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Knowledge Organization and Terminology: Philosophical and Linguistic Bases*

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The contributions of philosophy to the subject fields Knowledge Organization and Terminology are explored and exemplified. Special emphasis was laid on the philosophical fields of Logic, Theory of Science, Epistemology, Ontology, Phenomenology, Alethiology, and Metaphysics. Existing attempts are mentioned which assist in the recognition and application of pertinent principles and methods by terminological standards as well as the possible and necessary work towards reconciliation of the approaches of the two subject fields for the sake of an improved access to the knowledge of mankind. (Author)

1. Consciousness and Knowledge

If we compare texts written some hundred years ago with texts written today, or, if we compare texts written by children and those written by adults, or, if we compare texts written by 'outsiders' and by 'insiders' we will always note a remarkable difference in verbal distinction and in precision of expressivity. We assume that this results - respectively - from the differences in knowledge over the centuries, by education and by training. The texts compared may have had the same contents, but the words and terms utilized are not the same, revealing the state of awareness of a speaker's or a writer's competence, i.e., his knowledge of the concepts and terms of his subject.

In our knowledge-centered, or knowledge-conscious societies somebody must therefore take care to develop a consciousness for necessary activities to relate the existing and especially the 'hidden' concepts occurring in natural language discourse to expressions of highest possible degree of compression, whereby, however, expressivity in natural language should not be sacrificed, like for instance by the use of codes or abbreviations. This 'conscious somebody' can be all those, who feel themselves willing and able to solve the problems of knowledge organization and terminology, which - as it is obvious from the above - are associated essentially with a person's states of knowledge, insight, and openness as well as consciousness of existing linguistic possibilities.

Let us consider now in short which contributions from philosophy can help us to understand the implications of such an undertaking.

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2. Philosophical Bases

From the many special fields with which philosophical research is concerned the following seven seem to be useful to provide us with the intellectual tools for which we are looking:

1 Logic
2 Theory of Science
3 Epistemology
4 Ontology
5 Phenomenology
6 Alethiology
7 Metaphysics

2.1 Logic

In the word 'logic' the Greek 'logos' - word - is contained, but since Aristotle's writings this field has not been concerned with words but with concepts; in Aristotle's language our present understanding of concept has been termed 'horos'. Later on, Boethius translated Aristotle's 'horos' into Latin 'terminus'. But whereas in Aristotle's thinking *horos* was understood to include *pragma, noema*, and *logos*, Boethius and his medieval followers looked rather formally at Aristotle's triunity and emphasized only the verbal, linguistic part of it, the logos (1, 2). Medieval scholars got into arguments about the question of *conceptus* and *terminus*, they split into the groups of the Nominalists and Conceptualists. Still today we see the influence of this thinking in English philosophical terminology. It had been traded through the Neopositivistic School of Thought of Vienna into present-day American philosophy. We are still finding philosophers in our times who cannot accept the notion of *concept* but want to deal instead with *terms*. This can be related back to the times when the *terminus* was considered to include the notion of thought, that is, the conceptual element. When the German philosopher Christian von Wolff (1679-1754) translated *conceptus* into German *Begriff*, it was again possible to reunite in this notion what Aristotle had synthesized in his term 'horos', viz. at least the two: sign and contents.

Now, what indeed is a concept? The German philosophers Immanuel Kant (3) and Gottlieb Frege (4) inferred already the generation of concepts by predication. Our assumption that a concept is created by predicating about an object of concern, a socalled *referent* is rooted in the

writings of these philosophers. Any predication about such a referent yields one characteristic of the concept of this referent. The sum total of such predications possible will compose the sum total of characteristics of a concept and thus determine the contents of a concept. From this I derived the socalled *Referent-oriented, Analytical Concept Theory (5)* which allows to understand a concept as a carrier of elements/characteristics, gained from predications about its referent. It is of course necessary for communication purposes to synthesize the concepts elements into one expression or a short word combination, in order to deal with it. One can also just designate it by a code or a sign. Fig.1 shows the mode of concept construction; in Fig.2, derived from Fig.1, the concept triangle serves as a model for the formal "parts of a concept".

