Preserved Context Index System (Precis)

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Abstract: This article discusses the genesis and development of PRECIS Indexing System, its syntax and semantics, different formats and structure, and the primary notions underlying the system. It further explains how index entries are generated through a simple mechanical process called 'shunting'. The merits and criticisms of the system and its application across countries, across languages and across media have also been discussed. Finally, its relevance and workability in the online environment have been examined.

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1.0 Introduction

PREserved Context Index System (PRECIS) was developed by Derek Austin around the latter part of the 1960s as an alternative procedure for deriving the subject index entries for the *British National Bibliography* (BNB). Almost since its very inception, BNB had been using chain procedure or chain indexing [1], propounded by Dr. S R Ranganathan (Ranganathan 1938), for the preparation of its alphabetical subject index, but when it got involved with MARC (Machine Readable Catalogue) project, some difficulties cropped up in generating the subject index entries directly from the machine-readable records [2]. So, an investigation was started for an alternative method for generating alphabetical subject index entries directly from the computer instead of through an indexer, as was being done in the chain procedure [3]. PRECIS is, obviously, the outcome of that investigation (Chatterjee 1983) which had been carried out keeping the following objectives in view (Austin 1976; 1982; Sarkhel 1998):

- The original indexing will be intellectual, but all subsequent operations will have to be done by the computer. That means the indexer's only responsibility will be to prepare the input string and give necessary instructions to the computer to generate index entries according to definite formats.
- There should be an entry for each approach term, and each entry should express the complete thought content / full context of the document, unlike chain indexing where only one entry is fully coextensive with the subject and the others are cross-references showing only one aspect of the complete content of the document.

- Each entry should be meaningful to the user, preferably without the need for explanation, which in practice means that the language used should be close to natural language, and relationships that are not explicit should be made so by use of natural language devices such as prepositions rather than any neutral set of symbols.
- Indexers should, for the sake of consistency and collocation, work within the framework of a common set of indexing rules. These rules should be applicable irrespective of the subject-field or medium.
- The system should be based on the concept of open-ended vocabulary, which means that the terms can be admitted into the index at any time as soon as they have been encountered in the literature.
- There should be a system of cross references for semantically related terms generated by the computer from a machine held thesaurus.

After trial application of the system in indexing some 95.000 documents in the *British National Bibliography* from 1971 to 1973, the definitive version of the system was introduced in 1974, when the first edition of the *PRECIS Manual* was also published (Curwen 1985). In light of the experience gained through the application of PRECIS in different countries of Europe, as also in China, Austin brought out the second edition of the manual in 1984, in which some new codes were introduced, and some existing codes were modified by making more generalized and simpler coding of the PRECIS input string (Austin 1984; Sarkhel 1998).

1.1 Genesis of PRECIS

Nevertheless, the genesis of PRECIS may also be traced to the research carried out by the Classification Research Group in the UK in the 1960s for a new general faceted classification. Austin, who was actively associated with this project, devised a system of operators. Other members of CRG considerably influenced the system. This eventually formed the basis of PRECIS (Hancox and Smith 1985; Mcllwaine 2003). Austin admitted that "PRECIS evolved out of research originally aimed at a new shelf-order classification" (Austin 1998, 29). Naturally, "PRECIS has as its framework the principles of analytico-synthetic classification. In other words, PRECIS incorporates rules for both analysis and synthesis of concepts" (Dykstra 1989, 89). An indexer, following PRECIS, has first to analyze the contents of a document and then synthesize the concepts expressing the content in the form of a string in context-dependent order, based on which index entries are generated by a computer by applying a *shunting* process.

1.2 Type of indexing system

According to its creator Derek Austin (1984, 1)

> A PRECIS index is usually produced by a computer, but the system does not belong to the class of automatic indexes, in which terms, intended for use as keywords in retrieval, are extracted from texts entirely by a computer. The production of a PRECIS index can be considered in two stages, the first performed by a human indexer, and the second by a machine. The indexer is responsible for intellectual tasks, such as examining the document, selecting appropriate indexing terms and deciding how these terms are interrelated. The terms selected by the indexer are recorded in the form of an *input string,* where each term is prefixed by a code that indicates, for example, whether or not the term should function as a user's access point, a *lead,* in the printed index. These strings are inputs to the computer, which then takes over the various clerical jobs which indexers tend to find irksome for the same reason that computers do them so well: they consist of repetitive, step-by-step routines which can be described in algorithms and translated into programs.

Hence, Austin has often termed PRECIS as "a computer assisted [indexing] system" (1998, 43). Tonta (1992, 6) has found the system "akin to a natural language-based subject indexing system." It allows for "a very specific, syntactically meaningful, natural language representation of the subject content" (Bidd et al. 1986, 177-178). The various aspects of the system are described in the next section.

2.0 Relationships between terms and concepts

A common distinction in language is between syntactical and semantic relations, where *syntactical* relationships are related to grammar, such as the relation between adjectives and nouns, while *semantic* relations are about word senses, meanings, and the concepts they refer to. Semantic relations broadly include, for example, the generic relation [4] or the part-whole relation and lexical relations such as synonymy [5]. Both syntax and semantics are wide fields influenced by different philosophies, which also concern their relations. As Gärdenfors (1999, electronic source, no pages) wrote:

> For Chomsky and his followers, Individuals are Turing machines that process syntactic structures according to some, partly innate, recursive system of grammatical rules. Questions concerning the meaning of the words, let alone problems related to the use

> of language in communication, were seen as not properly belonging to a cognitive theory of linguistics. [...] On the other hand, a second tradition turns the study programme up-side-down: actions are seen as the most basic entities; pragmatics consists of the rules for linguistic actions; semantics is conventionalised pragmatics; and finally, syntax adds grammatical markers to help disambiguate when the context does not suffice to do so. This tradition connects with several other research areas like anthropology, psychology, and situated cognition.

Such different theories about syntax and semantics have, as Frohmann (1983) argued, important implications for classification and knowledge organization as well as for any information retrieval (IR) system and, therefore, for the view underlying the PRECIS system.

2.1 Syntactical relationships

Syntax means the grammatical arrangement of words or terms in a sentence. It is studied in relation to natural language, programming languages, and IR languages [6], such as classification and indexing systems. In 1957, linguist Noam Chomsky published Syntactic Structures, which was very influential (also in establishing the interdisciplinary field of "cognitive science"). It represents a view that there exists a universal grammar (UG) underlying the specific grammar of a specific language and that this UG is innate and thus hardwired in the human brain. and this idea also has corresponding views in information science, for example, Ranganathan's "principle of absolute syntax"[7] (Ranganathan 1967, 579). At this point, it is important to say that theories like those of Chomsky's have today been challenged by more pragmatic theories, such as functional grammar and functional discourse grammar (as also indicated in the above quote from Gärdenfors). We shall return to the implications of such different syntactic theories for PRECIS (and IR languages in general) in Section 11.

