Building a Virtual Music Library: Towards a Convergence of Classification within Internet-based Catalogues

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ABSTRACT: This paper aims to explore the changes in the role of classification and the opportunities presented for classification in the twenty-first century, especially in respect to the development of information technology. The issues arose as part of the EC funded MIRACLE Project (LB5670) that represents the foundations for a virtual music library to serve visually impaired people. The MIRACLE partners chose the Universal Decimal Classification (UDC) as the common classification for the converging music catalogues. This paper investigates the nature of adaptation required by each participating library and the way in which the classification is used as a searching tool. Further developments in the use of IT-assisted classification are proposed.

1. Introduction

This paper introduces the MIRACLE Project as an example of an Internet-based virtual library and investigates the opportunities for classification in this environment. It includes discussion of the change of purpose of classification for the twenty-first century; the role of classification as an intermediate language; and the case for local bias within classification. The process of classification convergence as a result of combining catalogues is then examined alongside the suitability of music as a test-bed for classification convergence. Since a discussion of these issues is itself also a review of significant literature, it is not necessary to insert a section specifically on existing publications in the field of classification. This approach is the most appropriate due to the number of classification issues that the Project addressed.

1.1 MIRACLE as a worldwide virtual music library

The MIRACLE Project aims to combine the main European catalogues of music in alternative formats, mainly Braille, in order to optimise the music available to visually impaired people. The music produced by participating organisations is exported from the local library catalogues into the central MIRACLE catalogue that is accessible via the Internet. This forms a combined catalogue of music in alternative formats.

Late twentieth-century technology allows information to be held electronically. In addition to a bibliographic description of the available music, it is now possible to download the actual music from the Internet. As well as taking advantage of recent developments in information technology, virtual libraries function primarily to allow access to rare, valuable and vulnerable texts without causing damage to the article by direct access. The MIRACLE Project allows access to data in other countries by overcoming geo-

graphical barriers. The customers have access to the material, and cooperation between producers reduces the risk of works being transcribed twice, thus allowing more music to be transcribed. The union catalogue is supported by the virtual database of digital files. These files are located on the site of the producer to ensure control over the distribution of the material especially in respect of Copyright restrictions.

The participating libraries are: The Federation of Dutch Libraries for the Blind (Netherlands); Organizacion Nacionales de Ciegos Espagnoles (Spain); Royal National Institute for the Blind (United Kingdom); Schweizerische Bibliothek fur Blinde und Sehbehinderte (Switzerland); Danmarks Blindebibliotek (Denmark); Stamperia Braille, (Italy). The Federation of Dutch Libraries for the Blind co-ordinates the Project and the programs are designed and developed by Shylock Progetti (Italy).

Further information can be found at http://www.svb.nl/project/Miracle/public/index.html

2. Change in purpose of classification in the twenty-first century.

The predominant purpose of classification has remained the same since its invention, although it faces a new context in the twentieth century. Classification was primarily devised in response to the need for organising a large amount of knowledge and information, (Chan, 1995, p.6) and, indeed, the applications may be wider today. W.T. Berwick Sayers described the classification system to be 'a map of things which have being – that existed, will exist, or may exist' (Sayers, p.14) and in doing so recognised the need for classification systems to be adaptable enough to accommodate knowledge from the past, the future and the conditional. The future will be demanding on the traditional classification systems, especially with information being stored electronically. Thus, we arrive at the beginning of the twenty-first century applying our fundamental classification to different problems.

During the nineteenth century, attempts were made to create classification systems that would encapsulate the entirety of knowledge in order for information to be stored logically within library environments. These are known as universal classification schemes, of which the two major schemes are the Dewey Decimal Classification (DDC) and the Universal Decimal Classification. The most famous and widely used is the DDC. (Subject..., p.2) These schemes focus on traditional philosophical arrangements of knowledge in which the academic disciplines are housed. As Clare Beghtol states, 'the desiderata for any classification system are that the classes be both mutually exclusive (ie do not overlap) and jointly exhaustive (ie account for all possibilities).' (Beghtol, p.7) The major challenge for today's classification is to accommodate interdisciplinary material.

