways. With many, but by no means all, configurations, the order of the contents is reflected in the sequence and grouping of visual items. Otherwise perceivable entries are arranged in response to visual requirements and technical constraints. The most important point is this: if two items are to be studied at the same time, they should, where possible, be placed so that they can be seen together. Beyond this requirement, practices of placement vary and may or may not be user-friendly. Details will be presented in their proper places.

2. Map-face aggregates and additional modules

2.1. Ensembles of map-face aggregates and marginal notes

In the simplest and clearest case, a modular ensemble is made up of a map-face aggregate and several marginal notes. The former is the core module of a map; the other modules fulfill functions for the core.[4] A marginal note provides a specification for a map-face aggregate; more exactly, some marginal notes relate to the MFA as a whole, while others are linked to specific sets of signs in the map. This function of specifying defines relations which underlie combination patterns and thus are combinatorial relations. There is a standard inventory of marginal notes, but not all of its members need be present in a given map.

In detail, marginal notes serve two functions for an MFA: they explain and provide background information (or contextual information). Thus they may be called explanatory notes and background notes (or contextual notes). The terms in parentheses point to the functional contexts in which signs and sign processes are embedded. Explanatory notes tell us what certain entries in the map face mean; put differently, they introduce a major part of map language. These notes include projection statement, scale statement and legend. Some of them relate to specific sign types, as do the definitions appearing in a legend and the entries on the neatlines which are used in spatial referencing. Others relate to classes of types. These are projection statement, scale statement, and, where applicable, general notes on symbolization, generalization, and spatial resolution (like "by county" in a statistical map). Background notes indicate theme, mapped place, and time and, where applicable, assign to a map a place in a series; they further identify the author and/or sponsor of a map and (perhaps) the intended audience. The major means to these ends are map title and credit note (including source statement). Others are statements on the procurement, processing and characteristics of data; they include the lineages (sheet histories) which are familiar from maps belonging to a series.

The term "marginal notes" comes from their most frequent placement, that is, in the margins of a map. Alternatively, marginal notes and the MFA may appear on pages which face each other or on sheets which can be placed side-by-side.[5] For lack of space, a legend is sometimes presented on the back of a map sheet, but this makes for awkward reading. In general, marginal notes are so important in map use[6] that they tend to be visually close to the corresponding MFA. As for their arrangement on the map paper, they should be assembled in few rather than many panels, and entries belonging to the same module should also be visually grouped together.

2.2. Ensembles of map components and adjuncts

Close to a map-face aggregate we find not only marginal notes but often also documents which expand on the message of the map, such as an index of mapped places (gazetteer), a table of figures, a textual comment, or photographs of specific mapped places. These documents are hereafter called adjuncts. There are various motives for creating them. The most frequent one is this: since information extracted or derived from a map often becomes more instructive if it is complemented by information taken from other sources, map makers supply such additional information, at least in part. Another purpose of adding adjuncts is advertising.

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[4]   One of them, the legend, is a separate device for modelling information; thus it may transcend its auxiliary role and present information which is not derivable from the map face (Schlichtmann, 1997).

[5]   In the 1960s, some large-scale topographic map series of Canada, the United States, and the United Kingdom were accompanied by legends printed on separate sheets.

[6]   An entry is the more "important" the more often it is generally consulted in using the map. In this sense, a legend is generally more important than a credit note.

An adjunct augments or complements an MFA or, less often, a marginal note[7] (see s. 2.2.1, point 4). Also, two entries may complement each other, the first supplying additional information for the second and vice versa (map and textual comment in example 4). The functions of adjuncts, like those of marginal notes, define relations on which the combination of items is based. Finally, adjuncts constitute a large, heterogeneous and ill-delimited category of entries. Consequently, and in contrast to marginal notes, there is no standard inventory from which adjuncts can be selected.

As regards adjuncts, several points are worth discussing. First, how are they recognized? The following remarks should be helpful.

1. As noted above, adjuncts come into view because they often appear on the front or back of the sheet that carries the map-face aggregate.

2. An adjunct adds to the information provided by another entry.

3. Some adjuncts are physically separated from their map, e.g., a booklet of text that comes with a geological map.

4. If an entry placed on the same sheet as an MFA does not complement the latter or a marginal note, it does not qualify as an adjunct. Example: if several town plans are printed on a common sheet, none of them is an adjunct to any of the others.[8]

To summarize, occurrence close to an MFA is a first indication of adjuncthood, but the ultimate criterion lies in the relations between the contents of the modules involved.

Further, what do adjuncts do for the items which they complement? Basic answers are found in table 1. The overview is not intended to be complete, and the boundaries between compartments are not rigid. The classification presented in the table is based on two criteria: the phenomena about which adjuncts provide information and the specific functions which they fulfill in their ensembles (in the first place functions for map-face aggregates, as noted in table 1). These issues will be considered in ss. 2.2.1 and 2.2.2.