Concerning PRECIS, syntax refers to the organization or sequence of terms in an input string, which express the contents of a specific document and that in entries generated by a computer from that string. Syntactical relationships are, thus, the relationships between the terms appearing in an input string and between the terms appearing in index entries generated from that string. Syntactical relationships of PRECIS are handled using a set of logical rules and a schema of role operators and codes. According to Curwen (1985, 247), these rules help an indexer to:

- select appropriate terms from the thesaurus (or add them to it, if necessary);
- organize them into a subject statement, which is a 'context-dependent' string (that is, each term is read in the light of those that precede it in the string);
- assign codes ('operators') which both fix that statement and also signify the syntactical function of each term (e.g., action, agent, property);
- decide which terms are to appear in the lead or other positions in the index entries and assign further codes to achieve these results; and
- add any further prepositions or phrases that will help the final output to be read clearly and unambiguously.

The use of role operators and codes has been shown in Section 5.

2.2 Semantic relationships

Semantics refers to the meaning and interpretation of words and concepts. In the context of controlled vocabularies (such as classification systems, subject heading systems, thesauri , and other kinds of knowledge organization systems (KOS), semantic and lexical relations have been established before indexing, they are pre-established relative to indexing (but this is not the same as saying that they represent a priori [8] relationships between terms in the KOS as it is sometimes claimed, including by Sørensen and Austin (1976).

In PRECIS, semantic relations are regulated by a machine-held thesaurus that serves as sources of *see* and *see also* references in the index (Biswas 1988; Sarkhel 1998). Nevertheless, there is no pre-constructed thesaurus for PRECIS. An indexer or an organization can create its own thesaurus according to the system's rules and depending on the need of literature and that of the organization concerned (Curwen 1985, 247). In fact, the thesaurus is gradually created during actual indexing work. As an indexer encounters a new term, it is inducted into the thesaurus. The indexer then looks for synonyms, generic terms and associated terms of the newly inducted term. This process (Ferrier 1978): (1) guarantees that the terms chosen are meaningful to the study and practice of the subject; (2) solves the problem of marginal domains, while working in a specialized domain, by avoiding too rigidly delimiting the field of the thesaurus; and (3) leaves the thesaurus open for new entries as and when required.

> Each accepted term is assigned a number identifying its address in the machine file. Each type of semantic relation (equivalence relation, generic or associative) is associated with a code which is specific to it. The network of relationships is established once and for all when a term appears. The references will be repro-

> duced automatically in the index each time the term appears again in a chain (Ferrier 1978, 164).

Thus, according to Biswas (1988, 104), the three main factors which form the basic components of the semantic aspect of PRECIS are:

- *Indexing Terms*: When building the thesaurus, only lead terms are taken into consideration. Any new term, as soon as it appears into the lead position of an entry, is admitted into the network; that is to say, the vocabulary is open-ended.
- *Reference Indicator Number (RIN)*: Each of such terms is assigned to an address in a random-access file in the computer, and is identified by a seven-digit number (called *reference indicator number* or RIN) which specifies this address.
- *Relational codes*: The various kinds of relationship between terms held at different addresses (RINs) are indicated by a set of codes. These codes are: Equivalence relationship (code $m), Hierarchical relationship (code $o), and Associative relationship (code $n, $x and $y). These codes form part of the data associated with each term.

The *PRECIS Manual* (Austin 1984) discusses in detail how online input records can be created for machine-readable thesaurus. Incidentally, the British Library compiled an internal thesaurus for PRECIS indexing of the *British National Bibliography*, which is available on microfiche. Similarly, UTLAS (University of Toronto Library Automation System), which now functions as a computer-based service unit under the International Thompson Organization, had also compiled such a thesaurus. In both cases, the thesaurus was built according to the international standard *Guidelines for the Establishment and Development of Monolingual Thesauri* (ISO 2788-1986 OE) (Dykstra 1989).

2.2.1 Relevance of thesaurus

Since, as Wellisch (1995, 475) has mentioned, "thesauri are primarily intended for indexing as well as for searching and retrieval from post-coordinated systems", a question may arise as to why PRECIS has a provision for the construction of a thesaurus though it is considered as a pre-coordinate indexing system because of the fact that the input string that the indexer creates represents pre-coordinated terms. The simple answer may be that it ensures the use of the same term to denote the same idea throughout the index and that it facilitates the creation of 'see' and 'see also' references, making searching more effective and accurate. Wellisch has also mentioned that although not the primary purpose, thesauri may also be used for pre-coordinate indexing (Wellisch 1995). "When this is done, users of the pre-coordinate index are not expected to consult a thesaurus (since cross-references to synonyms etc. may be embedded within the index)" (Dextre Clarke 2019, 446, Section 3.3).

2.2.2 PRECIS as a duel system

There is also another reason for provision in PRECIS for the development of a thesaurus – the duality of the system, as pointed out by Dykstra (1985b), who has worked with and written extensively on PRECIS (Dykstra 1985a). According to her, while being a pre-coordinate system, PRECIS also incorporates several features of a post-coordinate one. She has pointed out that

> each index entry generated by the computer is the result of the analysis and the synthesis by an indexer of all the terms or descriptors which comprise and are utilized in the expression of a particular subject" and that "the individual terms thus generated by the system are as amenable to thesaurus construction as is the vocabulary of any post-coordinate system (Dykstra 1989, 87).

3.0 Format and structure

As indicated earlier, the format and structure of entries represent the syntax and syntactic relationships of an indexing system. Format means the size, form, or shape in which the components or parts of an entry are written, while the structure indicates the relationship existing between the components, just as the relationship between component words in a sentence. To understand the format and structure of PRECIS, let us take up the following example of a compound subject consisting of four components as cited by Austin (1975):

> Training of skilled personnel in the Indian textile industries

A close analysis of the above subject reveals that in India, there are textile industries, and within textile industries, there are skilled personnel, and training is given to them. So, the four components of the subject can easily be written as:

> India – Textile industries – Skilled personnel – Training

This arrangement of components of a compound subject is called a *string*.

3.1 Primary notions

The string manifests two special characteristics:

- The terms representing components or concepts in a string are arranged in such a way that they are *context-dependent*. That means the meaning of each term in the string depends upon the meaning of its preceding term in the string, and taken together, they all represent a single context. For example, the term India gives the geographical context in which textile industries exist, and Skilled personnel, being a part of Textile industries, are being given Training.
- The four components of the string have a *one-to-one relationship* to each other; that means each term is directly related to the following term in the string.