2.1. Background of UDC and DDC.

The in-built flexibility of the DDC and UDC has ensured their survival during the vast expansion of knowledge that has occurred in the twentieth century. However, this flexibility can be problematic. The UDC, particularly, lacks uniformity across libraries as a result of its beneficial flexibility. (Marsh) This issue has been evident within the MIRACLE Project, where the preservation of the individual library's usage of the UDC was necessary when constructing UDC codes for the union catalogue. In its original form, UDC uses punctuation within the notation that provides additional information. However, this foresight into interdisciplinarity is paradoxically unsuitable for automated catalogues.

The editors of the DDC and UDC meet regularly to exchange information on revisions, and negotiations are under way for the publication of a joint area table. (McIlwaine, p.100) I.C. McIlwaine suggests that 'the UDC can complement the DDC by providing greater detail and by using clearly distinguishable facet indicators which, although they may create problems for shelving and other routine library practices, are not a difficulty for the retrieval of information in a machine-oriented world.' McIlwaine suggests the usage of DDC as a basis with expansion via UDC when greater detail or flexibility is needed as a sensible option as this would enable users of either classification to continue their present practices.

Beghtol suggests that being modelled on the DDC, the UDC was not intended for shelving in libraries but as a classified bibliography. The UDC may be more suited to virtual libraries, as it has never been restricted by linearity. (Beghtol, p.5)

2.2 Changing role of classification.

During the late twentieth century, developments in information technology brought about drastic changes in information management within libraries. The introduction of the Online Public Access Catalogue (OPAC) enabled literature searching to be undertaken by the end user instead of library staff. Library systems were established and developed to op-

timise the technological advantages. The procedures were standardised by systems such as AACR2, MARC, LCSH, LCC and DDC. However, further advances in technology brought about what one may term as an 'information explosion' in which the World Wide Web is being used to store increasing amounts of information of varying quality. Lois Mai Chan describes this new environment as 'vast, distributed, multifarious, machine-driven, dynamic/fluid, and rapidly evolving.' (Chan, 2000, p.1) This development presents a new challenge to library science: the organisation of knowledge within the Internet environment for retrieval that must be relevant, accurate and timely.

This has led to the application of traditional library tools to Internet-based resources which in itself presents different problems and opportunities. Classification was used traditionally for shelf-location and browsing the stacks; however, in the digital environment shelf location is no longer an issue. Chan states that the OPAC has enabled classification to regain its bibliographic function by using class numbers as access points to MARC records. (Chan, 2000, p.4) This is certainly the case in the MIRACLE catalogue where classification is used as an access point and search tool.

The digital library presents us with the opportunity to reinvent classification schemes that are not necessarily bound by traditional methods of subject definition. However, it is difficult to imagine a classification system that is not based on philosophic and therefore logical theory. This is because we are socially conditioned to accept the standard form of classification and, furthermore, because no feasible alternative has yet been proposed. With the problems associated with reclassification, namely cost, the new system would have to take on a completely different approach in order to be distinguished from just another variation on a fundamentally flawed system. Robert Losee suggests that in a digital age the reclassification of library material will require no physical changes in the systems, but will be simply a matter of running a computer program. (Losee, p.66)

The main opportunity for digital libraries is the dissolution of the physical linearity of library shelving. This has been a major issue in the physical library, as whatever order is ideal for the arrangements of subjects within a classification, it was not possible to change the linear nature of books arranged in a practical fashion on a bookshelf. Book arrangement had to be reflected in the classification. However impressively complex the structure of knowledge classification was on a diagram, it needed to be translated logically to the linear arrangement; otherwise the exercise had failed. Today the classification is no longer required to conform to such constraints; however, greater issues lie in the sheer volume of information which requires management.

Virtual libraries bring opportunities for postcoordinate classification, which, if a system allows the postcoordination of two or more facets, has a virtual multi-dimensional classification. (Chan, 1995, p.11) Chan recommends the development of polyhierarchical and multi-dimensional classification via hypertext.

