# Mediating knowledge across the activities of Information Science

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## Abstract

*This paper begins by identifying the implications of transdisciplinarity for knowledge organisation. If the goal for unified knowledge via the practice of transdisciplinarity is to be achieved, knowledge should be represented in a way that enhances the two main processes of transdisciplinarity: mutual learning and dialogue across disciplines towards a horizon of shared understanding. InfoFACET, a thesaural tool based on a faceted classification structure is proposed to represent the field of Information Science (IS) which, in terms of history, theories and methodologies, has become multidisciplinary. IS has also the characteristic of being driven by the need to develop strategies to solve problems resulting from the interaction between society and technology. The author demonstrates via a worked example centred on the concept of 'document' how the facet classification method can be adapted to serve the pragmatic nature of IS by attaching universal categories on a unique fundamental view point of activity which is a common feature to all disciplines involved and more meaningful to learners who can relate more easily to situations than to conceptual hierarchies based on rational division. It is explained and illustrated how the interface of InfoFACET fosters the understanding of the complexity of IS by providing a comprehensive socio-cultural context of the concept of document in relation to each of the related IS activities. It is believed that such a tool, by representing knowledge in a multidimensional and multi-referential manner offers potential to support Transdisciplinarity.*

**Keywords:** Faceted classifications, InfoFACET, Information Science, Thesauri, Transdisciplinarity.

## Resumen

*Se identifican las implicaciones de la trasdisciplinaridad en la organización del conocimiento. Para lograr la unificación del conocimiento por medio de la transdisciplinarierad, el conocimiento debe ser representado realizando los dos principales procesos de la transdisciplinariedad, que son: el aprendizaje mutuo y el diálogo entre disciplinas; la representación del conocimiento por medio de estos dos procesos nos llevará hacia un futuro donde el conocimiento será universalmente compartido. FACET es una*

*herramienta de tipo tesauro basada en la estructura de las clasificaciones facetadas y que ha sido propuesta para representar el ámbito del conocimiento de la Ciencia de la Información como disciplina. Disciplina que con referencia a su historia, teorías y metodologías se ha convertido en multidisciplinaria, y se ha caracterizado por la necesidad de desarrollar estrategias para solucionar los problemas resultantes de la interacción entre Sociedad y Tecnología. La autora muestra por medio de un ejemplo, centrado en el concepto de documento, como la clasificación facetada puede adaptarse para prestar servicio al punto de vista pragmático de la Documentación, mediante la asociación de categorías universales a una actividad concreta, que sea una caracterítica común a todas las disciplinas involucradas y tenga más significado para los estudiantes porque comprenderán más fácilmente situaciones que jerarquías conceptuales basadas en una división racional. Se explica e ilustra como la interfaz de FACET fomenta la comprensión de la complejidad de la Ciencia de la Información porque proporciona un exhaustivo contexto socio-cultural del concepto de documento en relación con cada actividad de la Ciencia de la Información. De esta manera al representar el conocimiento de manera multidimensional y multi-referencial FACET se convierte en una herramienta con gran potencial para sostener la transdisciplinaridad.*

**Palabras clave:** Ciencia de la Información, Clasificaciones facetadas, InfoFACET, Tesauros, Transdisciplinariedad.

## 1 Introduction

The recognition of the existence of different levels of reality governed by different types of logic is inherent in the transdisciplinary attitude. Any attempt to reduce reality to a single level governed by a single form of logic does not lie within the scope of transdisciplinarity (Article 2, Charter of Transdisciplinarity, CIRET, 1998)

The metaphysical discourse of transdisciplinarity has been supplemented for the last twelve years by concerns of a more pragmatic nature such as the application of transdisciplinarity theories in case study research and teaching (Scholz, 2005), in general education (Bot et al., 2005) and more specifically in curriculum planning (Coleman, 2002). In all cases, the emphasis is on a mutual learning process between scientists, practitioners and stakeholders via the creation of learning communities to serve as stepping-stones to the accomplishment of true transdisciplinarity and the attainment of unified knowledge. It is therefore timely to reflect on the kind of intellectual and material tools that would allow learners to function at a transdisciplinary level, i.e. beyond their respective disciplines and the associated classificatory structures. For the purpose of this paper, it is proposed to use Information Science as a case study to experiment with ways of organising knowledge to support the application of Transdisciplinarity in real-life situations.

