



## Facet Classification in Online Retrieval

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The study of faceted classification systems has primarily been directed towards application for precombined catalogues or bibliographies, not so much for use in postcoordinated retrieval systems. In this paper it is argued that faceted classification systems in some respect are superior to other techniques of online retrieval as far as facet and concept analysis is combined with an expressive notational system in order to guide a form of retrieval which will use Boolean operators (for combining the facets regardless of one special citation order) and truncation for retrieving hierarchically different sets of documents. This point of view is demonstrated by two examples, the first one uses a short classification system derived from B.Buchanan the second is built upon the classification system used by *Library and Information Science Abstracts (LISA)*. Further discussion is concerned with some possible consequences which could be derived from a retrieval with PRECIS strings.

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### 1. Introduction

Developments of facet classifications have so far mainly been marked by the creation of classification systems that permit the differentiated expression of document contents in an artificial character system (document-specific syntheses after a previous analysis according to preassigned categories), followed by the ordering of these contents in a linear sequence (bibliographies, catalogs, book arrangements)<sup>1</sup>. Less attention has been given so far to the possibilities and advantages, if any, of using facet classifications in online retrieval. This question will therefore be examined in the present contribution: after a general preparation, a first part will present a demonstration example, a second part will discuss the retrieval possibilities according to notations of the classification system used by *Library and Information Science Abstracts (LISA)*, while a concluding part shows possible consequences for a retrieval with PRECIS strings.

### 2. Processing of Synthesized Notations for Retrieval Purposes

Much specific information is encoded in the synthesized notation which a facet classification assigns to a given document. This makes it desirable that this information should be capable of also being searched for in

differentiated fashion, hence in particular that one should have direct access to secondary facet contents rather than only to the notations as a whole. This aspect finds its reflection in the development of *chain indexing* as a special indexing procedure for gaining access to the contents of the secondary facets. A possible retrieval realization must therefore recognize the beginning of a new facet in the synthesized notation and make the facet components thus identified available, e.g. for postcoordinated Boolean combining. This does not exclude the use of further retrieval aids, such as adjacency functions or proximity operators, but this matter will not be considered further in the following. They might be used for achieving further retrieval refinements to be derived from the application of the given citation order. Neither will those advantages be further considered here which are otherwise normally discussed in connection with the use of classification systems in online retrieval, such as the cutting-out of thematic segments from a large database, or the thematic 'placing into context' of verbally represented concepts; these advantages are present also in the realm of applications discussed here.

*Example:*

**NgDfe**      Synthesized notation from two arbitrary facets, each indicated by a capital letter

**Ng and Dfe**      Boolean combination for access to the components of the above notation differentiated according to facets.

If the notational system used furthermore is an expressive one, a hierarchically differentiated retrieval according to facets might be realized using various truncations or maskings<sup>2</sup>.

*Example:*

**N\$ and Df\$**      Boolean combination with truncation for retrieving all documents whose synthesized notations comprise components from the facets N or D, with all those notations being considered which begin with N (hence also all concepts subordinated to N) as well as all notations beginning with Df (hence also all concepts subordinated to Df).

One would regard it as a simplification for the user of such a system if the posing of a search question would not require the input of the given notation but if, instead, a verbal access possibility would be available.

A system resembling the one described here - without, however, using a facet classification - is available in the form of the ETHICS system<sup>3</sup>. This system bases the search process described above on the UDC, which leads to impressive retrieval results, although always encountering limits in those cases where the preparation of the conceptual structure in the UDC does not meet the requirements that must be imposed on it in such a retrieval<sup>4</sup>. The use of a facet classification with its a priori more carefully worked-out conceptual structuring - in which e.g. also such composites as *insect eye* or *library automation* would be split up into their conceptual components of the given categories - would make better recombination of complex statements and thus better retrieval results seem likely here.

Before elaborating on these statements with the aid of an example we will first stipulate what kinds of questions one would ask in an online retrieval system with the aid of classificatory structures and then suggest what a realization using facet classifications might look like.

1. Questions as to complex subjects on the a posteriori document level which are encoded as synthesized notations, with each notation representing a well-defined class of concepts. (Example: The nutrition requirements of the giant panda)

2. *All about*-questions, in which, besides the notation (concept) put in, also all its (hierarchically) subordinated concepts are to be taken into consideration for the hit quantity. (Examples: literature on birds of prey, both all such birds and individual species; forest animals)

3. *All about*-questions for complex subjects, i.e. combinations of several classes (concepts), including all hierarchically subordinated concepts, into a complex query. (Examples: Physiology of birds of prey; Physiology of land predators; Nervous systems of bone fish; Tropical freshwater animals)

4. Questions in which only the put-in search term itself, and not the relating thereof to other concepts, leads to a hit.

Precombined classification systems with no possibility of synthesis from individual (elementary) components are not suited for answering questions of the first type. To be retrievable, complex subjects must be contained in the system as classes; it is therefore a matter of chance whether, with respect to a specific document, such a class is present or not. Subject not mapped in the primary order of the classificatory structure cannot, as a general rule, be specifically and comprehensively addressed, nor is any procedure comparable to chain indexing available, while customary procedures for index preparation cannot make up for this<sup>5</sup>. Neither document-specific or co-extensive indexing, nor, therefore, querying, can be performed in this way. The second type of questions can be answered with precombined classification systems if they have an expressive notational system and if their conceptual structure is

based on clear criteria rather than on associative structures. Since precombined classification systems frequently try to subordinate complex subjects, this conceptual 'purity' is not always sufficiently guaranteed<sup>6</sup>. Questions of the third type require, for being answered, postcoordinating linkages and truncation possibilities. The fourth type of questions touches on a basic problem of all Boolean online linkages which cannot be solved exclusively through structural measures in the classification system but rather requires the retrieval component to possess specific properties lest together with a component of the search field all more comprehensive entries are found as well.

Facet classifications analyze the complex subject contained in the documents according to the categorial denominations preassigned by the facets, and they synthesize correspondingly complex notations from simple building stones, namely the classes contained in the facets. Thus, if one succeeds in re-identifying the facets contained in the synthesized notations and in having access, through truncation, to the conceptual hierarchy, the first three questions mentioned above may be handled through Boolean linkages. The handling of the fourth question requires access to the complex notation as search unit.