Table 1: Frequently observed adjuncts: their information and functions

Information about			*Function of an adjunct for a map-face aggregate*
Specific place(s)	**Class of places**	**Territory as a whole**	
Inset map of an urban agglomeration			*Clarification*
Inset maps of towns Cross-section Photographs of sites	Inventory (list) Road-distance matrix	Statistical table or diagram Commentary providing background information Advertisements by local firms	*Provision of complementing information*
Comment designed to direct the map user's attention			*Elucidation*
Interpretative comment			*Interpretation*
Comment using a map as a source of examples			*Demonstration*

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[7]   Therefore the phrase "map components" in the heading of this section.
[8]   These plans make up a collection of documents (see s. 3.2).

Finally a note on the arrangement of the visible entries. It is desirable that an adjunct and the document it complements are placed so that they can be studied together. But this may not be possible, owing to space constraints. Thus, in single-sheet representations like road maps, adjuncts often appear not only on the front but also on the back of a sheet, and sometimes they are not even placed on the same physical support. Even where space suffices, an adjunct does not always appear close to the corresponding map: the relevant practices are less strict than those applying to marginal notes.

2.2.1. Adjuncts: their information

As regards its content, an adjunct may or may not relate to the mapped territory. If it does so, it may inform about one or more specific places, about a class of places, or about the territory as a whole (as holds for marginal notes, too). These three cases are noted in the table, and a fourth one will be introduced later. Details follow.

1. Some adjuncts inform about specific mapped places: inset maps; a cross-section to go with a geological map; photographs of interesting sites placed in the margins of an excursion map, which, in turn, are accompanied by comments (Geological Highway Map Committee, 2002).

2. Other adjuncts relate to classes of places. Normally they are inventories: an index of towns complementing a road map; a matrix of road distances; lists of coal mines and coal consumers (such as thermo-electric plants) accompanying a map about coal resources (Falconer (ed.), 1985, sheet 27.1).

3. Adjuncts of a further kind pertain to the territory as a whole: statistical data, presented in a table or a diagram; a text which provides background information, e.g., on the sheets of the *Canada Land Inventory* (Agriculture Canada, 1963ff.); advertisements of business firms located in the mapped area, usually that of a city. Textual entries may, of course, also relate to specific places or classes of places.

4. The fourth category does not appear in table 1. Its members are entries which are not, or at best obliquely, linked to the mapped places. Instead, they may relate, often in a vague way, to the producer or the intended audience of a map, which may be indicated by marginal notes. In modern times, such items often are advertisements by a map sponsor – like a bank or a hotel chain – which may or may not have a specific connection to the mapped territory;[9] others are photographs and slogans accompanying official road maps, designed to attract fishermen and tourists (Bockenhauer, 1994) or to promote an oil company (Schmiedeler & Perucca, 1996). Sometimes it is debatable whether such items are adjuncts of maps or rather unrelated entries. In older maps we find images or – more often – emblems of representative personages, such as the coat of arms of a king or a member of the local nobility (Helgerson, 1986, p. 59); engravings of rulers or allegorical characters associated with a title cartouche (Harley, 1988, p. 298); or drawings of persons in local costumes, familiar from city representations produced around 1600 (Braun & Hogenberg, 1965).

Further, it is not always immediately clear whether or not a particular entry is an adjunct. Consider the following cases. First, because of their space requirements, climate diagrams, if used as map symbols, are not easy to accommodate within a map face and may have to be placed beside it. This has been done in the *Atlas of British Columbia* (Farley, 1979, p. 44),

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9   A curiosity under the present head: this author once saw a wall map of North America in which the "empty" area of Greenland accommodated an advertisement for a brand of chocolate.

but here the diagrams are linked, by connecting lines, to the corresponding place symbols. In this case, they are more simply and convincingly evaluated as map symbols rather than adjuncts. Second, inset maps are not always adjuncts. An inset that helps to locate a topographic sheet can be considered an extension of the title, and a lineage statement in the form of an inset map is part of the credit note. Third, adjuncts may also be incorporated into a legend. For example, a subdivided column may show the ethnic composition of the population in the mapped territory, and the sections of this diagram may do double duty as specimen symbols in the legend (Fung (ed.), 1999, p. 112, right). Comparable is the "column legend" found in geological maps: it is modelled after a drilling core, and the height of each subdivision corresponds to the normal thickness of the corresponding stratum; in addition, a subdivision may protrude beyond, or recede from, the vertical boundary line of the column in accordance with the resistance of the rock material to weathering (Hofbauer, 1998, pp. 57, 60). Finally, let a list of coal mines be printed beside a map of coal resources, and let each mine be identified by a number in both the map and the list (Falconer (ed.), 1985, sheet 27.1). In all these cases, an adjunct functions as part of a legend. Thus, it is appropriate to recognize hybrids of marginal notes and adjuncts. In fact, some legend functions arise from this hybridization (Schlichtmann, 1997).

