

Implementing the FRBR conceptual approach in the ISIS software environment: IFPA (ISIS FRBR Prototype Application)

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SUMMARY. This paper presents the IFPA software, an application for the UNESCO ISIS retrieval software, developed to manage the data and the relationships theorised in IFLA FRBR conceptual model. The application interfaces - a DOS, a Microsoft Windows and a WEB based one - are presented through their functionalities. A detailed database structure is explained as well as the way the relationships between the entities are managed in the ISIS underlying environment, not originally designed for this task. The author stresses finally how this tool will be available free of charge to everyone who wants to experiment this new cataloging approach.

Keywords: IFPA, ISIS retrieval software, FRBR, library software.

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Introduction

IFPA (the ISIS FRBR Prototype Application)¹ is an application based on the ISIS Information Retrieval Software², that implements the FRBR conceptual model.

IFPA is an academic experiment, the main purposes of which are: a) to explore the ISIS potentialities in managing relational databases; b) to make the prototype available free of charge³ to everyone who wants to experiment this new theoretical cataloguing approach creating his own data.

Brief history

IFPA dates back to 1999, when it was conceived as a MS thesis in Library Science at the University “La Sapienza”, Rome, Italy. It was abandoned as a thesis topic, but in 2002 it was resumed as a hobby project targeted to the international community of librarians and information professionals. The first public release of the Application is expected in the first half of the 2004. It is still considered by its author a beta stage software, nevertheless already fully functional.

Functionalities and interfaces

The Application allows one to search, browse and navigate; to insert, edit and delete the entities theorised in the FRBR model, and to establish their complex reciprocal relationships. The Application does not support any specific import/export functionality beside the ISIS ISO 2709 built-in ones.

The Application consists of three interfaces. The first one is based on DOS, i.e. it is character-based, and it has been designed to manage all the functions of the Application: browsing, searching, navigating and editing. Two more interfaces that take advantage of the

graphical environment have been developed solely for browsing, searching and navigating tasks: a Microsoft Windows based one and a WEB based one. No graphical interfaces exist so far for data-entry.

The IFPA DOS interface consists of the same platform CDS/ISIS basic system distributed by UNESCO, plus an integrated set of utilities called BEx. The BEx modules⁴ were developed to manage a relational database structure in the ISIS environment long before IFPA was conceived. This set supports all the features required to manage such type of databases: browsing, searching, sorting, selecting and navigating between records plus an advanced editor that supports among other things the relationships management. The BEx utility set has been written in ISIS Pascal, a CDS/ISIS built-in programming language, which allows to enforce the CDS/ISIS basic system with the development of very complex programs; these programs can interact with the CDS/ISIS basic system and its databases.⁵

The Windows IFPA interface is based on CDS/ISIS for Microsoft Windows, (called simply WINISIS) and developed by UNESCO in recent years. WINISIS, compatible with the databases created and edited with the DOS version, implements many new features, such as a hyper linked environment, largely used by IFPA in order to search, browse and navigate among the FRBR entities. Although much richer in capabilities, the basic WINISIS environment still required some programming⁶ in order to provide all the searching, browsing and navigating functionalities among the FRBR records.

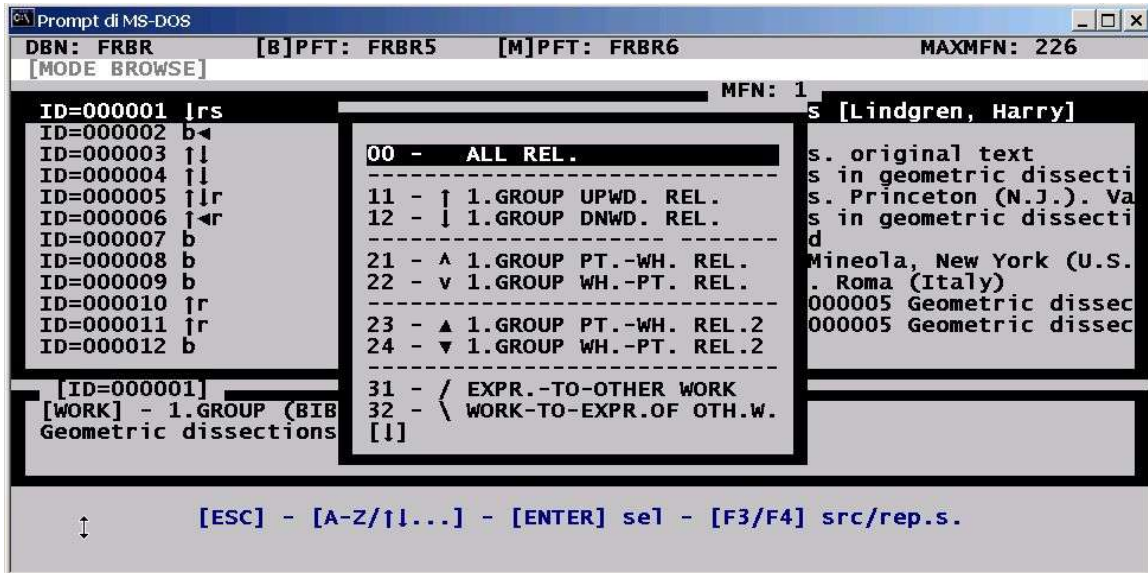
The WEB interface is based on the same philosophy as the WINISIS one, i.e. it relies mainly on a hyper linked environment. This interface has been partially set-up using GenISIS,⁷ a generator tool of HTML pages finalised for searching in ISIS databases. GenISIS in turn relies on the WWISIS searching engine.⁸

The IFPA functionalities described through an Application “tour”

The DOS CUI interface⁹

The BEx utility, on which the DOS IFPA mainly relies, allows users to explore the database by browsing the whole database records, or just a subset thereof; by displaying the results of a search query; and by sorting those results. The navigation between the entities, i.e. the display of those records that are linked to a record that is on display, can be done using a dedicated menu, as in the example shown on Figure 1.