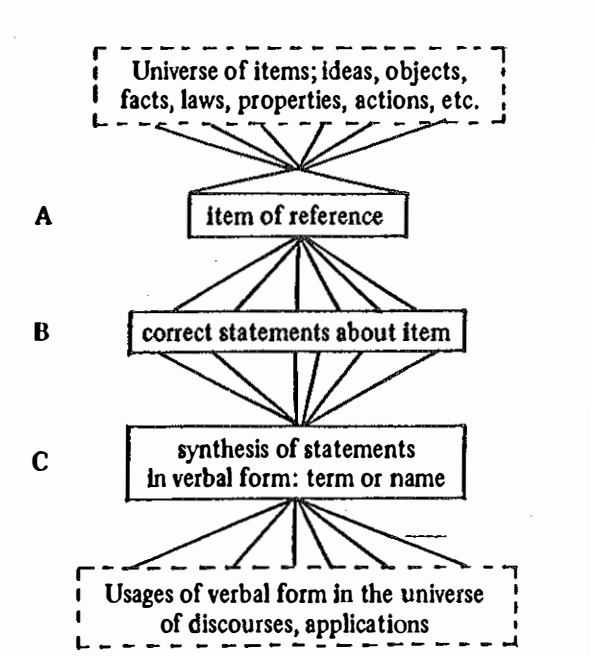

Fig.1: *Model for concept construction*

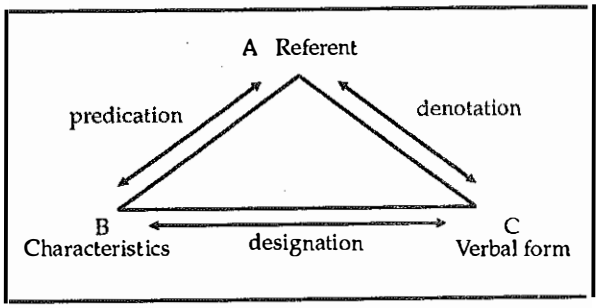

Fig.2: *Concept triangle, the formal representation of a knowledge unit*

Obviously one can distinguish between essential or rather necessary predications, yielding *essential/necessary characteristics* and others which are possible in a given case only; these have been called *accidental characteristics*. Both kinds of characteristics play also a determining role in the forming of adequate concept expressions: terms (6). Individual and general concepts will be distinguished by their referent being either an individual or a general item: their predications differ accordingly, see Figs.3 and 4.

the event
is a conference
of experts and interested people
on the topic "Knowledge Organization and Term Analysis"
organized by Peter Petrov
taking place in Varna
at F.J.Curie International House of Scientists
on Sept.16-18, 1992

Fig.3: *Characteristics to be derived from predicating an individual object*

the event
is a conference
of a certain group of people participating
on a certain topic
organized by
at a certain place/city
and a certain location there
on a certain date

Fig.4: *Characteristics to be derived from predicating a general object*

We will deal with further implications of this theory in the next sections.

2.2 Theory of Science

This philosophical field is contributing to our concern in several ways. It provides a theory of

1 knowledge
2 knowledge elements and units
3 systems
4 the science concept
5 knowledge fields
6 a logical syntax and
7 a possible overall structure of knowledge areas

The theories listed had been treated in a recent paper delivered at the 5th International Study Conference on Classification Research at Toronto, June 1991 (7), and will be included in the forthcoming proceedings volume. What we need to mention here, however, is the understanding of a concept as a *knowledge unit*. In the preceding section we stated that a concept is generated by predications. One cannot predicate a true fact without expressing one's knowledge of something. Thus every predication yields a *knowledge element* and the necessary sum total of predications can be synthesized into the corresponding *knowledge unit*. Concepts are thus the units of our knowledge, and this is an essential finding on which we can base all our activities in the area of knowledge organization and terminology.

2.3 Epistemology

This philosophical field contains the Greek word *episteme* which means *knowledge*. The field was once considered to be 'material logic' in opposition to 'formal logic' concerned with logical statements and inferences. Epistemology regards cognition as the act of a cognizing subject toward an object of cognition with the aim to take this object into its mental possession. Such a mental possession is then called 'to have knowledge', or just 'somebody's knowledge' represented by statements, propositions, judgements (8). Here again we encounter the relationship between concepts and language, as in logic, however with the additional feature of the mental act and the ability of the mind to compare something new with what has already been acquired in different previous acts. This subjective kind of knowledge needs to be made accessible and verifyable by somebody else, it needs to be made explicit, i.e., intersubjective. This can be done either by listing the characteristics of a concept in question or by formulating a definition or similar kind of summarization of its essential and sometimes also its accidental characteristics.

