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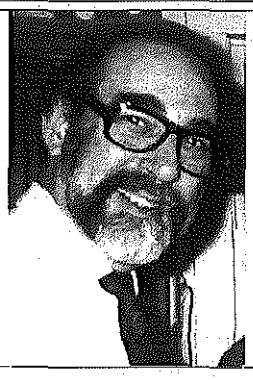
Categories and Relators: a New Schema*



Jean M.Perreault (b.1931, Kansas City, MO) received his education at Jesuit Colleges and the Univ.of Wisconsin in Philosophy, English and Library Science. At Florida Atlantic Univ. involved in the development of MARC; taught at Univ. ofMaryland,Library School, and became Prof.of Bibliography at the Univ.of Alabama in Huntsville.

Perreault, J.M.: **Categories and relators: A new schema** Knowl.Org. 21(1994)No.4, p.189-198, 30 refs.
Reprint of an article which appeared in Rev.Int.Doc. 32(1965)No.4, p.136-144, also reprinted in the FID/CR Report No.4 and the author's book *Towards a Theory for UDC.* London: C.Bingley 1969. p.119-148, including the author's "emendations". Based on the works of Aristotle, Ramon Lull, LKant, and the experiences with relationships published in the works of S.R.Ranganathan, E.de Grolier, J.Mills, J.C.Costello, E.Wall, R.Pagès, A.Leroy, P.Braffort, M.Kervégant, J.C.Gardin and J.Farradane, categories and relationships were collected, analyzed, grouped and classified in a triadic way so that a scheme resulted by which 120 relationships could be defined and identified by their positions and their codes. The exercise was meant to create and supply a tool for the replacement of the non-significant relation symbol, the colon, in the UDC by a letter code which could express the actual relationship contained in a classificatory statement. Examples for their application illustrate different cases occurring. (KO)

1. Introduction

If the (major) premise is accepted, that fully effective machine strategization of a retrieval system depends upon the use of a (hierarchically) structural (but highly flexible) notation as the equivalent for the verbal access provided by either unitermic or articulated conceptual indicators, a faceted[1] classification logically emerges as the desideratum[2].

The two aspects of a structural notation most determinative here are hierarchicality and uniform use of general categories[3] (the latter, not merely for the sake of uniformity as such, but as the means to a heghtened flexibility). These desiderata could of course be present on the idea plane alone; but without their being present notationally they do not furnish, to a mechanical retrieval system, the type of assistance it requires for optimal functioning.

The second (minor) premise ought to be that the Universal Decimal Classification, being both hierarchical and general-categoric, provides the desired structurality. But the melancholy fact is that this desideratum is not always satisfied, for instance when UDC uses direct division of a hierarchy when division by general category would be equally appropriate[4]

However, research by Ranganathan, Perry-Kent-Berry-Melton, the US Patent Office, the Engineers Joint Council, Pagès, Farradane, Gardin, and several others, leads inevitably to the conclusion that even if the desired lexical and relational aspects within the substantive elements of the classification are provided for in a way to enable strategisation of mechanical searching, there is need for many relations not provided by hierarchy and general categories/relations, in fact between rather than within the classifying terms themselves. B.C Vickery points out[5] that

A second defect of the UDC, from the standpoint of faceted classification, is the symbol for general relationship, the colon, gives no guidance as to the specific relation existing between the terms linked. Recently, Dr.Kervégant has studied the matter, on the grounds that the indexing of periodical articles makes the indication of relationships practically indispensable[6]. M Kervégant's tabulation[7] is included in the comparative enumeration that follows (fig. 3)

2. Two Different Classes of Relationships in UDC

My intention to embark upon the construction of a philosophically adequate schema of relators was not as precisely focussed as the foregoing would seem to indicate to begin with. However, considerations of the means for increasing the applicability of UDC to mechanised retrieval were present from the first. The original starting point, rather than inter-classificatory relationships, was the suspicion that the symbols at present in use in the UDC were not actually all members of the same class.

The *differentia specifica* which I applied was: "Does this symbol refer to the conceptual structure as such? - or to the particular document being classified?" If the former, it is characterised as logical, if the latter, as documentary[8]. The symbols are accordingly distributed as in fig. 1

	LOGICAL	DOCUMENTARY
conjunction, 'product'	*n:n*	
disjunction, 'sum'	*n+n*	*n+n*
span	*n/n*	
compounder	*n'n*	
sub-grouper		[*n . . . n*]
language	=*n*	=*n*
form		(O*n*)
place	(*n*)	
race	(=*n*)	
time	"*n*"	
point of view	.OO*n*	
auxiliary aspects	.O*n* / –*n*	

Figure 1: Relationship symbolization of the UDC.

There are several points here that could be improved upon (for instance, use of the comma to replace the period in .0*n* and .00*n*[9]; elimination of closing quote and closing parentheses or their use in some other connection; use of the compounding apostrophe in wider connections than chemical compounds[10]; elimination of the confusion arising from the dual use of any sign) - but the most important improvement would be the substitution, for the colon, of a larger gamut of relational indicators, as called for in the quotation from Vickery.

The various categorical and relational tabulations consulted proved intractable to collation at first - until it was noted that, though some belonged to the general group, 'attributes of beings', others belonged to the general group 'relations between beings'[11], and some had features (or even terms) belonging to both groups. In general, however, a broad pattern revealed itself - it looks as a different sort of vicious circle (fig. 2).

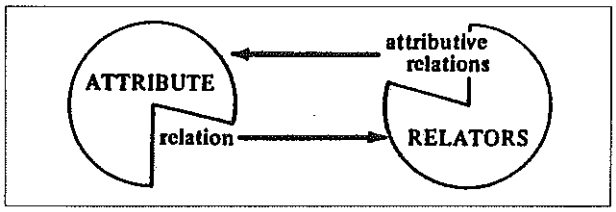


Fig. 2: Relations vs attributes

Enumeration of the categorical and relational tabulations studies gives fig. 3 (this enumeration constituting the *first step* toward the final relator-schema).

