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Retrospect Lexicalisation: A Recurrent Phenomenon in the Lexicalisation Process of the Life Sciences

Abstract

The analysis of a corpus of *reflective text fragments* concerning the lexicalisation and relexicalisation of the disciplines and subdisciplines of the life sciences (biotechnology, molecular biology, genetic engineering, recombinant DNA technology, etc.) shows the recurrent phenomenon of *retrospect lexicalisation*.

The case of 'biotechnology' is studied in detail starting from a corpus of *reflective text fragments*.

The question is raised whether the observations on (a) the impossibility of an analytical definition, (b) chronology and periodicity as structuring principles for meaning description, and (c) polysemy, could and should have their implications for terminographical practice.

0. Introduction

Traditionally terminology believes the relevant aspects of the meaning of concepts and terms to be the characteristics that make it possible to delineate one concept from its related concepts.[1]

The model of meaning description offered by terminology (a) wants to clearly delineate related concepts from one another by listing characteristics and studying relationships, (b) restricts the relationships which are emphasised to the logical and ontological ones, (c) tends to ignore conceptual evolution and linguistic evolution in stressing that terminological meaning description is synchronic.

Traditional terminology does not want to concentrate on studying phenomena like metaphor, polysemy and meaning extension, which are believed to obstruct objective thinking and communication.

Under the pretext of wanting to facilitate unambiguous communication, terminology excludes and ignores a number of meaning elements that are discarded of as encyclopaedic information. Terminology limits itself to the essential or semantic information in meaning description, i.e. in enumerating the necessary and sufficient conditions for something to belong to or be an example of a concept.

Terminographers know that quite a few concepts that are encountered in LSP can hardly be treated in the fashion just described. Most

terminographers have to start from a corpus of LSP texts for their information on the subject field the terminology of which has to be described. Therefore one of the principles of terminology, i.e. to start from concepts, which have to be clearly delineated and described by a definition before the 'ideal term' is assigned to the concept can hardly ever be met. Practice implies that one is confronted with terminology in context of which one has to make sense.

We would like to question the appropriateness of the constraints that are imposed by traditional terminography. First we want to investigate whether the meaning description of a concept can always be limited down to enumerating essential characteristics and expressing basic meaning relationships. Second we want to question whether the meaning of all concepts can be described purely synchronically. The type of concept we would like to concentrate on is of a specific nature. We want to study concepts for which specialists in trying to define the concept explicitly mention that the concept they are at this moment defining and naming with a term is not really new, only the term is, as in retrospect, what is being named, is now realised to have existed for a long time. The naming of a concept with a term on the basis just described, could be referred to as **retrospect lexicalisation**.

We should like to define 'retrospect lexicalisation' as follows: a concept was latent but not categorised as a term had not yet been coined to name the concept.

A concept x which appears to have existed for a long time but had never been named before becomes part of the extension of the now for the first time named concept x+. This category x calls for a name because of meaning extension (+). As soon as the new lexicalisation (lx) comes to life what existed before is referred to as 'traditional lx', what is new is referred to as 'new lx'.

Our claim is that for terms which are created in full awareness of retrospect lexicalisation the historical information on the coming into existence of the concept is part of its essential meaning. Not only can the terms not be understood fully without the time information, what is more is that the concepts are shaped in time and only exist in time. The characteristics which make up part of the concept's meaning are structured in time.

We should like to concentrate on 'biotechnology' as an example of retrospect lexicalisation in the life sciences.

1. Reflective text fragments on biotechnology

In their LSP texts, specialists regularly reflect on their terminology in text fragments we shall refer to as Reflective Text Fragments (RTFs). In these RTFs specialists verbalise their struggle with the lexicalisation of concepts. The problems accompanying the coining of new terms are given some reflection by field specialists.

When terms like 'microbiology', 'biochemistry', 'biotechnology' 'molecular biology', 'biochemical genetics', 'molecular genetics', 'genetic engineering' and 'recombinant DNA technology' were coined, it were lexicalisations which could be classified under the category of *umbrella terms* for currents which had been taking shape for some time, without being recognised as a specific category.

The new lexicalisation captures a process in time: the new term is a *retrospect lexicalisation.*

The term 'biotechnology' was coined when recombinant DNA technology was developed (in the 1970s) to refer to the 'commercial application of engineering and technological principles of the life sciences' (Harford, 1988:149). At that moment when this term was introduced, it was realised that since at least 5000 years bio-techniques had been used for production.