These two special characteristics, the first of which is called *Context Dependency* and the second *One-to-One Relationship,* are the primary notions or principles on which the whole idea of PRECIS is based. Incidentally, both these notions are also recognizable features of any natural language.

3.2 Approach term

One of the most important characteristics of a sound indexing system is its ability to retrieve a document from every point of approach. For this, each component term in a string must work as an approach term for the user, and the entries derived out of an approach term must be able to specify the clear context of the document. In the above example, the first term India and the last term Training can easily be approach terms, such as –

India – Textile industries – Skilled personnel – Training

Or in the reverse way –

Training – Skilled personnel – Textile industries – India

Both of these give the same context and preserve the one-to-one relationship of the component terms. But difficulty arises when the middle order terms Textile industries and Skilled personnel are made the approach terms. Definitely, bringing those terms to the beginning of the string as approach terms in the following manner:

Skilled personnel/India – Textile industries – Training

Or

Textile industries/India – Skilled personnel – Training

do not give a clear context of the document, and the one-to-one relationship between the components of the string is also lost.

3.3 Three-part format

Therefore, in PRECIS a special two-line and three-part entry format is used to preserve these important characteristics. This is illustrated in Figure 1.

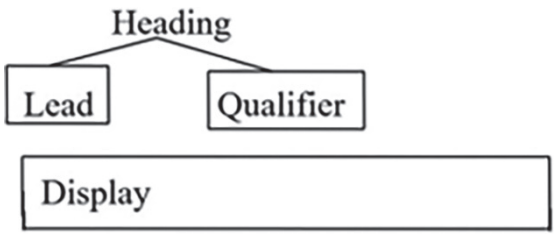

Figure 1: PRECIS two-line three-part structure

Here the components of the entry format are named as:

- *Lead*: The term which acts as an approach term;
- *Qualifier*: The term/terms which qualifies/qualify the lead term or bring the lead term into its proper context; and
- *Display*: The remaining term/terms which also helps/help preserve the context.

Lead and *qualifier* are together called *heading*. It may be mentioned that in the index entry, *heading* starts from the left-hand margin and continuation of the heading in the next line begins after leaving eight-letter space and *display* starts from left-hand margin leaving two-letter space and its continuation in the next line starts after leaving four-letter space.

4.0 Generation of entries

Adopting this two-line three-part structure helps generate a set of different index entries from a single string through a simple mechanical process called shunting. For example, in the string India – Textile industries – Skilled personnel – Training, the first term India is automatically shunted out of the linear structure into the lead by the computer, giving us the following entry.

India
Textile industries. Skilled personnel. Training

As any term moves into the lead position, it is printed automatically in bold font. The rest of the terms are printed in normal font except in a few cases. At the next step, the term in the lead is shunted across into the qualifier, and the lead position is then occupied by the next term in the string. Through this process, we get the following entry:

Textile industries. India
Skilled personnel. Training

By repeating the same procedure, we further get the following two entries:

Skilled personnel. Textile industries. India
Training
Training. Skilled personnel. Textile industries. India

Thus, all four component terms become lead terms by keeping the context intact. According to Austin, "the *lead* is always set into its wider context by the *qualifier* (if any), and itself then establishes a context for the terms in the *display*. This is the property that named the system: the PREserved Context Indexing System." (Austin 1998, 39). It may, however, be mentioned that the generation of lead terms is not entirely mechanized; it is under the control of a human indexer who indicates his choice of leads. A computer handles all clerical operations: it "processes the coded index strings to make the required number of entries in specified layouts and typographical styles, extracts the requisite references from the thesaurus, and merges and files them" (Curwen 1985, 247).

5.0 Aids for term organization

As indicated earlier, PRECIS has developed a schema of *role operators* and codes, which help organize terms in input strings and manipulate them to generate index entries.

5.1 Role operators

A role operator is a code or symbol that specifies the grammatical role or function of the term to which it is prefixed and determines its position in the input string. Role operators thus help write the input string by regulating the order of terms in the string. These operators and their associated rules also serve as computer instructions for determining the format, typography, and punctuations associated with each index entry. The role operators do not, however, appear in the index entry.

5.1.1 Kinds of role operators

There are two kinds of role operators:

– *Primary Operators:* Earlier known as Mainline Operators, these operators control the sequence of terms in the input string and also determine the format of entries in the printed index. Primary operators consist of numbers in the range of 0 to 6 having built in filing value. Certain conditions must be satisfied while writing the input string and the computer will check these at the time of input. These conditions have been mentioned under *Arrangement* in Section 6.

– *Secondary Operators:* Earlier known as Interposed Operators, these operators can be introduced into a string at any point to raise its level of exhaustivity, but these operators cannot be used to start a string. A secondary operator is always preceded by a primary operator to which it relates.

The schema of role operators is given in Figure 2 (Austin 1984).

5.2 Codes

The revised version of *PRECIS Manual* has made provision of three types of codes – primary, secondary and typographic – for bringing expressiveness in the index entries. Besides, some more codes and techniques have been provided for manipulation of string to derive index entries. The schema of codes is given in Figure 3 (Austin 1984).

6.0 Input string making

As indicated, an input string is a set of terms arranged according to the role operators which act as instructions to the computer for generating index entries. A fully expressive input string is constructed in the following manner according to PRECIS (Chatterjee 2016):

– *Subject Analysis:* Like all other indexing and classification systems, the first step in preparing a string is the analysis of the subject content of the document to be indexed. By analyzing the subject of the example mentioned above, the following title-like phrase may be formulated.

Training of skilled personnel in the Indian textile industries

– *Search for 'Action'***:** The next step is to determine whether a term denoting an action is present in the phrase. If present, the action will usually determine how the rest of the

Primary Operators		
Environment of core concepts	0	Location
Core concept	1	Key System *Things when action not present.* *Things towards which an action is directed, e.g. object of transitive action, performer of intransitive action.*
	2	Action; Effect of action
	3	Performer of transitive action (agent, instrument); Intake; Factor
Extra-core concepts	4	Viewpoint-as-form
	5	Selected instance; study region, study example, sample population
	6	Form of document; Target user
Secondary Operators		
Co-ordinate concepts	f	'Bound' co-ordinate concept
	g	Standard co-ordinate concept
Dependent elements	p	Part; Property
	q	Member of quasi-generic group
	r	Assembly
Special classes of action	s	Role definer; Directional property
	t	Author attributed action
	u	Two-way interaction

Figure 2: Schema of role operators

subject should be handled. Here, the word 'training' denotes an action. This term should, therefore, be prefixed by the role operator 2 in the following manner:

(2) training

– *Kind of Action:* The next step is to find out the kind of action represented by the term, whether the action is transitive or intransitive. If it is a transitive action, it will take an object according to the principles of English grammar. In the present example, Training is a transitive action. So, it has taken an object skilled personnel who is being trained. Therefore, the concept of skilled personnel is the key system that should be prefixed by role operator 1'.

