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TERMINOLOGY SCIENCE AT THE CROSSROADS ?

Are the different views on the theoretical foundations of terminology drifting apart ?

Since the publication of the book Ausgewählte Texte zur Terminologie (1993) (Selected Texts on Terminology), in which Ch. Laurén and H. Picht took up the challenge of comparing the different schools of terminology (pp.493-536), some considerable time has lapsed. Things have continued to develop, new approaches have appeared, differences or perceived differences have been resolved. It therefore seems timely to take stock now, in order to establish in which respects fundamental theoretical positions have changed, whether they are contradictory in any way or only differ in certain aspects.

The aim of the terminology section at the 13th European Symposium on Languages for Special Purposes held in Vasa, Finland in August 2001 was to clarify as far as possible the theoretical bases of terminology theory. It seemed that the need for clarification was an urgent one for several reasons. First, it can only be beneficial to theoretical developments in terminology science; secondly, it is to be hoped that such a discussion will help to prevent basic theoretical positions drifting fur-

ther apart; thirdly, it can provide a sounder theoretical base to our subject; and fourth, it is an essential foundation for the principles of standardisation in terminology.

In the section, the following subjects were dealt with by the speakers listed below, and in the subsequent colloquium each contribution was commented on by one or more opponents:

1. *Gerhard Budin: A critical evaluation of the state-of-the-art of terminology theory*
   Opponents: Merja Koskela, Bertha Toft

2. *Christer Laurén; Heribert Picht: Terminologie aus linguistischer Sicht*
   Opponent: Heinz Leonhard Kretzenbacher
   Johan Myking: Socioterminology, terminology planning and standardisation
   Opponents: Bassey Antia, Outi Järvi

3. *Nina Pilke: The concept and the object in terminology science*
   Opponents: Bassey Antia, María Pozzi

4. *Heribert Picht, Christer Laurén: Repräsentationsformen in der Terminologie*
   Opponents: Margaret Rogers, Sue Ellen Wright

5. *Bertha Toft: Systems of concepts and the organisation of knowledge*
   Opponent: Øivin Andersen

This issue of the IITF Journal contains the contributions of the authors indicated under 4 – 6 above plus the contributions of their respective opponents. The former issue of the journal, IITF Vol. 12 (2001) no. 1-2, contained the first 8 contributions. It is our hope that these two issues will provide an image – however sketchy – of the dynamic development which has taken place within terminology science over the past 10 years.

Bertha Toft *Heribert Picht*

CONTENTS

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THE CONCEPT AND THE OBJECT IN TERMINOLOGY SCIENCE

1. Introduction

The present paper discusses two central concepts in terminology science: the concept of 'concept' and the concept of 'object'. The presentation proceeds in two stages. Firstly, I will show how the two core concepts are outlined in terminological literature (2). Secondly, I will put forward my own view of how 'concepts' and 'objects' could be approached within the terminological framework (3).

The discussion is based on my research project (Pilke 2000b) concerning knowledge representation of concepts which are related to field-specific actions or events (=*dynamic concepts*). The aim of my research was to offer suggestions for how the knowledge concerning field-specific actions and events can be analysed, structured, recorded, and passed on.

In my study I have examined how conceptual knowledge is de-

scribed in written definitions in LSP glossaries and have introduced classes of characteristics for dynamic concepts. In this paper the terminological framework will be applied to non-verbal representations in specialised communication (4).

2. The concepts of 'concept' and 'object'

The concept of 'concept' is central in terminological theory no matter what the orientation or emphasis is. Philosophers, logicians, psychologists and others have busied themselves with the essence and existence of concepts for centuries without being able to produce final answers. Also in terminology science there are at present many opinions on what concepts are and what kind of status they should be given in the field. So far nobody has, however, denied the existence or the significance of concepts.

In the Wüsterian manner the majority of researchers working at terminological issues regard the concept as the starting-point of all terminological activities: "Jede Terminologiearbeit geht von den Begriffen aus" (Wüster 1985: 1). The role of the concept and the Wüsterian view of its importance to terminological analysis has been questioned lately (se Wüster 1985: 1; ISO 1087–1; DIN 2342). The critics start from the communicative aspect and give priority either to the term or to the definition over the concept (see Sager 1990: 22; Temmerman 2000: 224). Pozzi (1999) suggests that terms and above all definitions rather than concepts should be focused on in terminological activities. Her statement is based on the criteria (universality, eliminated ambiguity, priority and independence of linguistic representations) which are connected with concepts but can not be met in practice. According to Pozzi concepts as abstract phenomena do not have the precision required in effective special communication. Definitions are according to her concrete entities which can be fixed and liberated from individual interpretations. This is the reason why definitions should be given priority over concepts.