FIGURE 1. DOS IFPA interface: linked records menu

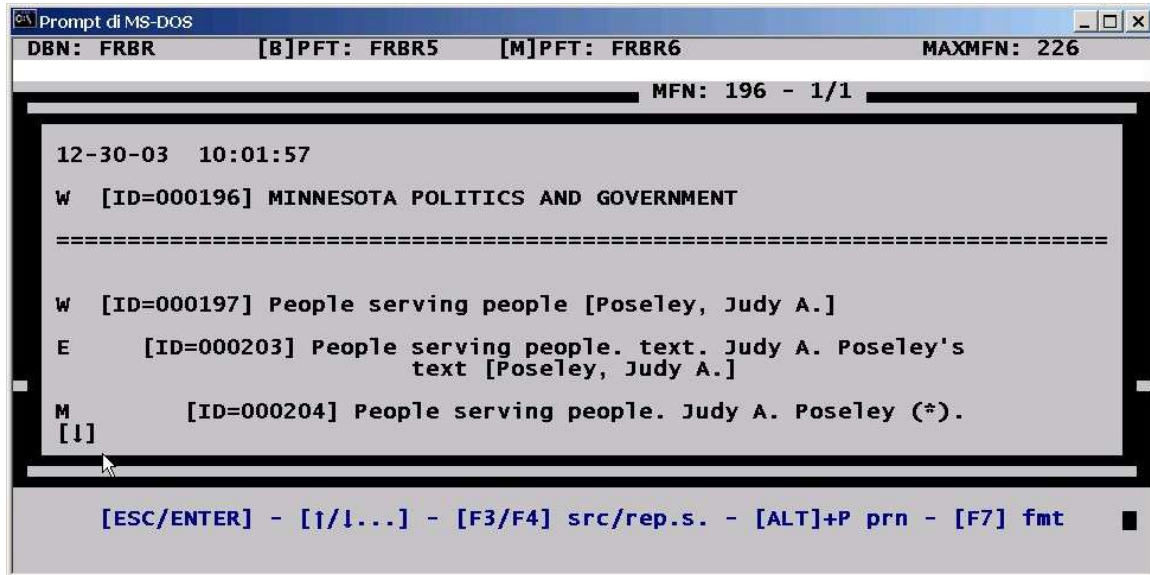


The navigation is possible among all the entity groups (1, 2 and 3), but the Navigation along the primary hierarchical bibliographic relationships (FRBR Final Report 1998, 13) is possible only from an entity to its contiguous related entity types, i.e.: you can navigate from Expression to Work and to Manifestation, but not directly to Item, and from Manifestation to Expression and to Item, but not directly to Work.

In order to allow the display of all the hierarchical relationships from top to bottom,

regardless of the entity level (Work, Expression, Manifestation and Item), a special program routine has been developed; the whole downward bibliographic tree pertaining to a selected bibliographic entity is consequently displayed like on Figure 2.

FIGURE 2. DOS IFPA interface: bibliographic tree display



The editing functionalities include the creation of new entities and their relationships and the editing/deleting of existing ones. Editing is performed by a BEx module, which does not use the CDS/ISIS standard worksheets, but dedicated ones.

Some identification entity values - mainly attributes not defined in the FRBR model - are entered/updated automatically by the system: the record ID number, the date of record creation, the date of the last record update and the record type. The user can choose any entity attribute for editing and insert/modify the desired data. Multiple values for the same attribute are supported. While the entity attributes are usually entered by typing from the keyboard, relationships can be created in two ways. If the entity to be linked already exists in the database, it has to be

“captured” from a pick-list, as in the example shown on Figures 3 and 4.

FIGURES 3 AND 4. DOS IFPA interface: “capturing” an entity in order to establish a relationship



But if the entity to be linked does not exist yet in the database, it has to be created. A special program routine allows one to temporary leave the entity that is being edited and to create

another one which will be automatically linked to the former. The creation of new related entities can be called as many times as needed, which allows for example for the creation of an entire FRBR tree.

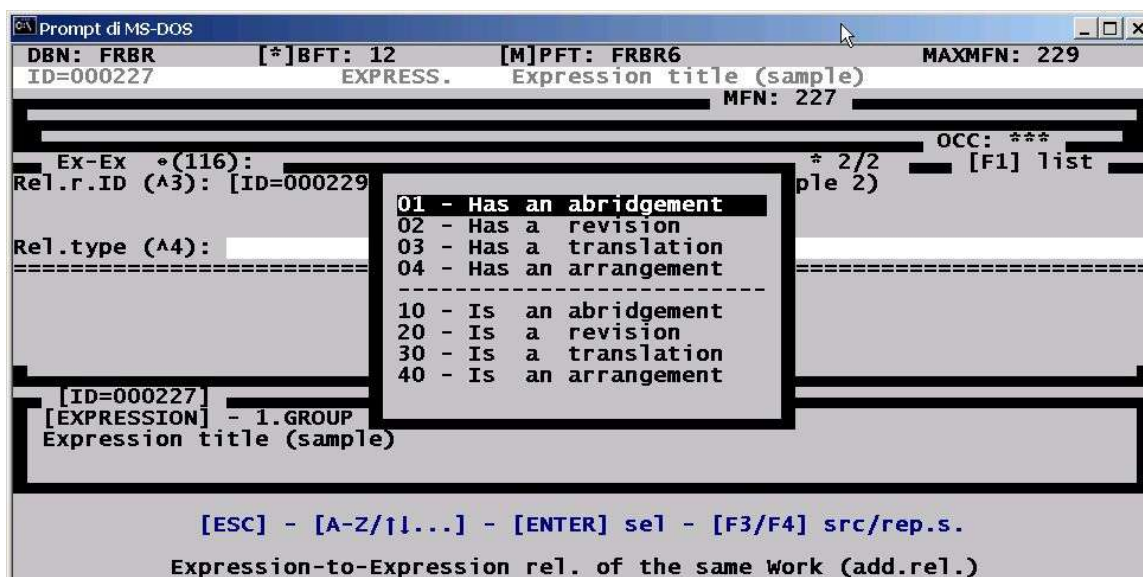
Any time the user attempts to exit from the editing of a record or even the editing of some fields, a validation procedure is performed and the system notifies the user about possibly missing mandatory data, or wrong data, data incompatibility, etc.

The editing of an existing record is performed through the same procedure, except that the record to be edited is selected from one of three lists (entire database, search results, selected records list).

So far we described the creation of bibliographic entities only, but the same steps take place when the user wants to create a link to an entity from FRBR Group 2 or 3 of entities. The only difference is that Group 2 and 3 entities cannot be created as stand-alone records, but only as a dependency of a bibliographic one or as a dependency of another responsibility or subject entity.

Sometimes a relationship specification, i.e. an additional information about the relationship type is required and has to be chosen from a pick-list, as in the example shown on Figure 5.