2.3 Interdisciplinarity

Musicological research is as susceptible to interdisciplinarity as any subject. For example, articles on the psychology of music or the theory of composition via Artificial Intelligence encounter the same interdisciplinary problems within classification structures. However, because music has a separate written form, it can be segregated from other disciplines in a more useful fashion. Music as an art form rarely exists by itself. Music is often written for a purpose, whether it be sacred music or music for dance. Opera is a prime example of interdisciplinarity within the arts as this attempts to combine the forms of art, dance and music to provide a wholly artistic experience. However, the music aspect of the final production can stand independent of the other arts. Orchestral suites from ballets and other works are often produced by the composer, intended for 'concert' performance. The music aspect of such works is the only concern of the MIRACLE Project.

Music for concert performance combines a number of disciplines. The physics of sound and mathematical operations by performers all contribute to produce the live sound. However, these aspects belong to the process of producing sound from written music and do not present problems for classification. Only the printed music, or accessible equivalent, is being presented in the catalogue and not the means by which the piece is performed.

In a physical library, it may be desirable for a sound recording of a work to be housed adjacent to the music score. However, different media of music may provide problems within strict classification. This issue is usually governed by security in practice, as sound recordings tend to be kept separate to prevent theft.

The nature of research has shown that the segregated academic disciplines are interconnected in surprising ways. It is comparatively recently that anyone linked the discipline of classification with psychology as the way in which humans devised and understood concepts, and yet that is a valuable stance to producing more realistic classification schemes. As the amount of information becomes greater, the structure of the traditional disciplines becomes less distinct. Therefore, documents can no longer be adequately accommodated in a disciplinary structure. (Beghtol, p.1)

The increasing use of computers in libraries allows many search tools to be implemented if required. Whereas it was not possible, nor desirable, to apply more than one classification system to a physical library, there is no reason why the interdisciplinarity of the texts should not be reflected in the assigning of multiple classification codes. Brian Quinn suggests that even with a physically arranged library, other classification systems could be used for searching via computers. (Quinn, p.124)

2.4 Classification as indexing.

The new role of classification can be distanced from the traditional all-inclusive classmark allocation, allowing for a type of notational indexing system to take place. Diane Vizine-Goetz notes the use of multiple Dewey numbers in records from NetFirst, but warns that 'care must still be taken to apply numbers consistently to like topics so that users are not confronted with the situation that the same topic is entered under different numbers at different times.' (Vizine-Goetz, p.2) This is the situation with the MIRACLE catalogue, where multiple UDC codes are used to describe the material. The codes are simple, but many may be applied whereas one complex classification mark in a traditional physical library would previously indicate the shelf location and fully describe the item. It is hoped that the MIRACLE catalogue will allow searching on multiple UDC codes.

A.J. Tinker, et al, suggest that 'a decision or policy would need to be established to determine how exhaustive this 'classification as indexing' would be, or some weighting scheme applied to indicate the relative importance (extent of coverage) of each descriptor.' (Tinker, et al, p.88) As the classification no longer needs to serve a purpose as a physical locator, it can be subject to multidisciplinary treatment just like the material itself.

2.5 Classification as intermediate language.

The major advantage of searching by classification within the MIRACLE catalogue is that the UDC is used to overcome language barriers. The classification acts as an intermediate language so that all can understand, via their own language, the meaning of the code. Therefore, the ethos established by the sharing of music is reflected in the use of classification as intermediary language. Klaus Schubert discusses the use of an intermediate language in a multilingual thesaurus, and states that 'the basic function is to express the 'definitions' of concepts so that they need not be repeated in more than one language.' (Schubert, p.138) Both the classification notation and the music meet this criterion as both can communicate over language barriers. It is precisely this attribute of music that allows us to share music between countries and forms the ideology of the Project.

Joan Mitchell suggests that the 'classification systems have rich potential as switching languages in the polyglot Web environment, because the controlled vocabulary (the notation) remains the same when the concept descriptions and indexes appear in a different language.'(Mitchell, p.3) This idea is reflected within the MIRACLE catalogue, but care must be taken to apply the notational classification in a consistent manner in order to produce the most effective searching tool.