Pozzi's discussion is many-sided but has a linguistic bias. She does not give her own/new definitions of the concepts of 'concept', 'term' and 'definition'. Because the terminological standards include circular definitions and leave some concepts undefined, Pozzi (1999: 33) accepts Sager's (1990: 23) notion of 'concept' as an axiom that does not need to

be defined. Thus the central question remains open. Furthermore, Pozzi does not discuss the new problems which arise from a change in point of view: how to form a definition that would be valid in all situations and how to handle synonymy and polysemy if the linguistic form is the starting-point for the analysis ?

Normative definitions are, in spite of their important role in the specialised communication, always characterised by a pre-fixed point of view, they have always a restricted validity and they can show only a small part of a concept's intension.

The existing definitions of 'concept' have been criticised because they are much too wide in character (see e.g. Rey 1995: 34 f.). The most often cited definitions in terminological literature are relatively similar to each other both as regards their content and their formulation:

- "mental föreställning om en referent" ("a mental idea of an object"; Terminologiordlista 1986: 22)
- "... das Gemeinsame, das Menschen an einer Mehrheit von Gegenständen feststellen und als Mittel des gedanklichen Ordnens (Begreifens) und darum auch zur Verständigung verwenden. Der Begriff ist also eine Denkelement." (Wüster 1985: 7)
- "Denkeinheit, die aus einer Menge von Gegenständen unter Ermittlung der diesen Gegenständen gemeinsamen Eigenschaften mittels Abstraktion gebildet wird." (DIN 2342)

The definitions above start from the assumption that concepts are units of thought that are formed from objects, i.e. that human mental activity is founded on objects. The definitions of the concept of 'object' show that an object can consist of practically anything perceivable or conceivable:

- "väsende, skeende eller egenskap som betraktas" ("phenomenon, event or property that is observed"; Terminologiordlista 1986: 23)
- "alles worauf sich das Denken eines Menschen richtet oder richten kann"
- (Wüster 1959/60: 183)
- "any thing perceivable or conceivable" (ISO 1087–1)
- "Ausschnitt aus der sinnlich wahrnehmbaren oder gedachten Wirklichkeit mit einer
- Menge von Eigenschaften" (ÖNORM A 2704)

These definitions do not throw much light on the essence of a concept, because they only define the concept in relation to human thinking or human observation. A problem with regard to objects is also the contrast between concrete and abstract or material and immaterial which occurs in terminological literature. Concrete objects are said to be located in the world which can be observed by the senses (or instruments), whereas abstract objects which do not have any determination in relation to time or location exist outside this world (see the discussion in Laurén, Myking & Picht 1997: 96 ff.). This kind of distinction unavoidably raises the question of what then is the difference between abstract objects and concepts as unit of thoughts.

Side by side with the opinion that concepts are units of thought there is an alternative view according to which concepts are units of knowledge (e.g. in the new ISO 1087–1 standard the concept of 'concept' is defined as "a unit of knowledge created by a unique combination of characteristics" instead of a mental unit). According to this alternative view concepts cannot be units of thought because thinking is always subjective in nature (see Dahlberg 1984: 96; ISO 1087–1 1998: 6; see also Ozeki 1987).

Also Picht (1992: 26 ff.) has discussed the possibility of regarding concepts as units of knowledge which have an intension that include all the knowledge that human beings have at some point of time. The difference between a unit of thought and a unit of knowledge is said to be that the former has an intension chosen for a certain purpose. As a third alternative Picht gives the possibility of regarding concepts as units of cognition (*erkendelsesenhed*). As a unit of cognition a concept goes through certain modifications and becomes a new, true unit of knowledge in a continuing process. (Ibid.)

In my opinion, the solution to the problem that Picht discusses but does not come to a clear decision about on could be that the epistemic priorities of the subject field instead of the object or the term should be regarded as a determining factor when forming concepts.

As I see it, the terminological theory lacks a discussion of how concepts within different subject fields are formed and which aspects characterise such concepts. A clear distinction between how on the one hand "general" concepts and on the other hand special concepts are formed could be a way in which more precise definitions fulfilling the

demands on specialised communication can be reached.