FIGURE 5. DOS IFPA interface: “capturing” a relationship specification

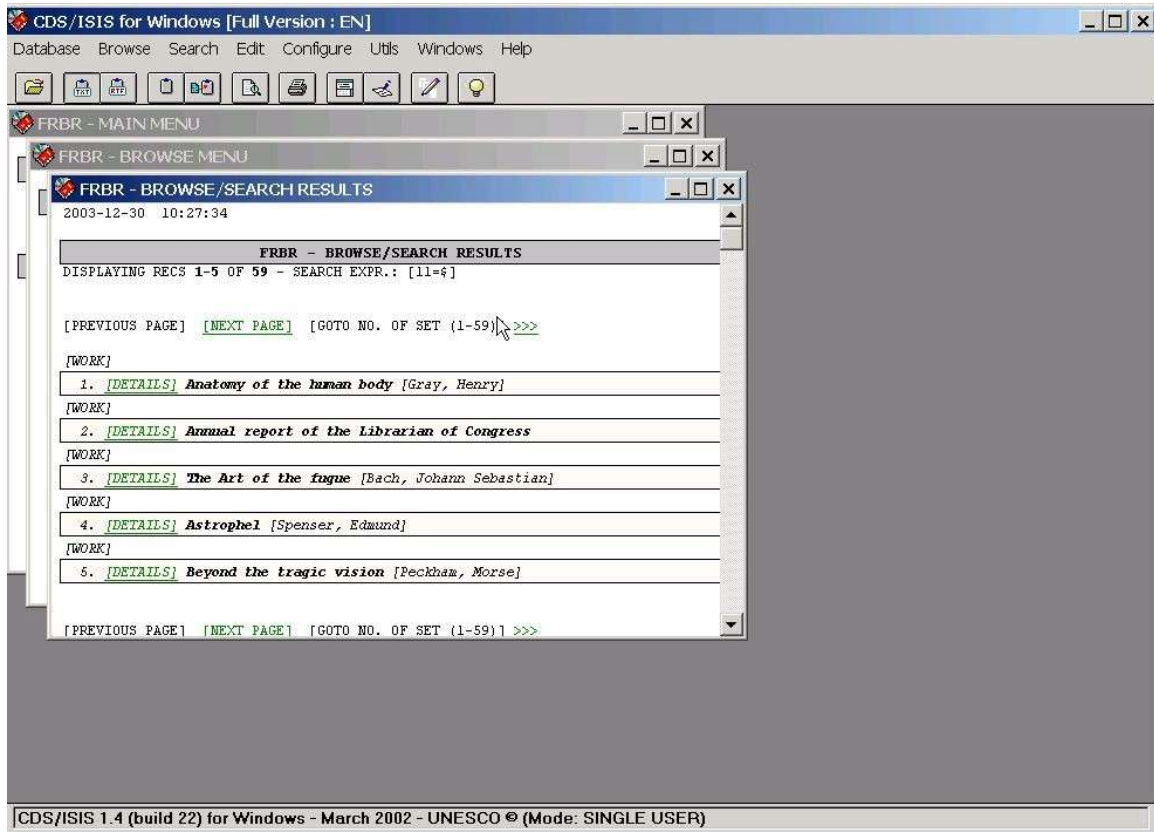


IFPA supports the managing of variant forms, i.e. of “see” reference entries, and of “see also” reference entries. This approach applies to the first attribute only of each entity, since all the other entity attributes are repeatable, i.e. they support multiple values.

The WINISIS and the WEB GUI interface

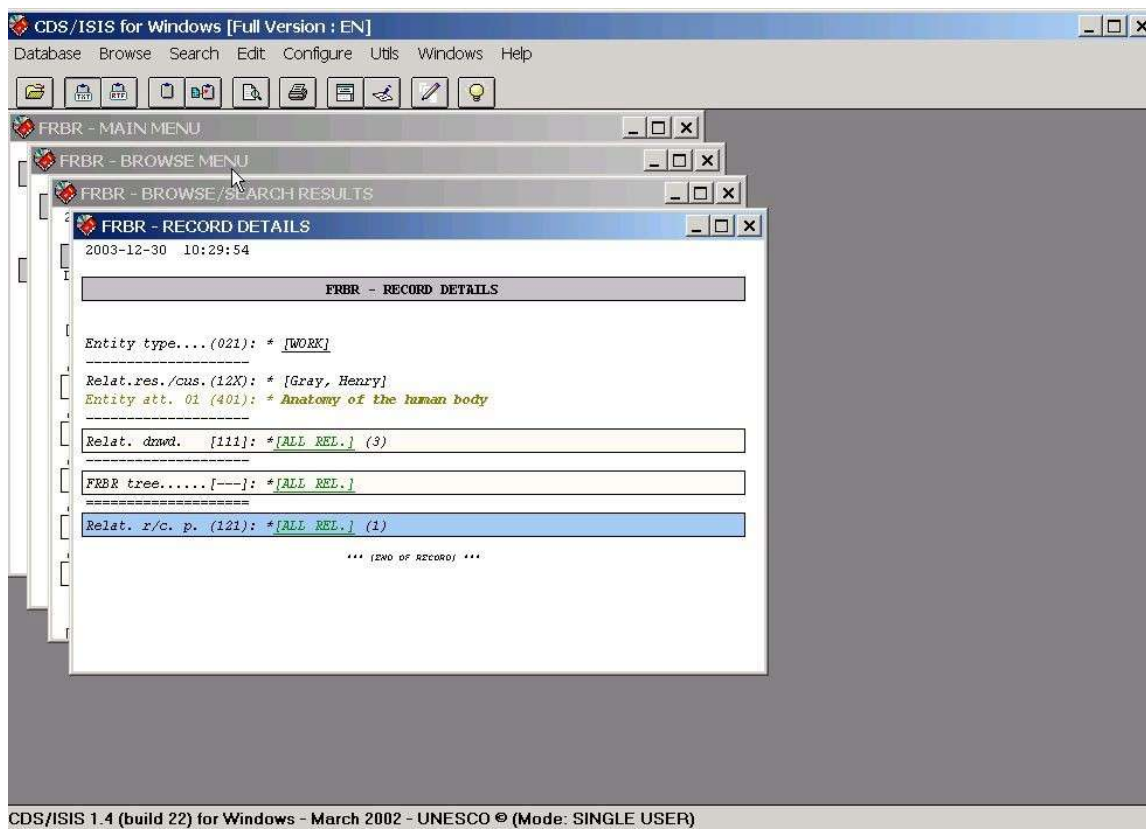
Basically the same philosophy has been adopted during the development of the Microsoft Windows interface as for the DOS version: a list of records is displayed as the result of a query, the list can be browsed, and the details of a record can be displayed in a separate window. The example on Figure 6 shows these features.