3. The Detection of Tripartite Relationships

If, instead of assuming that a relator can be categoric (=capable of a variety of meanings, thus avoiding the need for explicit enumeration of a near-totality of the appropriate and useful relations as is the case with Farradane's operators[25] or Gardin's syntagmata[26] - which, however, may be less successful in a machine scanned searching system than in an optically scanned one), a general outline of these tabulations is attempted, the following seem to me to comprise the major types present (with examples);

a: ordinal (earlier than..., less than..., smaller than...)
b: determinative (causing..., giving rise to..., limiting...)
c: attributive (with characteristic...)
d: interactive (differing from..., in concord with..., imitating...)
e: subsumptive (with kind such as..., with parts such as...)
f: logical (negation of..., reciprocal with..., converse to...)

In each of these cases a generally applicable line of division can be seen:

a: mean + extremes, several sub-types (time: *simultaneous, prior, posterior;* size: *equal, smaller, larger;* degree: *equivalent, inferior, superior;* position: *lateral, axial, vertical* each with its own tripartition)
b: a triadic movement from favourable to unfavourable: *production, limitation, destruction*
c: (the categories of *attribution* here become part of the relational "sphere", just as at *relation* the converse occurs; cf fig. 2)
d: a triadic movement from favourable to unfavourable: *concord, difference, contrariety*
e: intersection of the two aspects "subsumed" and "intrinsic/extrinsic" give rise to the triangle and the resultant relations in fig. 4

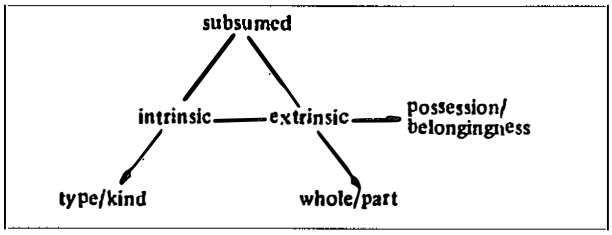


Fig.4: The relationships of subsumption

f: aside from the triadic (and rather arbitrary) division of "capacity for..." there is the more legitimate triad: *reciprocal, converse,* and *negative,* which could perhaps be shown to be the basic structure holding all the sub-types together into types as will be attempted in Sect. 4.

Thus, while not wishing on the one hand to denigrate Pagès' or Kervégant's careful divisions nor, on the other, Farradane's and Gardin's stimulating variable-context methods, I would conclude to the need for a more universal and more systematic deduction of relations. But first, as the second step toward the final arrangement, I exposit a semi-systematic version (fig. 5) of the tabulations previously simply enumerated (fig. 3), abstracting from all of them all distinct relations.

4. The Third and Final Step

Particular deficiencies in this preparatory scheme can be seen with relatively little trouble, though the systematic correction of the arrangement as a whole is by no means so obvious. It seemed to me, while seeking for the path to such a systematic corrective, that the tripartite relation (for instance, as most fundamentally embodied in the three interactive terms *concord, difference,* and *contrariety* taken from Ramon Lull's relative principles) was characteristic of the tabulation as a whole. The same has been already mentioned of the logical terms *reciprocal, converse,* and *negative.*

There seemed no way of having this general-categoric ideal cover the whole extent of the schema, until it was noticed that the tripartition under *determinative* consists of terms all of which are active, as are the further tripartitions. If passive determination is also to be included, the tripartition of determinative can be seen to require *interactive* as well. Our main member classes then have become *ordinal, determinative, subsumptive* and *logical.* And if any one of these four can be seen as congruent to the other three taken together, a perfect

ARISTOTLE	LULL[12,13]	KANT[14]	MILLS[15]	COSTELLO-WALL[16]	EJC[17]	WRU[18]	PAGES[19]	LEROY-BRAFFORT[20]	KERVEGANT[21]	GARDIN[22,23]	FARRADANE[24]
substance *accident* quantity quality relation place time position state action passion	*general questions* possibility definition materiality formality size quality temporality locality modality instrumentality	*relative principles* difference concord contrariety beginning middle end majority equality minority *quantity* unity plurality totality *quality* reality negation limitation *relation* inherence/ subsistence causality/ dependence community *modality* possibility/ impossibility existence/ non-existence necessity/ contingency	whole thing kind parts materials processes properties agents operations	2, application 2, cause 3, matter 4, means 5, medium 6, by-product 7, product 8, research 9, dependent variable 10, design 11, processed (passive)	1, matter 2, product 3, by-product 4, application 5, environment 6, cause 7, effect 8, major topic 9, passivity; location 10, means 0, bibliographic data	A/E, categoric/ intrinsic I/O, inclusive/ aggregate Q, affected U, productive W, instrumental X, negative Y, attributive Z, simulative	a, *order in general* ab, equal ac, prior af, first ag, last e, *determinative* eb, cause ec, influence ed, source; origin ef, suppression; injury eg, frame of reference i, *concrete* ib, simultaneous ic, means id, barrier if, aiding ig, supply; transfer ij, competition il, aggression im, attack in, resistance o, *capacity* ob, high cap, oc, average cap, od, low cap. u, *reciprocity* ü, *converse*	action A, relation to B, for the ad, intermediate purpose L, location M, by *means* of R, results in	:, *relation in general* → 1⟶, appurtenance → 11⟶, inclusion; implication → 12⟶, parts; organs → 13⟶, constituents → 14⟶, properties → 141→, physical pr. → 142→, chemical pr. → 143→, biological pro. → 15⟶, aptitudes; predispositions → 2⟶, process → 21⟶, action → 211→, favourable ac. → 212→, unfavourable ac. →2121→, retardation →2122→, inhibition →2123→, destruction → 21←, interaction → 21k←, favourable i.a. → 212←, unfavourable i.a. → 22⟶, operation; product → 3⟶, dependence → 31⇢, causality → 32⇢, origin → 33⇢, conditions → 31←, correlation → 32←, association → 33←, combination → 4⟶, orientation → 41⟶, aspect → 42⟶, application → 43⟶, utilisation → 5⟶, comparison → 51⟶, resemblance → 511→, analogy → 512→, equality; identity → 52⟶, non-resemblance → 521→, difference → 522→, opposition → O⟶, negation of the relation	subject object qualifier location instrument *SYNTOL* *words* predicates entities states actions *SYNTOL* *relations* coordinative consecutive associative predicative	concurrence comparison association equivalence state; dimension appurtenance distinctness reaction causation

Figure 3

12 This tabulation of *quaestiones generales* is freely translated from T & J Carreras y Artau, *Filosofia Cristiana de los siglos XIII al XV* (Madrid, Real Academia de Ciencias Exactas, Fisicas y Naturales, 1939), i, 425, citing Lull's *Logica nova*.