Thus (1) skilled personnel
(2) training

– *Part Concepts:* But a close examination of the term skilled personnel shows that at least in the present context, it is a part of some other concept, like textile industries, and, therefore, the term textile industries should be made the key system indicating skilled personnel as a part of the key system by prefixing the secondary operator that introduces a part or property to a concept. The revised input string, thus, will be:

(1) textile industries
(p) skilled personnel
(2) training

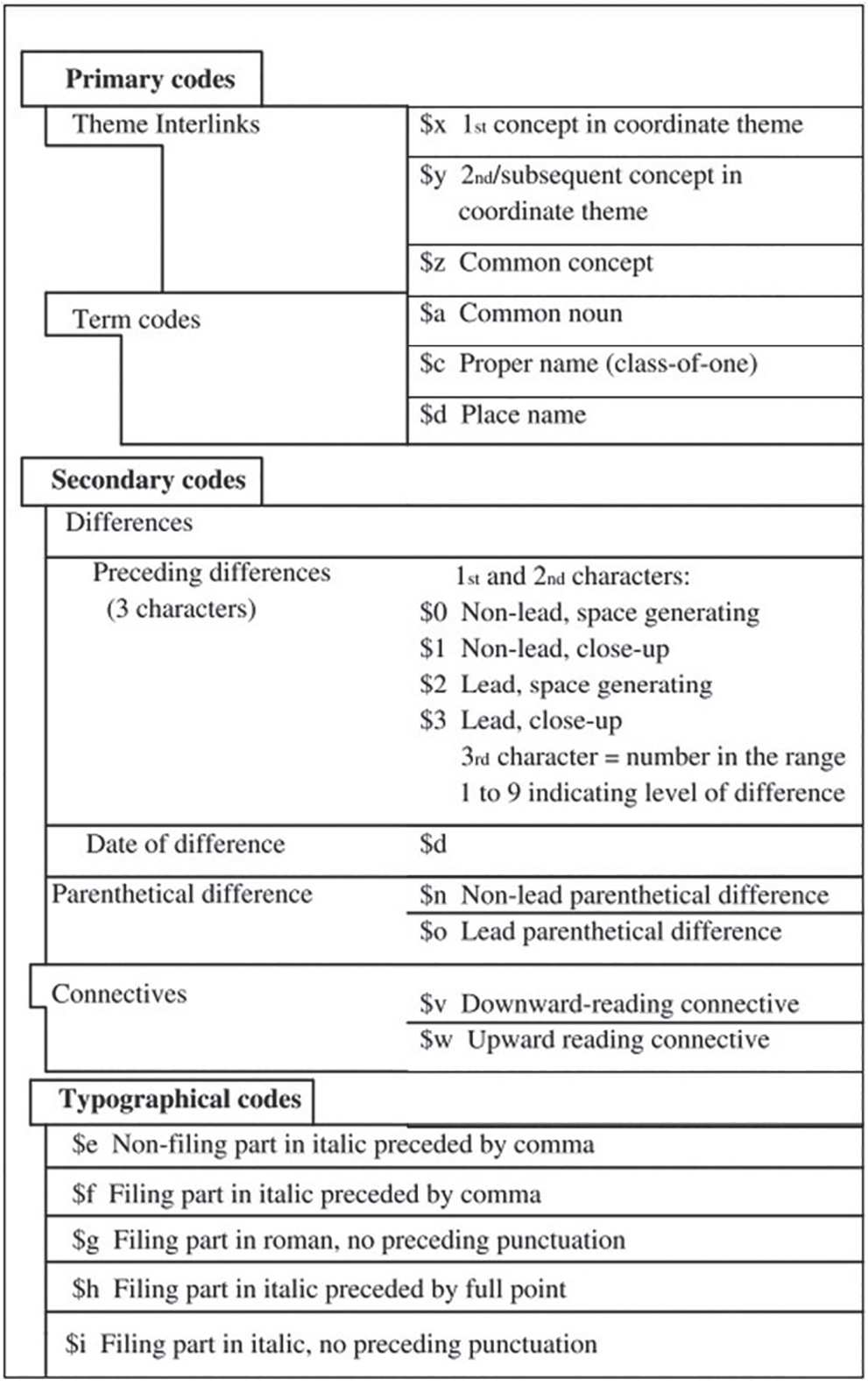

Figure 3: Schema of codes

– *Environment:* The remaining concept in the subject, namely India, clearly functions as the environment in which the author has considered the whole subject. Therefore, this should be prefixed with the role operator 0. The final input string now becomes:

(0) ✓India
(1) ✓textile industries
(p) ✓skilled personnel
(2) ✓training

Note: In the input string, each term, except a proper name (e.g., 'India' in the above string), begins with a lowercase letter, while in an index entry, the same term begins with a corresponding uppercase letter. As shown above, a tick mark (✓) is provided for each term that shall appear as lead (access point) in the index entry.

– *Arrangement:* The arrangement of the component terms in the input string is guided by the following principles:

- the numbered or primary operators are arranged according to their ordinal value;
- all other operators are attached to the concept with which they are related;
- every string must begin with a term prefixed with a primary operator in the range 0 to 2 and
- Every string must also contain a term prefixed by the operators 1 and/or 2.

7.0 Final entries

In the above input string, each term that should come as *lead* has been duly ticked (✓). Now, through the process of *shunting,* the following entries can be generated:

India
Textile industries. Skilled personnel. Training
Textile industries. India
Skilled personnel. Training
Skilled personnel. Textile industries. India
Training
Training. Skilled personnel. Textile industries. India

Note: The lead term in each entry is rendered in bold, while the qualifier is rendered in lightface. The display is rendered in light face or Italics depending on the role operator (e.g., the term coded with (q) or (5) in inverted format is rendered in Italics).

7.1 Arrangement of entries

In a printed index all the entries generated through the above process are arranged alphabetically by headings. Under common headings, displays are arranged alphabetically.

8.0 Treatment of compound terms

The order of components of a compound term (such as Trained, Female and Pilots in case of Trained Female Pilots), has been a genuine problem since the days of Cutter. Different indexing experts have tried to solve this problem differently. According to Austin, "the terms in PRECIS are always printed in natural language order – there are no inverted headings." (Austin 1984, 46). Access can, however, be provided under any of the component terms in a compound term without losing or distorting the meaning of the whole term. This is accomplished by the technique called *differencing*. A compound term usually consists of a *focus* and one or more *differences*. Focus consists of a noun or substantive element that indicates the general class of things, properties, or phenomena to which the term as a whole refers, e., g. Pilots in the above example. *Difference* modifies or qualifies the focus, thereby creating a sub-class of focus, e.g., Female and Trained in the above example. *Differences* are of two types from the point of view of the strength of their relationship with the focus – *direct* and *indirect*. In the above example, Female directly qualifies the focus Pilots, while Trained does so indirectly. Further, two main structural types of *differences*, each with sub-divisions, have also been distinguished in PRECIS (Biswas 1988, 63):

– *Preceding difference*, where the difference precedes its focus, either as a separate adjective (as in Compact discs) or as the component of a concatenated word (as in Videodiscs).
– *Following difference*, where the difference is printed after its focus, either as an adjective (as in Attorney general), or as a noun or nominal phrase following a preposition (as in Economies with uncertainties).