FIGURE 6. WINISIS IFPA interface: list of works



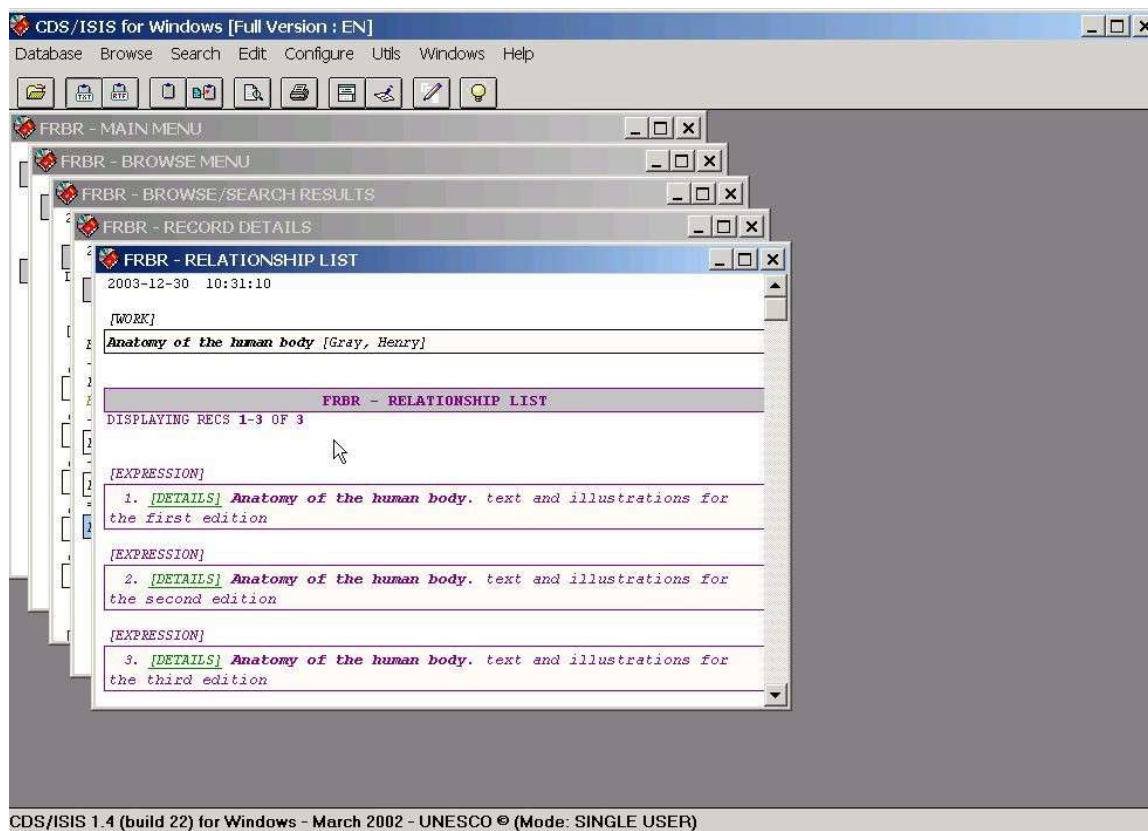
The difference between the DOS and the Windows interfaces regards the way the selection and the navigation among records is done: in the latter ones this is performed by clicking with the mouse on hyper links. Any time an entity is selected that way, it is displayed in a new window, with all its relationships, grouped by type (see Figure 7).

FIGURE 7. WINISIS IFPA interface: detailed record view



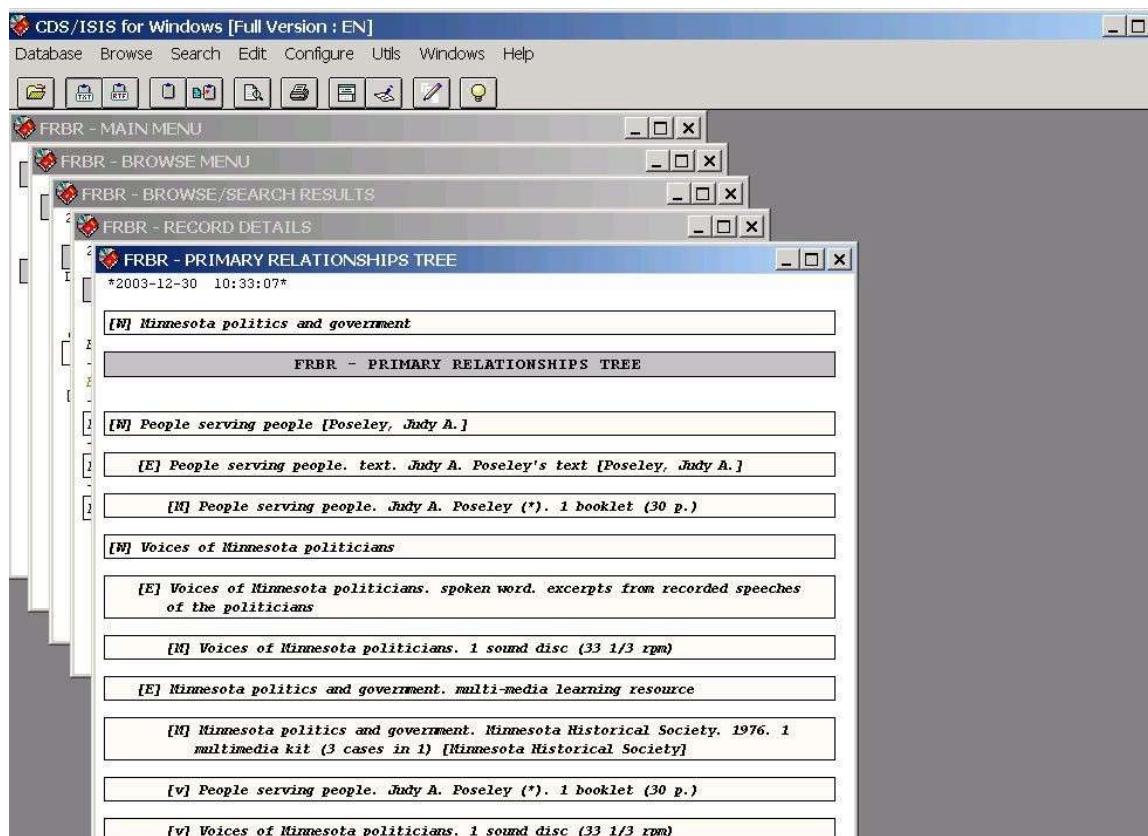
Clicking further on any relationships group hyper links causes the filling-in of the previous list with the recalled linked records, as shown on Figure 8.

