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A Proposed Methodology for Examining the Provision of Subject Access in the OPAC

The development of the OPAC has stimulated renewed interest in the provision of subject access in the catalogue. Significant differences between the new and earlier formats have prompted the suggestion that there should be a radical reappraisal of the provision made. A methodology for such a reappraisal is proposed, based on the proposition that a radical reappraisal will need to refer back to the theory on which subject access is based. The Five Axiom Theory developed by R.Fugmann is outlined, which is considered to provide a possible basis for the reappraisal. Some existing data derived from a cooperative cataloguing environment is described which is considered to be relevant to the axiom in Fugmann's theory which is concerned in part with the significance of consistency in indexing. The data is analysed in terms of consistency, with the objective of indicating what kind of results might be obtained from the application of the proposed methodology. The conclusion drawn from the results of the analysis is that the methodology may well be worth further exploration. Such exploration will need to examine a more extensive data sample than the limited one used for the analysis undertaken in the article, and will need also to examine the role other axioms of the theory might play in implementing a reappraisal of subject access. (Author)

1. Introduction

In his survey of OPACS published in 1985, MATTHEWS reports on 48 operational systems (1). HUDSON discusses the impact made on the cataloguing operation of six institutions which have adopted the new format. Considerable benefits are reported from its adoption, for both the production and utilisation of the catalogue, and these are expected to promote its use by a growing number of libraries (2).

A number of writers discussing the impact of the new format, especially on subject access, have asserted that its adoption provides the opportunity, perhaps the necessity, for a radical reappraisal of the provision made in earlier formats (3-6).

WILLIAMSON, reviewing subject access in the online environment in 1984, commented that much of the research up to that point had been devoted to adapting traditional techniques to the online environment, rather than attempting a radical reappraisal (7). A later commentator observes that much development has been determined by commercial viability, and not by the need for a fundamental reappraisal (8). Two projects which exemplify the adaption of existing methodology to the new format have been concerned with increasing the depth of indexing in order to make searchable records more like those created in indexing for existing online bibliographic databases, and with the use of traditional classification in the new environment (9, 10).

One of the prerequisites for attempting a radical reappraisal would be to decide on a methodology. One investigation which involves detailed analysis of how OPACS are constructed and used is in progress at the Polytechnic of Central London. This research is noted as one of the most significant projects in TEDD's review of recent developments (11). The purpose of this article is to suggest another, complementary rather than alternative approach, and to use existing data to indicate the kind of results it might produce.

2. Theoretical Basis for the Proposed Methodology

The rationale for the proposed methodology is the proposition that a reappraisal, if it is to be truly radical, will need to refer back to theoretical principles, on which the revised techniques should be based. The rationale, therefore, necessitates the identification of such principles. One assumption is made: that some form of indexing will continue to be necessary for a mechanism which provides access to the subject content of a collection containing a significant proportion of documents in monographic form. Given this, the principles sought have to address the problem of how the searcher, when devising search strategies, can predict what assignments have been made.

A number of theoretical approaches have been suggested, but none yet fully developed and evaluated. Four were discussed by BORKO in 1977 (12), and two are noted as significant in the context of retrieval effectiveness by ROBERTSON (13). The techniques discussed by both authors use computational methods to calculate utility and probability. SALTON, one of the theorists discussed, concludes in a later article that while much has been achieved using this methodology, much remains to be done in developing this line of approach (14). Moreover, the methodology has mainly been tested on types of documents amenable to full text searching, such as periodical articles, or abstracts of these. An approach suggested by COOPER does appear to be equally applicable to monographic material, bus some doubt remains as to the suitability of the methodology to such material (15).