2.2.2. Adjuncts: their functions for map-face aggregates

As for functional relations between maps, photographs, written texts, etc. (see also Wolodtschenko, 2007, p. 14), especially those which hold between written material and images have received attention (Nöth, 1995, pp. 453f.). In the present context, the relations between adjuncts and map-face aggregates are of interest; they are noted in the rightmost column of table 1. Cases which do not pertain to an MFA (point 4 in the preceding section) will be left aside. Five major functions are identified, although a more detailed classification is conceivable. Some observations may be subsumable under more than one head.

Here are the five functions:

1. Clarification of the map image. For example, an inset map at a larger scale clarifies an inevitably cluttered part of the main map.

2. Provision of complementing information (which is the basic function of adjuncts). The information supplied by an adjunct goes beyond that which is accessible in the map. Often the process of adding information works both ways: two documents complement each other by virtue of their different semiotic potentials. For example, a map permits to show the spatial distribution of mines, while a list enables us to present them in an order that makes them easy to look up or memorize. Inset maps of towns accompanying a highway map present traffic information which cannot be accommodated in the main map and thus combine the functions of clarifying and of providing complementing information. Usually information supplied by the adjunct is more or less closely linked to the MFA, but sometimes the connection is quite tenuous, as is the case with advertisements of local business firms.[10]

3. Elucidation. This is the function of a comment which points out important issues in order to direct the map user's attention. It is encountered in certain popular atlases (e.g., Kidron & Segal, 1991).

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[10] Some city maps are specifically made for tourists. In such a product, adjuncts – mostly business advertisements and texts about sites and attractions – may become so numerous and take up so much of the available space that the complete document might be alternatively viewed as a collection of texts with a map "tacked on" for general orientation.

4. Interpretation. The author of a text starts by studying the corresponding map image, extracts and/or derives information from it, and places the information on the background of previously acquired knowledge (e.g., Institut für Landeskunde (ed.), 1969[11]). It is assumed that he is aware of the capabilities and limitations of map interpretation.

5. Demonstration. Let the author of a text write about the reclamation and cultivation of boglands and, in order to demonstrate certain points, refer to entries in an accompanying map (as in Knowles & Stowe, 1971, pp. 142-147). In contrast to the preceding case, the author already has the relevant knowledge and uses the map image as an illustration. In practice, to be sure, interpretation and demonstration are often intertwined.

3. Assemblages of documents as ensembles

We know from experience that assemblages of documents – like systematic textbooks, anthologies, and atlases – are often intuitively taken as units, especially if they have a common title. It is tempting to extend the notion of modular ensemble to such assemblages or at least to some kinds of them. In what cases can such an extension be justified? The following paragraphs should make matters clearer.

1. Some assemblages consist of components that stand in combinatorial relations. Examples are a world atlas which consists of modules -- title and credit note, table of contents, general legend, maps, and gazetteer – and an annual report of a business firm with components as listed by Gluck (1998, pp. 10f.). The resulting configuration is a combinate (grouping). It is comparable to an ensemble made up of a map-face aggregate and marginal notes.

2. A road atlas for motorists and an edited book on cartosemiotic research in various areas of the world (Schlichtmann (ed.), 1999) exemplify a second case. The components are thematically alike and are related by virtue of a common notion which they share. The resulting configuration is a collection of documents or a cumulate.

3. Both principles may be encountered in the same document. For example, a world atlas with several modules (see point 1 above) is a combinate, and the maps, in turn, make up a cumulate. In example 6 (s. 1), a map with its title and, further, a textual comment make up a combinate, and various ensembles of this kind constitute a cumulate with an underlying common notion.

4. Some sets of documents do not fit either description, e.g., a sequence of articles in a newspaper or a journal issue (unless they fall under a common theme). That is, their members are linked neither by combinatorial relations nor by commonality. These sets do not constitute ensembles and thus are not of interest here.

5. As noted earlier (s. 1, end), an assemblage may contain documents of various presentation forms. Often one of these is thematically dominant, while others explain or complement it and are subordinate. The present article concentrates on assemblages the dominant components of which are maps.[12] This includes the situation in which the place of the dominant module is occupied, as the case may be, by maps or other space-modelling devices, such as satellite images and photographs (as in Dresch (ed.), 1985).

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[11]   Here the interpretative texts are published separately from the corresponding map sheets.

[12]   For comparison: maps and related representations appearing in corporate reports (Gluck, 1998) are subordinate items; therefore they are not of interest here.

6. Sometimes, however, a neat division into dominant and subordinate components is not possible or realistic. This applies to certain modern thematic atlases (e.g., Juvik et al. (eds.), 1998), which are of a hybrid nature: maps and texts complement each other to such an extent that it can be debated whether an assemblage is a collection of maps with comments added on or a regional handbook with maps inserted in texts.[13] Such artifacts permit alternative analyses: as commented collections of maps or as illustrated handbooks.