FIGURE 8. WINISIS IFPA interface: linked records view



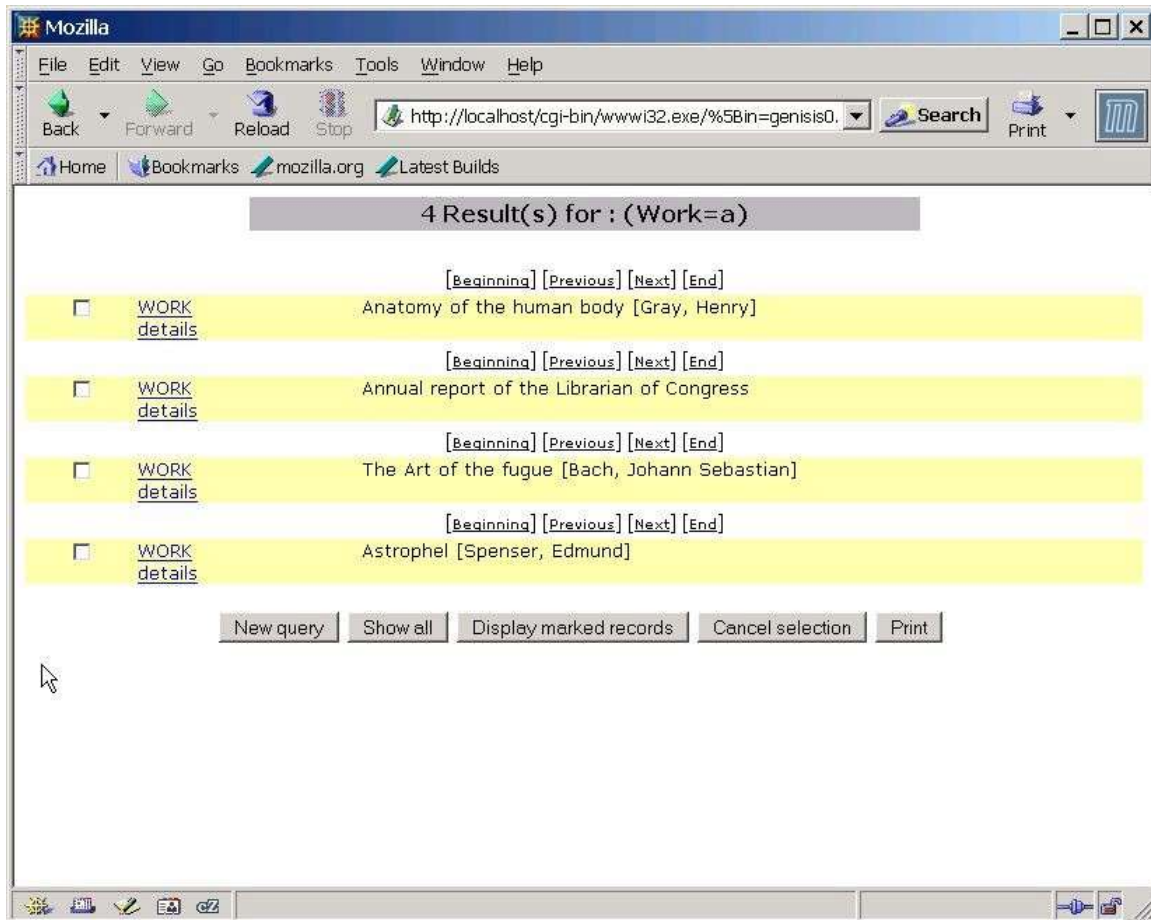
The Microsoft Windows interface allows also the display of the hierarchical “tree” structure of a single bibliographic entity (see Figure 9).

FIGURE 9. WINISIS IFPA interface: bibliographic tree display



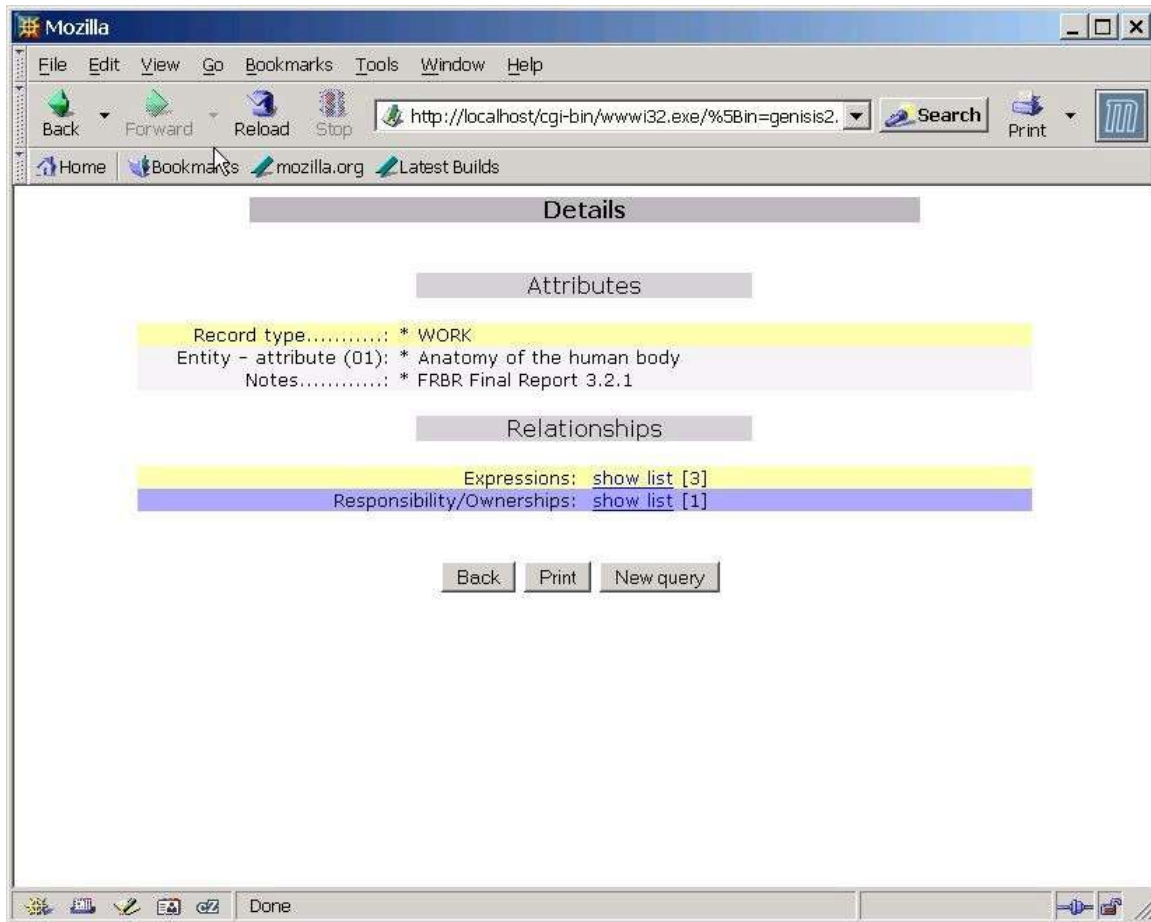
The WEB interface follows the same principles as the Microsoft Windows one, with the exception that it does not display the bibliographic “trees”. The user’s query is performed from an initial WEB form and the search results are displayed as shown on Figure 10.