An alternative approach has been suggested by FUGMANN, who specifically mentions the revision of existing systems as one possible area of application for his theory. He developed a Five Axiom Theory for Indexing

and Information Supply, which appears to be less dependent on computation than methods utilising utility and probability theory. One article in which the theory is explained cites 45 references which include several contributions based on such methods, but cites earlier work by RANGANATHAN and RUSH and LANDRY as precursors of the Five Axiom Theory (16). The theory has been developed in the context of chemical documentation, and a need is acknowledged for testing its relevance in other areas. One area of potential application could be the OPAC, which, because of its role in documenting monographic material, relies heavily on indexing for subject access.

One of the stated constraints which has prevented full testing of the theory in operational systems is the lack of time available to workers in such systems for testing new theories (17). Some relaxation of this constraint would result if existing data could be used to test the theory. The following section explains the derivation of some data which appears to be relevant to part of Fugmann's theory, and therefore suitable for a preliminary exploration of the kind of results which could be derived from using the theory as a basis for a reappraisal of indexing needs. Such a preliminary testing of the viability of the methodology is advisable in view of the investment of time and effort required for full testing.

3. Origin and Relevance of the Data Utilized

The data in question was collected during the initial stages of the automation of the cataloguing operation from which it was derived, when an inhouse system was abandoned in favour of membership of a cataloguing cooperative. As a part of the change, Library of Congress subject headings were substituted for locally created headings in the subject heading catalogue. At the time the data was collected, evidence was sought on the effect of adopting headings assigned by the two major cataloguing agencies which supplied records to the cooperative, without local modification, or local selection when several headings were assigned to a document. Heading assignment was done locally by professional staff, and was thought to be one of the areas in which automation might reduce the amount of staff time required. One of the factors identified as determining the effect of abandoning local editing of heading assignments was the consistency with which headings were assigned by the agencies, and the extent to which there was agreement between them on headings assigned.

Agreement between the agencies was considered to be the easier to measure objectively, since for documents catalogued by both, a direct comparison of descriptors assigned could be made, and this comparison indicates the likely extent of agreement between descriptors assigned to a topic in documents for which records from one only of the agencies are available.

The indexing of documents for which a record from only one agency was available was thought to be specially significant in determining indexing agreement, since any differences arising from differing agency indexing policies could be eliminated by always selecting the records supplied by the same agency, in the case of documents for which both had created records.

The data was collected, therefore, to determine the extent to which indexing assigned by two agencies agreed, in cases where both had created records. This agreement was considered to be a readily available and reasonably objective indication of the degree of consistency a cooperative member taking records from both agencies might expect to find in the descriptors assigned by the agencies to the documents it acquired.

Indexing consistency is one of the topics considered by Fugmann in his discussion of the Five Axiom Theory. The discussion, mainly in terms of predictability and fidelity of indexing, results in the conclusion that indexing consistency is not a useful overall criterion of indexing quality. Instead, representational predictability is proposed as such a criterion. The discussion is in terms of a two stage indexing process: selection of concepts to be indexed and choice of descriptors to represent these concepts. At the concept selection stage, indexing consistency is considered to be conducive to, but not sufficient to ensure, the predictability of concepts selected to index a document. At the representation stage, consistency in the choice of descriptors to represent the concepts selected for indexing is considered neither necessary nor sufficient to ensure predictability.

Consistency then is not seen as having a central role in ensuring representational predictability, only as one factor promoting its attainment at one of a two stage indexing process. Analysis of data on indexing consistency will therefore be in terms of a peripheral part of the Five Axiom Theory. Such an analysis can nevertheless have value at a preliminary stage, where the objective is an initial test of a proposed methodology, by using it to analyse some data, in order to determine what kind of results are obtained. Any part of the theory, even a peripheral part, can be used at this preliminary stage, though plainly, if results prove encouraging, much will still remain to be done in exploring the role the whole theory might play in developing the methodology further. In the following sections, further details of the data are given, and an analysis of the kind outlined above is made in terms of indexing consistency, one of the factors considered in the development of the theory on which the proposed methodology might be based.