2. Types of information contributing to the meaning of 'biotechnology'

We shall first briefly examine what types of information one can find in RTFs.

The following is an example of an RTF on the concept and the term 'biotechnology' (Harford, 1988:149).

> Biotechnology can be defined as the commercial application of engineering and technological principles of the life sciences. The history of biotechnology can be traced over many millennia and it has been described as the world's second oldest profession. For its first five thousand years, the food and drinks industries were the main province of biotechnology with the manufacture of bread, beer, wine, cheese, and many other fermentable products. Over more recent times the chemical and pharmaceutical industries have used biotechnological processes for the synthesis of many natural products, e.g. industrial alcohol, citric acid, a range of amino acids, antibiotics, vitamins, etc..

During the past decades research successes in engineering, biochemistry and genetics have led to the major upsurge of interest in biotechnology. This has been largely brought about by the advent of recombinant DNA (rDNA) technology, otherwise known as gene cloning or genetic engineering. It was soon realized that the methods of genetic engineering greatly enhanced the potential of biotechnology, providing the prospect for the development of many new products and bioprocesses. Biotechnology is now viewed by many as the final major development of the century, likely to have profound commercial and sociological effects in the 21st century. This has been documented in every conceivable publication, be it scientific journal, national magazine, or daily newspaper, such that the impact of rDNA technology on biotechnology is common knowledge. Early economic forecasts predicted a bright future for the new industry and were sufficiently optimistic that they stimulated the growth of a new venture-capital based biotechnology sector. Several hundred new companies have now been set up worldwide to exploit and supply this new technology.

We tried to visualise the main meaning elements we find in this RTF in a concept map (figure 1).

CONCEPT MAP

DEFINITION	'Biotechnology can be defined as the commercial application of engineering and technological principles of the life sciences.'		
HISTORY:	PERIOD	TECHNIQUE	RESULT
	since 5000 years	fermentation	food and drinks like: bread, beer, wine, cheese and many others
	in recent times	biotechnological processes used by chemical and pharmaceutical industries	synthesis of many natural products like industrial alcohol, citric acid, a range of amino acids, antibiotics, vitamins, etc.
	in the past decades	recombinant DNA technology (= gene cloning, = genetic engineering)	new products bioprocesses

Figure 1. Concept map visualising some of the meaning elements in Harford's RTF

An analysis of the meaning elements in this RTF shows four types: a stipulating core definition (2.1), characteristics and their possible values which are structured in a chronological way, according to three periods in time (2.2), topical information (2.3) and ideologically coloured

information (2.4). We shall first briefly describe each of these types of meaning elements.

2.1 A core definition

The 'stipulating core definition' is 'stipulating' because it is what the author of the text explicitly stipulates to be the definition ('biotechnology can be defined', 'we define biotechnology as') and it is a 'core' definition because it could be seen as the minimal amount of information which is necessary to make clear what 'biotechnology' refers to. This core definition is not a traditional analytical definition, i.e. it does not give the necessary and sufficient characteristics for an 'exemplar' (here in its abstract sense) to be an example of the concept. It does give part of the essential information about 'biotechnology', however. The information is essential as it expresses what one needs to know to distinguish 'biotechnology' from other related disciplines in the field of the life sciences. We found that the essence of the core definition was present in most of the 15 RTFs on biotechnology we studied. It has the following typical structure:

'biotechnology is the application of x in order to achieve y', in which x prototypically stands for 'biological techniques' and y for 'tradable results'. This core definition was explicitly present in 8 of the 15 RTFs, and implicitly in three more RTFs.

What is important for our argumentation is that it is impossible to define 'biotechnology' in an analytical definition. The reason is, as we shall see in the next section, that the characteristics are not used for logical or ontological structuring, but for expressing the time structure. Because the characteristics are structurally interwoven with the periodicity we claim the time structure to be part of the essential meaning of 'biotechnology'.

2.2 A time frame structuring for characteristics and values

In the RTF from Harford (1988:149) TECHNIQUE and RESULT are two characteristics of 'biotechnology'. Each of these characteristics has values, e.g. 'fermentation' and 'recombinant DNA technology' are values of TECHNIQUE, 'bread', 'wine', 'antibiotics' are values of RESULT.