To summarize, a set of documents can be taken as an ensemble only if the said documents are linked either by combinatorial relations or by commonality traits (i.e., if they are combinates or cumulates). The two cases will be treated in detail in ss. 3.1 and 3.2. Finally, we shall concentrate on assemblages in which maps are thematically dominant.

3.1. Combinates

A world atlas comprising different sets of documents – title, maps, index of mapped places, etc. –, where the latter stand in combinatorial relations, is an example of a combinate, similar to the grouping of an MFA with marginal notes or that of a map component with an adjunct. Detailed information about configurations of this type may be gleaned from semiotic studies of atlases (e.g., Wolodtschenko, 2007). At this place we only mention a few frequently observed components, some of which belong to standard inventories, while others do not. The set of maps constitutes the core component, while other modules fulfill functions for the core. Title and credit note of an atlas correspond to marginal notes in a map, and so do a table of contents and, where available, a general legend. A table of contents becomes necessary because several documents are assembled, and a general legend replaces, at least in part, the legends of individual maps. A gazetteer and a textual introduction to maps are adjuncts. Non-map entries may relate to the assemblage of maps as a whole (title) or to each of the maps (gazetteer).

3.2. Cumulates

To recapitulate, a cumulate or collection of documents consists of members which are alike and related by a common notion or commonality, the latter being derivable from their complex meanings. The commonality may be based on their theme(s), their regional coverage, or both. Maps and other documents in a collection often, but not always, show uniform design characteristics. In addition to the commonality, the compiler employs a criterion according to which documents are selected to become members of an intended cumulate (see below). The common notion must be accessible to the map users. Normally it is spelled out in the title of a collection. Issues of selection may or may not be made explicit in a preface.

A collection of documents usually appears in bound or loose-leaf form; sometimes it is accommodated on a single sheet. As for the physical arrangement of its members, several observations are pertinent. First, where the mapped places have been assigned a thematic or regional order – as is normal in atlases –, the maps themselves are presented in the same order. This includes the case of a sub-collection within a more comprehensive cumulate – familiar from thematic atlases –, where the former takes up one or more pages or sheets (like the series on temperature in Falconer (ed.), 1985, sheets 4.6-4.7).

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[13] For a comparable case among combinates involving adjuncts, see note 10.

Second, where a collection of maps (and perhaps other presentation forms) is limited to a single sheet, it may make up what is sometimes called a one-sheet atlas, or its members constitute a sub-collection held together by a thematic commonality, or a number of maps are placed together merely in order to save paper, as in the familiar assemblages of town plans which inform about several places located in the same general area (e.g., MapArt Corporation, 1995). Artifacts of the latter kind, in turn, tend to belong to series, i.e., larger collections. Finally, if maps in a cumulate are to be compared, they are more likely to be placed side-by-side (sometimes even printed on transparent overlay sheets) than if they are to be read separately.

In the following discussion, we start by listing major kinds of cumulates with maps as dominant members and then comment on commonality and selection.

3.2.1. Major kinds of collections

In geography, three major kinds of collections are normally encountered: atlas, map series, and set of case studies. They are dealt with in turn.

1. An atlas in the strict sense is "a systematic, deliberate, ordered combination of maps" (Ormeling, 1994, p. 226 after Wolodtschenko, 2007, p. 7, transl. H.S.) which constitutes a whole by virtue of some integrating conceptual trait and tends to be complete (Stams, 1983, p. 24). In terms of the modes of discourse distinguished in rhetoric, an atlas can be likened to a description and/or an argument; in the case of a historical map collection a narrative orientation is present as well.

Atlases can be classified from several points of view and exhibit different degrees of thematic complexity and regional coverage. Some frequent types may be noted. In a world atlas with small-scale topographic maps (reference maps), all regions of the world are to be dealt with, although they are not necessarily covered at a uniform level of detail. The collection Nouvel atlas des formes du relief (Dresch (ed.), 1985) is a thematic atlas which, in principle, has no regional limitation of coverage. Those types of landforms are dealt with which commonly are of interest to geomorphologists, and examples come from many parts of the world. National and regional atlases, finally, are thematic in orientation and, in their spatial coverage, limited to specific parts of the earth's surface.

2. Within a region, sections or compartments are identified – these may, but need not, constitute a closed set of tiles –, and each of them is the subject of a separate map. Examples: a topographic map series of a country; a geological map series of a country; a set of street maps covering parts of a city and assembled in an atlas for motorists. Maps belonging to such a set normally are at the same scale.

3. A set of case studies exemplifies the third kind. Here, parts of a region are selected for mapping at the same or different scales. Often such a work is designed to inform about the geography of a region. If all relevant themes or sections of land are represented, the collection is a systematic one, a trait which it shares with an atlas. Not surprisingly, such assemblages, if they are composed of large-scale topographic maps, have been called topographic atlases (e.g., Fehn et al., 1968).