### 3. Discussion of an Example

The preceding considerations will now be illustrated by means of a more detailed - but still overseeable - example. The starting point used here is a small facet classification that was employed by *B.Buchanan*<sup>7</sup>. This system was slightly expanded for the purposes envisaged here and equipped with an expressive notational system (cf. Annex 1), upon which it was used for the indexing of 300 'documents' (cf. Annex 2). With the aid of the LIDOS system<sup>8</sup> these documents were finally made retrievable so as to be able to demonstrate the various search possibilities. In so doing, the classification system was administered in the thesaurus component of LIDOS, while the notations were agreed to be synonyms for the class designations, which at the same time permits verbal access to the notations; Annex 4 shows an excerpt from the relevant structure<sup>9</sup>. Annex 3 shows, in excerpts, an arrangement of the documents according to the synthesized notations (in the manner of a systematically arranged bibliography), with the inverse citation order being used as filing order.

With the above we can now discuss the possibilities for the realization of the four types of questions indicated in the above.

#### Type 1:

*Query:* Nutrition requirements of the big panda

*Search:* Lemiaae and Fdg

*Hits:* 2 (for hit list, see Fig.1)

(Boolean combination of notations from primary and secondary facets)

**Type 2:**

*Query:* Forest animals  
*Search:* KBk\$ (only in the habitat facet)  
*Hits:* 7 (for hit list, see Fig.2)  
 (Truncation in a secondary facet)

*Query:* Tropical forest animals  
*Search:* KBk\$ and KDF\$  
*Hits:* 1 (for hit list, see Fig.3)  
 (Boolean combination of elements of two secondary subfacets with truncation; actually Type 3)

a) *Query:* Birds of prey  
*Search:* Leka (only in the animal facet)  
*Hits:* 8 (for hit list, see Fig.4)  
 (Access to the notation of a facet as part of a synthesized notation)

b) *Query:* Birds of prey, including all subordinated concepts  
*Search:* Leka\$ (only in the animal facet)  
*Hits:* 16 (for hit list, see Fig.5)  
 (Access to the notation of a facet with truncation as part of a synthesized notation)

**Type 4:**

*Query:* Only birds of prey in general; without subordinated concepts, without relations to other aspects  
*Search:* Leka (in the entire fields of synthesized notations)  
*Hits:* 2 (for hit list, see Fig.6)

**Type 3:**

Several examples of differentiated truncation of notations in arbitrary, but firmly selected facets using Boolean combinations:

*Query:* Physiology of birds of prey  
*Search:* F\$ and Leka\$  
*Hits:* 5 (for hit list, see Fig.7)

*Query:* Physiology of birds  
*Search:* F\$ and Lek\$  
*Hits:* 6 (for hit list, see Fig.8; hit No.3 is new)

*Query:* Physiology of land predators  
*Search:* F\$ and Lemia\$  
*Hits:* 8 (for hit list, see Fig.9)

*Query:* Nervous systems of bone fish  
*Search:* Fdd\$ and Leaa\$  
*Hits:* 5 (for hit list, see Fig.18)

*Query:* Tropical freshwater animals  
*Search:* KDF\$ and KFaa\$  
*Hits:* 2 (for hit list, see Fig.11)

A final example may demonstrate the effect of differentiated truncating in arbitrary, but firmly determined facets:

*Query:* All literature on the anatomy of all vertebrates  
*Search:* Fa and Le\$  
*Hits:* 15 (for hit list, see Fig.12)

but:

*Query:* General literature on the anatomy of vertebrates  
*Search:* Fa and Le (without truncation)  
*Hits:* 3 (for hit list, see Fig.13)

A search using the synthesized notation LeFa in the field of the complete notation would turn up none of these documents.

#### 4. Differentiated Retrieval According to Notations in 'Library and Information Science Abstracts (LISA)'

To be able to demonstrate the considerations presented here on a real database, recourse was had to the document base of the CD-ROM edition of *Library and Information Science Abstracts (LISA)*. For classificatory description and arrangement of documents LISA uses a facet classification<sup>10</sup>. Unfortunately the notations of this system are not wholly expressive, so that in the following only such examples could be considered which permit truncation. Under the SilverPlatter software of the CD-ROM edition the notations are not addressable in differentiated fashion and not truncable<sup>11</sup>. Therefore, for this retrieval study the notation fields of the documents with a year of publication from 1986 to 1989 (totalling 16.787 documents) were made retrievable with the aid of the *askSam* Software<sup>12</sup>.

In the following we will present, again, a few retrieval examples.

*Case 1:* Query object: a simple notation in the primary facet  
*Search:* Nkz (Management by objectives)  
*Hits:* 2 (for hit list, see Fig.14)

*Search:* Nk (Management techniques)  
*Hits:* 7 (for hit list, see Fig.15)

Remark: These searches would also have been possible directly with the CD-ROM edition, but not the ones now following.

*Case 2:* Query object: a simple notation, not specifically in the primary facet  
*Search:* \*Nk (Management techniques, not necessarily in the primary facet)  
*Hits:* 9 (including 2 new ones; for these, see Fig.16)

*Case 3:* Query object: a truncated notation in the primary facet  
*Search:* Nk\$ (all forms of Management techniques)  
*Hits:* 44 (for an excerpt from the hit list, see Fig.17)

Remark: This type of query formulation is far more difficult to realize with verbal methods; it is particularly here that the advantage of expressive notations becomes evident.

*Case 4:* Query object: a truncated notation, not specifically in the primary facet  
*Search:* \*Nk\$ (all forms of management techniques, not necessarily primary facet)  
*Hits:* 106 (for an excerpt from the hit list, see Fig.18)

Remark: Of these 106 hits, 62 ones have a different notation component in the primary facet (cf. the number of hits in Case 3).

*Case 5:* Query represented by a Boolean combination of truncated notations.