13 This tabulation of relative principles is freely translated from *ibidem*, i, 430. Lull, however, is hardly the most representative thinker between Aristotle and Kant, so R J Deferrari's *Lexicon of St Thomas Aquinas* (Washington, Catholic University of America Press, 1948) was examined as well, without all of St Thomas' relational terms being listed in figure 3; but the only relations given in the *Lexicon* and not included in figures 5-8 are *master/slave, principle/procession*, and *relatio personalis*. The first of these can be assimilated to the relations of *degree*, the second (which Deferrari equates with that of filiation) to *origin/derivation*, and the third is, I feel, entirely peculiar to theology.

14 From *Critique of pure reason*, tr N K Smith[2] (London, Macmillan, 1950), 113.

15 From *Guide to the Universal Decimal Classification (UDC)* (London, British Standards Institution, 1963).

16 From B C Vickery, *On retrieval system theory*, (London, Butterworth, 1961), 49, citing J C Costello & E Wall, *Recent improvements in techniques for storing and retrieving information* (Wilmington, DuPont, 1959). *Cf* J C Costello, 'A basic theory of roles as syntactical control devices in coordinate indexes' (*Journal of chemical documentation* iv/2 (1964), 116-124).

17 From the Engineering Joint Council's *Thesaurus of engineering terms* (New York, author, 1964), XVII.

18 From Vickery, *On retrieval system theory*, 27-28, 36.

19 From deGrolier, *op cit*, 72-74, citing several publications of Pagès' listed on 174 (note 11).

20 From *ibidem*, 80, citing P Braffort, 'Strategies optimales pour la recherche automatique des informations' (*Automatic documentation in action* (Frankfurt/Main, Nachrichten für Dokumentation, 1961), 154-163).

21 From Vickery, *Classification and indexing in science*[2], 186; and from Kervégant, *art cit* (footnote 7). The fullest statement is in Kervégant's mimeographed note 'Subdivisions communes de relation; exposé des motifs'.

22 From J-C Gardin, 'On the coding of geometrical shapes and other representations, with reference to archaeological documents' (*Proceedings*, international Conference on Scientific Information, Washington, 1958 (Washington, National Academy of Sciences, 1959), ii, 889-901), 900.

23 From J-C Gardin & F Lévy, 'Le SYNTOL (Syntagmatic Organisation Language)' (*Information processing 1962* (Amsterdam, North Holland, 1963), 279-283).

24 From J E L Farradane, 'Relational indexing and new methods of concept organisation for information retrieval' (*Automation and scientific communication* (Washington, American Documentation Institute, 1963), II, 135-136).

Fig. 3: Enumeration of the categorical and relational tabulations studies

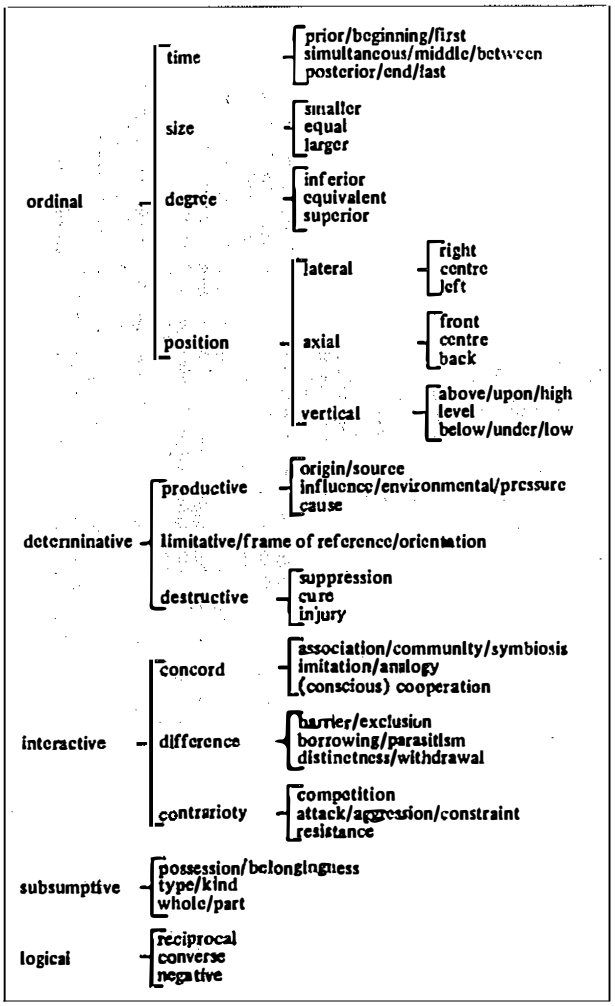


Fig.5: Semi-systematic version of the juxtaposition in Fig.3

tripartition-schema might become possible. This new attempt is not abstractive (like that embodied in fig. 5) nor tabulative (like that in fig. 3) but systematizing, and constitutes the third and final step toward the desired schema.

The logical relations are the first choice for the task of matching all the others, and can be seen to fulfil the need thus:

The relation *reciprocity* is a true relation (though *affirmation* would be merely an attribute), and when seen in correlation with the three residual members, clearly shares many characteristics with *subsumptive*: they both refer to a relation in which a totality is presented as a totality, including its elements.