4. Description of the Data

The data collected were the subject descriptors assigned by the British Library and the Library of Congress, and in the local catalogue, to documents added to the local collection between 1978 and 1980 in the area of librarianship and information science. Two kinds of descriptos were assigned to MARC records by both agencies and also used in the local catalogue: Dewey Decimal Classification class numbers and subject headings from the Library of Congress Subject Heading List. Table 1 presents the basic facts on the size of the data sample, and the extent to which records were available from both agencies. Agency names are abbreviated to BL and LC in this and subsequent tables.

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Table 1: Total documents added to the local collection

BL and LC record found	264
BL record only	87
LC record only	111
No agency record	134
Total	596

5. Analysis of Data

Table 2 analyses the descriptor assignments to documents catalogued by both agencies. The table assumes one class number per document. In cases where class numbers from more than one edition of the Dewey Decimal Classification were assigned, that closest to the 16th edition, from which most of the class numbers in use in the local catalogue are derived, was recorded. The subject heading totals record the number of times the same subject heading was assigned by both agencies to the same document, and the number of times a heading was assigned by one agency only. Exactly matching descriptors only are counted as assignments by both agencies. On this basis, Table 2 indicates that the agencies differ considerably in descriptor assignment.

Table 2: Analysis of documents catalogued by both agencies

Documents catalogued by both	264
Same class number assigned by both	127
Headings assigned by both	230
Headings assigned by one only	395

The analysis in Table 2 is based on the extent to which descriptors in the sample match exactly. In assessing the extent of agency agreement on assignments a less rigorous definition may be advisable. There is, for example, a significant difference between disparate class numbers which represent different decisions on the main focus of a document, and class numbers which differ merely by the addition of a form or geographical extension to an agreed concept designator. Differences of the latter kind are readily taken into account by truncation of the more specific class number. Differences of the former kind may require a complex disjunctive search statement, if all possible variations are to be included.

Table 3 represents the result of an attempt to take such qualitative differences into account in further analysing the class number divergence shown in Table 2. The analysis is based on the structure of the Dewey Decimal Classification. The assumption, generally valid, is made that the earlier the divergence occurs between two class numbers read left to right, the more radical is likely to have been the difference between the conceptual analysis of the main focus of a document.

The table concentrates on three significant points in the divergence continuum: differences in main class numbers; differences at the third digit, indicating choice of different subdivisions of the main class; differences beyond the decimal point, frequently indicating a more specific subdivision of the same topic, or the same topic qualified by non-topical qualifiers, such as form or geographical treatment.

Table 3: Analysis of class number differences

Different main class numbers	35
Third digit differences	37
Post decimal point differences	65
Total	137

Table 4 contains the result of a similar qualitative analysis of the subject heading assignment data of Table 2. It was based partly on the structure of the Library of Congress Subject Headings, partly on the way such headings are used to index the subject content of documents. The structural element was based on the use of subdivisions to designate specific aspects of a heading. Many of the differences noted consisted in the use of such subdivisions. Such differences are considered analogous to the kind of difference included in row 3 of Table 3 in the class number analysis.

Analysis of differences other than of subdivision was based on the way both agencies use Library of Congress Subject Headings to index the subject content of documents. Both frequently assign several headings to a document, which can result in partial agreement in the assignments made. The differences were divided into two categories: those derived from documents on which assignments were partially agreed, and those derived from documents on which there was no agreement. The first category is identified in Table 4 as headings additional to agreed assignments, and is considered analogous to the kinds of differences included in rows 2 and 3 of Table 3, in that there is some measure of agreement between the agencies. The second category, headings assigned to documents with no agreed headings, is considered analogous to the more radical class number differences of row 1 of Table 3, in that there is no element of agreement between the agencies on descriptor assignment.