The required explicitness may even involve the analysis and representation of concept relationships and subsequent generation of concept systems according to the different kinds of relationships possible.

In earlier papers (5, 9, 10) I distinguished the following kinds of concept relationships:

(1) Formal Relationships
- Identity
- Inclusion
- Intersection
- Exclusion

(2) Form-categorial Relationships
- Object-relatedness
- Property-relatedness
- Activity-relatedness
- Dimension-relatedness

(3) Material (contents-related) Relationships
- Generic relation
- Partitive relation
- Opposition/Complement relation
- Functional relation

Fig.5: *Concept Relationships*

Formal Relationships are applied in mere form comparisons of concepts as a first step before any other comparison may take place. They will reveal the synonymy and homonymy of terms in one or in different natural languages, they are also useful in compatibility investigations of ordering systems, see Fig.6.

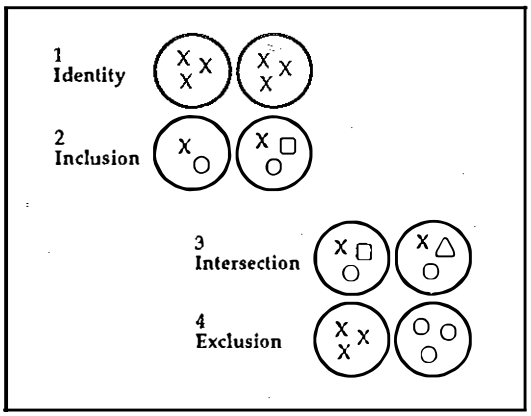

Fig.6: *Formal relationships of two concepts*

Form-categorial Relationships help to distinguish and define concepts according to their form classes of being Objects, Properties, Activities, Dimensions (space, time, position). Many concepts are also combinations of such form classes. In classification theory these form classes - when occurring in subject fields - have been called *facets*, see Fig.11.

Material Relationships will use the inclusion and intersection relationship of the Formal Relationships shown above and create conceptual systems. They are also useable to relate to these their corresponding kinds of structure-oriented definitions, see Figs.7-10.

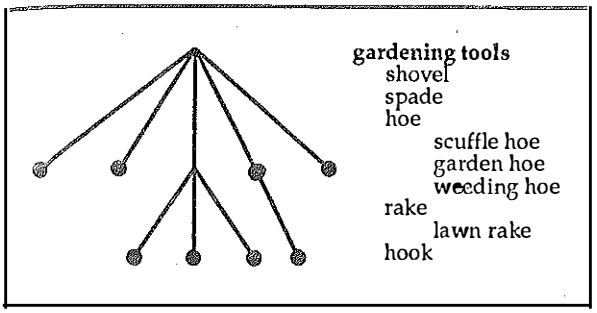

Fig.7: *The tree structure of a generic relationship. The concepts on one level form a Concept Array and concepts on different levels and connected with each other form a Concept Chain.*

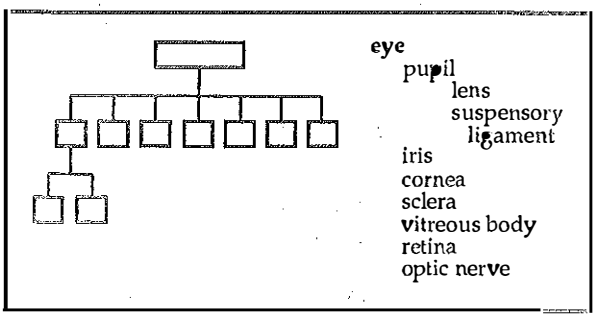

Fig. 8: *The "beam"-structure of a partition relationship. Here the concepts on one level form a Partition Array and those on different levels but connected to each other form a Partition Chain.*

a. the relation of contradictory opposition, including a negation, as in numeric–non-numeric presence–absence

b. the relation of contrary opposition,
as in north pole-south pole
large-small

c. the relation of
positive-indifferent-negative (PIN), as in
favourable-neutral-unfavourable
higher valued-equally valued-less valued

d. the relation of analogy, homology,
duality, etc., as in a model and its reality
arm (of a human being)-wing (of a bird)