The relation *converse*, on the other hand, is one in which a totality is presented as elements-in-relation; this corresponds to the relational type *determinative*, which implies action/reaction/passion.

The relation *contradictory* (or the attribute *negative*) corresponds to the type *ordinal*, in that what-is-ordered is contradictory to (or at least farthest from) the subsumptive idea of totality.

The categories (*attributive*), not discussed since Sect. 2, are included here wherever they can be seen to be appropriate. In general, any relational codification can be transformed into an attribute (category) by the prefixation of (say) a semi-colon[28]. It should be noted that the notational radix is 9, so that, while I have used letters (as the most appropriate symbolisation to combine with the predominantly numerical UDC[29]), these notations could be easily transformed into numbers for use with a verbal notation system. Also note that the derivational factor is shown with each tripartition. The characteristic of a thoroughgoingly systematic deduction (as of a literal translation) is the possibility of retranslation back into the source language. This characteristic, it is hoped, is to be found in fig. 6.

Note that though this schema absorbs almost all of the concepts enumerated in fig. 3, treating even pure attributes as left-to-right relations, *quality* and *quantity* are not included in the vast ramificative enumeration of which they are capable, but only generally in Ranganathan's terms, only the facets are shown, not all the foci. Fig. 7 gives a systematic tabulation.

5. Examples

A few examples of how such coding could be used in conjunction with UDC numbers in the classification/indexing of articles, chapters, and books follow. (Note that the relators, though designed for use with UDC, and for incorporation into mechanised retrieval, can also be used with any substantive classificatory vocabulary.)

'Clouds prior to the hurricane' would be
551.576 **fffa** 551.55[30]

Two other temporal relationships could be similarly expressed

551.576 **fffb** 551.55 'Clouds during the hurricance',
551.576.**fffc** 551.55 'Clouds after the hurricance'.

If 'clouds' were modified by some sort of accidental characteristic in the document being reduced to its surrogate - for instance 'speed of clouds', the relation (always read from left to right) would be coded as

511.576 **dfd** 531.76

When forming a complex expression such as 'speed of clouds during the hurricane', square brackets[31] are used to indicate syntactic subordination, as in

[551.576 **dfd** 531.76] **fffb** 551.55.

Another expression could include the cause of the speed of the clouds: 'Speed of the clouds caused by atmospheric pressure', coded as

[551.576 **dfd** 531.76] **eigd** 551.54.

Or, if atmospheric pressure were not the cause, but somehow influenced the speed of the clouds, as

[551.576 **dfd** 531.76] **eigf** 551.54.

When using a real title like '*A study of general categories applicable to classification and coding in documentation*' we will first have to transform its conceptual content into an order from which assignment of numbers and relators is possible: 'general categories applied to

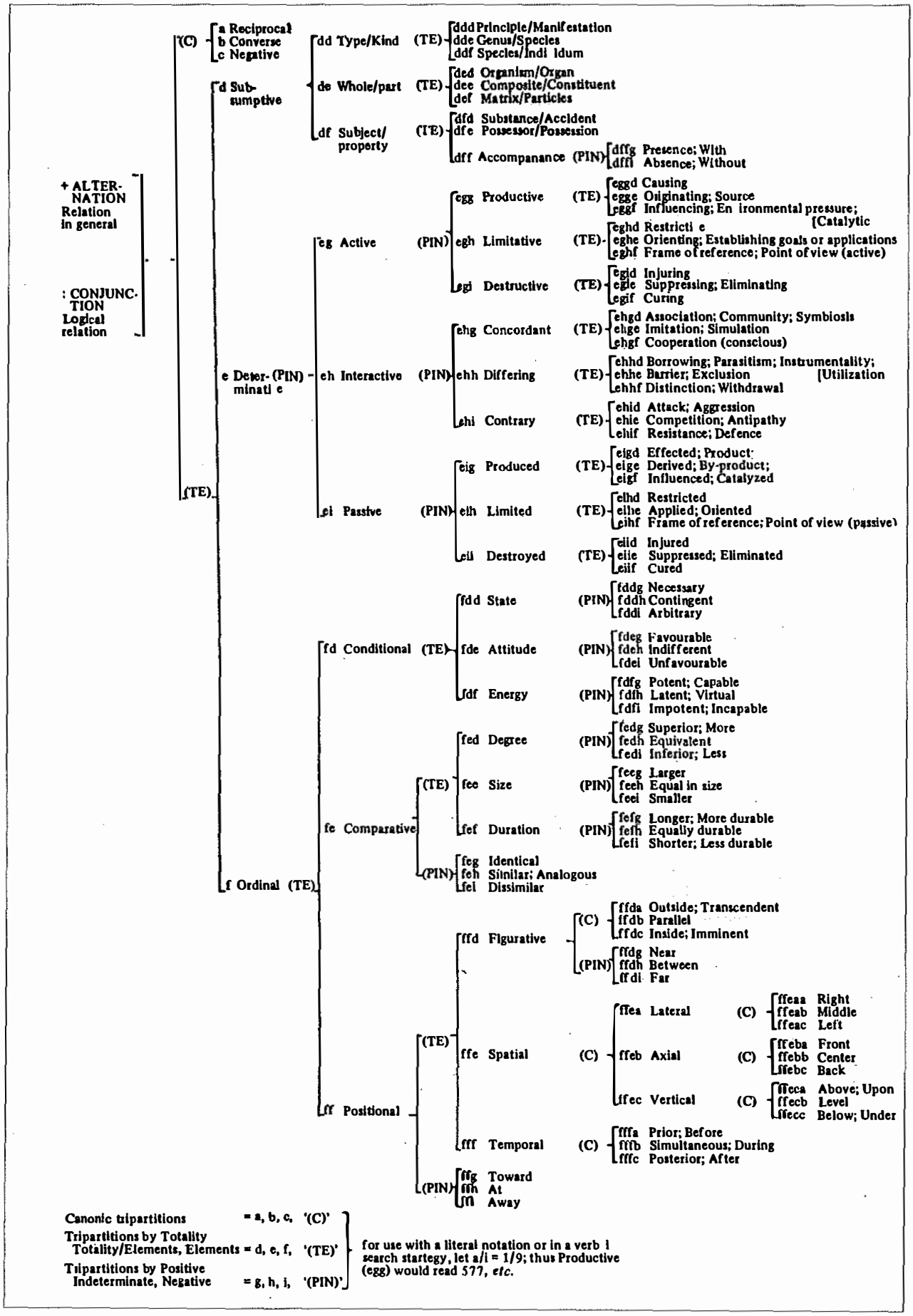


Fig. 6: The Relator-Schema

areas within documentation, namely classification and codification':