FIGURE 10. WEB IFPA interface: display of works



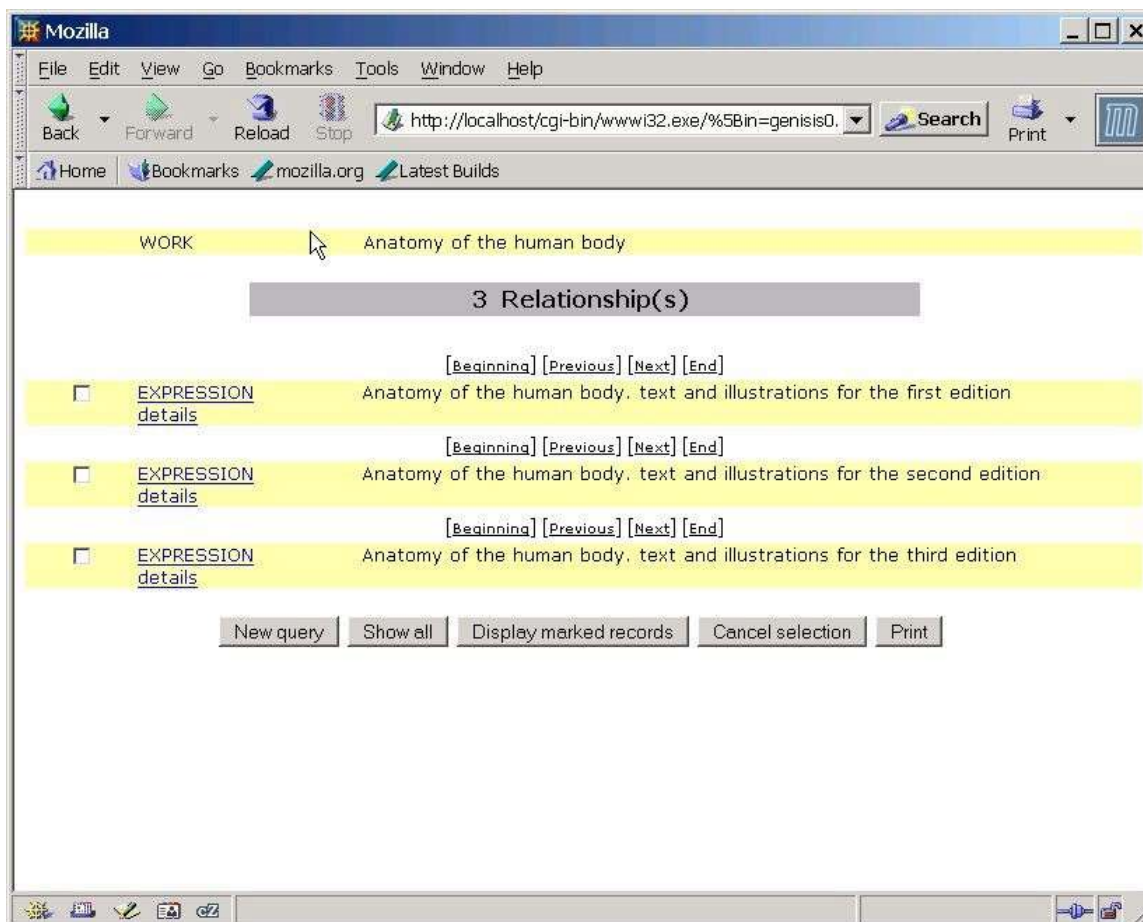
Users can select one work from this list and display it in full form (see Figure 11).

FIGURE 11. WEB IFPA interface: single entity full details



Relationships can be displayed by clicking on hyper links (see Figure 12).

FIGURE 12. WEB IFPA interface: relationships window



The IFPA technical specifications

The database structure

The FRBR database design was very much influenced by the way the BEX utility manages the records and especially the relationships among them. In the RDBMS (Relational Database Management Systems) the relationships between records are stored in dedicated tables,¹⁰ each relationship in its own record. Such a structure, which allows an unlimited number of

relationships, is not easy to implement in an IRS (Information Retrieval System) such as ISIS. This is the main reason why a structure in which each entity record holds also all its relationships was chosen: in ISIS it is simpler, easier to manage; it is “natively” supported by the BEx as well.

It should be stressed also that the FRBR model as it appears in the *FRBR Final Report* cannot be considered a “data model” ready for implementation. “[...] It seems that the attributes it [the data model] defines for each entity are in many cases too generic to allow for an implementation of the model such as it stands, without having to refine it. [...]” (Le Bœuf 2003, 3). According to the creators of FRBR, neither the attributes nor the relationships defined in the model are exhaustive: “[...] The scope of attributes defined in the model is intended to be comprehensive but not exhaustive [...]” (FRBR Final Report 1998, 32); “[...] the additional relationships between group 1 entities [...] are not meant to be exhaustive [...]” (FRBR Final Report 1998, 63). Consequently some data elements (attribute specifications, some relationships and their specifications) have been added to the “data structure” such as it emerges from the *FRBR Final Report* during the IFPA database design (see above).

In the IFPA implementation, all data elements are stored in a unique physical database. This unique database holds all 3 types of FRBR records:

- bibliographic entities (Group 1 of entities);
- responsibility/ownership entities (Group 2 of entities);
- subject entities (Group 3 of entities).

A specific format was developed for this implementation. In that format, the record type (1st, 2nd, 3rd group) is identified by the first character of the two-character field with tag 021; the second character of this field (tag 021) is used to distinguish the entity type within the same group: for example to distinguish between concepts, objects, events or places in the Group 3.

In the IFPA format there are 5 field “blocks”:

- block 0xx (record identification information)
- block 1xx (relationships between Group 1 entities and any other Group)
- block 2xx (relationships among Group 2 entities)
- block 3xx (relationships among Group 3 entities)
- block 4xx (entity attributes)

Attributes

Block 4xx consists of 40 fields (tags 401-440). All fields except the first one (tag 401) are repeatable, i.e. they support multiple values. In the case of multiple values of the first attribute (tag 401), a variant form of the entity, i.e. a separate record, linked to the preferred form record, is created.