While coding for the purpose of computer processing, three characters are used for *differences*. The first character is the $ (dollar) sign, which serves as an instruction code. It enables the computer program to identify the boundaries of each data element. The instruction code is followed by two digits. The first digit is selected from the following decision matrix or grid, as demonstrated in Figure 4.

A digit between 0 and 3, as shown in the above matrix, indicates two commands – first, that the *difference* is to be a lead or non-lead, and second, whether the *difference*, when printed in the natural language order is to be separated by a space or is to be closed up to the end of the difference. The

	Space-generating difference	Close-up difference
Non-lead	0	1
Lead	2	3

Figure 4: Decision matrix

second and final digit indicates the level of *differences*, i.e. its distance from the focus – 1 indicates first level *difference* or *direct difference*, while digits 2-9 indicate the successive levels of *indirect differences*. For example, Trained Female Pilots will be coded as (1) Pilots $21 Female $22 Trained.

9.0 Variant formats

The format in which the entries have been generated above is called standard format. Thus, it can be said that index entries in the standard format are generated when any of the primary operators i.e. (0) or (1) or (2) or any of its dependent elements appears in the lead. There are two other formats of PRECIS: Inverted format and Predicate transformation. Some specific rules have been formulated for each of these formats.

9.1 Inverted format

Index entries in this format are generated whenever a term coded by an operator in the range of (4) to (6) or its dependent element appears in the lead. When a lead is generated under any of these terms, the display consists of the earlier terms in the string selected in their input order. For terms in this group, a special type of font, i.e. Italics, is used when it appears on display. An input string of this kind is shown below:

A Report on child marriage in India
Input String:
(0) ✓India
(2) ✓child marriage
(6) ✓reports

The index entries for the above string will be:

India
Child marriage – *Reports*

Child marriage. India
– *Reports*

Reports
India. Child marriage

9.2 Predicate transformation

Predicate transformation format is generated when a subject deals with a transitive action related to its performer and the performer term appears in the lead (Austin 1987). In other words, when an entry is generated under a term coded by (3) which immediately follows a term coded either by (2) or (s) or (t) – each of which introduces an action of one kind or another – the predicate transformation takes place. An input string of this kind is shown below:

Designing of libraries by architect
Input String:
(1) ✓Libraries
(2) ✓designing $v by $w of
(3) ✓architects

In order to bring expressiveness in the resulting index entries, the connective codes ($v and $w) are attached to the term representing action and it results in a compound phrase. The rule for predicate transformation is that when the term coded (3) goes to the lead, the computer checks the operator assigned to the next preceding term. If that operator is (2) or (s) or (t), the term coded with any one of these operators and the term accompanied by the code $w (i.e. upward reading connectives, if any) are printed in the display position instead of qualifier position (Sarkhel 1998). Accordingly, the index entries for the aforesaid input string will be:

Libraries
Designing by architects

Designing. Libraries
By architects

Architects
Designing of libraries

According to Biswas (1988, 91), predicate transformation ensures that

- the actions in which an entity is engaged are collocated, together with the names of its parts and properties (and to some kinds) in the display; and
- it is possible to retain one-to-one relationships between concepts which may have become separated in the input strings, due to their different syntactical roles.

10.0 Merits of PRECIS

The merits of PRECIS are (Craven 1986; Foskett 1996; Chatterjee 2016) the following:

- Since indexing is not dependent on class number, as in chain procedure, any deficiency in the classification scheme cannot influence indexing in any manner;
- Indexing is done by analyzing the subject content of the document and all aspects of the subject are included in the subject string;
- It gives a complete subject statement at each entry point and the search through any aspect of the subject retrieves the required document;
- Since the subject string is formulated following some definite rules, subject string formulation will not change with change of personnel doing the indexing job;
- Shunting system ensures lead position to every component of the subject string and permutation of components is not required;
- The complete set of operators of PRECIS can deal with compound words (such as armchair, where 'chair' is effectively lost) and 'portmanteau' words;
- PRECIS guides indexers to express certain types of links and adjectives through codes; the result tends to be a mixture of different grammatical constructions in index strings, which aids comprehension in a way similar to that of good style in ordinary language.
- Since context is preserved in every index entry, selection of pertinent documents during search becomes easy;
- The user of one PRECIS index will find that all other PRECIS indexes can be searched in very much the same way. Likewise, a PRECIS indexer approaching a new collection does not have to work out or become familiar with a new set of rules.
- Within a single index, searchers may become used to one kind of collocation of index strings and one kind of meaningful order of terms, and indexers find decision-making less worrisome.
- Use of full-stops in PRECIS before qualifying terms in the "qualifier" part of an index string largely avoids the sort of dilemma created by prepositions.
- PRECIS can be adapted for indexing documents in languages other than English too, which has been proved by experiments in several languages.

11.0 Criticisms on PRECIS

Despite the above merits, the system has been criticized on different grounds. The main critics on PRECIS (Craven 1986; Curwen 1985; Foskett 1996; Sarkhel 1997) are the following:

- The syntactic structure of PRECIS is complex and time consuming. Its complex system of role operators served to provide the output string for printing, but was not otherwise utilized – though there is no reason why it should not have been.
- PRECIS appears to be imprecise in some aspects; for example, in many instances it does not appear to make any difference whether a concept is coded (1) or (2), which suggests that the operators would not be of much help in searching a computer file, where they might be included.
- Place name has been treated in several ways as part of the subject string. Depending on the sense, a place name is coded by the operator (0) or (1) or (5) or occasionally (3).
- The author's information may be of value if an individual or a corporate body is closely associated with a particular subject. Persons as subjects, for example, biographies, also form part of the PRECIS subject string. As a result, entries for an individual may be found in both the author/title file and the subject file. A common practice for many years has been for libraries to file such entries in the author/title file, making this a name file. Of course, if a record is being searched online, it is to some extent immaterial where in the records a piece of information occurs, so long as it is there to be found.
- PRECIS allows very long headings. For example,

Acquisition. Books. Stock. Libraries. Universities. United States.
Selection. Approach plans – *Reports*

Long headings like this are not likely to be shared by more than one index element, and the main purpose of distinguishing headings from subheadings seems to be thwarted. Even when more than 100 index elements begin with Acquisition, a PRECIS index display will repeat this term each time if the other component terms of the heading are different. By contrast, in a system in which the lead term alone always forms the heading, the lead term Acquisition could be displayed once for many index elements.