161.1 **ehe** [002 **ded** [025.3+003.61]][32]

An even more complex real title would be *'On the coding of geometrical shapes and other representations, with reference to archaeological documents'* (geometrical shapes and pictorical elements (coding applied to), in reference to the documentstion for which archaeology sets goals):

[[515+084] **eihe** 003.6] **eghe** 930.26]

These relators (and other punctuation modifications) are suggested for incorporation into a large scale (perhaps centralized or cooperative) mechanization of classification/indexing and retrieval activities, especially if such an activity were intended to supply a variety of levels of institutions with documents classified/indexed, at correspondingly differing levels of richness and depth, in terms of UDC[33]. The computerized mechanism of such supply could of course confound all of these relators into the colon for print-out of surrogates in the form of catalog-cards, or could (say) use the colon for all relations except the *determinative,* or for all except the *subsumptive* and the *conditional*, or could use the notation as a whole only up to two digits for any of the institutions needing such variations.

Fig.7 contains the scheme in listed form. (See page 195)

To summarize, then the following revised tabulation of UDC punctuation is suggested, fig. 8.

	LOGICAL		DOCUMENTARY	
conjunction, 'product'	*n:n*	(=a/ffi)	*n:n ::n:n*	to join complex interrelated groups one of which already contains a colon or a/ffi)
disjunction, 'sum'	*n+n*		*n...ln...*	to join complex but non-related groups sharing the same bibliographical matrix.
span	*n/n*			
compounder	*n'n*	to be used wherever applicable		
sub-grouper			*[n...n]*	to be used wherever applicable
language	*=n*		*==n*	
form			(On	without closing mark
place	*(n*	without closing mark		
race	*(=n*	without closing mark		
time	*"n*	without closing mark		
point of view	*,OOn*	comma replaces period		
	,On	comma replaces period		
auxiliary aspects	*-n*			

Fig. 8: Revised tabulation of UDC relationship indications

6. Emendations to the Relator-Schema

6.1 Investigation and experimental use has led to the discovery of a serious but not uncorrectable lapse in my schema of relators. The origin of the problem was an uncritical use of the (PIN) relator-elements g, **h, i** to mean both a: *positive, indeterminate,* and *negative* in terms of content, and b: *normal* (ie, left/right), *bi-directional,* and *reversed* (ie, right/left) in terms of orientation. Thus there resulted several relators whose orientation could not be reversed, since only **g, i** digits represent positive and negative in terms of content, as in **fdeg, fdei** (*favourable, unfavourable*). But *A*-**fdeg**-*B* is not properly reversible into *B*-**fdei**-*A* (*A* is favourable to *B*, *B* is unfavourable to *A*).

Another possible origin of the problem is that the (C) relators subsumed under **ff** are both *positive, indeterminate*, and *negative* in terms of content and *normal, bi-directional* , and *reversed* in terms of orientation, for example *A*-**fffa**-*B* = *B*-**fffc**-*A* (*A* prior to *B* = *B* posterior to *A*).

But reversible orientation is available (without change of content from positive to negative or vice versa) under **e**, and is successfully shown by the **g, i** transposition. How to preserve this advantage while not tampering with the apparently correct formulations under **ff**?

6.2 A theoretical/practical problem[34] in the use of UDC demands such a reversibility. Such code as 820:22 could well translate *Bible influenced [stylistically] by English literature.* Permutation of such entries would therefore almost inevitably result in misapprehension. Thus only Bible and English literature in mutual influence should be permutable; only for this meaning does no misapprehension result. It was partly in order to remedy this unfortunate situation (namely, that permutation is allowed to occur even when misapprehension inevitably follows) that the schema was constructed but as has been seen, the intention was not fulfilled throughout.

6.3 A solution seems available by substitution of **a, b, c** for **g, h, i** when the orientation-reversibility is necessary. This gives **ea, eb, ec** for **eg, eh, ei,** which percolates down to the lower levels of **e,** thus **eag** for **egg,** etc, and **eagd** for **eggd,** etc.

This solution leaves all determinative relations reversible[35], but does not make those ordinal relations which need reversibility reversible, since their **g, h, i** elements are (PIN) in the content sense only. Nor does it make subsumptive relations reversible, since they have no **g, h, i** elements except for **dffg, dffh**[36], **dffi** (which do not require reversibility, being no less symmetrical than the *n:n* properly used).