3. Use of local bias in classification within libraries

Libraries must operate in a customer-focused environment in order to provide the best service to their customers. Customers differ in different places and therefore the strategies of the libraries may not suit all customer groups. Libraries may implement different tactics to overcome their local problems. For example, classification schemes may be used to suit particular local environments, and therefore issues such as library layout may have affected the use of classification. Libraries also have a major commitment to local studies and these sections of the classification are likely to be more developed. The library's choice of classification system may reflect the needs of the local bias.

The library's classification is often established long before any thought of negotiating with other libraries about the need to merge catalogues. The primary aim of the library is to provide service to its customers. Once this is successful, then the library can offer its

efficient service for merging with other library services. For the library service to be efficient, local bias is inevitable and should not be discouraged, as Rita Marcella and Robert Newton state. 'The scheme should deal with all subjects without bias, although there is something to be said for the potential to provide extra attention to the home country and culture.' (Marcella & Newton, p.62)

Universal classifications occasionally have options included that allow choices to be made by the classifier. Beghtol states that the purpose of these options 'is to allow emphasis or preference for a topic of local importance and to accommodate cultural differences.' (Beghtol, p.4) These local and cultural issues need to be accommodated within universal classification schemes and this relies on social consensus of knowledge. However, between countries there are differing views on fundamental classification issues such as historical periods. (Quinn, p.143) Quinn states that it is 'difficult to create a universal classification system that is free of nationalistic or ideological biases.' Local bias may also appear intrinsically within the structure, as Quinn suggests, where socially acceptable concepts are given prominence in a hierarchy, while socially unacceptable ideas or terms are not. Therefore, attempts at creating a truly 'universal' classification are not realistic, as a person will always be influenced by his or her upbringing that in turn will be reflected within the knowledge structure extracted from his or her worldview. Attempts have been made within the 21st edition of the DDC to apply international usage and sensitivity to the preferred usage of social and national groups. (Koch & Vizine-Goetz, p.3) Whether this is internationally appropriate would be difficult to assess from within the Anglo-American library environment.

Individual libraries do not wish to interfere with their systems if they are successful in respect to their library services. However, the bringing together of the music records in the MIRACLE database has definite advantages to users of all libraries concerned. Braille music production is a highly specialised, time-consuming and therefore expensive activity so the opportunity to make available music produced by other Braille music libraries is immensely beneficial. However, this has brought a compromise in the usage of classification and cataloguing procedures in order that the MIRACLE database can be independently effective. This compromise should not be on the side of the individual library or the searcher. The bringing together of the library catalogues presents a natural convergence of classification that is to be used as a basis for a music classification convergence project.

4. Music as a test-bed for classification convergence

Music, being a discrete medium, is not affected by the major problem that faces the classification of knowledge at the beginning of the twenty-first century, the increase of interdisciplinarity in respect to major knowledge breakthroughs. The effect of disciplinary basis does not apply to music in the same way that it poses a threat to other sections of the library. Generally, one would house all music together in a physical library, it being nonsense to classify, for example, primarily by country in order that Spanish music was placed with Spanish literature and other material concerning Spain. This is because there is no doubt that music is a medium that is distinct from a general printed text. There would never be any doubt whether the text was more music of history than history of music. Therefore, to create a classification convergence of music may not present a realistic model for other disciplines.

4.1 Expansion of knowledge in respect to music.

New music can easily be accommodated within a classification scheme as it can be defined as music, and accommodated as 'experimental', or 'twenty-first century', if appropriate. The major difference between the expansion of music and the expansion of other branches of knowledge is that new knowledge and theories are subject dependent: in descriptive terms, music is more concrete than other subjects.

It is paradoxical that scientific discoveries uncover theories that already exist and these cause problems for the classification structure. The theories on which the classification is based change according to the research. These theories may explain things that have existed since the beginning of time, but because they are only recent discoveries, there is no place for them within the classification structure. However, music that is created, can easily be accommodated as the genre reflects the style of the age. This allows for chronological classification, which must be one of the easiest systems to administer. There is no scope for development of new music which would threaten the foundations of the classification structure.