3.2.2. Commonality

The members of a collection (of maps, of written texts, etc.) are held together by a common notion. This process is not fully understood. Apparently it is based on global connotations, i.e., meanings mediated by more basic meanings.[14] They are released by entries or groups of entries in the constituent documents. Further, they may come from a generally shared semantic patrimony (for example, document users know that the mapped places, or at least a large part of them, are located in British Columbia), but more often they belong to the conceptual universe of a professional group (e.g., readers recognize that all the assembled maps show landforms resulting from glaciation). In addition, the collection usually is given a title, which makes the common notion explicit.

3.2.3. Selection

Documents which satisfy a commonality criterion (e.g., maps informing about the geography of British Columbia) are assessed for possible inclusion in the intended collection. This is a process of selection. Two basic selection modes have been observed, corresponding to the purposes the collections are to serve. In the first, all or most of the relevant places or topics are covered. Every case mentioned in s. 3.2.1 exemplifies this selection mode. The compiler aims at providing a systematic and reasonably comprehensive treatment of the general topic or region which is of interest. In the second case, a limited part of relevant places and themes are dealt with. This applies to open-ended collections of case studies, like those designed to aid in teaching map use (e.g., Raitz & Hart, 1975; Upton, 1970). Here, the compiler's aim is to provide a sufficiently large set of pedagogically useful examples. Another motive for creating open-ended ensembles was mentioned above (s. 3.2) with reference to town plans assembled on a common sheet, namely, to use the available space economically.

Not only the compiler but also the user of a collection has, or develops, a basic idea of what it should contain. This idea may come from general or professional experience with atlases, map series, etc.; in other words, it is background knowledge about a genre of representations. Consequently, it often does not escape the user's attention if one or the other document is absent while, under the general theme of the collection, it can reasonably be expected to be included. For example, it may be noticed that, in certain world atlases, small islands or island groups (such as Guam, Kiribati, the Azores) are not assigned separate maps where they could be shown at a satisfactory level of detail. It is with such situations in mind that the phrase "all or most …" was used above in the definition of the first selection mode. Whether a collection, especially one of case studies, is quasi-complete (systematic) or open-ended is not always immediately clear, and a decision may require professional knowledge.

4. Basic issues and perspective

4.1. Basic issues: units, structure, and unifying characteristics

Having discussed four kinds of modular ensembles, we can now address some basic points. Since an ensemble is perceived as a unit and is made up of modules, and since these are assembled according to some pattern, at least the following questions arise:

1. How is a module identified?

2. What relations between modules underlie the internal structure of an ensemble?

3. What unifying characteristics define an ensemble as a unit?

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[14] On connotations see Eco, 1976 (pp. 54-57) and, with respect to maps, Schlichtmann, 1979 (passim).

4.1.1. Modules, elementary or complex

The first question relates to the identification of a module. Elementary modules, as mentioned in s. 1 (examples 1-3), are defined by the information they carry. Thus, a map-face aggregate informs about the mapped territory, a scale statement specifies the reduction, and a gazetteer lists the mapped places: each of these devices conveys a specific kind of information. If space constraints force a map maker to distribute a marginal entry, such as a legend, over two or more blocks of print, these blocks still carry information of the same kind and thus constitute a single module. With respect to the spatial delimitation of sections in earth space, the following holds: if an uninterrupted section is represented within a single map frame, then there is a single map-face aggregate; if the section is divided into two and each part is shown in a separate frame, then there are two MFAs. This definition permits us to analyze single maps and maps belonging to a collection in a consistent way (see s. 4.2.1). The spatial section to which an MFA corresponds may be a schematically delimited cutout from a spatial continuum or, in the case of an "insular map",[15] the territory of, say, Luxembourg, where the symbols for the country's boundaries also serve as the border of the map face.

Although in the present context modules are taken as unanalyzed, they can be decomposed where a more analytical approach is desired. In this respect, it is instructive to compare legend and map-face aggregate. A legend is a written document (which incorporates some graphic items); it is like a piece of expository writing. It is often thematically subdivided, and its subdivisions are arranged in a sequence. Its decomposition is a task for text linguistics. In contrast, the map image obviously shows no sequential arrangement. To decompose it is tantamount to analyzing map language. This point shall not be pursued further (for a basic summary see Schlichtmann, 2008a, s. 3.3.1).

So much for elementary modules. Complex ones (example 4) have elementary or complex modules as their components. What defines them as units are unifying characteristics. These are the topic of s. 4.1.3.

4.1.2. Structure of ensembles

The second question concerns the structure or organization of ensembles, which is based on relations between modules. Two types of ensembles have been described, both defined in terms of their structure: combinates and cumulates. Their characteristics have been introduced already in s. 1. In the first case, documents are directly linked by combinatorial relations. In the second case, documents are indirectly related through a commonality. For perspective, it may be recalled that members of a cumulate are alike by virtue of sharing a conceptual component, while constituents of a combinate are unlike, each providing a different item of information.