The characteristics and their values can be listed as such but sense is obtained because there are links between several characteristics

according to principles. The link between the characteristics TECHNIQUE and PRODUCT is *cause and result* (see Figure 2).

TECHNIQUE	PRODUCT
fermentation	food and drinks
biotechnological processes used by chemical and pharmaceutical industry	natural products
recombinant DNA technology	new products
the *linking principle* is cause and result	

Figure 2. Visual representation of the linking principle between two characteristics of biotechnology based on Harford (1988:149)

The core definition (2.1) and the structuring in time (2.2) of the characteristics and their values are essential information for the description of the meaning of 'biotechnology'. What we treat under 'topical information' (2.3) and under 'ideologically coloured information' (2.4) we do not consider to be part of the essential meaning.

2.3 Topical information

By 'topical information' we mean any information which adds to the understanding of the concept but which is less essential for the understanding of the concept. Traditionally this was called encyclopaedic information.

In the RTF from Harford (1988:149), for instance, we find **economical** information:

> Early economic forecasts predicted a bright future for the new industfry and were sufficiently optimistic that they stimulated the growth of a new venture-capital based biotechnology sector. Several hundred new companies have now been set up worldwide to exploit and supply this new technology.

2.4 Ideologically coloured information

A second type of non-essential information is ideologically coloured information.

It shows the opinion of the author concerning the meaning of the concept. In the RTF from Harford (1988:149) we find the author is giving his opinion on the meaning of 'biotechnology' in:

> Biotechnology is now viewed by many as the final major development of the century, likely to have profound commercial and sociological effects in the 21st century. This has been documented in every conceivable publication, be it scientific journal, national magazine, or daily newspaper, such that the impact of rDNA technology on biotechnology is common knowledge.

and: "... biotechnology ... has been described as the world's second oldest profession."

3. The stucturing function of the time frame

The analysis of Harford's RTF on biotechnology has shown that the essential information consists of (a) the core definition '**biotechnology is the application of biological techniques in order to achieve tradable results**' and (b) characteristics, theirs values and the principles linking the characteristics, all this structured in time.

3.1 To understand a term which is an instance of retrospect lexicalisation one needs to understand the structuring of the characteristics and values in time

In several RTFs we found a description of the development of the concept in time.

PERIOD IN TIME clearly allows to get a grip on the evolution of the meaning of a concept.

Apparently the definition of the concept 'biotechnology' calls for a structuring or positioning-in-time component. This information is not just part of the non-essential encyclopaedic information. It is information which explains the reason why 'biotechnology' was coined as a term at a specific moment, giving testimony of a culminating point in the evolution of the life sciences which called for reshuffling and restructuring of existing knowledge, calling for a new name for a growing concept.

Several authors make the origin of the coinage of 'biotechnology', the reason for the need for a new term for a new concept, part of their RTF.

The meaning of 'biotechnology' cannot be sufficiently captured without this information. Consequently it is impossible to stick to the credo of terminology that terminology should describe meaning on a purely synchronic basis.

3.2 Retrospect lexicalisations comprise the roots for polysemisation

It can be pointed out that the roots for the polysemisation of the category biotechnology in (a) 'traditional biotechnology' and (b) 'new biotechnology' are clearly present in Kingsman & Kingsman, (1988:414). The distinction between (a) and (b) is due to the discovery of 'gene transfer technology'. 'Traditional biotechnology' is defined as *"the exploitation of the biochemical potential of micro-organisms for medical, agricultural and industrial purposes"*. 'New biotechnology' is *"the exploitation of the biochemical potential of micro-organisms, plants, animal cells, animals, for medical, agricultural and industrial purposes"*.

The reason for the meaning extension of biotechnology is the development of new gene transfer technology, referred to in Harford (1988:149) as recombinant DNA technology.

'The exploitation of the biochemical potential of micro-organisms for medical, agricultural and industrial purposes' was a fact before the development of new gene transfer technology (or recombinant DNA technology) but this activity had not been recognised as a concept in itself, important enough for it to be assigned a term.

This brings us to another principle in terminology: the strife-for-monosemy principle. Ideally a clearly delineated concept should be named with one specific term and conversely one term should only have one meaning if communication is to be unambiguous.