6.3.1 As elements that can be employed in solving this problem, I would mention the following: Each subsumptive relation is possible only in the left/right and right/left orientations; if *A* is whole and *B* is part, then *B* is part and *A* is whole; but there can be no intermediacy of orientation (bidirectionality). Each determinative relation is possible in left/right, bi-directional, and right/left orientations, and (PIN) relations are present here under **e** as they were not under **d**. Ordinal relations do not form such a homogeneous mass as do either the subsumptive or the determinative ones; but all that was available in **e** over **d** is present in **f**, plus the mentioned factor of the occasional mutual assimilation of orientational indeterminacy and content indeterminacy

6.3.2 Each relation that requires reversibility (that is, each one that is oriented, not symmetrical like *A*-**fe**-*B* = *B*-**fe**-*A* = *A* compared to *B*), either has or lacks **a, b, c**

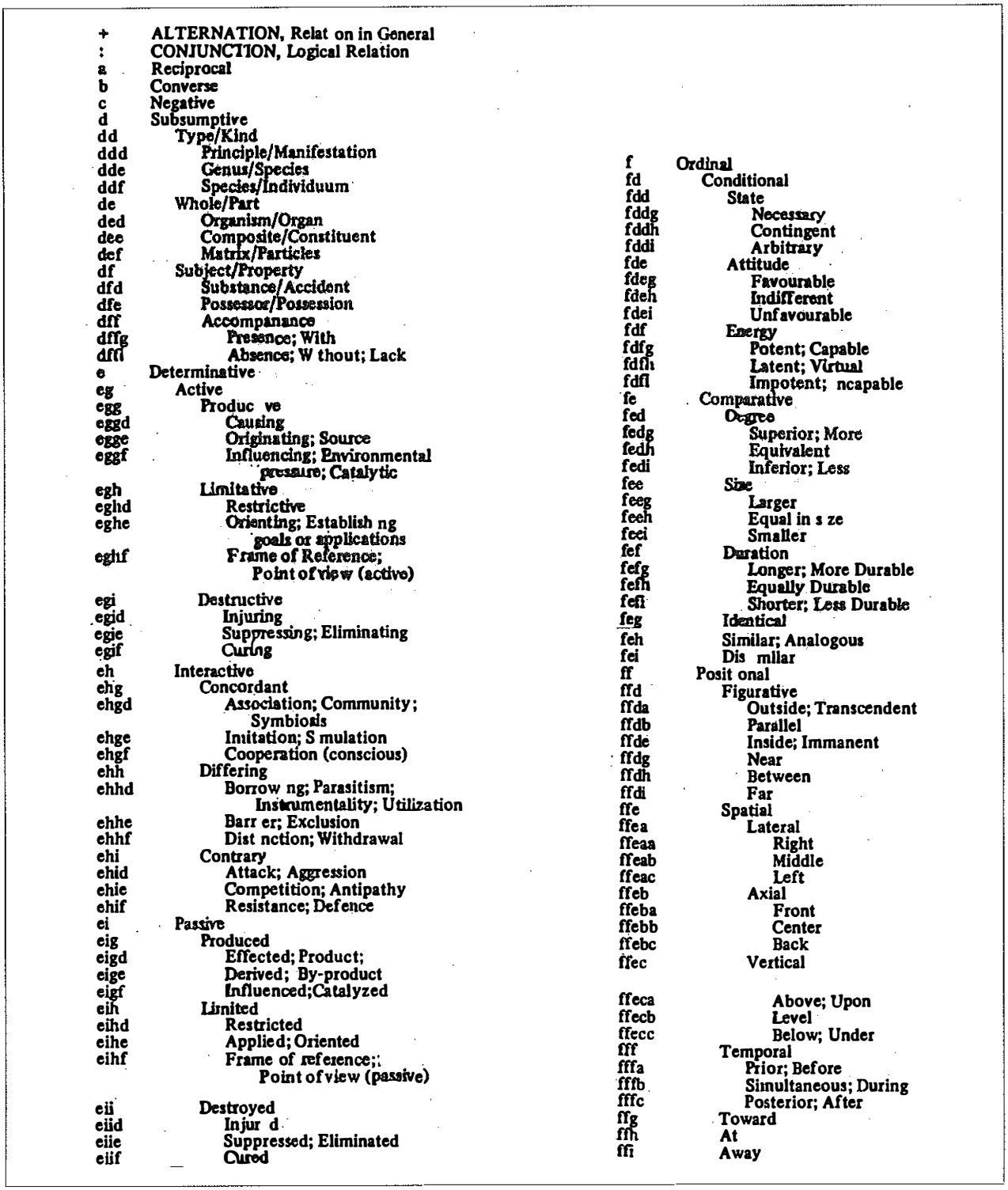


Fig. 7: Systematic tabulation of relators

element(s); if it has then reversibility is made possible by transposition (e.g., from *A*-...**a**...-*B* to *B*-...**c**...-*A*); if it has not, reversibility is made possible by addition at the end of the relational notation of **a** or **c** as called for. Thus a document concerned with the principle/manifestation relation between topics *A* and *B*, but not coming to any conclusion as to their orientation (e.g., *A* = criminality, *B* = drug addiction) would be coded *A*-**ddd**-*B* = *B*-**ddd**-*A* one arguing for an orientation with *A* as principle and *B* as manifestation would be coded *A*-ddda-*B* = *B*-**dddc**-*A*; one arguing for the opposite orientation would be coded *B*-**dclda**-*A* = *A*-**dddc**-*B*.

6.3.3 The addition of **a, c** to those codes which lack them, effects reversibility quite adequately in **d; e** has the necessary reversibility from the presence of reversible elements within each code (if the notation is changed as suggested in Sect. 3.0); we are left then with the ordinal relations, **f**, where there is occasional mutual assimilation of orientational and content indeterminacy. *A*-**fd**-*B* means

that *A* and *B* are conditionally related, and must therefore (if *A* is taken as the condition for *B*) be made reversible without giving *B*-**fd**-*A*, since that would mean that *B* is the condition for *A*, not (as is desired) that *B* is conditional upon *A*; so the solution in 3.2 applies here, giving *A*-**fda**-*B* = *B*-**fdc**-*A*, but also giving *A*-**fdb**-*B* for the document thematically concerned with the biconditionality of A and B, leaving *A*-**fd**-*B* for those for which permutation causes no change in meaning.

Comparative and positional relations at the general levels are properly permutable: *A*-**fe**-*B* = *A* and *B* are being compared; *A*-**ffe**-*B* = *B*-**ffe**-*A* = *A* and *B* are in spatial relation to each other.

6.3.4 In addition to the extension of reversible relations by **a, b, c,** some substitutions of **a, b, c** for **g, h, i** need to be made in the lower levels of **fd** and **fe**, namely under **fdd, fed, fee,** and **fef**; these changes are shown in the revised schedule given below in section 5.