4.1.3. Ensembles as units − unifying characteristics

In the third place, we must inquire about unifying traits, i.e., such characteristics as impart to an ensemble the property of unity, put differently, by virtue of which an ensemble is spontaneously understood to be a (complex) unit. At least five traits, listed below, contribute to this end.

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[15]   From the German term "Inselkarte".

1. Quite often, an ensemble "stands alone", that is, it is not obviously part of a more comprehensive assemblage. Example: a single map as opposed to a map in an atlas.

2. In a combinate, the fact that elements are directly linked is a unifying trait. Elements are understood to belong together because they occupy places in the same network of combinatorial relations.

3. In addition to being linked, the elements in a combinate may be taken from a standard inventory of types. In this case, exemplified by the combination of a map-face aggregate and marginal notes, the said standard nature integrates the constituent modules into a whole, even though not all members of the inventory need be present in a given case. On the other hand, there is no standard inventory of adjuncts. Therefore a configuration involving adjuncts does not have the coherence of the aforesaid type of groupings. Finally, if the combinate is an assemblage of documents, it may have elements of both kinds (s. 3.1).

4. In a cumulate, elements are understood to belong together because they are related through a common notion.

5. If a cumulate is a quasi-complete collection, such as a well-planned world atlas, it can be taken as a whole in the sense that almost all possible elements are present. In contrast, an open-ended collection is not integrated in this way.

To summarize, the unifying traits differ in kind, indicating that an ensemble is not part of a larger assemblage, or that its modules are linked by relations, or that they are integrated into a whole. This enumeration can also be read in terms of degrees, that is, as a progression from lesser to greater unity. Different traits may apply to the same ensemble. The characteristics listed under points 3 and 5 may be called integrating traits.

4.2. Perspective: sign system and text

Under a separate head, some theoretical issues of wider scope will be looked at in order to place the preceding discussion in perspective. Thus we shall comment on the concepts of sign system and text (as understood in semiotics). The discussion of sign systems will be presupposed when A. Wolodtschenko's ideas are considered (s. 5).

4.2.1. Sign system

In the most general sense, a system is a set of elements along with relations by which they are linked. In this section, we are concerned with systems of signs (besides which also systems of contents and of expressions can be of interest). We speak of sign systems in several contexts.

First − a simple point −, modular ensembles are systems just because they are organized by relations. The constituent elements which enter into relations are the documents. Second, the term "sign system" refers, in the present context, to a structured set of signs which carry information about the mapped territory and its places. Following de Beaugrande (1980, p. 16), one can distinguish actual and virtual systems. An actual system of signs is the structured set of sign tokens in an individual map face. A virtual system is the structured inventory of sign types from which items and relations are selected to be instantiated in specific actual systems. It may be the comprehensive system of a given map as a whole, or a system of one or the other of its components, such as classes or hierarchies (ibid.). In cartosemiotics, actual systems are usually not studied for their own sake but in order to understand map language, which is the type of the said virtual systems.[16] Consequently, where reference is made to sign systems, it is usually virtual systems that are at issue.

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[16]   This also applies to related "languages", which correspond to cartographic models other than maps.

The actual sign inventory of each map is based on a separate virtual sign system. This statement may appear immediately evident where maps are authored and published separately, but it also applies to maps belonging to a collection, even though the underlying sign types are to some extent identical. There are various situations, which are aligned between two poles. One extreme is exemplified by a topographic map series: the same rules of sign production – i.e., of concept formation and transcription – are valid throughout, and different sheets tend to share many types of entries.[17] The other extreme is found in thematic atlases of national or regional coverage, where conceptualization and transcription obviously vary with topics and only entries in the base maps are more or less constant. Thus, we recognize several virtual systems, one for each map, which coincide to some extent. In the second case, only small parts of the systems coincide, while in the first case large parts do so.

A minor issue arises where an atlas is under discussion. Since entries in the constituent maps tend to be alike to some extent, one may be tempted to consider the signs found in all of its maps as a single, comprehensive actual system (and perhaps also postulate a single virtual one). But this would amount to confusing two levels. In representing the world, signs are created for specific maps, and if the sets of sign types instantiated in different MFAs tend to be more or less identical, this is still a matter of the individual maps, not of the collection. On the other hand, the commonality that unites maps is a matter of the collection and only indirectly linked to the sets of specific signs found in the assembled maps. In order to keep the two levels separate, one must rather conceptualize this way: the maps are joined under a common notion and thus make up a system, while each constituent MFA is a separate, embedded sign system. Stams (1983, p. 24) views an atlas as a system of higher order; this idea must be re-interpreted in line with the preceding argument. Finally, Wolodtschenko (2009a, p. 48) speaks of an atlas language or the language of an atlas. One obviously should rather speak of a set or aggregate of languages, one for each map in the atlas.