*Search:* Nk\$ and \*Fv\$ (Management techniques in the primary facet, Local authority public libraries)  
*Hits:* 3 (for hit list, see Fig.19)

Search: \*Nk\$ and \*Fv\$ (cancellation of the restriction to the primary facet)  
Hits: 4 (of which 1 is new; for hit list, see Fig.20)

A further example is given to show what use can be derived from employing truncated notations for limiting ambiguous verbal search inputs. Let the search interest pertain to the query use of CD-ROM for online catalogs, with variants such as CD-PAC also being taken into consideration. The database used for the search consisted of all LISA documents with publication year 1988 and the search fields TI, SO<sup>13</sup>.

Search: \*CD\$  
Hits: 167

Now let the query be directed at documents with assigned notations from the *Cataloguing* field:

Search: \*CD\$ and (\*T\$ or \*U\$)  
Hits: 19 (for an excerpt from the hit list, see Fig.21)

If the notational component \*Tog\$ for *Computerized cataloguing* is used one obtains a highly precise quantity of 17 hits, avoiding the 2 documents shown in Fig.22.

In conclusion, an example will be shown for which the database consists of all documents of the LISA-CD-ROM edition.

Let the search be directed at literature on the question of online retrieval according to PRECIS data. A verbal realization of this query in the LISA-CD itself, together with the relevant document list, is shown in Fig.23. Be it remarked that the use of the search words *Retrieval* and *Online* is problematic. PRECIS and *retrieval* produces too many hits, PRECIS and *online* probably too few. With LISA notations a search might look as follows:

Search: PRECIS and Vr\$ or \*Zk\$ or \*Ueg\$  
Hits: 9 (for hit list, see Fig.24)

More precise statements on the quality of retrieval in the manner as described here and as differing from verbal retrieval possibilities should not be made yet at this point; they would require further research. Further investigations in this direction appear promising, however. One must take into account, though, that the classification system used at present by LISA does not possess an expressive notational system, so that the number of questions available for a retrieval study is limited.

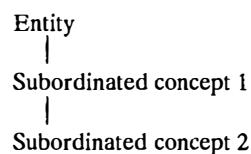
## 5. Concluding Remarks and Outlook

The above remarks form a contribution to the discussions currently under way on the shape to be given to search components in online retrieval systems. The idea of seeking verbal access to the contents of the individual

elements of a classificatory structure makes it appear worthwhile to pay closer attention to the ideas of faceted thesauri. It also becomes clear, on the other hand, that classificatory structures permit the answering of questions that cannot be answered by verbal methods alone, i.e. without the elaboration of conceptual networks. The concrete shaping of the access is, in the end, more in the nature of a question directed at the design of the user interface: the separation between the retrieval processes taking place in the background of the querying system and the part serving for communication with the user.

If one thinks of fully worked-out conceptual networks such as e.g. the RIN file<sup>14</sup> prepared with PRECIS, it appears well imaginable that the conceptual relationships contained in this file, the classificatory structure of the conceptual network, might, together with the categories contained in the PRECIS syntax, be developed into an effective retrieval system under a common user interface. Such a system would not only permit of Boolean linkages of individual descriptors, but also of retrieval strategies that might link a flexible search-down in the semantic network with specifications imposed also by syntactic categories. As an example one might mention e.g.: a search for literature on the role of a specific entity together with *all* its subordinated concepts as the object of a specific action.

Let this be demonstrated symbolically by the following case. Let the semantic network contain the following structure:



Let there furthermore be the following indexed items<sup>15</sup> relating to different documents:

1. (1) Object  
(2) Action  
(3) Entity
2. (1) Entity  
(2) Action  
(3) Agent
3. (1) Subordinated concept 1  
(2) Action  
(3) Agent
4. (1) Subordinated concept 2  
(2) Action  
(3) Agent

A query *Entity as the object of action* would produce Document 2 as a hit, but not Document 1. The query *Entity with all its subordinated concepts as the object of action*, on the other hand, would produce

## Documents 2, 3, and 4 as hits.

This little example makes clear what possibilities of further development the applications of faceted classificatory structures presented here may have in online retrieval once the necessary preconditions in the fields of data and retrieval technology have been created.

## Notes

1 A useful example for illustrating this overall application field is found in the bibliography *Library and Information Science Abstracts (LISA)*, which uses a facet classification

(*A classification of library and information science, London 1971, unpublished*) for classifying the titles indicated in the various issues.

2 This aspect has already been theoretically discussed in (1) and (2)

3 Cf. the description of the system and its retrieval possibilities a.o. in the articles (3-8)

4 This aspect has been presented in more detail in (9)

5 This question is well observable in numerous pre-combined classification systems through the example *Literature*, where as a matter of principle the aspects *Language and geographical spreading, time, category or genre* compete with one another, with one aspect (frequently the language) being declared the primary aspect, while the other ones are in the end, in variable order, reduced to hierarchical subdivisions, thus precluding any direct or comprehensive access to them.

6 Cf. the description in (10).

7 For this see (11) and (12). The classification system contained in (12) has also been used in (13). The recommendations given in (13), however, could not be taken into consideration in our article.

8 See LIDOS 3 in (14)

9 The reader should not be confused by the abbreviations used by LIDOS to characterize conceptual relationships. Contrary to common usage, *VB* does not mean "Verwandte Begriffe" (Related Concepts), but rather denotes concepts having a common superordinated concept, thus indicating with respect to the latter concept all its subordinated concepts of *identical* hierarchical level.

10 See (15) as well as (16)

11 Cf. for instance (17) and (18)

12 See AskSam, described in (19)

13 The limitation to these categories resulted merely from the insertion of the 3990 documents with the year of publication 1988 from LISA into the retrieval environment of *askSam* and from the experimental retrieval study.