TAG	DESCRIPTION
401	first attribute of the entity
402	second attribute of the entity
...	
440	fortieth attribute of the entity

Each attribute field (tags 401-440) holds two sub-fields:

- sub-field “^1” introduces the very value of the attribute itself;
- sub-field “^2” introduces a qualifier for that value. For example, in a record created for

an instance of the Manifestation entity:

TAG	SUBFIELD	SUBFIELD CONTENT
...		
401	^1	Physics in medicine
401	^2	cover title
...		
406	^1	1964 [first value]
406	^2	copyright date

406	^1	1965 [second value]
406	^2	printing date

Relationships

The IFPA entity records also hold all the relationships with the other entities of the database. The relationships are stored in dedicated fields, grouped in blocks 1xx, 2xx and 3xx:

- block 1xx stores the relationships between and among Group 1 entities and all the other entities and is used in the bibliographic records only;

- block 2xx holds the relationships among Group 2 entities only (“see” and “see also” forms) and is used just in the responsibility/custodianship records;

- block 3xx reflects the relationships among Group 3 entities only ("see" and "see also" forms) and is used in the subject entities only.

BLOCK 1xx

The first sub-block (11x, bibliographic-to-bibliographic relationships) of BLOCK 1xx encompasses:

a) THE PRIMARY BIBLIOGRAPHIC RELATIONSHIPS (*FRBR Final Report* §3, p. 12, and §3, p. 56)

TAG	RELATIONSHIP
111	Upward link to the higher level bibliographic entity belonging to the same bibliographic tree (item-to-manifestation, manifestation-to-expression, expression-to-work).

**b) THE SECONDARY BIBLIOGRAPHIC RELATIONSHIPS (*FRBR Final Report §5.3,*
p. 63-81)**

TAG	RELATIONSHIP
112	Whole/part relationship to an upward level entity of the same bibliographic tree: work-to-work (§5.3.1.1, p. 59-60), expression-to-expression (§5.3.2.1, p. 73), manifestation-to-manifestation (§5.3.4.1, p. 77-78), item-to-item (§5.3.6.1, p. 80-81). Note however that some whole/part relationships can be stored in the field tagged 114 as well.
113	Expression-to-other work relationship (§5.3.3, p. 74).

TAG	RELATIONSHIP
114	<p>Whole/part relationships between manifestations that belong to different bibliographic trees; the distinction between the two types of the part/whole relationships implemented in the fields with tags 112 and 114 is not expressly stated in the <i>FRBR Final Report</i>, but it is needed to create a link between a monographic publication and its series (§4.4.8, p. 43), or e.g. between an analytical part and its “whole” like a serial. According to the <i>FRBR Final Report</i>, “[...] Manifestation-to-manifestation relationships [secondary relationships between 1. group entities] normally involve manifestations of the same expression [...]” (§5.3.4, p. 76). Even if the <i>FRBR Final Report</i> underlines that “[...] the other relationships between group 1 entities [...] are not meant to be exhaustive [...]” (§5.3, p. 63), the implementation of any theoretical model requires it must be clearly defined. Some problems arise as consequence of this definition for manifestation-to-manifestation relationships in the FRBR model. Sometimes a ‘whole’ manifestation entity, which does not embody the same expression as its part, is needed in order to group some manifestation at the part level not according to their content (primary relationship), but according to other characteristics, e.g. the belonging to a series, to a serial, or even to a monographic publication if component parts have been catalogued. Even if this problem can be solved by linking the manifestation at the part level directly to its ‘whole’ at the expression level (e.g. a monographic publication to its series), a manifestation entity at ‘whole’ level is required in order to define its item entities, i.e. the holding records of a series, serial, monographic publication, etc. According to this interpretation of the FRBR model, the field 114 is needed, even if it is not explicitly defined. This topic about the Manifestation-to-manifestation relationships should not be confused with the attributes of some entities, e.g. the series statement attribute at the manifestation level (8th manifestation attribute, §4.4, p. 40). This attribute serves just as a description and its form is copied here from the manifestation itself such as it appears and is not normalised.</p>
115	Expression-to-other work expression relationship (§5.3.2.1, p.73).

TAG	RELATIONSHIP
116	Not-hierarchical relationship between the entities belonging to the same type and at the same time belonging to the same higher level entity (in other words to the same “tree”): work-to-work, both referential and autonomous (§5.3.1, p. 64), expression-to-expression of the same work (§5.3.1, p. 71-73), manifestation-to-manifestation (§5.3.4, p. 76).
119	Manifestation-to-item relationship (§5.3.5, p. 78-80).

c) THE OTHER RELATIONSHIPS

TAG	RELATIONSHIP
117	Relationship between a not preferred form and a preferred one of the same entity type, i.e. the bibliographic variant forms (§4.1, p. 30; see also §4.2.1, p. 33, §4.3.1, p. 36, §4.4.1, p. 41). The not preferred form can exist for the first attribute of an entity only.

The second sub-block (12x - bibliographic-to-responsibility/ownership relationship) (§3.1.2, p. 13-15, and §5.2.2, p. 60-62), includes:

TAG	RELATIONSHIP
121	Bibliographic-to-personal name relationship.
122	Bibliographic-to-corporate body relationship.

The third sub-block (13x - bibliographic-to-subject relationship) (§3.1.2, p. 13-15, and §5.2.3, p. 62-63) of BLOCK 1xx encompasses:

TAG	RELATIONSHIP
131	Bibliographic-to-Group 1 entity (subject relationship).
132	Bibliographic-to-Group 2 entity (subject relationship).
133	Bibliographic-to-Group 3 entity (subject relationship).

BLOCK 2xx

This block contains the following fields:

TAG	RELATIONSHIP
221	Person (not preferred form)-to-person (preferred form) relationship (§4.6.1, p. 51).
222	Corporate body (not preferred form)-to-corporate body (preferred form) relationship (§4.6.1, p. 51).
226	Person-to-person (“see also”) relationship (§4.6.1, p. 51).
227	Corporate body-to-corporate body (“see also”) relationship (§4.6.1, p. 51).

BLOCK 3xx

This block contains the following fields:

TAG	RELATIONSHIP
331	Subject (Group 3 entity, not preferred form)-to-subject (Group 3 entity, preferred form) relationship (§4.7.1, p. 52).
336	Subject (Group 3 entity)-to-subject (Group 3 entity, “see also”) relationship (§4.7.1, p. 52).