4.2.2. Text

It may be asked whether modular ensembles are what in some semiotic fields are called texts and what some scholars appear to regard as the basic objects of culture-related studies (Nöth, 1995, p. 331).[18] Examples of texts are a business letter, a news story, a poem, but also a complete novel, further a painting, a stage play, a ceremony. Although such artifacts are often easy to recognize, the covering term is notoriously difficult to define; moreover, texts can be characterized from different points of view. In the present discussion, the semantic aspect – which relates to contents – is the most important one. From this point of view, a text is an information-conveying artifact which is a coherent whole (Nöth, ibid., pp. 331-333; Halliday & Hasan, 1976, pp. 1-3). Dealing specifically with artistic (belletristic) texts, Lotman (1977, p. 22) describes their constitution as integral signs. Texts are of widely varying size and complexity, and at least in linguistics it has been observed that their degree of determinateness varies, i.e., that the characteristic of being a whole is immediately obvious in some cases and less clear in others (Halliday & Hasan, ibid., pp. 294-297).

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[17] Sheets differ, of course, with respect to absolute location and other geometric characteristics, place names, and the fact that certain kinds of features are present or absent.

[18] The term "text" obviously has a different sense here than it had in earlier sections.

We return to the question posed at the outset. Although a modular ensemble is a unit by one criterion or other, it does not necessarily qualify as a text as specified above. Of the unifying characteristics listed in s. 4.1.3, only traits 2 and 3 combined and 4 and 5 combined define an ensemble as a whole and make it coherent, so that it may be considered a text. As relevant configurations qualify an ensemble composed of a map-face aggregate and marginal notes, an atlas, and a systematic collection of case studies. This answer is tentative; it may be revised when more is known about the phenomenon of text, especially as it relates to sign-system types other than language.

5. Comments on some of A. Wolodtschenko's recent publications

This paper originated as a reaction to some of A. Wolodtschenko's recent publications, among them a monograph on the national atlas of Germany (2007). The thoughts expressed on the preceding pages were formulated in order to understand what concerns arise if atlases are treated as objects of cartosemiotic study.[19] For Wolodtschenko does not convincingly cover these concerns; even such fundamental issues as are addressed above in s. 4.1 are not explicitly raised. Moreover, several of his general arguments are not clear and evoke questions and comments.[20] For further discussion, we select three points which are directly relevant to the present article.

1. When advocating the study of atlases and other collections of documents, Wolodtschenko repeatedly claims that the research emphasis in cartosemiotics, or even the general orientation of this field, has recently shifted from studies of signs to structural research[21] into cartosemiotic models (his term) like atlases and map series. These are used with the aim of procuring "new or forgotten space-related knowledge" (2006a, p. 38)[22] and are considered to be "space-related knowledge models" – here apparently the conceptual modelling of the world is at issue – and repositories of spatial (or spatio-temporal) knowledge (Wolodtschenko, 2006b, p. 2; 2007, pp. 5, 10). The second part of this claim will be considered first. For Wolodtschenko, a sign is a perceivable item with which a meaning is associated (2009a, p. 5; see also s. 1). Now, it is meanings that are at issue when we are dealing with knowledge (which, incidentally, may be space-related or non-spatial). The above-mentioned uses and characteristics of modelling devices (Wolodtschenko's knowledge models) involve the manipulation of concepts, which are ultimately given to us as meanings of signs. Modelling devices include textbooks, encyclopedias, and atlases; they also include individual maps, a fact which Wolodtschenko pointedly fails to mention. Consequently, with respect to the said manipulation of concepts, an atlas is not qualitatively different from, and, in principle, not superior to, an individual map.

Certainly the study of knowledge models deserves to be extended from individual maps to assemblages of maps, but in terms of underlying ideas the object of research remains the same; it is the handling of knowledge by means of signs, more exactly: through the meanings of signs.

2. According to the first part of Wolodtschenko's claim, the alleged shift has been away from "syntactic characteristics of map symbols" (2006b, p. 2), "from the semiotics of signs, graphic primitives and variables" (2007, p. 5) or, with a slight twist, "from the semiotics of signs (graphic primitives and variables)" (2009b, p. 57). The three cited passages, especially the last one, reveal that by "signs" the author means sign vehicles.

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[19] That they can legitimately be treated this way is taken for granted. Also, Wolodtschenko's actual atlas analyses are not under discussion.

[20] Attempts, on the part of this author, to get matters cleared up by correspondence yielded no satisfactory response.

[21] That is, research aiming at uncovering the structure of cartosemiotic models. By "structure" Wolodtschenko (2003, 2007) appears to mean the fact that the material of a map or atlas is composed of subsets defined by various criteria. In s. 4.1, by contrast, the term stands for the organization of a modular ensemble by relations between its components.