14 Cf. for this (20)

15 The numbers in brackets are meant to indicate the role operators used in PRECIS.

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## Annex 1: The Classification System

### ZOOLOGY

#### A.FORM OF DOCUMENT

- Aa..Contributions
- Ab..Periodical
- Ac..Monograph
- Ad..Conference Report
- Ae..Picture volume
- Af..Maps of distribution
- Ag..Lexicon, Encyclopedia
- Ah..Handbook

#### B.ACTIONS ON/WITH ANIMALS

- Ba..Collection
- Bc..Kind of experiments

Bca...Observations	KD..By latitude
Bcb...Field experiments	KDa...Polar animals
Bcd...Laboratory experiments	KDd...Temperate zone animals
Bf..Kind of identification	KDf...Tropical animals
Bfa Determination, classification, taxonomy	KDfa...Equatorial animals
Bfb...Naming, nomenclature	
<b>C.GENERAL PROCESSES,</b>	
<b>DEVELOPMENT OF THE ANIMAL KINGDOM</b>	
Ca..Individual development, growth	
Cd..Theory of derivation, evolution	
<b>D.ACTIVITIES, BEHAVIOR</b>	
Da..Social behaviour	<b>KF..By element</b>
Daa...Play	KFa...Aquatic/Water animals
Dd..Hibernation	KFaa...Fresh water animals
Dg..Migration	KFaaa...River animals
	KFaad...Lake animals
	KFad...Marine/Sea/Salt water animals
	KFd...Amphibious animals
	KFg...Land animals
<b>E.ATTRIBUTES, PROPERTIES</b>	
Eb..Intelligence	<b>L.ZOOLOGICAL TAXONOMY</b>
Ef..Agression	La..Invertebrates
<b>F.PHYSIOLOGICAL PROCESSES, SENSE ORGANS</b>	Laa..Arachnids
Fa..Anatomy	Laaa...Spiders
Fd..Physiology	Lad..Insects
Fda..Skin	Lada...Lepidoptera
Fdd..Nervous system	Ladaa....Moths
Fdda...Brain	Ladaaa....Leaf moths
Fddd...Senses	Ladad....Butterflies
Fddda....Optical senses	Ladd....Hymenoptera
Fdf..Respiration/Breathing	Ladda....Bees
Fdg...Eating	Laddaa....Honeybees
Fdh...Moving	Le..Vertebrates
Fdha....Running	Lea...Fishes
Fdhb...Flying	Leaa...Bone fishes
Fdi...Reproduction	Leaaa...Genuine bone fishes
<b>H/L.ANIMALS, FAUNA</b>	Leaaaa...Soft finned fishes
<b>H.BY RELATION TO HUMANS</b>	Leaaaaa....Herrings
Ha..Beneficial animals, useful animals	Led..Amphibians
Hd..Harmless animals, non-dangerous	Leda....Frogs
Hg..Dangerous animals	Lede....Toads
Hga...Poisonous animals	Lef...Reptiles
<b>J.BY HABIT/ATTITUDE</b>	Lefa....Lizards
Ja..Migrating animals	Lefe....Snakes
Jaa...Vagrants	Lefi....Tortoises
Jd..Hibernating animals	Lek...Birds
<b>KA/KF.BY LIFE AREA</b>	Leka...Raptors/Birds of prey
<b>KA By ground topography</b>	Lekaa...Eagle
KAa..River bank and coastal animals	Lekaaa....Golden eagle
KAaa...Coastal animals	Lem...Mammals
KAd..Lowland animals	Lema....Rodents
KAf...Hill, highland animals	Lema...Rats
KAm...Mountain animals	Lemi...Beasts of prey
	Lemia....Land beasts of prey
<b>KB..By ground vegetation</b>	Lemiaa....Dogkind land beasts of prey
KBa...Desert animals	Lemiaaa....Procyomidae
KBd...Prairie animals	Lemiaaaa.....Red Panda
KBf..Grassland animals	Lemiae....Bears
KBk...Woodland/Forest animals	Lemiaeae.....Giant Panda
KBka...Djungle animals	Lemo....Primates
	Lemoaa....Monkeys
	Lemoaa....Colobus monkeys
	Lemoab....Claw monkeys
	Lemoaba.....Golden-yellow lion monkey
	Lemoabb.....Dwarf silkmonkey
	Lemoabc.....Whitefaced-silkmonkey
	Lemob....Man

## Annex 2: List of Document Titles

01. Poisonous snakes at the equator <LefeKDaHga>
02. Contributions on the raptors of the deserts <LekaKBaAa>
03. Endangering of toads by car drivers <Lede>
04. Congress on the economic utility of honeybees <LaddaaHaAd>
05. Guidelines for the determination of middle European river fishes <LeaKFaaaKDdBfa>
06. Rodents in field and forest <LemaKBk>
07. Moving processes of the leaf moth's flying <LadaaaFdha>
08. Who hibernates in the woods and fields? <KBkJd>
09. Adaptation of the lizard's skin to the desert climate <LefaKBaFdaCd>
10. Golden eagles in high mountain regions <LekaaaKAm>
11. Tortoises in tropical rivers <LefiKFaaaKdf>
13. Butterflies of the German middle highlands and their names <LadadKAfBfb>
14. Food requests of tropical spiders <LaaaKDfFdg>
15. Contributions on the anatomy of bone fishes <LeaaaFaAa>
16. Bears of the polar region <LemiaaeKDa>
17. Journal on the theory of evolution <CdAb>
18. Animal determination guide <BfaAc>
19. Easy finding names of birds; a guide to their determination <LekBfa>
20. Observation of monkeys playing <LemoaDaaBca>
21. Bird determination book <LekBfaAc>
22. Birds of middle Europe: a determination book LekBfaAc>
23. The social behavior of Colobus monkeys <LemoaaDa>
24. Aggression of monkeys <LemoaEf>
25. Adaptation of primates <LemoCd>
26. Special food requests of the giant panda <LemiaaeeFdg>
27. The nervous system of bears <LemiaaeFdd>
28. The reproduction of bears <LemiaaeFdi>
29. The anatomy of red pandas <LemaaaFa>
30. The evolution of procyomidae and bears <LemiaaaCd; LemiaaeCd>
31. The relationship of the red panda with the giant panda <Lemiaaee; Lemiaaaa>
32. Dogkind land animals of prey: a picture volume <LemiaaAe>
33. Land animals of prey of the temperate zones <LemiaKDd>
34. Polar animals: a picture volume <KDaAe>
35. Animals of prey- do they play? <LemiDaa>
36. Golden eagles and their habitat: with maps <LekaaaAf>
37. Food requests of the golden eagle <LekaaaFdg>
38. Distribution maps of rats <LemaaAf>
39. The ecological significance of rodents: a congress <LemaHAd>
40. Hibernating rodents <LemaJd>
41. Physiological processes in hibernation: a congress <FDd>
42. Social behavior of mammals <LemDa>