The relationship is depicted by a
double arrow:

Fig.9: *The four kinds of opposition relationship*

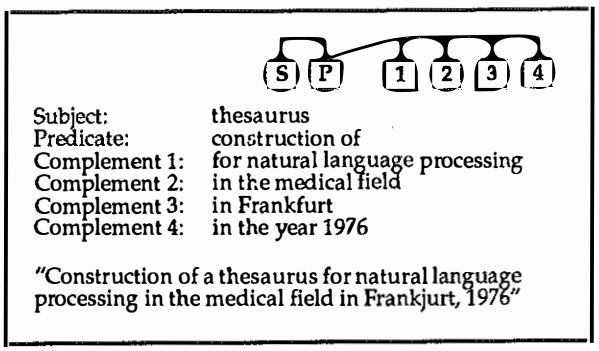

Fig.10: *Functional relationships of Subject (S), Predicate (P), and Complements (C).*

2.4 Ontology

So far we had been dealing with objects of our intellectual world, concepts, knowledge units in general. Now, we turn to the Earth as our material world of which we are certainly still a part and realize what Ontology as the Science of Being will have to teach us.

Interestingly enough, we can turn to Aristotle for help also in this regard. He said: "About all that (exists) one speaks in as many senses as there are forms of categories; for, as many kinds of statements exist, just as many senses can be acquired by anything existing" (10). Thus he distinguished his 10 categories which can be brought into an order of 4x3 if one adds to the ten two more categories, thus gaining 4 super- or ur-categories, as follows:

	Principles
Entities	Immaterial Objects
	Material Objects
	Quantities
Properties	Qualities
	Relations
	Operations
Activities	Processes
	States
	Time
Dimensions	Place
	Position

Fig.11: *Categories of Form*

It may well be seen in Fig.11 that the four super- or ur-categories are also those establishing the word- or syntactical categories which we need to form sentences. We are calling these and their triadic subdivision *form categories*.

With these, however, we are still not dealing with the hardware of our world rather with the algorithms by which anything existing can be grasped in forming statements about it. Aristotle has also established a theory of the existing 'hardware' by distinguishing four levels of Being:

Inanimate Being ("dead" matter)
Animate Being (plants, animals)
Mental Being (man)
Divine Being (God)

Fig.12: *Aristoteles' Levels of Being*

where the last level was considered by him as Being in pure form. Philosophers of our century (e.g. 12, 13) have also been concerned with the structure of being and developed a so-called Theory of Levels of Being and explained their "Laws of the Levels", showing a.o. that each level follows logically from the preceding and that their component characteristics develop from one level to the next so that the final level will include the characteristics of all the foregoing ones. (Translated into German in (14)). On the basis of this theory a new universal classification system of nine onticallevels has been constructed where the component analysis or the definitions of concepts arranged in such a structure can be derived in part from the levels in which concepts have been placed or are to be found. This universal system has - with a few exceptions - only been developed for areas, groups and fields of knowledge, not (as yet) for their components (objects, activities, properties, etc.). It has, however, been used for about 20 years in a number of application cases (15).

2.5 Phenomenology

This philosophical field is usually not understood as dealing with phenomena, although it started with the German philosopher Johann Heinrich Lambert 1764 (in his Neues Organon) defining it as the science and critique of phenomena (Sinnerscheinungen) as part of his epistemology. G.F.W.Hegel, however, in his *Phänomenologie des Geistes* (1806) defines it as: "die Darstellung des Bewußtseins in seiner Fortbewegung von dem ersten unmittelbaren Gegensatz seiner und des Gegenstandes bis zum absoluten Wissen" (the representation of consciousness in its movement from the first direct opposition of itself and of an object till to the absolute knowledge, my translation, ID) - by this indicating that phenomenology is to be understood as "letting the Logos, spirit and ratio appear in reality". Accordingly then "Phenomenology sees its actual task in reducing the phenomena according to extension and intension (Umfang und Tiefe) to the

concealed Logos" (16). Later on in philosophical development, phenomenology was understood as a kind of radical empiricism and positivism which does not question the sense of something or a fact but just describes it as it is and as precise as possible. Again later, philosophers like E.Husserl, Max Scheler and especially Martin Heidegger went further and taught that a phenomenon could not be understood as such but has to undergo a "hermeneutic interpretation" revealing its "concealed Logos" (16, p.246).