- PRECIS index generation rules are quite complex. It is insuperably difficult for an indexer to keep nearly 200 rules in mind every moment.
- Users of the PRECIS manual (students, teachers, or practicing indexers) are too often confronted by the fine distinctions and interpretations, which sometimes seem incomprehensible and inconsistent.

More philosophical criticisms have also been raised against PRECIS. Swift et al. (1973) examined PRECIS' suitability for indexing documents within the sociology of education. They conclude that PRECIS could not satisfy the requirements of professionals regarding precision and validity of the indexing because PRECIS' formal characteristics and presuppositions prevented a satisfactory indexing. PRECIS assumed an agreement between authors in a domain and did not allow them to cope with multi-paradigmatic research [9]. Alternatively, Swift et al. (1977) proposed a multi-modal approach to indexing and classification. This criticism of PRECIS is related to the distinction between theories related to "absolute syntax" on the one side and more pragmatic theories of languages. As Svenonius (2000, 184-185) wrote: "Sørensen and Austin [1976] construe the PRECIS syntax as also conforming to this principle [of absolute syntax, cited above] and, further, on its basis argue the adaptability of PRECIS to multilingual information organization". It can be added that Sørensen and Austin (1976) directly refer to Chomsky's theory.

Further, Bernd Frohmann (1983) made a distinction between a priori semantics and a poteriori semantics. The last position is related to Ludwig Wittgenstein (1979), who argued that the meaning of words must be found in their use, in human social activities, and Frohmann found that also early work (1955–1960) by researchers in the Classification Research Group (1955) had adopted this a posteriori semantics by demanding that classification and indexing must be based on the examination on the literature in the field, but that the works by Derek Austin on PRECIS ignored these arguments and adopted the a priori view, which implicates that semantic relations are neutral as to subject fields. Frohmann showed how Austin thereby suggested that any source about semantic relations could be used without having to examine the literature in a given field in order to determine the relations in that field, which he (supported by Wittgenstein) found to be an unfruitful basis for classification and indexing.

12.0 Applications of PRECIS

PRECIS was basically designed as an alternative method for generating index entries for the *British National Bibliography*. The two most important factors that played a significant role in the search for an alternative method of indexing were (i) the dependence of chain indexing, which was being used in BNB, on class numbers of documents, and (ii) the decision of the British Library to generate computer produced BNB with all the indexes. The new system was successfully applied in BNB for more than a decade. But when, in 1990, it was decided to revise UKMARC, the need was felt to have a more simplified system of subject indexing for BNB. Consequently, a new Computer Aided Subject System (COMPASS) was introduced for producing index entries in BNB in 1991. Nevertheless, the new system used the same kind of basic principles as those of PRECIS. Incidentally, in 1996, COMPASS was also terminated, and BNB started using Library of Congress Subject Headings. In the UK, many other organizations made independent use of PRECIS for their catalogs and indexes. PRECIS was also used in the *British Education Index* (Bakewell 1975, 165). It is, however, not known how many, or if any, organizations are still using PRECIS in the UK. The first important user of PRECIS outside the UK was the *Australian National Bibliography* in 1972, and in most respects, it became a replica of BNB. But it discontinued use of the system in 1985 "on the grounds that it is no longer justified in devoting resources to the production of a PRECIS index to the bibliography when libraries are otherwise hardly making use of the data" (Curwen 1985, 254). PRECIS has been most widely used in Canadian libraries and institutions. A few organizations, including the National Library of Canada, adopted PRECIS for their printed catalogs (Tonta 1992, 7). In Germany, a revised and simplified version of PRECIS was brought out by *Deutsches Bibliotheksinstitut* for use in German libraries (Maaßen 1983), while in the USA, Phyllis Richmond (1981) brought out the book *Introduction to PRECIS for North American usage.*

12.1 Applications across languages

According to Austin, natural curiosity had prompted experiments on application of PRECIS in non-English languages from the first adoption of PRECIS in 1971 in BNB (Austin 1998, 49). This led to inclusion of an exemplary string in ten languages in the second edition of *PRECIS Manual* (Austin 1984). This exercise demonstrated that the order of terms in a string (as organized by the role operators) need not change between languages (Hancox and Smith 1985, 122). Foskett commented that "PRECIS appears to be the only indexing language with real possibilities for multi-lingual indexing and the number of languages in which it has proved successful is impressive" (Foskett 1982, 139)." Austin himself demonstrated in his PhD thesis that PRECIS was a multilingual system, being neutral as to the language from which it drew its vocabulary (Austin 1982). The system was tested for its application across languages like French, German, Swedish, Danish, etc. and solutions were

found for most, if not all, of the syntactical and thesaural problems (Curwen 1985, Hancox and Smith 1985). "There was pressure to expand the set of role operators to address particular issues with certain languages. For example, codes to handle Komposita (compound words) in German were devised but never added to the core set. However, even if extra codes for special situations with certain languages had been added to PRECIS, these would never have complicated the majority of indexing which would have used the core operators" (Poulter 2013, 56). The British Library Research and Development Department (BLRDD) took up PRECIS Translingual Project in 1976 aiming

> to create a set of routine and computer programs which will add a translingual component to the PRECIS system. This will enable the computer to convert the input string into a series of language-independent codes and translate these later into appropriate terms in a target language. These terms will then be manipulated into index entries in the target language without further intervention by the indexer (BLRDD 1976, 2).

However, due to the non-availability of computer support, the research team could only design detailed specifications for all translingual procedures (Verdier 1980). In Canada it was used to produce a bilingual bibliography (Foskett 1982, 139). PRECIS was also actively studied in countries as linguistically and culturally far apart as Denmark, Italy, Poland, India, and China (Curwen 1985, 253). Experiments in using PRECIS in different Indian languages showed that it worked well in some languages like Tamil and Telugu (Venkatachari 1982, 103-104).

12.2 Applications for different media

"PRECIS has been applied to many different types of media including films, filmstrips, video, stock shots, maps, and realia such as puppets and other theatrical materials" (Dykstra 1989, 84). For example, PRECIS was used in *The British National Film Catalogue* (BNFC) but was abandoned after four years (Curwen 1985, 255) and at the invitation of the National Film Board of Canada (NFB), Christine Jacobs, an expert in PRECIS, prepared a simplified version of PRECIS (PRECIS-MO, i.e., modified PRECIS) for use by the board. It was found that the PRECIS-MO framework ensured good coverage of all aspects of the subject(s), and the subject analysis was as precise as necessary. This prompted NFB to take up PRECIS in 1978 for indexing films and videos (Jacobs and Arsenault 1994, 88-89). PRECIS was also used in the *British Catalogue of Music* in 1984 (Curwen 1985, 259).