## Annex 3: Systematic Order of the Classed Titles

- Bfa Ab
  - \* Journal for Taxonomy (Doc.No.221)
  - \* Taxonomy: a Journal (doc.No.158)
- Bfa Ac
  - \* Animal-Determination Book (Doc.No.018)
- CdAb
  - \* Letters on Evolution (Doc.No.157)
  - \* Evolution: a Journal (Doc.No.156)
  - \* Journal for Evolution (Doc.No.017)
- D Ab
  - \* Journal of Animal Behavior (Doc.No.160)
- F Dd
  - \* Physiological Processes of Hibernation: a Conference (Doc.No.041)
- Fa Ab
  - \* Journal of Physiology (Doc.No.154)
- Fd Bc \* Experimental Physiology: a Journal (Doc.No.161)
- Fd BcAd
  - \* Contributions on Experimental Physiology: Proceedings (Doc.No.162)
- FdDd
  - \* Physiology of Hibernation (Doc.No.216)
  - \* Physiological Processes of Hibernation (Doc.No.104)
- Fd Dd
  - \* The breathing in hibernation (Doc.No.005)
- H/LD a
  - \* Social behavior of animals (Doc.No.179)
  - \* Animals and their social behavior (Doc.No.222)
- Jaa
  - \* Migrating birds (Doc.No.193)
- JaaAe
  - \* Picture volume of migrating birds (Doc.No.217)
  - \* Migrating birds: a picture volume (Doc.No.048)
- Jaa Dg Bca
  - \* Watching migrating birds (Doc.No.049)
- Jd
  - \* Hibernation (Doc.No.203)
- Jd Fdf
  - \* The respiration of hibernating animals (Doc.No.106)
- Jd Fdf Dd
  - \* The respiration of hibernating animals in hibernation (doc.No.107)

## Annex 4: Classification System in the LIDOS Thesaurus Format

Brain  
BT: Nervous system  
NT:  
UF: Fdda  
RT: Senses

Giant panda  
use *Panda*

Golden-yellow lion monkey  
BT: Claw monkeys

NT:  
UF: Lemoaba  
RT: Dwarf silkmonkey; Whitefaced-silkmonkey

H use *By relation to humans*

H/L  
use *Animals*

Ha  
use *Beneficial animals*

Handbook  
BT: Form of document

NT:  
UF: Ah  
RT: Contributions; journal: monograph, congress volume; picture volume; maps of distribution, lexicon

Insects

BT: Invertebrates  
NT: Lepidoptera; Hymenoptera  
UF: Lad  
RT: Arachnids

Poisonous animals  
BT: Dangerous animals

NT:  
UF: Hga  
RT:

Raptors

BT: Birds  
NT: Eagle  
UF: Leka  
RT:

Skin

BT: Physiology  
NT:  
UF: Fda  
RT: Nervous system; respiration; eating; moving; reproduction

## Annex 5: Examples of Retrieved Document Titles

1. Special food requests of the giant panda  
< LemiaaeeFdg > (Doc.No.026)
2. The eating habits of pandas < LemiaaeeFdg > (Doc.No.196)

**Fig.1: Title list retrieved by 'Lemiaaee and Fdg'  
(Food requests of the giant panda)**

1. Who hibernates in forest and field? < KBkJd > (Doc.No.008)
2. Handbook on tropical forest animals < KDFKBkAh > (Doc.No.044)
3. Forest birds < LekKBk > (Doc.No.050)
4. Raptors in the forest < LekaKBk > (Doc.No.191)

5. The birds of the forest < LekKBk > (Doc.No.201)
6. Who sings in fields and forests?  
< LekKBfBfaAc; LekKBkBfaAc > (Doc.No.230)
7. The rodents of our home country.  
< LemaKBk > (Doc.No.292)

**Fig.2: Title list retrieved by 'KBk\$'  
(animals in the forest)**

1. Handbook of tropical forest animals  
< KDFKBkAh > (Doc.No.044)

**Fig.3: Title list retrieved by 'KBk\$ and KDF\$'  
(tropical forest animals)**

1. Contributions on the raptors of the desert  
< LekaKBaAa > (Doc.No.002)
2. Determinations of birds of prey < LekaBfa > (Doc.No.047)
3. Observing the raptors' flight < LekaFdhaBca > (Doc.No.061)
4. Can one speak of an aggressiveness of raptors? < LekaEf > (Doc.No.126)
5. Birds of prey < Leka > (Doc.No.184)
6. Raptors in the forest < LekaKBk > (Doc.No.191)
7. The flight of raptors: Observations  
< LekaFdhaBca > (Doc.No.286)
9. Raptors < Leka > (Doc.No.288)

**Fig.4: Title list retrieved by 'Leka'  
(raptors/birds of prey)**

1. Contributions on the raptors of the desert  
< LekaKBaAa > (Doc.No.002)
2. Golden eagles in high mountain regions  
< LekaaaKAm > (Doc.No.010)
3. Golden eagles' distribution: with maps  
< LekaaaAf > (Doc.No.036)
4. Food requests of the golden eagle  
< LekaaaFdg > (Doc.No.037)
5. Eagles: a picture volume < LekaaAe > (Doc.No.046)
6. Determination of raptors: a guideline  
< LekaBfa > (Doc.No.047)
7. The reproduction of the golden eagle  
< LekaaaFdi > (Doc.No.052)
8. Observing the raptors' flight  
< LekaFdhaBca > (Doc.No.061)
9. Can one speak of an aggressiveness of raptors < LekaEf > (Doc.No.126)
10. Distribution map of the golden eagle  
< LekaaaAf > (Doc.No.145)
11. Birds of prey < Leka > (Doc.No.184)
12. Raptors in the forest < LekaKBk > (Doc.No.191)
13. The life of the golden eagle < LekaaaAe > (Doc.No.202)
14. The flight of raptors: observations  
< LekaFdhaBca > (Doc.No.286)
15. What is the food of the golden eagle?  
< LekaaaFdg > (Doc.No.287)
16. Raptors < Leka > (Doc.No.288)