6.3.5 Spatial relations, **ffe**, should not be partitioned a, **b, c,** for the terms *lateral, axial, vertical,* since this would imply that the lateral is the reverse of the vertical; the ideal solution would seem to be to change **ffea, ffeb, ffec** to some triad of elements not previously used at all, as being incommensurable with any of the three original triads. Assuredly we could not substitute **d, e, f,** so a weak solution (one that might not cause irrelevant retrievals and would not go beyond the desired nonal radix) would be to use the (PIN) elements **g, h, i.**

6.4 With these changes, we can be assured that any code reading *A*-**...a...**-*B* can be permuted, without change of meaning, to *B*-**...c...**-*A*; and that any code reading *A*-**...g...**-*B* has as its opposite in terms of the relational content *A*-**...i...**-*B*.

6.5 A revised schedule, replacing fig. 7 of the original schema, is given in fig.9 (additional relations are shown by +, change of terminology by #, change of notation by *);

[(O)#Tripartition by Orientation: **a, b, c**]

[(TE) Tripartition by Totality/Elements, Elements: **d, e, f**]

[(PIN) Tripartition by Positive, Indeterminate, Negative: **g, h, i**]

a # Normal; Left/right

b # Bi-directional

c # Reverse; Right/left

d Subsumptive.

Notes

* 'Categories and relators: a new schema' [presented to the 1965 FID Congress] (*Rev. Int. Doc.* 32(1965)p.136-144); reprinted in: *On the Perreault schema of relations and the rules of formation in UDC* (Copenhagen, 1966 = FID/CR Report no 4) and above; translated into Russian in: Razrabotka i primenenie Universal'noi Desiatichnoi Klassifikatsii (Moscow, VINITI, 1967).

1 Taking this term in the broadest sense, to include all the structures comprehended in the various types 'analytico-synthetic', 'faceted', and 'free' - principally to avoid the strictures of J C Gardin's paper *'Free classifications and faceted classifications; their exploitation with computers'* In: Classification Research: Proc. Int. Study Conf. on Classification Research, Elsinore, 1964, ed P Atherton, Copenhagen: Munksgaard 1965. 161-176

2 Cf *'The need for a faceted classification as the basis of all methods of information retieval'*, reprinted in Proc. Int. Study Conf. on Classification for Information Retrieval (ISCCR), Dorking, 1957. London: ASLIB 1957. p.137-47.

3 Cf E de Grolier: A study of general categories applicable to classification and coding in documentation. Paris: UNESCO 1962.

4 Ibidem, p.18-42 (Sect.11).

5 B C Vickery: *Classification and indexing in science.* London: Butterworth 1959. p.186.

6 There is a fairly commonly held opinion that only in a truly enormous collection of documents does the need arise for relational terms (see for instance the comments by R A Fairthorne: Proc ISCCIR (cited in footnote 2) p.107); and by F W Lancaster: *Some observations on the performance of EJC role indicators in a mechanised retrieval system.* Spec. Libr. 1(1964)No.10, p.696-701). However, the Itek Laboratories' *Summary of project activities* (Program of Research on Information Searching Systems) (=IL-4000-17; NSF-C88), p.13, states that: 'Experiments were conducted where syntactic features of subject entries were ignored, and search was made only for co-occurrence of pertinent words within an entry. Results of searches made gave useful data. For example, (in one search) 60 percent of the responses were invalid. (in another) some 24 percent of the responses were invalid'.
J-C Gardin states also In: *SYNTOL.* New Brunswick, NJ: Rutgers University Graduate School Library Service 1965. p.54, that: 'an earlier experiment showed that retrieval with unrelated descriptors in this same field leads to an appreciable percentage of false drops, ie, to a substantial fall in the relevance ratio'. He also cites R C Cros, J C Gardin, F Levy: L'automatisation des recherches documentaires. Paris: Gauthiers-Villars 1964. chapt. 5 and B, 3.1.

7 D Kervégant: *Developpement de l'analyse des relations dans la CDU.* Quart. Bull. IAALD 3(1958) p.111-116.

8 There is a good deal of similarity between this distinction and that of WCB Sayers between 'inner' and 'outer' 'forms' (see J Mills: *A modern outline of library classification.* London: Chapman & Hall 1960. p. 35.

9 See J M Perreault's essay *A new devise for achieving hospitality in array.* Amer. Doc. 16(1965)No.3, p.245-246).

10 In J Mills: *The Universal Decimal Classification.* New Brunswick, NJ: Rutgers University Graduate School of Library Service, 1964), 61, an example is given of a four-element number representing 'Supersonic flow: Cones: Pressure gradient: Shear flow' - 533.696.4 : 533.6.011.5 : 539.386 : 533.69.048.3 - comprising thirty numerical digits and twelve marks of punctuation. By use of the compounding apostrophe this could be reduced to twenty-three digits and ten marks - 533.6'964.4'011.5'9.048.3 : 539.386. The fact that the order of the original elements (a:b:c:d) had been changed (to a:b:d:c) would make no difference in a mechanized search of a linear file, as long as the citation order was one determined by convenience alone and not by exigencies of meaning. (This device, of course, would be all the more likely to be