12.3 Other applications

PRECIS was manually applied for preparing the subject catalog in Aurora High School in Ontario, Canada, from 1972 to 1975, and the collected evidence showed a significant increase in the use of the subject catalog by students. Consequently, a model for a computer-based catalog for an Ontario-wide Information Network for School Libraries using PRECIS was developed in Canada in 1978 (Burnham et al. 1978). Several other schools also adopted PRECIS for their subject catalogs, eliciting a response from the users that supported the claim that "a PRECIS subject catalog not only responds well to the curriculum needs of students and teachers but also has applications as a learning tool" (Taylor 1984, 85). Besides, PRECIS was also used for producing back of the book indexes, including those of the second edition of the *PRECIS Manual* (Austin 1984) and *IFLA UNIMARC Manual* (Holt 1987).

13.0 PRECIS in online environment

As indicated, PRECIS indexing system was basically designed and developed for generation of printed index with the help of computer, especially the index of the *British National Bibliography*, during late 1960s and early 1970s. Obviously, Derek Austin did not think about its possible application in searching online catalogues or databases as these were only at their infancy at that time and their future development was beyond anybody's imagination. Despite its original purpose, it "has attributes which make it easily manipulated by machine," asserted Williamson (Williamson 1984, 83). Dykstra pointed out that "PRECIS has been used in online catalogues with very impressive results" (Dykstra 1989, 81). She further stated that "several years of experience (both in England and in Canada) have made it clear that PRECIS online works both effectively and efficiently, taking advantage of the technology presently [i.e. in 1980s] available. Even more, the use of PRECIS so far in online retrieval, has revealed avenues for further investigation and research" (92). She felt that "the classification and indexing concepts, which Derek Austin used to create a state-of-the-art indexing system for the technological environment of those years, still hold enormous potential for the improvement of subject access in the online catalogues of today and tomorrow." (81). Also, "because of the building blocks of PRECIS are terms, the system is as adaptable to online searching as any post-coordinate system. One simply devises a search strategy using the Boolean operators" (90). Incidentally, Butcher and Trotter worked on developing strategies for online subject access using PRECIS in the British Library (Butcher and Trotter 1989).

Initially, some studies were made on the retrieval effectiveness of PRECIS in online searching as compared to that

of *Library of Congress Subject Headings* and some other subject access systems (Schabas 1976; 1979; 1982; DeHart and Glazier 1984). But PRECIS certainly had more potential than that. According to Tonta (1992, 11), "although PRECIS offers great potential in online subject retrieval, a great deal of experimental research needs to be conducted in order to see how this potential can be used to best advantage and to find out the relative merits of PRECIS in an online environment". Dykstra (1989, 93) pointed out that

> the duality of PRECIS as a pre-coordinate and a post-coordinate system has opened the way for the investigation into the possibility of replacing or enhancing a standard Boolean search with a search based upon the grammatical or syntactic role of a particular term – a search, for example on the term "teacher" *as agent* AND the term "Student" *as object*. Any or all of these research and development activities could lead to even more powerful subject retrieval capabilities. In the longer term, the development of these more powerful and effective retrieval capabilities, based upon what PRECIS has to offer, would most logically pave the way for major multidisciplinary research in complex semantic information processing and the development of expert systems for textual analysis and retrieval.

Dykstra published a '*Logico- Linguistic Study of PRECIS as a Possible Model in the Shift from Indexing to Automated Text Analysis'*, in 1986, while another valuable study was made by Hancox (1983) on '*Machine Translation of String Indexing Languages between English and French using PRECIS'*. However, the full potential of PRECIS in an online environment does not seem to have been investigated.

Dykstra (1985a, 235) explained how PRECIS input strings can be utilized for online subject retrieval:

> each term (or each single word in a compound term) in a PRECIS string is individually searchable using the standard Boolean operators. In other words, the search is post-coordinate, with PRECIS terms used as keywords. The terms in PRECIS strings, however, are of course pre-coordinate, having been synthesized by an indexer by means of the syntactic operators and codes. Thus each search on two or more individual terms in Boolean combinations yields the various syntactical arrangements in which those terms occur in the database (Dykstra 1985a, 235).

Explaining the process to be followed for PRECIS in online system, the author said:

> PRECIS in online system provides an intermediate step, in which the searcher is able to screen the various term configurations retrieved *before* an actual display or printout of titles. Or, if this step were considered unnecessary in a particular system, one could proceed immediately to a title display or printout which would provide as additional information in the PRECIS entry for each title, as a kind of 'mini-abstract.' In either type of system, increased relevance is achieved with no loss of recall. Once individual terms in PRECIS strings are retrieved, there is of course no need for the computer to go through all the shunting procedures to place these terms in the lead position as would be required for access in a printed index. (1989, 91).

Despite these positive evaluations about the potentials of PRECIS in the online environment, there is no indication that PRECIS has ever played an important role in online searching. The criticism raised by Swift et al. and Frohmann may also indicate that its use for online searching may not fulfill the expectations expressed by Dykstra.

14.0 Conclusion

PRECIS was evolved to meet a specific need, but it was adopted for producing several indexes in the UK and elsewhere, besides the *British National Bibliography* and the *Australian National Bibliography*. Some studies were conducted to assess the reaction of indexers using the system (Higgins 1991; Peters 1981; Peters and Bakewell 1981; 1984). In most cases mixed reaction from its users was reported. Some problems were also identified, which helped Austin and his associates to improve the system. Nevertheless, the indexing performance of the system, as found during studies and experiments with PRECIS by different agencies, showed that its performance "was one of the best in terms of indexing rates (i.e., string writing), search time, recall and precision, etc." (Sarkhel 1998, 186). Unfortunately, the system was abandoned in many cases, citing one reason or another without fully assessing its capabilities and potential. Furthermore, since the demise of its innovator, Derek Austin, in 2001, nothing much has been heard about the system. Nevertheless, it must be admitted that "PRECIS was a turning point in the indexing field for a variety of reasons, and that its influence was wide-ranging and powerful" (Higgins 1991, ii).

It may be mentioned here that Svenonius (2000, 177, italics in original) has summarized the fate of syntax-based "subject languages" thus:

> Kaiser's *Systematic Indexing* is now a period piece; Ranganathan's Colon Classification is used infrequently, even in India; and the heyday of PRECIS is over. Nevertheless, the languages, particularly in the development of their syntax, have served as proto-

types in guiding the ongoing development of other languages with better economic backing and survival power.