**Fig. 5: Title list retrieved by 'Leka\$'  
(raptors including all narrower concepts)**

1. Birds of prey <Leka> (Doc.No.184)
2. Raptors <Leka> (Doc.No.288)

**Fig.6: Title list retrieved by 'Leka' as a complete notation  
(raptors in general; without narrower concepts,  
without relationships to other aspects)**

1. Food requests of the golden eagle <LekaaaFdg> (Doc.No.037)
2. The reproduction of the golden eagle <LekaaaFdi> (Doc.No.052)
3. Observing the raptors' flight <LekaFdhaBca> (Doc.No.061)
4. The flight of raptors: Observations <LekaFdhaBca> (Doc.No.286)
5. What is the food of the golden eagle? <LekaaaFdg> (Doc.No.287)

**Fig.7: Title list retrieved by 'F\$ and Leka\$'  
(physiology of raptors)**

1. Food requests of the golden eagle <LekaaaFdg> (Doc.No.037)
2. The reproduction of the golden eagle <LekaaaFdi> (Doc.No.052)
3. The anatomy of birds: a picture volume <LekFaAe> (Doc.No.053)
4. Observing the raptors' flight <LekaFdhaBca> (Doc.No.061)
5. The flight of raptors: Observations <LekaFdhaBca> (Doc.No.286)
6. What is the food of the golden eagle? <LekaaaFdg> (Doc.No.287)

**Fig.8: Title list retrieved by 'F\$ and Lek\$'  
(physiology of birds)**

1. Special food requests of the giant panda <Lemiaeefdg> (Doc.No.026)
2. The nervous system of bears <Lemiaeefdd> (Doc.No.027)
3. The reproduction of bears <LemiaeFdi> (Doc.No.028)
4. The anatomy of procyomidae <LemiaaaaFa> (Doc.No.029)
5. Contributions to the respiration behavior of hibernating bears <LemiaeFdfDdAa> (Doc.No.108)
6. Physiological processes of hibernating bears <LemiaeFdDd> (Doc.No.109)
7. The eating habits of pandas <Lemiaeefdg> (Doc.No.196)
8. Why is it that the red panda can climb so easily? <LemiaaaaFa> (Doc.No.297)

**Fig.9: Title list retrieved by 'F\$ and Lemia\$'  
(physiology of land beasts of prey)**

1. The senses of the herring <LeaaaaaFddd> (Doc.No.072)
2. Contributions to the nervous system of soft finned fishes <LeaaaaFddAa>
3. The structure of the eye of soft finned fishes

1. <LeaaaaFddd> (Doc.No.077)
2. Contributions to the nervous system of bone fishes <LeaaaFddAa> (Doc.No.079)
3. The brain of bone fishes <LeaaFdda> (Doc.No.084)

**Fig.10: Title list retrieved by 'Fdd\$ and Leaa\$'  
(nervous system of bone fishes)**

1. Tortoises in tropical rivers <LefiKFaaaKdf> (Doc.No.012)
2. Distribution map of tropical fresh water fishes <LeaKFaaKdfAf> (Doc.No.144)

**Fig.11: Title list retrieved by 'Kdf\$ and KFaa\$'  
(tropical fresh water animals)**

1. Contributions to the anatomy of bone fishes <LeaaaFaAa> (Doc.No.015)
2. The anatomy of procyomidae <LemiaaaaFa> (Doc.No.029)
3. The anatomy of birds: a picture volume <LekFaAe> (Doc.No.053)
4. Anatomy and physiology of soft-finned fishes <LeaaaFa; LeaaaFd> (Doc.No.073)
5. Contributions to the anatomy of soft-finned fishes <LeaaaFaAa> (Doc.No.074)
6. Anatomy of the genuine bone fishes <LeaaaFa> (Doc.No.078)
7. Anatomy of bone fishes <LeaaaFa> (Doc.No.083)
8. Handbook on the anatomy of vertebrates <LeFaAh> (Doc.No.099)
9. Contributions to the anatomy of vertebrates <LeFaAa> (Doc.No.141)
10. Anatomy of fishes <LeFa> (Doc.No.233)
11. Handbook on the anatomy of vertebrates, 2nd ed. <LeFaAh> (Doc.No.267)
12. Bone fishes and their skeleton <LeaaFa> (Doc.No.275)
13. Anatomy of rodents <LeMaFa> (Doc.No.293)
14. Why is it that the red panda can climb so easily <LemiaaaaFa> (Doc.No.297)
15. Anatomy of primates <LemoFa> (Doc.No.299)

**Fig.12: Title list retrieved by 'Fa and Le\$'  
(all documents on the anatomy of vertebrates)**

1. Handbook on the anatomy of vertebrates <LeFaAh> (Doc.No.099)
2. Contributions to the anatomy of vertebrates <LeFaAa> (Doc.No.141)
3. Handbook on the anatomy of vertebrates, 2nd ed. <LeFaAh> (Doc.No.267)

**Fig.13: Title list retrieved by 'Fa and Le'  
(general literature on the anatomy of vertebrates)**

SilverPlatter 1.6

LISA (1/69 ~ 9/89)

TI: Libraries and management by objectives [in Japanese] 1 of 2  
AU: Mori, -Koichi  
CC: Nkz Nkz  
AN: 88-5048

TI: Management by objectives and university libraries 2 of 2  
AU: Lavergne, -Philippe-de  
CC: NkzGd Nkz  
AN: 88-2906