5. Classification convergence as a result of combining catalogues.

Research undertaken as part of the EU funded HARMONICA Project indicates the following points concerning classification and subject indexing procedures in music libraries:

- It is common practice to prepare in-house lists of subject indexing based on the classification used, and that these lists often vary between libraries.
- The descriptive cataloguing rules do not differ significantly, but a great variety of systems is used for classification. (HARMONICA, D1.2.3, p12)
- One of the recommendations of the HARMONICA Project was that the possibilities of developing the standard Z39.50 be looked into. It would be more realistic to modify this system rather than to try to recommend general changes in existing descriptive cataloguing rules or classification systems. (HARMONICA, D1.2.1 and D1.2.2, p17)

Further details of the HARMONICA Project can be found: http://www.svb.nl/project/harmonica/harmonica.htm

Within the MIRACLE Project, the short-term solution was found by a compromise in the use of classification by the libraries. The classification of the individual catalogues needed to be consistent within the MIRACLE database to enable searching to take place across all records. This was particularly important in overcoming language barriers across the European countries.

The extent to which the libraries adapted their classification scheme for the music records to be imported into the MIRACLE catalogue is outlined below:

- RNIB procedure:
  Classification scheme used in house: Dewey 21
  Subject index used in house: In house, derived from Dewey 21.
  Procedure of adapting classification for MIRACLE: From terms used in Dewey derived subject index (chain index) match individual subject heading (term in index chain) to individual UDC code.
- ONCE procedure:
  Classification scheme used in house: UDC
  Subject index used in house: Spanish National Library subject index.
  Procedure of adapting classification for MIRACLE: None, the simplified UDC classification is used which complies with the UDC codes used in MIRACLE.
- FNB procedure:
  Classification scheme used in house: UDC
  Subject index used in house: UDC 78 Music (English full edition)
  Procedure of adapting classification for MIRACLE: None.
- SBS procedure:
  Classification scheme used in house: Systematiken für Öffentlichen Musikbibliotheken of the Deutsches Bibliotheksinstitut.
  Subject index used in house: Systematik der Musikalien
  Procedure of adapting classification for MIRACLE: Correspondence created between 'Systematik der Musikalien' and the UDC codes. This resulted in multiple UDC codes being assigned to represent different aspects of the piece. (I.e., codes for musical form, kind of music, instrumentation given.)

The RNIB and SBS's task of adapting classification for use in the MIRACLE catalogue was the most complex. The need to establish multiple UDC codes to represent the subject description meant that each individual record needed to be edited. The process resulted in cross-tables between DDC and UDC being created. The tables below give examples of how this process was carried out. The Dewey index string is fragmented and the corresponding UDC codes matched.

Dewey = 782.5231723.

Dewey index string	Corresponding UDC code
Christmas	783.23
Oratorios	783.3
Mixed Voices	78.087.684
Vocal Music	78.087.6

Dewey = 786.21884

Dewey index string	Corresponding UDC code
Mazurkas	78.085.2
Dance Forms	78.085
Pianos	786.2
Keyboard Instruments	786

MIRACLE usage of UDC differs from standard use in that only basic UDC codes are used; they are not connected together in a string as the UDC grammar proposes. This use of UDC eliminates the need to use punctuation in the codes, which cannot be accommodated by automated systems. Therefore, MIRACLE

usage of UDC is enumerative. Like DDC, UDC was designed as a faceted classification. This reflects the use of 'classification as indexing' previously discussed.

5.1 Difficulties in classification of printed music.

The Federation of Dutch Libraries for the Blind acts as authority control over all the records in the MIRACLE catalogue. There have been many challenges associated with the combining of catalogues. The major challenge being to prevent the duplication of records within the catalogue. For this there were four instances which required attention:

- Same composition but different arrangement and / or publisher.
- Same composition, arrangement and publisher, but different availability. For example, different instrumental part or media.
- Same title, different composer.
- Series, same title but different volumes.

These instances required work in different ways in order to produce an efficient catalogue.

From a technical cataloguing perspective, the main issues relate to the treatment of information within the catalogue. Particularly, variants of composer name, treatment of the uniform title and procedure for constructing UDC codes were issues that had to be addressed. The Project partners had previously agreed to adhere to the standards presented in Richard Smiraglia's *Cataloging Music* (1986) for constructing uniform titles. The UDC codes imported within the records were checked against the UDC Master Reference File 2000 provided by the UDC consortium, and further agreement is expected within MIRACLE Project for the assignment of UDC codes.