Table 4: Analysis of subject heading differences

Headings with differences of subdivision	124
Headings assigned in addition to agreed headings	165
Assignments to documents with no agreed headings	106
Total	395

Tables 2-4 indicate that even if agreement between agencies is defined less rigorously than the assignment of exactly matching descriptors, considerable differences in assignment remain. 52% of documents are assigned different class numbers, and of these, 25% are differences of main class number, suggesting different conceptual analysis of the main focus of a document. 63% of all heading assignments are made by one agency only, and 17% of headings represent radical divergence between the agencies, in that no agreed headings are assigned to a document.

Assignments of different main class numbers or totally different sets of subject headings to documents appear to offer the strongest evidence of differences in agency analysis of the subject content of documents. Such descriptors need not be wholly inconsistent, however. Differences could result from consistent choice between options allowed by the classification scheme, or between headings related by the syndetic structure of the subject heading list. Such consistent, and therefore predictable, choices would reduce the element of uncertainty to the user of an operational system. A further analysis of the subset of documents with the most disparate descriptor assignments was therefore made, to establish whether there is any evidence of such underlying consistency.

Table 5, detailing items assigned different main class numbers, is arranged by class numbers other than those from Dewey Decimal Classification main class 020. The first four rows may be considered to exemplify the kind of predictable choice for which evidence was sought. The choice between grouping topical bibliographies with the topic or at the bibliography number is probably one of the Dewey Decimal Classification options which can be most readily recognised and consistently applied. Rows 5 to 14 exhibit a discernible pattern: the choice between a business technique or operation and its employment in the field of library administration or publishing. Rows 15 to 18 exhibit a similar pattern of choice between alternatives: the provision at 001 for the general process of communication, and separate provision for systems and materials employed in that process. The range of class numbers in the second column, however, does not suggest the kind of consistent choice between alternatives which could easily be predicted by searchers, and this is certainly true of the remainder of class numbers in the table.

The analysis of totally disparate subject heading sets is based on the relationships between headings. Two relationships common to many thesauri are used: broader-narrower term, and related term. Most relationships between headings of these two kinds will fall within two broader kinds of relationship used in the analysis of indexing languages: syntagmatic and paradigmatic.

The introduction of these broader relationships into the field of information retrieval from that of linguistics has been attributed to Gardin by Foskett. In the original usage, a particular relationship could be of either kind, depending on the indexing language used (18). Various definitions of the terms have subsequently been given (19 21). Common to most is the idea that paradigmatic relationships are of a more permanent nature, deriving from the definitions of terms, rather than the more transient relationships between terms found in documents. Most broader term-narrower term relationships will be of the paradigmatic kind, related terms are more likely to fall within the syntagmatic category.

The two general kinds of relationship between descriptors may be significant in explaining the choice of different descriptors for documents. If the relationship between selected terms is paradigmatic, an agreed assessment of the subject content of a document may result in the choice of different descriptors owing to the employ-

ment of differing policies on indexing specificity. Specific descriptors may equate to a more general term, linked by the paradigmatic syntactic structure of the indexing language, used at a less specific level of indexing. This is a less likely explanation of indexing differences where the relationship between selected terms is syntagmatic, since there is no such general related term which represents an agreed broad analysis of the subject content of a document.