**Fig.14: Title list to search for LISA Notation 'Nkz'**

SilverPlatter 1.6	LISA (1/69 - 9/89)	
		1 of 44
TI: Consulting to rural public libraries: a survey of state library agencies. AU: Griffith-Leah-M. CC: Nkm Nkm AN: 89-3924		
TI: Analysis, process and use of information 8: a view-point of a solution to a problem [in Japanese]. AU: Nawa-Kotaro CC: Nk Nk AN: 89-3437	2 of 44	
TI: CPM and PERT in library management. AU: Main-Linda CC: Nky Nky AN: 89-3441	3 of 44	
TI: Management information in libraries: its exploitation. AU: Redfern-Margaret CC: Ndk Ndk AN: 89-3439	4 of 44	
TI: A management information system for the public library. AU: Zijlstra-Paul CC: NkkFv Nkk AN: 89-3440	5 of 44	
TI: Quality assurance in Canadian hospital libraries--the challenge of the eighties. AU: Eagleton-Kathleen-M. CC: Nk&HuD71 Nk AN: 89-3438	6 of 44	
TI: Quality assurance: establishing a program for special libraries. AU: Fredenburg-Anne-M. CC: Nk& Nk AN: 89-2863	7 of 44	
TI: Thinking about management: an approach to self-analysis for library managers. AU: Hannabuss-Stuart CC: Nk Nk AN: 89-2361	8 of 44	
TI: The system viewpoint and library reforms [In Chinese]. AU: Li-Chaoxian CC: Nkv Nkv AN: 89-1233	9 of 44	
TI: Methodology work. AU: Risko-Andrej CC: NkmD437 Nkm AN: 89-714	10 of 44	
TI: Integrated Academic Information Management Systems (IAIMS) AU: Matheson,-Nina-W-(ed); IAIMS-(Integrated-Academic-Information-Management-Systems); Integrated-Academic-Information-Management-Systems CC: NkkEr(61) Nkk AN: 88-5759	11 of 44	

Fig.17: Extract of title list to search for LISA Notation 'Nk\$'

SilverPlatter 1.6	LISA (1/69 - 9/89)	
		1 of 10
TI: Integration of text, facts, graphics and pictures into a knowledge base. AU: Scholz-Kordula CC: ZmRnNkv Zm AN: 89-4775		
TI: Human centred IT. CC: SaOgNkv Sa AN: 89-4606	2 of 10	
TI: Le Musee Documentaire: reflections on a database of works mentioned in art treatises and town descriptions before 1800. AU: Schwartz-Gary CC: ZmRnM(7(091))Nkv Zm AN: 89-4774	3 of 10	
TI: Building your own database: potentials for creativity. AU: Horowitz-Roberta-S.; Latinwo-Larry; Weiner-John-M. CC: ZmRnNkv Zm AN: 89-4241	4 of 10	
TI: Information behaviors in the preparation of research proposals: a user study. AU: Nilan-Michael-S.; Fletcher-Patricia-T. CC: ZmVticNkv Zm AN: 89-4272	5 of 10	
TI: The value of information: approaches in economics, accounting, and management science. AU: Repo-Aatto-J. CC: RmNko Rm AN: 89-4006	6 of 10	
TI: A generalization and clarification of the Waller-Kraft wish list. AU: Cater-Steven-C.; Kraft-Donald-H. CC: ZjNkv Zj AN: 89-4133	7 of 10	
TI: Composition of hypertext nodes. AU: Garg-Pankaj-K.; Scacchi-Walt CC: ZjOthNkv Zj AN: 89-4143	8 of 10	
TI: Systems astigmatism. AU: McKee-Bob CC: OgNkv Og AN: 89-3941	9 of 10	
TI: Constructing data bases--professional issues. AU: Moulton-Lynda-W. CC: SaOgNkv Sa AN: 89-3021	10 of 10	

Fig.18: Title list to search for LISA Notation '\*Nk\$'

Fig.15 could not be included because of lacking space

Fig.16 see page 109

TI: CD-ROM and satellite plans in NSW TAFE library services.  
 AU: Woods-Lois; AUSSAT;  
 CIANN-(College-Libraries-Activity-Network-in-New-South-Wales)  
 SO: LASIE; 19 (1) July/Aug 88, 4-9. 3 refs  
 PY: 1988  
 CC: TogOjc Tog  
 AN: 89-4667

TI: CD-ROM and on-line public access catalogues. A project of Bielefeld University.  
 AU: Binder-Wolfgang; Kemminer-Jurgen; Summan-Friedrich;  
 Bielefeld-University-(West-Germany).-Library  
 SO: ABI-Technik; 8 (2) 1988, 107-110, 113-120. illus. 16 refs  
 PY: 1988  
 CC: TogOjcGd Tog  
 AN: 89-4670

TI: CD-ROM in the library: it's more than the fiche of the 21th century.  
 AU: Pearson-Ellen-M.; MacKinnon-Ron; Guelph-University-(Ontario).-Libraries  
 SO:  
 In:-International-library-cooperation:-10th-Anniversary-Essen-Symposium,-19-October-22-October-1987; 153-160  
 PY: 1988  
 CC: TogOjcAx Tog  
 AN: 89-4669

TI: Updating of online catalogue on CD-ROM?  
 AU: Neubauer-Karl-Wilhelm  
 SO:  
 In:-International-library-cooperation:-10th-Anniversary-Essen-Symposium,-19-October-22-October-1987; 161-178. illus. 4 refs  
 PY: 1988  
 CC: TogOjc Tog  
 AN: 89-4668

TI: An example of catalogue management on CD-ROM: BIBLIOFILE.  
 AU: Cormouls-Martine; Gaudin-Frederique; BiblioFile  
 SO: Documentaliste; 25 (3) May-June 88, 122-128. tables  
 PY: 1988  
 CC: TogOjc Tog  
 AN: 89-4105

TI: The compact disk circulation system interface at Tacoma Public Library:  
 beyond stand-alone CD-ROM.  
 AU: Hegarty-Kevin; Tacoma-(Washington-State).-Public-library  
 SO: Library-Hi-Tech; 6 (3) 1988, 103-111. tables  
 PY: 1988  
 CC: TogOjcAw Tog  
 AN: 89-4106

Fig.21: Extract from title list to retrieve **\*CD\$ and (\*T\$ or \*U\$)**

SilverPlatter 1.6 LISA (1/69 - 9/89)

1 of 3  
 TI: A management information system for the public library.  
 AU: Zijlstra-Paul  
 CC: NkkFv Nkk  
 AN: 89-3440

2 of 3  
 TI: Management information systems for public libraries. Concepts, principles and outline research programme  
 AU: Thomas,-H-A; Waghorn,-C-A; British-Library-Research-Paper-25  
 CC: NkkFv Nkk  
 AN: 88-690

3 of 3  
 TI: The 75th anniversary of Hagen library centre: forward into an open future  
 AU: Traub,-Johannes  
 CC: NkmFvd433 Nkm  
 AN: 87-769