Applied to the problems of knowledge organization this means that any entity with which we are dealing ought to be understood and described "according to extension and intension", in other words, the concepts existing in our minds, books, texts, and discourses are more or less concealed and must be made explicit by adequate methods. As such, phenomenology will provide the possibility of clarifying humanity's concepts in a way that they can be made accessible, even by computer.

2.6 Alethiology (Wahrheitslehre)

A foremost interest in the organization of knowledge must be seen in being only concerned with things that are true. Is this not rather obvious? Not at all! Alethiology - the philosophical field concerned with truth - can supply us with its scientific background and with the necessary criteria for its identification. Here are the truth concepts which Diemer distinguished (17, p.327-334) and described:

Substantivistic truth
Attributive truth
- Formal truth
- Theoretical truth
  - Material and semantic truth
- Existential truth
- Ontological truth
- Historical truth

In addition, he explained also the following truth criteria in which we may recognize some of Kant's "Urteilskategorien":

Evidence
- problematic (open, possible)
- assertoric (empirically stating)
- apodictic (absolute, non-refutable)

Certainty
Verifiability

The concepts of alethiology are applicable and thus also true in all of the above mentioned fields of philosophy. Although it seems obvious that any scientific endeavor must obey the truth postulate, one can experience quite opposite attitudes; we are all consciously or unconsciously open for influences which deter our transcendental aims of working towards the perfect, the absolute, the transcendentals which once were named the Unum, the Verum, and the Bonum. To overcome negative influences is possible only for a very humble mind who is able to accept that we are deemed to fail as long as we are attached to the matter of our earth and as long as we are not willing to love GOD above all. But as long as we believe that the truth which we think to have found is the only one and want to dominate others with it, we will not succeed. Philosophers help themselves therefore by saying, that 'true' should never be an element of the object language but only of a metalanguage, that is, a statement about a statement in the object language.

2.7 Metaphysics

As probably everybody knows, the term 'metaphysics' stems from the title of a book which the compiler of Aristotelian writings (Andronikos of Rhodos, 1st century before Christ) had given to the writing which followed the ones dealing with nature - physica. Meta means 'after' and implies also the 'about'. Already in antiquity Metaphysics acquired its specific philosophical sense, and especially since Kant, the science of the basis of experience of reality which is concerned with identifying the points of view and beliefs which guide man's thinking. Every action of a human being is rooted in such a metaphysical ground. From the different starting points (main class arrangement) of universal classification systems existing and being still used today such differences are very easily to recognize (see (14), Chap.3). There may be about as many different approaches as there are people and it is to deplore (counteracts so-to-speak the human strive for unity) that there does not seem to exist a striving for a common goal with a positive influence on the different backgrounds of our contemporaries. Therefore, every action toward an optimal organization of knowledge must take into consideration that values and beliefs are involved and have to be taken care of.

3. Linguistic Bases

So far almost all of the knowledge of the philosophical fields mentioned is related to the contents aspects of the organization of knowledge. But no contents can be communicated without a carrier, and the one for concepts are just the language forms, the words and especially the terms.

In an earlier German publication (6) which was a counterproposal to the then existing German Standard DIN 2330 on Concepts and Terms (18) - which has an international correlate in ISO 704: Principles and Methods of Terminology (19) - the principles governing the form of a term were listed. Later, in (5), in an English description of these principles, though not in the context of a proposal for a standard, the following criteria were listed and discussed for an adequate designation of a concept:

1 Compliance with referent
2 Reflection of characteristics
3 Minimum length
4 Verbal derivability
5 Internationality

We could discuss these criteria here also at length, however, it may suffice, to realize that there are such criteria - and probably some more - and that there exist of course implications and relationships with what has been outlined in previous sections.

When one is dealing with the generation and production of new things which need to be named, one has to create also the verbal form for its concept. This necessity has brought about in our present time a great variety of different names/terms when the same things were developed at different places. In information science, we are at present confronted with the necessity to translate between our existing terms and the newly coined terms in the field of artificial intelligence and computer science for concepts already existing in our field and which are penetrating or rather conquering our field as if they were denoting new concepts, such as "domain" for subject field, "inheritance" for hierarchy, etc.