Table 5. Documents assigned different main class numbers

#			
1	016.02100973	021.00973	American library history:a bibliography
2	016.0253	025.3	Indexing and abstracting:an international bibliography
3	016.0255	020.7	Library instruction:a bibliography
4	016.091	091.094	Medieval scribes, manuscripts and libraries
5	658.154	029.11	Zero based budgeting in library management
6	658.1594	070.5	Scholarly publisher's guide: financial and legal aspects
7	658.401	025.1	Planning approach to library management
8	658.4032	025.1	Systems analysis in libraries
9	658.45	025.1	Communication in library management
10	658.809070573	070.57	Information through the printed word
11	658.8090705730947	338.4707057 30947	Soviet book publishing policy
12	658.91021	025.1	Library structures and staffing systems
13	658.9102100	027.742547	Loughborough Library Management Unit report to the British Library
14	658.9107050941	070.50941	The small publisher:manual and case histories
15	001.5	029.7	Implementation of complex information systems
16	001.552024092	025.17	Printed ephemara
17	001.64404	029	Formal models and practical tools for information systems design
18	001.6443	621.3819534	Guide to computer output microfilm
19	011.2	025.060013	Reference work in the humanities
20	070.5	025.236	Librarians Booksellers and Publishers Working Party: LAIG guidelines
21	070.594	029.9001430973	Enquiry into scholarly communication
22	300.141	070.572	Scientific publication system in social sciences
23	302.23	070.502854	Future of the printed word
24	338.47027473	027.473	Public libraries:an economic view
25	338.768620942951	070.90942951	History of the Gregynog Press
26	346.410482	070.52	Publishing agreements
27	351.004094	025.49351004094	List of uniform headings for higher legislative and ministerial bodies in European countries
28	352.16	029.9352	Local government and information technology
29	501.41	029.95	Communication:the essence of science
30	574.072041	029.9574	Biological Information Review Committee report
31	610.7	026.61	How to use a medical library
32	686.43	025.179	Serials management and microforms
33	727.8	022.3	Mason on library buildings
34	745.67	091	The illuminated manuscript
35	973.07041	026.773	American Studies Library Conference

In addition, paradigmatic relationships may be marginally easier to incorporate in searching, perhaps because of their permanent nature. This is most clearly evident in the case of generic-specific relationships: moderation of a strategy to incorporate more or less specific terms is a likely early response to an inappropriate level of recall.

Table 6, appended to the end of the article, analyses totally disparate heading sets in terms of paradigmatic and syntagmatic relationships. Columns 2 and 4 list the headings assigned by each agency to a document. Column 3 indicates which of the column 4 headings are related to column 2 headings in the 11th edition of Library of Congress Subject Headings (22). P indicates a column 43 heading which is designated a broader or narrower term under one of the headings in column 2. S indicates a related term. A relationship is classed as P if the column 4 heading is treated in LCSH as a broader or narrower term of a heading not assigned by either agency, which is related to a column 2 heading in either way. Since Library of Congress Subject Headings are modified continually, some additional headings may have been related at the time the assignments were made. The list is relatively stable, however, and the number of related headings shown in table 6 is unlikely to be significantly increased by such headings. In most cases, several headings are assigned by both agencies to a document, and relationships between such multiple headings can be complex. The attributions in column 3 are not intended to map such complex relationships, merely to indicate that a column 4 heading falls within the category in relation to at least one heading in column 2. The complex structure of Library of Congress Subject Headings also requires a somewhat arbitrary definition of what constitutes a totally different heading. Included in Table 6 are phrase headings where some element of the phrase is different, for example Document 10 and headings which appear as subheadings of other headings, for example Document 2.

Although all except one of the relationships fall into category P, a number of headings are not related at all in LCSH. Differing policies on indexing specificity cannot explain, therefore, all the assignment differences, and the evidence from subject headings tends to confirm that from class numbers. No pattern of underlying consistency is evident which would explain descriptor assignments to documents manifesting the greatest variance between the agencies.

6. Conclusion

The combined evidence from documents with different main class numbers assigned by the agencies, or with no shared heading assignments, tends to confirm the results from the whole sample. Considerable diversity in the descriptors assigned to documents exists. Wile some of the divergence could be attributed to differences in specificity, or to non-topical additions to descriptors, significantly different assignments were made in many cases. Little evidence of differing, consistently applied, indexing policies was evident. The conclusion must be that indexing consistency, one factor identified in Fugmann's theory as conducive to effective indexing, would not be realised in the operational environment examined, were indexing was to be taken uncritically from available records. The problems presented by this kind of consistency do not appear to be ones which would be solved by increasing indexing depth, nor by exploiting the more flexible approach to subject access made possible by the OPAC, in an attempt to utilise techniques developed in online bibliographic searching.