Fig.19: Title list to retrieve LISA Notation **'Nk\$ and \*Fv\$'**

SilverPlatter 1.6 LISA (1/69 - 9/89)

1 of 1  
 TI: An independent advisory unit on library automation supported by South Holland Provincial Council  
 AU: Hardonk,-Harry; South-Holland-(Netherlands)-Public-libraries  
 CC: OqNkmFv Oq  
 AN: 87-6083

Fig.20: A new title having searched for LISA Notation **'Nk\$ and \*Fv\$'**

TI: Cataloguing CD-ROMs at the Ohio State University.  
 AU: Wang-Anna; Ohio-State-University.-Libraries  
 SO: Serials-Review; 14 (3) 1988, 11-21. illus. 9 refs.  
 PY: 1988  
 CC: ThUz& Th  
 AN: 89-2543

TI: The politics of CD-ROM: the legislative perplex  
 AU: Wismer,-Donald; MaineCat  
 SO: Laserdisk-Professional, 1 (1) May 88, 76-79  
 PY: 1988  
 CC: UzhOqjc Uzh  
 AN: 88-5292

Fig.22: Titles, missed in searching for LISA-Notation **'Tog'**

SilverPlatter 1.6 LISA (1/69 - 9/89)

1 of 2

TI: Microcomputers and LAN's: are they a viable part of your future?  
AU: Schmidt,-Sandy  
CC: OunNk Oun  
AN: 88-3458

TI: Quality assurance and online searching  
AU: Chitty,-Mary; Gelb,-Linda;  
New-England-Online-Users-Group-Quality-Assurance-Committee  
CC: ZmRnNk Zm  
AN: 88-478

2 of 2

Fig.16: New titles in searching for LISA Notation '\*Nk'

SilverPlatter 1.6 LISA (1/69 - 9/89)

No.	Records	Request
1:	213	PRECIS
2:	17648	RETRIEVAL
3:	4335	ONLINE
4:	176	#1 and #2
5:	6	#1 and #3
6:	6	#1 and #2 and #3

1 of 6

TI: Online public access to library files: 2nd National Conference, 5-7 April 1986, University of Bath  
AU: Rau,-Peter;  
Centre-for-Catalogue-Research,-Bath-University-(UK)-National-Conference-(1986)  
CC: UegsAg Uegs  
AN: 88-2049

2 of 6

TI: Browsing through PRECIS: structured subject access in an online catalogue  
AU: Congreve,-Juliet; Middlesex-Polytechnic-(UK)-Library; PRECIS  
CC: UegsTiAw Uegs  
AN: 87-4659

3 of 6

TI: Problems of subject access: (i) automatic generation of printed indexes and online thesaural control  
AU: Congreve,-Juliet; Middlesex-Polytechnic-(UK)-Library  
CC: UegsAwYa Uegs  
AN: 86-5282

4 of 6

TI: Computer searching on PRECIS: an exploration of measuring comparative retrieval effectiveness  
AU: DeHart,-Florence-E; Glazier,-Jack; PRECIS  
CC: YpkVnnOq(PRE) Ypk  
AN: 85-2121

5 of 6

TI: The AAT in the online catalog environment  
AU: Petersen,-Toni; ARLIS/NA-(Art-Libraries-Society/North-America);  
Art-and-Architecture-Thesaurus-project-ARLIS/NA-(Art-Libraries-Society/North-America)  
CC: Zdm(7) zd  
AN: 83-5070

6 of 6

TI: Southern Ontario: regional initiatives and trends  
AU: Granda,-Sally  
CC: RmD71 Rm  
AN: 79-2892

Fig.23: Title list of the search in LISA-CD mentioned above

SilverPlatter 1.6 LISA (1/69 - 9/89)

1 of 9

TI: Online public access to library files: 2nd National Conference, 5-7 April 1986, University of Bath  
AU: Rau,-Peter;  
Centre-for-Catalogue-Research,-Bath-University-(UK)-National-Conference-(1986)  
CC: UegsAg Uegs  
AN: 88-2049

2 of 9

TI: On-line public access to library files: 2nd National Conference. Progress and Prospects. April 1986. Centre for Catalogue Research, University of Bath  
AU: Whitsed,-N;  
National-Conference-on-On-line-Public-Access-to-Library-Files-(UK,-1986)  
CC: UegsDlAg Uegs  
AN: 88-931

3 of 9

TI: Browsing through PRECIS: structured subject access in an online catalogue  
AU: Congreve,-Juliet; Middlesex-Polytechnic-(UK)-Library; PRECIS  
CC: UegsTiAw Uegs  
AN: 87-4659

4 of 9

TI: On-line public catalogues: some aspects of subject access  
AU: Estivill-Rius,-Assumpcio; Ruis,-A-E  
CC: Uegs Uegs  
AN: 86-4741

5 of 9

TI: Problems of subject access: (i) automatic generation of printed indexes and online thesaural control  
AU: Congreve,-Juliet; Middlesex-Polytechnic-(UK)-Library  
CC: UegsAwYa Uegs  
AN: 86-5282

6 of 9

TI: UDC as the medium for information retrieval in the automated network of university and research libraries  
AU: Kautto,-Vesa  
CC: ZkjVcXsi(UDC) Zkj  
AN: 80-1451

7 of 9

TI: A complete delivery service for Canadian non-print media  
AU: Dykstra,-Mary; National-Film-Board-of-Canada;  
N-F-B(National-Film-Board,-Canada); PRECIS; Preserved-Context-Index-System  
CC: ZkjVrsSjc Zkj  
AN: 79-1178

8 of 9

TI: Syntactic versus non-syntactic indexing languages  
AU: von-Cotta-Schoenberg,-Michael; Cotta-Schoenberg,-M-von  
CC: VrhAzVdk Vrh  
AN: 76-3010

9 of 9

TI: Card indexes or printed pages-physical substrates in index evaluation  
AU: Coates,-E-J  
CC: YaVrh Ya  
AN: 76-3678

Fig.24: Title list of the search 'PRECIS and (\*Vr\$ or \*Zk\$ or \*Ueg\$)