## 2 The case of Information Science

A few months before it merged with the UK Library Association, the Institute of Information Scientists defined Information Science (IS) as the ‘theory and practice of creating, acquiring, assessing and validating, organising, storing, transmitting, retrieving and

disseminating information'[1]. This listing of activities suggests two things: 1) Information Science can be best defined in terms of what its practitioners do and 2) these activities are using knowledge and skills belonging to a wide range of disciplines ranging from computer science on the one hand (itself an interdisciplinary subject including psychology, physics, mathematics and logic) to philosophy, sociology, linguistics and cognitive science (another interdisciplinary subject) on the other. The resulting eclecticism hinders the creation of a unified metatheory of Information Science and emphasises its inherent pragmatic nature with technical skills and expertise tending to precede any theoretical framework which, in turn, is deemed to undermine the performance of IS activities (Vickery, 1997 and Hjørland, 1998).

Like environmental sciences, IS is driven by the need to develop strategies to solve the problems resulting from the interaction between society and technology such as the increasing production of information and the imperative to make it easily accessible. Wersig (1993) calls IS a 'postmodern science' as being a typically 'problem solving' approach to knowledge where common sets of axioms tend to supplement not only traditional, disciplinary activities but also the problem-centred 'interdisciplinary' ones, such as those mentioned above.

As an alternative to a metatheory for which it would be difficult (if not impossible) to reach a consensus, it is proposed, instead, to work towards enhancing the quality of the 'dialogue' between librarians, computer scientists, software designers, and information system developers by mediating the discourse belonging to each of those professions.

## 3 The transdisciplinary process towards unified knowledge

It is assumed in this paper that mutual learning as advocated by the proponents of transdisciplinarity involves two simultaneous processes: one leading to the attainment of knowledge by individual learners and the other involving the exchange of that attained knowledge between them. It is also assumed that the knowledge to be exchanged does not remain at the level of facts but that it should involve the sharing of conceptual understanding on the part of the individuals involved. There is a crucial difference between knowledge and understanding in the sense that understanding requires an internal grasping of how the various elements in a large and comprehensive body of information are related to each other not only conceptually but also with an appreciation of their cultural dimensions. If the latter were not achieved, the resulting common understanding amongst learners would be incomplete. Therefore, a state of understanding seen from a humanist perspective should be considered as a necessary requirement to foster a transdisciplinary dialogue.

This understanding process implies the existence of a 'conceptual and cultural space' which learners can explore beyond the conventional framework of their disciplines and professional institutions towards a horizon of unified knowledge, in a similar fashion to the hermeneutic approach proposed by Gadamer (1975):

> *To acquire a horizon means that one learns to look beyond what is close at hand, not in order to look away from it, but to see it better within a larger whole and in truer proportions (Gadamer, p.272).*

[1] The Institute of Information Scientists and The Library Association. *Our professional future. A proposal for a new organisation for the library and information profession: a consultative document.* November 1998. This document was accessed online shortly after its publication but the URL has been discontinued since.

From an Information Retrieval (IR) perspective, one can see how such an approach is similar to that of online browsing. Browsing can be defined as an interactive search activity in which the direction of the search is determined by the searcher on the basis of immediate feedback from the IR system. When browsing, searchers do not need to represent an information need linguistically as required in the direct search process but they need to be able to position themselves in an area of interest within the database and to recognize appropriate directions in which to further the search. One of the main requirements to allow effective browsing in an online environment is for its structure to be *understandable* conceptually and to have useful properties to help the process.

## 4 Implications for Knowledge Organisation

It may be that the object of understanding is an 'informational chunk' rather than a number of single information items. In this case the knowledge organiser must decide how these chunk of information are to be constituted. Although it is beyond the remit of this paper to pursue Nicolescu's metaphysical exposition of Transdisciplinarity (1998), we need to consider the following: how can the 'different levels of reality' be 'accommodated' (and not represented [2]), what 'types of logic' should be considered and how these should be 'conveyed' (and not structured)? These are the practical questions which this paper begins to address.

It may be also the case that we are facing a fundamental incompatibility between the requirements of Transdisciplinarity and those of Organisation of Knowledge. Indeed, the notion of organisation itself necessarily implies categorisation which, in turn, leads to a fragmented representation of that knowledge. Furthermore, principles of organisation such as hierarchical structuring within disciplines are imposed and perpetuated as a given. In spite of efforts on the part of the knowledge organiser to signal conceptual relationships within and across categories, it is inevitable that the categorisation of knowledge, as it has been practised so far, constitutes the first obstacle to the development of Transdisciplinarity.

In these circumstances, one should aim to supplement the building of classificatory tools with a *mediation* of the elements which *transcend* established categories. Examples of this are the historical development of a concept and its varied interpretations according to different cultures. The viewpoint adopted here is not primarily concerned with the intellectual (indexing language) and material (the performance of a retrieval software) conditions of the act of representing knowledge, but *with the man who transmits*, a process which transcends these conditions because it involves factors such as the intentionality of human action and the complexity of human perception. Rather than resulting from the application of strict rationalistic and objective principles the representation of knowledge becomes then a by-product of the transmission of culture (Debray, 2000). It is therefore the task of the knowledge organiser to engineer learning situations where knowledge is systematically presented in its social cultural context.