[22] Translations from the original German are the present author's.

According to a personal communication[23], the old position alluded to ("semiotics of signs") is that of Tainz & Koch (presumably in their encyclopedia article of 2002). Unfortunately, however, neither these scholars nor the source are mentioned at the places referred to above, and a reader can only assume that the cited statements relate to cartosemiotics in general. In this case, however, at least the following errors and omissions come into view. First, as regards units, researchers have not limited themselves to primitives − graphic or otherwise −, but units showing different degrees of complexity have been recognized and studied. For a preliminary overview see Head (1999, pp. 19-20). Second, some reference to the conveyed meanings would have been helpful, since signs, however defined, presuppose meanings. One may add that Tainz & Koch at least mention meanings − in addition to sign vehicles − and recognize their study as a task of cartosemiotics (ibid., p. 39). Third, the claim of a shift away "from the semiotics of signs" (above) suffers from unfortunate wording, to say the least. After all, semiotics, whether past or present, is of necessity concerned with signs.

3. As regards sign systems, it is only occasionally that Wolodtschenko speaks of them, e.g., when calling knowledge models like atlases "sign systems in analogue ... and digital (virtual) form" (2007, p. 10). The underlying idea is obviously that of the actual sign system[24] of a map (2006b, p. 2) or, by analogy, of an atlas (2007, p. 10). The former has, on these pages, been called map-face aggregate. Concerning the latter, it was argued in s. 4.2.1 that there is no single sign system of an atlas, but an aggregate of sign systems − one for each component map −, held together by commonality and selection criteria. As for virtual sign systems, in contrast, Wolodtschenko does not appear to consider them at all. This is surprising, given his interest in models. After all, as we know from linguistic semantics, it is the virtual sign systems in which ultimately our ways of conceptualizing are laid down. The role of these systems in the conceptual modelling of the world has also been well demonstrated in cartosemiotics (e.g., Schlichtmann (2004; 2006, pp. 27-31; 2008a, s. 3.3)).

6. Summary and conclusion

This article is somewhat complicated because it deals with three issues, albeit related ones. The first issue (s. 2) is that of maps as ensembles composed of modules (modular ensembles). Each ensemble consists of a map-face aggregate (MFA) − i.e., the set of signs brought together in a map face − and additional documents. An MFA and additional entries are often consulted jointly, that is, they are involved in the same process of sign reception. This is why the said ensembles are often considered complex units. The additional entries are marginal notes and adjuncts. They can be classified with respect to the information they carry and the functions they fulfill within an ensemble. Marginal notes explain or contextualize the entries in the MFA, while adjuncts augment and complement the MFA or − less often − a marginal note. Within an ensemble, modules stand in combinatorial relations; the resultant configuration is therefore called a combinate (or a grouping).

The second issue (s. 3) is this: the idea of modular ensemble is tentatively extended from single maps to assemblages of documents, such as map series and atlases. However, the said notion cannot reasonably be extended to all kinds of assemblages but only to those where documents are linked by combinatorial relations (example: set of maps together with a common title, table of contents, and gazetteer) or are related through a crucial common notion (example: sheets of a geological map series). Such assemblages are often intuitively taken to be complex units, so that it appears justified to consider them modular ensembles. The first-mentioned sort is that of combinates, the second that of cumulates (or collections of documents).

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[23]   Letter of 20.12.2009.
[24]   We are using de Beaugrande's terms, introduced in s. 4.2.1.

When ensembles and their modules are studied, at least the following basic issues must be addressed (s. 4): identification of a unit (module) – an elementary or complex one –, the internal structure (organization) of an ensemble – based on relations between modules –, and unifying characteristics, which establish an ensemble as a unit. As regards the last concern, there are various unifying characteristics, and the unity of an ensemble may appear more or less strong. In this context, observations are offered about the semiotic concepts of sign system and text (in the sense of a message-carrying artifact that, in semantic terms, is a coherent whole) as they relate to the study of modular ensembles.

The third issue are views recently expressed by A. Wolodtschenko (s. 5). Some of his statements which relate to the topic of this paper are discussed and in part criticized.

Finally a note on the systematic position of modular ensembles in cartosemiotics. The central research objects of this discipline are systems of signs which carry information about places and are deployed in cartographic models (maps, globes, panoramas, reliefs, etc.). In the second place, cartosemiotics is concerned with sign processes and with functional contexts in which signs and sign processes are embedded (Schlichtmann, 2008a). Modular ensembles, now, bring together cartographic models, or such models and other documents, in more comprehensive, meaningful configurations, thus presupposing the existence of cartographic models. They may be considered phenomena of peripheral signification[25] and, as such, occupy a legitimate but marginal position within cartosemiotics.

7 . References

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[25] Another relevant phenomenon is ideology (Schlichtmann, 2008b).

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