It is only via proper definitions that one can recognize identical concepts and it is only by friendly cooperation between people concerned that the boundaries set up between apparently competing groups can be overcome. One is reminded here of the value-oriented philosophical fields of alethiology and metaphysics that may be of influence in the "verbal behavior" of people. However, this is not to say, that terms of some tradition are always more adequate than new ones. The criterion of compliance with referent, mentioned above, may change minds also to accept a more adequate but new term instead of sticking to the one to which one got used. Many terminological working groups of standardizing agencies are busy at present with creative work in this respect.

We owe great admiration for the work of Eugen Wüster who started the contemporary endeavors in the field of terminology already in the early thirties by his classic book (20) based on his dissertation. He was instrumental in setting up the respective German and international terminology standards and has established the Information Center for Terminology in Vienna, called INFOTERM which has developed a worldwide activity in spreading knowledge and information about terminology and is at present preparing for its Third Infoterm Symposium (Nov.1991) after a first one in 1975 and a second in 1985. Its books series, journals and bibliographies are invaluable sources of information on all questions of this field. At the recent NISKO'91 conference in Bratislava, the director of this Center, Christian Galinski, outlined the present problems and also called for the establishment of terminological concept systems as it had already been requested by E.Wüster in 1970 (21). Wüster had studied the existing universal classification systems and had found that they were filled with classes containing precombinations of concepts, not just elementary concepts but actual themes as found in the titles of documents. Such 'classes' were terminologically useless as they were composed of several words to the effect that their hierarchical position could not possibly be defined clearly. Wüster called these classification systems therefore "Theme Classifications", and stated that they may be alright for the ordering of document collections but cannot serve the terminologist who needs concept systems in a strict sense in correct application of defined relationships, as e.g. the generic and partitive concept systems.

It was unfortunate that Wüster got only to see such universal classification systems which are not organized as faceted classifications of which a universal one is exemplified in Ranganathan's Colon Classification (1st ed.1931, 7th 1989 (22). Systems which organize concepts in facets are socalled 'category pure' systems and will, by necessity, not include any precombinations; the hierarchies ought to be 'in correct order' (23). For any combination necessity such systems must also provide for a syntactic formula so that a concept combination can be accomplished in a reproducible way. Ranganathan has provided such formulae for each of his 31 main classes (22) and the German Standard for Classification Systems (24) explains how one should proceed in the sequence of facets when establishing a system that will provide for this necessity of concept combinations for the adequate forming of document content descriptions by classates.

4. Work Ahead

The necessity of establishing classification systems which organize concepts into facets for combinability according to the demands of a given application case has been recognized among classificationists since about forty years. Nevertheless we are still very far from seeing the majority of our concepts organized in such a formalized and reproducible way for better access and for better understanding. The International Society for Knowledge Organization, ISKO, at present invites to form Working Groups to deal with the matters involved and it is looking for members to cooperate in this worthwhile activity.

The need for keeping track with the newly produced knowledge as documented in our scientific journals is recognized by scientists, this counts for the future of the scholarly journals as well as the relevant databases which store their data. But the need for dealing with the control of concepts and their terms as well as their documentation in glossaries, especially the onomantic ones as postulated by F.W.Riggs (25) is still very far from universal recognition, acceptance and support. Except for Infoterm in Vienna - people at only a vrey few places start to realize what needs to be done in the control of our knowledge units. The European Communities are trying to install a universal source thesaurus, combining all the important existing thesauri available in their languages into one database. But they seem to be far behind what has already been realized in the VNIIKI center in Moscow where this has apparently been accomplished already some time ago - according to a recent paper by Prohorov (26) and has even been combined with the task of letting scientists have a second look at the conceptual relationships of thesauri and control their correctness. We would like to

propose that this work should have followers and that centers should be installed in each country leading to a fruitful collaboration between all the colleagues of such centers in order that in a future peaceful society which knows of no boundaries those interested may share any existing knowledge about existing knowledge units and their relationships in concept systems. This is precisely what had been suggested by F.W.Riggs (25) for social scientists but it should not be limited to them alone but become a kind of an institution for the benefit of all of mankind.

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