Alternative approaches which take account of indexing theory need to be considered, if a truly radical reappraisal of subject access in the new OPAC environment is to be realised.

A methodology for implementing such an alternative approach has been briefly examined, using an available limited sample of data, and a small part of a significant contribution to indexing theory. The results suggest that the methodology is worth further development, to exploit fully the whole of the theory used for the preliminary exploration reported.

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Table 6. Documents assigned different subject heading sets

Col.1	Col.2	Col.3	Col.4
1	Acquisition of serial publications Library surveys-Great Britain	 P	Libraries,Special-Great Britain Libraries,University and college-Great Britain Periodical selection
2	Acquisitions (Libraries)	P	Libraries-University and college-United States -Acquisitions
3	Acquisitions (libraries)-Addresses, essays, lectures	S	Collection development (Libraries)
4	Book selection Selection of nonbook materials	P	Collection development (Libraries)
5	Aged Handicapped Hospital.libraries Libraries and the aged Libraries and the physically handicapped Library services Prison libraries Prisons	P P	Libraries and the socially handicapped-Great Britain Libraries and the socially handicapped- United States
6	Authors, British	P	Authorship-History Copyright-History Publishing and publishers-History Society of authors-History
7	Bibliographical services Research Libraries Scholarly periodicals Scholarly publishing University presses		Comunication In science-United States Communication of technical information-United States
8	Bibliographical services-Case studies Machine readable bibliographic data- Case studies		Information storage and retrieval systems-Case studies
9	Book industries and trade-Collected works Libraries-Collected works Libraries-Scholarly publishing-Collected works Scholarly periodicals-Collected works		Scholarly publishing
10	Catalogs, Union-Great Britain German philology-Bibliography-Union lists		German language-Library resources-Great Britain German literature-Library resources-Great Britain
11	Citizens' associations-Great Britain Public libraries-Information services- Great Britain		Libraries and commmunity-Great Britain Libraries and metropolitan areas-Great Britain Libraries and the socially handicapped-Great Britain
12	Communication In physics-Great Britain	P	Physics-Information services
13	Communication in science Communication of technical information		Documentation Information networks Information services
14	Communication in science Communication of technical information		Information storage and retrieval systems- Science-Handbooks, manuals, etc. Information storage and retrieval systems Technology-Handbooks, manuals, etc.
15	Data transmission systems		Teletext (Data transmission system) Viewdata (Data transmission system)
16	Electronic data processing-Addresses, essays, lectures Information storage and retrieval systems- Addresses, essays, lectures		Question-answering systems-Congresses
17	Fiction in libraries Public libraries-Great Britain	P	Libraries-Special collections-Fiction collections
18	Information guides-Great Britain		Reference services(Libraries)-Great Britain
19	Information networks Information services Reference services-Libraries	P	Referral centres
20	Information science-Congresses	P P	Information services-Congresses Library science-Congresses
21*	Information services-Congresses Information storage and retrieval systems-Congresses On-line data processing-Congresses		On-line bibliographic searching-Congresses
22	Information storage and retrieval systems		Subject headings-Information science
23	Libraries-Great Britain-Directories	 P	Library resources-Great Britain-Directories Research libraries-Great Britain-Directories
24	Libraries and readers Libraries, University and college		Library education-Great Britain Library orientation-Great Britain
25	Library finance-Great Britain-Congresses Photocopy services in libraries-Great Britain-Congresses	P	Library fines and fees-Great Britain-Congresses Public libraries-Great Britain-Congresses
26	Library science-Great Britain-History- 20th. century-Congresses		Public libraries-Great Britain-Administration- Addresses, essays, lectures
27	Little magazines-Economic aspects		Scholarly periodicals-Publishing
28	Newcastle-upon Tyne City Libraries- History		Public libraries-England-Newcastle-upon-Tyne History

* Two documents, reporting successive years of a conference, assigned identical headings.
Counted as 8 assignments.