5.2 Music Classification Convergence program

As a result of the MIRACLE Project, a Music Classification Convergence program is proposed. The system would support the convergence between the music sections of the major classification systems, UDC, DDC and Library of Congress. In this case, the convergence will cover only music, but it is expected that the model can be established to encapsulate other branches of knowledge organisation.

The process of the classification convergence is as follows:

- Material is classified according to one system (usually) within a library context. Although a universal classification system is used, this may be subject to local application and local bias.
- The numerical codes of the classification systems are stated with their corresponding language descriptors. These language descriptors are then classified within the other classification systems. The result being that the natural language can be eliminated and corresponding notation from the different classification schemes matched.

A cross-reference table has occurred by process of the catalogues being combined. As some records in the MIRACLE catalogue are now classified by both DDC and UDC, and some by UDC and Systematik der Musikalien, this enables new records to be accepted from libraries using any of these classification systems. The most common codes have already been matched so only a small proportion of codes would need to be re-classified. The classification matching takes place as a consequence of more records being added.

All the organizations involved in the Project experience restricted funding for music transcriptions. Sharing resources in this manner has many benefits. The organisations are therefore prepared to assist in the maintenance of the catalogue in order to benefit from the facility. The Project is based on co-operation rather than commercial gain. Access to records assists everyone and co-operation to provide data is an essential aspect of the Project.

6. Automatic classification of music from digital files.

As discussed, IT has created major advances in searching and general library practices. There are also applications of IT within classification, namely the electronic representation of the classification scheme, where classifiers could enter keywords that would automatically generate appropriate classification codes. In the digital library, it should be possible, for the computer to extract information from the digital file in order to enable automatic classification.

Search engines perform an analysis of web pages in order to extract information that can be matched against searches as a robot-controlled approach to information retrieval. Techniques such as term frequency and proximity are used to assess the thematic content of the text. This technique could be applied to music. Music, like language, is based upon structural grammatical rules that enables the music to be aesthetically pleasing when perceived by a human.

The 'grammar' of music could be formalised, and via Artificial Intelligence, the computer instructed to recognise the characteristics of musical form. However, this would be complex as many recognisable forms would appear in different contexts. It may be easy for a computer to recognise sonata form, however a fugal passage found within a larger work could lead to the assumption that the piece was a fugue and therefore the piece would be classified incorrectly. Text recognition would enable the computer to identify instrumentation.

Context recognition is being developed within automatic language-based indexing to make the results more relevant to the human searcher. The success of this would partly depend on the nature of the searching. If the searcher requests items by instrumentation then the task is easy: music for two pianos. Predicting user enquiries presents a problem in any form of indexing. Automatic classification from digital files may overcome this problem, as the computer would search from 'first-principles' rather than searching a representation of the item, as is the case in catalogued collections. The computers of the future may be powerful enough to undertake this type of searching.

7. Conclusion.

The MIRACLE Project has provided a great opportunity to explore the possibility of classification convergence. At the beginning of the twenty-first century, classificationists are presented with new issues concerning the nature of knowledge requiring retrieval and the tools available with which to retrieve the information. The suitability of traditional universal classification systems devised in the nineteenth century has been discussed and the concept of automatic classification via Artificial Intelligence suggested.

The MIRACLE Project has presented mulitlinguistic issues for the classification to overcome which have been reflected for centuries in the music that the catalogue represents. The converging of the data in the music in alternative formats catalogues has facilitated both a convergence of classification and the preservation of the individual libraries' local classification standards. It is hoped that a mechanism for classification can be established for music as a result of the Project that can be applied to all disciplines of knowledge. However, music being a discrete medium gains advantage over other subjects in respect to future expansion and discovery.

It should not be inconceivable that within the digital library environment programs can be established to classify directly from the digitally held music via Artificial Intelligence, thus providing classification consistency and eliminating the need for any intermediate language beside the music itself.

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