Given the fact that knowledge is made available increasingly online, it is appropriate to exploit the technology already in place while ensuring that it does not play a determining role in the way knowledge is presented. This could be achieved by the elaboration of a *milieu*

[2] See Nicolescu's statement: 'By Reality I intend first of all to designate that which *resists* our experiences, representations, descriptions, images or mathematical formalizations' (Nicolescu,1998).

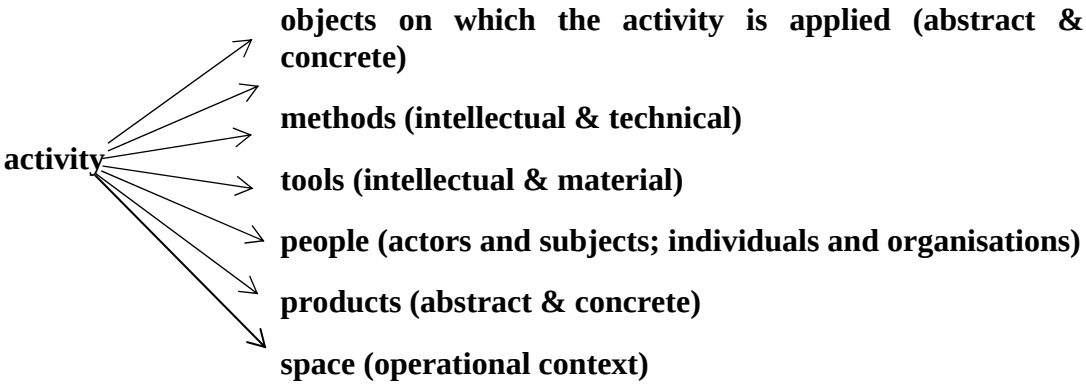
where the cultural and the material interact to allow the transmission of culture to take place. Debray (2000) describes the milieu as the interplay between two sets of factors underpinning the transmission of culture: 1) the Organised Material (OM) such as the technical and the logistical elements (e.g. relational database and hypertext technology), and 2) the Materialised Organisation (MO) such as the strategic and the institutional (e.g. principles of division, organisation by disciplines, indexing language). This provides us with a possible solution to overcome the dilemma explained above, at least partially.

## 5 Implementation of the milieu

The next two subsections describe an attempt at creating a milieu in the form of a thesaural tool named *Info*FACET. This tool combines a faceted arrangement of Information Science concepts with the application of hypertext technology to provide a conceptual and a cultural context.

### 5.1 The Materialised Organisation: arrangement of Information Science concepts

As a marked departure from earlier attempt (Jorna and Davies-2001), the present approach uses the concept of *activity* as a unique viewpoint from which an understanding of Information Science is developped. Indeed, it is believed that the necessity of performing tasks to solve information problems is a common feature to all involved in Information Science regardless of their disciplinary background. Consequently, an arrangement by activities should be more meaningful to learners who can relate more readily to *situations* lived by humans than to the allocation of concepts to disciplines. A set of universal concepts provides the ontological context to the activity as illustrated below.




This ontology can be represented within a faceted arrangement by applying a combination of rational and pragmatic methods of facet analysis which are empirically based on observation of what information professionals do (Maniez,1997). In accordance with facet analysis procedures, sub facets are created within the initial ones using the characteristics that are specific to a particular concept as criteria of division. Thus in *Info*FACET, documents can be further distinguished by types according to function, format and each subfacet can be subdivided in a number of arrays representing the components of a document. In our case study, the practice of Information Science has been tentatively defined as a set of four main activities, each one being applied to information regardless of its format. They are:

A cataloguing (as in physical description of information)
B indexing (as in representation of document content
C information searching (formulation of information needs and information seeking behaviour)
D dissemination of information (as part of communication efforts)

The list below shows how IS concepts can be easily accommodated by the first and second framework. Different ontological components of the activity B indexing are detailed below:

| | |
|---|---|
| documents as | objects to which the indexing is applied |
| subject analysis | as one of the methods used in indexing |
| thesaurus | as one of the tools used in indexing |
| indexer | as the person performing the indexing |
| index entry | as the product of the indexing process |
| library services | as the operational context |
| Society of Indexer | as an element of the cultural context |

## 5.2 The Organised Material

### 5.2.1 The interface

As an aid to understanding, the interface is the most important feature of the organised material. It has been designed to give as much information as possible in a clearly structured space, so that terms can be understood in their full conceptual and cultural contexts. As can be seen in Figure 1, the six conceptual categories are displayed on the horizontal axis (Objects, Methods, Tools, People, Products and Context) while the activity components (Cataloguing, Indexing, Searching, Disseminating) are listed on the vertical axis. This results in 24 top categories representing the domain of Information Science. However these categories represent merely the first layer of *Info*FACET which would not differ much from a conventional classification display if it were not for the facilities provided by database and hypertext technology. A worked example centred on the concept of *electronic document* helps to understand how a learning situation can be achieved by combining intellectual and technological tools. The term *electronic document* (as would be any other descriptor in *Info*FACET) is treated in five ways:

1) by displaying its semantic context within the hierarchical content of the facet it belongs to (here being the facet representing the objects to which indexing is applied);
2) by providing in a central frame a verbal definition in relation to the relevant activity, i.e. by explaining its relationships to indexing;
3) by displaying a comprehensive range of related terms distributed across the other categories such as those dealing with methods, tools and people;
4) by always placing it adjacent to the activity to which it is conceptually linked in order to highlight its operational context;
5) by linking it to sources of information which will provide the cultural context of its usage.

While each concept is defined in relation to its operational context, each activity is understood in its conceptual and cultural context. Each term functions as a hyperlink, taking the user to a page where it is treated identically. However, unlike unstructured hypertext situations where users end up loosing themselves in a mesh of disjointed information, the interface will always

provide the broader context of the 'destination' term. Users thus progress in understanding during the navigation process. Frequently visited routes will become familiar until the broadest level of understanding is achieved. This is particularly a useful point since the broadest levels of knowledge tend to be the most culturally specific, therefore the most difficult to communicate adequately.

As a thesaural tool *Info*FACET deals with relationships explicitly by providing a visual display of the full extent of the hierarchy within which the selected term sits and by including on the interface the different facets which constitute the ontological context of the activity which, for its part, provide the operational context of the preferred term. It is assumed that all terms featuring in the display are preferred terms. Equivalence relationships can be dealt with by listing synonyms and quasi synonyms in a drop-down menu attached to the preferred term.

Although there is no scope to discuss this facility in this paper, Figure 1 suggests that *Info*FACET can also function as a multilingual and cross-cultural tool by providing similar browsing space in terms of layout but culturally and linguistically different in terms of content and, again, using hypertext to bring them together.

| **Query** 'indexing electronic documents' | **OBJECTS** | METHODS | TOOLS | PEOPLE | PRODUCTS | CONTEXT |
|---|---|---|---|---|---|---|
| **CATALOGUING** | documents<br><br>*by function*<br>primary<br>secondary<br>tertiary | manual | authority list<br>thesaurus<br>subject heading list<br>classification scheme | **- indexer**<br>**- computer scientist**<br>**- software developer**<br>**- content manager** | **- inverted file**<br>**- automatic index**<br>**- automatic classification**<br>**- automatic thesauri**<br>**- cluster** | *Operational*<br>databases<br>web<br><br>Cultural<br>Intellectual<br>foundations |
| **INDEXING** | *by format*<br>print<br>**electronic**<br><br>*by form*<br>bibliography<br>record<br>full text | **- Natural Language Processing (NLP)**<br>**- statistical analysis**<br>**- syntactical analysis**<br>**- automatic classification**<br>**- clustering**<br>**- compression**<br><br>Citation indexing<br>Hypertext | **algorithm** | | **- index term**<br>**- keyword**<br>**- data** | Historical development<br>**Luhn, 1957.**<br>**Salton, 1989**<br><br>Current research<br><br>Education<br><br>Institutions |
| **SEEKING** | | **Electronic document** | | | | |
| **DISSEMINATION** | | **document numérisé** (equivalent page in a French context)<br>**elektronische Träger** (equivalent page in a German context) | | | | |

Figure 1. Milieu of document in an electronic format provided within the operational context of indexing

### 5.2.2 Software

Little attention has been given thus far to this aspect of the milieu as it is felt that the underlying programming is of little relevance to *Info*FACET, provided it can fulfil its functions. So far, experimenting with Microsoft ACCESS database combined with an HTML

interface has proven to be satisfactory. However, it is expected that using XML will improve functionality.

## 6 Final remarks

Apart from providing the intellectual space to operate at a transdisciplinary level, the anticipated benefits of *Info*FACET are as follows: 1) it will enhance the capability of an Information Retrieval system beyond the mere transfer of information towards transmission of culture; 2) consequently it will enhance query formulation at a very specific conceptual level and provide criteria to assess the relevance of retrieved documents; 3) it will contribute to the creation of a multi-dimensional and multi-referential knowledge of the topic of Information from a humanist perspective via an analysis of its activities. In contrast with direct searching where procedures are determined by database technology at the expense of unified knowledge, hypertext technology has been used to exploit the flexibility of faceted classification to attain knowledge in its unity. It can be said that *Info*FACET represents a balanced milieu where the human and the technology can interact successfully towards the organisation of transdisciplinary knowledge.

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