Svenonius then continues describing the scene today, where older and less research-based systems, like the Library of Congress Subject Headings (LCSH), the Dewey Decimal Classification (DDC), the Library of Congress Classification (LCC) and the Universal Decimal Classification (UDC) dominate the picture. This picture is, unfortunately, rather unrelated to intellectual developments in philosophy, linguistics, and social sciences on the one hand, and information technology (with, for example, ontology construction) on the other hand. The evaluation of PRECIS and its influence must be done with a more overall consideration of the intellectual foundations of knowledge organization.

Endnotes

1. The principles of chain indexing (or chain procedure) are described, for example, by Batty (1979) and Chatterjee (2016, 179–184). This procedure is about deriving alphabetical subject entries from records with class numbers in hierarchical systems. Originally developed by S.R. Ranganathan for deriving subject headings for the alphabetical part of a classified catalogue and incorporated in his Classified Catalogue Code (CCC), it has been improved by other researchers and applied to a range of other bibliographical classification systems, besides Colon Classification. Batty (1970, 425, italics in original) wrote: "It is often attributed solely to him [Ranganathan], but like his theory of classification, it is really a brilliant restatement and recognition of undiscovered potential of ideas implicit in the often *ad hoc* developments of predecessors"). Batty described it as a semi-mechanical process: "By relying on the hierarchy of the classification, by using its terminology as a foundation, and by making mostly *negative* decisions (i.e., decisions only to delete or to alter), the indexer's task is made easier" (425). Chatterjee provided examples, including the following: A document entitled *Treatment of Heart Diseases in India* has the following class number according to CC (sixth edition): `L32:4:6.44`. In CC these symbols stand for (here simplified):
   `L` Medicine
   `L3` Circulatory system
   `L32` Heart
   `L32:4` Disease
   `L32:4:6` Asia
   `L32:4:44` India
   Relatively automatically, this classification number can therefore produce the following description of the document: India, Treatment, Disease, Heart, Medicine (supplemented by cross-references such as `Circulatory system, Medicine` *See also* `India, Treatment, Disease, Heart, Medicine`, and similar cross references for each term in the description). The technique is obviously strongly dependent on the nature and quality of the classification system and should therefore not be considered an independent indexing of the document, but a mechanical translation of its classification (but it is not totally mechanical as an indexer is required to identify the nature of links (sought links, unsought links, false links, and missing links, which have not been presented in this simplified example). Only one specific subject entry is created, and that subject entry can only answer a specific query formulation that corresponds to it.
   Among the writings on chain indexing, Ranganathan (1964, 287-289 and passim), Coates (1960, Chapter IX), and Mills (1955, 143-148) can be added.
2. At the same time the development of PRECIS started in England, Ranganathan's team started to develop another system to deal with some of the problems of chain indexing. This system was called Postulate-based Permuted Subject Indexing (POPSI), based on analyzing the subject matter of a document through the first six steps of classification as propounded by Ranganathan. (See further in Chatterjee 2016, 192–197).
3. According to Dutta (2017, 346): "Up to that time the BNB had three parts:
   a. Classified main part in which entries were organized according to DDC number;
   b. An alphabetical index of authors, titles etc. (i.e. Name index); and
   c. An alphabetical subject index derived according to the chain procedure.
   It was possible to produce (a) and (b) directly from the MARC tape. But no satisfactory source of subject index data was available in MARC. The chain indexing procedure so long being considered as the most versatile and logical method for deriving subject heading and used worldwide had to face certain disadvantages particularly in the context of mechanization. These are as follow –
   a. Unsuitability for machine – The formation of 'chain' is very much a human intellectual process which is logically absurd for the computer to manipulate;
   b. Very much depends on classification scheme;
   c. In most cases access to specific subject heading was possible at the cost of running from pillar to post since only one entry is specific subject entry and others are cross references.
   That is why, a research for a suitable alternative for generating subject indexes was undertaken by British Library".

4. ISO 1087:2019, 3.2.13: "generic relation, generic concept relation, genus-species relation: *concept relation* (3.2.11) between a *generic concept* (3.2.19) and a *specific concept* (3.2.20) where the *intension* (3.2.6) of the *specific concept* (3.2.20) includes the intension of the *generic concept* (3.2.19) plus at least one additional *delimiting characteristic* (3.2.5)
   Example:
   A generic relation exists between the concepts (3.2.7) 'word' and 'noun', 'vehicle' and 'car', and 'person' and 'child'.
   Note 1 to entry: Outside the terminology community, "type-of relation" and "is-a relation" are also used instead of "generic relation".
   Note 2 to entry: In a generic relation the *subordinate concept* (3.2.16) is a *specific concept* (3.2.20) and the *superordinate concept* (3.2.15) is a *generic concept* (3.2.19)".
5. WordNet 3.1: "synonym, equivalent word (two words that can be interchanged in a context are said to be synonymous relative to that context)".
6. IR languages are sometimes called *indexing languages*, *documentation languages* or *information languages*. Svenonius (2000, 127) called them *subject languages* (which she, in other chapters, contrasted with *document languages* and *work languages* (87): "The present chapter [6] deals with work languages, which are used to identify and structure information. Chapter 7 deals with document languages, which are used to describe particular space-time embodiments of information. Chapters 8 through 10 deal with the subject languages used to characterize the content of information". Chapter 10 "Subject-Language Syntax" presents PRECIS among other "languages". This distinction between the three languages, as well as their names, is, however, highly idiosyncratic and has not been used by other authors.
7. Svenonius (2000, 184, italics in original): "*Principle of absolute syntax* – Another Ranganathan principle, this one prescribes that the order of terms in a subject string should mirror the seminal or deep structure underlying syntactic constructions common to all natural languages. A function of hard-wiring in the human brain, absolute syntax parallels the process of thinking, irrespective of the language in which these thoughts are expressed".
8. A priori knowledge (or relations) is a knowledge independent from experience, such as mathematical and logical knowledge. A posteriori knowledge is a knowledge that depends on empirical evidence. When we classify, for example, a square as a parallelogram (generic relation), by a priori, logical means, without any empirical study of quadrilaterals. However, when we classify a common blackbird (*Turdus merula*) as a "True thrush" (also a generic relation) this is due to empirical (a posterior) study of birds (and recent empirical studies based on DNA-analysis have changed the classification radically, see Fjeldså 2013, 141). That means that semantic relations (such as the generic relation) in KOSs not necessarily are a priori, as sometimes claimed. On the contrary, they are mostly a posteriori. See Hjørland (2015) for a criticism of the view that semantic relations in IR languages are a priori.
9. An anonymous reviewer suggested that PRECIS' "viewpoint role" might be suitable to cope with multi-paradigmatic research and referred to Kleineberg (2018) about viewpoint analysis in indexing.

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