The example we have just given of the **retrospect lexicalisation** of the category biotechnology is a proof of the need for the exploitation of polysemisation as a process in a scientific environment in which the emphasis is on change, innovation, progress.

The retrospect lexicalisation which we observe in the case of 'biotechnology' could be summarised as follows: a soon as recombinant DNA technology (or gene transfer technology) was used in the commercial application of biology the term 'biotechnology' arose. In retrospect specialists then distinguished between the period before (i.e. traditional biotechnology) and the period after (i.e. new or modern biotechnology) recombinant DNA technology had been established.

As soon as the term 'biotechnology' occurs it is inherently vague and ambiguous as it immediately demands for the distinction between two types of biotechnology: traditional and modern.

Moreover, within the field of the life sciences, meaning distinctions occur right away, as is illustrated in Brum & McKane (1989:713–14):

> *Biotechnology* is a term that defies simple definition. Some people equate it with the new field of *genetic engineering*, while others take a broader viewpoint, defining it as any application of biological knowledge. This broad definition would encompass an enormous number of endeavors, from agriculture to modern genetic engineering. To reduce confusion, we will limit our interpretation to the two areas most often equated with biotechnology. One of these, the genetic engineering of organisms, is the endeavor that inspired the coinage of the term "biotechnology" in the 1970s. The other area consists of recent developments in the fields of tissue (and cell) culture, most notably those that have enabled us to fuse two different eukaryotic cells into a single cell that possesses the combined properties of both.

The polysemy is visualised in figure 3.

Biotechnology
1. Some people equate it with the new field of *genetic engineering*.
2. Others take a broader viewpoint, defining it as any application of biological knowledge. This broad definition would encompass an enormous number of endeavors, from agriculture to modern genetic engineering.
3. We will limit our interpretation to the two areas most often equated with biotechnology. One of these, the genetic engineering of organisms, is the endeavor that inspired the coinage of the term "biotechnology" in the 1970s. The other area consists of recent developments in the fields of tissue (and cell) culture, most notably those that have enabled us to fuse two different eukaryotic cells into a single cell that possesses the combined properties of both.

Figure 3. The polysemy of 'biotechnology' according to Brum & McKane (1989:713–14)

Traditional terminology aims at being prescriptive and would encourage standardsation in order to try and control polysemisation. The idea is to do away with ambiguity. It is a fallacy however to claim that the progress of science suffers from vagueness and ambiquity of the concepts which are being studied and discussed. We believe the opposite can be the case. Because of the possibility for multiple interpretation, concepts have to be constantly refined and questioned which allows for nuance and evolution.

4. Conclusions and impact for terminography

The biotechnology-case of retrospect lexicalisation showed that some of the principles of traditional terminology cannot be applied for the meaning description of this concept: (a) an analytical definition proved

impossible, (b) chronology and periodicity proved to be structuring principles in the framework of which characteristics and values could be understood, (c) synchronic meaning description proved to be impossible as the history of the concept 'biotechnology' is part of its essential meaning, and (d) 'biotechnology' is inherently polysemous.

The obvious conclusion is that terminology needs to revise and elaborate on its model of meaning description.

Suggestions have been given by Bowker & Meyer (1993) and Meyer, Eck & Skuce (1994). Since the technology is available now they believe multidimensionality need not be a problem in terminological meaning description. Terminographers are encouraged to include e.g. graphical representations of conceptual information of a variety of types. The problems for semantic description we raised are more specifically: (a) how does one deal with a time frame structure which is part of the intensional meaning of a concept and (b) how to incorporate polysemy in terminography.

If terminology wants to maintain its status of discipline it will have to acknowledge the impact of non-objectivism on meaning description (Johnson, 1987) and consider the alternative models for meaning description proposed in cognitive semantics (Geeraerts, 1989). More research is required in the prototypical nature of LSP concepts (Zawada & Swanepoel, 1994).

Notes

1. By 'traditional terminology' we mean terminology in line with the principles developed by the three traditional terminology schools (the Vienna school, the Prague school and the Soviet school) as they are described in Laurén, C. & H. Picht "Vergleich der Terminologischen Schulen" in: Laurén, C. & H. Picht (eds). 1993. *Ausgewählte Texte zur Terminologie*. Wien: Termnet. IITF Infoterm, 493–539.

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