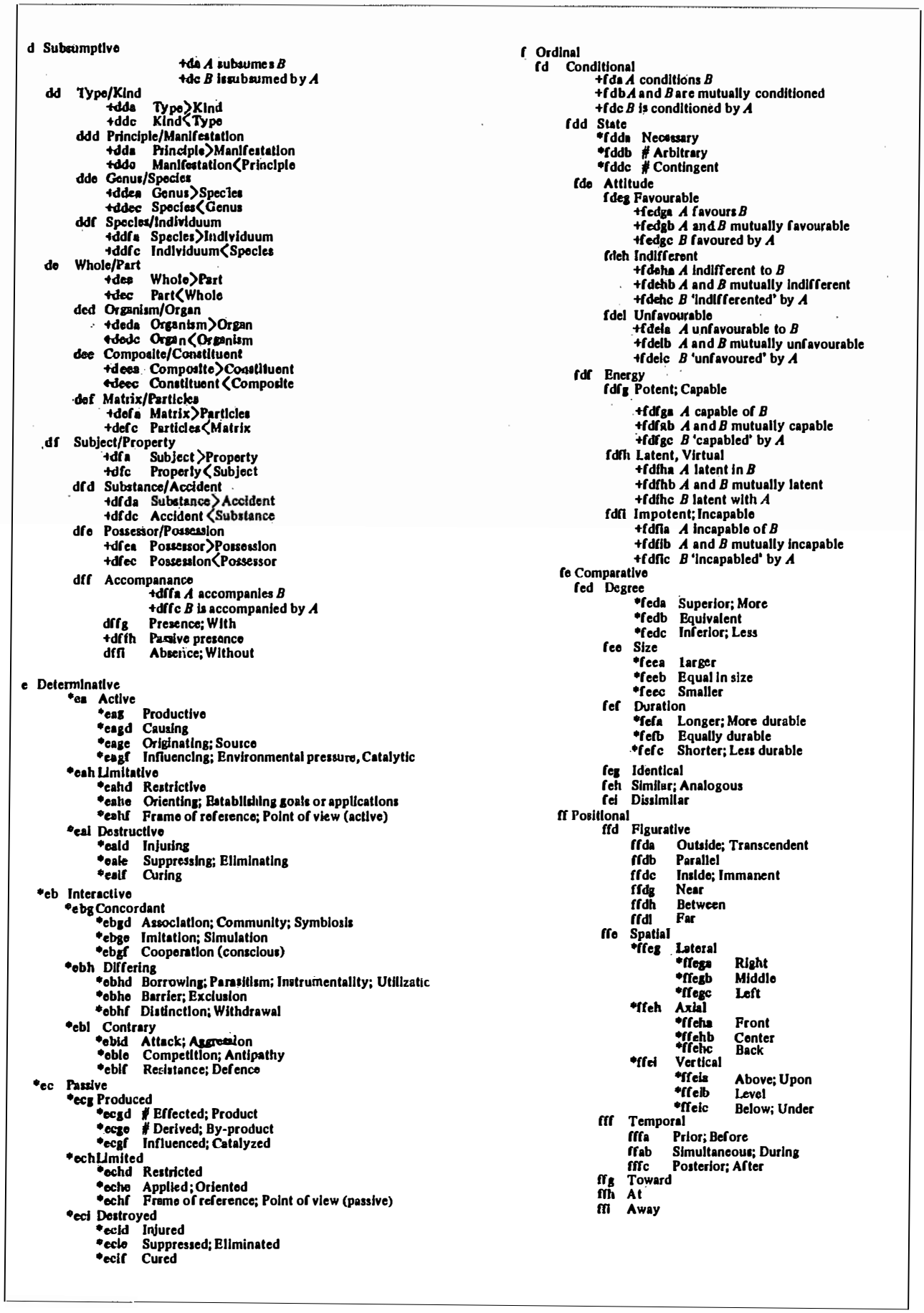


Fig.9: Revised scheme in listed form

suggested in the absence of a developed repertory of relators, since if several relators are appropriate to replace each of the colons in the original expression, it is wholly evident that the apostrophe could not replace them).

11 The two types are analogous to the two fashionable words 'roles' and 'links'. J C Gardin, commenting on the deficiencies arising in the use of simple roles, says (*SYNTOL*, p.27) that: 'A better answer is to do without roles altogether, and amplify links so that they convey the same information as roles and links taken together...' The cited passage came to my attention after the elaboration of the final form of the schema (figures 6-8), but it quite clearly expresses intentions identical to those that guided me.

Footnotes 12-24 see under Fig.3

25 *Cf ibidem*, p.135: 'Since each operator is in effect a category, each may express varieties of meaning.'

26 See Gardin in the work cited in footnotes 24 and 25, and his and R C Cros' *Final report on a general system for the treatment of documentary data*. Paris: Association Marc Bloch, 1963. p.1.

27 A more general statement of this tripartition might be *affirmative, contrary,* and *contradictory;* but *affirmative* is not actually a relation, but rather an attribute - and the same can be said of *negative*.

28 A convention must establish the position of such attributive usages with reference to the substantive code being modified; the examples given below, however, will refrain from such usage and hence from the need to establish such a convention.

29 As mentioned above, this schema was intended as the basis for a structural notation capable of forming complex classifications from a compound classificatory schedule, and the notating of it offered at least three choices: *a*: punctuation symbols, *b*: letters, *c*: numbers. The first was attempted, but the results were so bizarre as to make optical scanning highly difficult. Letter- or number-combinations of the radix a-i or 1-9 are therefore recommended.

30 The UDC numbers used here are from the Trilingual Abridged Edition.

31 For the use of square brackets (as against the English usage), see K Fill: *Einführung in das Wesen der Dezimalklassifikation*. 2nd ed. Berlin: Beuth 1960. p.20-21

32 A questionable point is whether it is necessary to specify classification and coding as areas within documentation; this inclusion is fairly nearly obvious.

33 See (as general background) J M Perreault's papers '*On bibliography and automation; or how to reinvent the catalog*'. Libri 15(1965)No.3, p.287-339 for a proposal oriented toward such a centralized activity.

34 The abstracts/codes used here to exemplify this problem were suggested by C David Batty.

35 Note that *A*-**e**-*B* may be taken to be properly permutable, since it means only that *A* and *B* are in some (indeterminate, in terms of content) relation, whereas *A*-**ea**-*B* is reversible into *B*-**ec**-*A*, and *A*-**eb**-*B* indicates that *A* and *B* are interactive (ie, indeterminate in the orientational sense) relation (mutual therefore symmetrical).

36 This code should be added, as suggested by J C G Wesseling in *On the Perreault schema*, cited in the first footnote *, to mean 'passive presence'.

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