Record identification fields (Block 0xx)

As already stated, block 0xx contains the record identification fields, none of which is defined in the *FRBR Final Report*:

TAG	DESCRIPTION
001	Record ID
011	Date of record creation
012	Date of record last update
021	Record type (coded field)
022	Additional record type specification (coded field)

031	Record status (coded field)
051	Notes

Among the fields of this block, it is necessary to stress the presence of the field tagged 022 (“Additional Specification”). This field is used for manifestations only and has been introduced in order to distinguish between the different kinds of manifestation records. It is a one-character field that can be filled with the MARC codes related to the bibliographic level: “m” = the manifestation is a monographic publication; “a” = the manifestation is an analytic part; “c” = the manifestation is a series; “s” = the manifestation is a serial. This field regards manifestations only and is not mandatory. The value of this field allows one to identify also whether a manifestation embodies the same expression as its related “part” manifestation record(s) or not.

Managing the relationships between records

Even if the ISIS family software has some output built-in relational capabilities, as an IRS it has not been designed to manage relational databases, at least not in the data production environment. The highly relational structure of the FRBR data can be managed in the ISIS environment with appropriate extra tools only. The BEx set of utilities, written long before the FRBR Application, seemed to meet all the requirements to manage such data.

This utility allows to establish relationships between records by copying the ID of a record in another one; at the same time the ISIS built-in “ref” function allows one to display simultaneously a selected record with all its linked records values. The relationships are established by browsing and selecting records from appropriate lists, i.e. through “capturing”.

The BEx utility manages the relationships between records in two ways: some relationships are established by copying the record IDs reciprocally: from the “source” record to the “target” and vice-versa. Other relationships involve just a “one-way” ID transfer, e.g. from

the “target” to the “source” record. In the latter case the presence of a relationship in the source record is recognised through the presence of the ID in a specific record field; on the contrary the presence of the relationships from the target record is recognised through the inverted file: after the copying process the source record fields are (re)-indexed producing among others one term containing the transferred record ID with a specific prefix. When the target record is examined, the output format language performs a look-up in the inverted file for the same term, using the prefixed record ID as key; if it is found, an appropriate message is displayed to notify that a relationship to other records exists (e.g.: “PART/WHOLE RELATIONSHIPS EXIST”). In some cases the list of all linked records can be further displayed by pressing a function key.

This more complex way of managing relationships has been chosen in order to minimise the room occupied by the few critical relationships in the records themselves and is used only when a relationship type can be named differently if envisioned from the first or the second record of a relationship.¹¹ Such relationships are managed in the record navigation in two ways, both based on the execution of a hidden search expression and on the display of its results: in the first case a search is performed on the record ID(s) present in a field, in the second on a prefixed term containing the ID of the same record.

FRBR package internationalisation

The ISIS family software is a multi-language tool: it allows one to translate all the menus, messages and display formats in order to meet any local requirements, although this requires a good knowledge of the basic software. The CDS/ISIS package is also configurable in order to ensure the correct extraction of data, especially the word-by-word extraction and the upper-case conversion in the database dictionary according to the specific language code pages. Regarding all these aspects the IFPA package has been so far configured for the English language only.

Conclusion

A Web site dedicated to IFPA, including an on-line demo will be hopefully available soon. Its URL will be announced on the FRBR and on the CDS/ISIS discussion lists; check the latter at the URL <<http://www.bib.wau.nl/isis/isislist.html>>, since it is a public discussion list.

IFPA comes with a sample set of data, which contains nearly all the examples presented in the *FRBR Final Report*.

Notes

1. Among the many people who contributed to the final shape of this Application and/or gave me precious suggestions, I like to mention at least: prof. Mauro Guerrini, Università degli Studi di Firenze, Italy; Fabrizio De Castro, cataloguing services head at the Università degli Studi di Trieste, Italy; Lucio Lubiana, librarian at the S.I.S.S.A. Library, Trieste, Italy; Maurizio Biraghi, head of the Sistema Bibliotecario, Comune di Venezia, Italy. Finally I am grateful to all the volunteers who revised the English language software documentation.

2. More precisely based on the ISIS family software, since many versions, that followed the first developed by UNESCO in the 1980s, have been released so far; a good starting point to explore the ISIS family software is the URL (<www.unesco.org/isis>).

3. The IFPA software will be probably released as freeware. Note however that this license applies to the application only, since the ISIS environment(s), on which the application relies (CDS/ISIS for DOS, WINISIS, GenISIS, WWISIS), are proprietary software copyrighted by third parts, even if distributed free of charge.

4. The BEx programs were developed by the IFPA author.

5. For more information about the BEx utility see the separate documentation provided with the software.

6. Written in ISIS Pascal, still partially supported by the WINISIS version.

7. GENISIS has been developed by Pierre Chabert (<http://perso.wanadoo.fr/pierre.chabert/index.htm>).

8. WWWISIS has been developed by Bireme (<http://www.bireme.org/br> and <http://productos.bvsalud.org/html/en/home.html>).

9. With such an emphasis on relational data structures as can be found in FRBR and with such a wide proliferation of relational database management systems as we can see nowadays, one can wonder why a developer could choose an Information Retrieval System to manage the FRBR model and why he decided for a character-based interface. First of all, the ISIS software, on which the FRBR Prototype relies, was available at no costs at the time the Application was conceived; it was moreover a stable system and supported a programming environment. Secondly, the author was aware, through personal experience, of its capabilities. Thirdly, an interface to manage a relational structured database written for the CUI based ISIS environment already existed at the time the project was conceived. Fourthly, IFPA, as has been stressed above, is simply an academic experiment which does not care about providing a user attractive interface. Moreover the DOS version of CDS/ISIS is still widely used among the CDS/ISIS community. Lastly it supports multi-language menus, messages and allows one to configure properly data indexing and sorting for any languages. Not even the physical limitation of the ISIS record length (8K, 32K in the Microsoft Windows version), which affects some IFPA implementation features, especially the limitation of the number of relationships supported per each entity - considering that all the relationships pertaining to a single entity would be stored in the same record - turned off the author from the decision to use the ISIS software. The mentioned record capability was in fact considered sufficient for the purposes of this application, i.e. for the

management of sample databases.

10. A table is a collection of data, a database is a collection of tables.

11. Such an example is, in the FRBR model, the part/whole relationship, which becomes a whole/part relationship; the “see also” relationship is on the contrary always such, no matter what side you look at it.

Works cited

(FRBR Final Report 1998) IFLA Study Group on the Functional Requirements for Bibliographic Records. 1998. *Functional requirements for bibliographic records: final report*. München: K. G. Saur. Also available online at <<http://www.ifla.org/VII/s13/frbr/frbr.pdf>> and at <<http://www.ifla.org/VII/s13/frbr/frbr.htm>>.

Le Bœuf, Patrick. 2003. “Brave New FRBR World”. In *IFLA Meeting of Experts for an International Cataloguing Code*. Frankfurt: Die Deutsche Bibliothek. Available online at <http://www.ddb.de/news/pdf/papers_leboeuf.pdf>.