Specialised knowledge is characterised by a set of special aspects which do not apply to everyday knowledge (cf. Laaksovirta 1986: 57 ff.). Therefore it can be assumed that scientific concept formation differs from general concept formation. Felber (in Ozeki 1987) has taken this into consideration by stating that special concepts should be defined and separated from those which are regarded as concepts in everyday life: "Denkelemente die definiert sein müssen, und sich wesentlich von dem unterscheiden, was man im Alltag als Begriff bezeichnet".

2.1 Characteristics

In order to be able to analyse, describe and systematize concepts it is necessary to chart the component parts, the characteristics of the concepts. According to most of the definitions in terminological literature the abstract characteristics are based on the properties of an object:

- "abstraction of a property of an object or a set of objects" (ISO 1087–1)
- "Durch Abstraktion gewonnene Denkeinheit, die eine Eigenschaft von Gegenständen wiedergibt, welche zur Begriffsbildung und -abgrenzung dient." (DIN 2342)

Wüster (1985: 8 ff.) uses the term *Merkmale* both for the property of an object and for the characteristic of a concept. Nuopponen (1994: 61) points out that it is important that the ontological level with the phenomena and their properties, and the conceptual level with the concepts and their characteristics are kept apart. It can, however, be difficult to decide which level is actually meant, because the difference between properties and characteristics is not quite clear (e.g. when ontological concept systems are built up).

The properties of an object are fixed by means of observations, measurements, commonly accepted statements about the phenomena or □ealize□ng□i views. The properties turn into characteristics through an abstraction process. (Nuopponen 1994: 61; Dahlberg 1978: 145.)

The abstraction process itself, the transition from a property to a characteristic, has not been discussed in more detail in terminological literature. The discussion mostly concerns the selection of properties (see e.g. Nuopponen 1994) and the fixing of the statements on the basis of the properties. Laurén, Myking and Picht (1997: 112) state that the

choice of method in connection with concept formation depends on the nature of the objects. The analytical method can be applied to material objects or objects that can be □ealize□ng□i. The method starts from statements about the object's properties. When these statements are summed up, the characteristic features of the concept are derived. If the object is a non-materialised phenomenon it is required that the properties are linguistically □ealize□ before they can function as a basis for an intersubjective process of concept formation. (Ibid.)

Based on what kind of properties the characteristics represent, they can be divided into different classes. The classification systems of characteristics in terminological theory concern concepts with material objects, and can therefore not be applied directly to other kinds of concepts (see e.g. Haarala 1981: 20 f.; Arntz & Picht 1989: 56). Temmerman (2000) suggests that a prototype structure of categories could be used when □ealize□n certain types of concepts. As I see it, the problem with this kind of analysis is that the units need to be individually studied, and that the information needed can not be fully described in advance, not even on a general level. (See Temmerman 2000: 122.)

So far there exists no standard system that would be valid in all situations, though such a system considering the nature of LSP communication is most probably possible to build up. Furthermore, the existing arrangements of possible characteristics do not show how the different characteristics are related to each other (except by the division into inner and outer characteristics). However, the decision on which characteristics are primary and which secondary can be assumed to be relevant when describing a concept. One attempt to distinguish between different kinds of characteristics is to regard some of them as essential and the rest as non-essential (Laurén et al. 1997: 112–113; Nykänen & Kalliokuusi 1999).

Below I am first going to discuss how concepts are formed. Secondly, I will present my own view of what a field-specific concept is and how it can be described. Like any other attempt of this kind, my description is also a situation-bound model that can not be supposed to explain or correspond to the multidimensional reality in every respect.

3. An alternative approach

As several researchers have stated, it is necessary for terminology

to define its basic concepts in an unambiguous way in order to be considered a scientific discipline rather than a working method (Sager 1990: 29; Temmerman 2000: 15; Rey 1995: 40). In my opinion, the existing theoretical basis should be strengthened by discussing and developing the theory by using the discipline's own frame of reference, i.e. LSP communication, as a starting-point. In the existing definitions too much is left to individual interpretation.

The existing definitions of the concept of 'concept' both in terminology science and in philosophy show that it is not easy nor even possible to provide a definition that could be accepted by the whole scientific community in every situation. In every definition there is something that can be questioned. This is typical of scientific descriptions. Because a complete definition in this sense seems to be a theoretical ideal, it is in my opinion not expedient to try to aim at a generally applicable, fixed definition. The position that is given to concepts in terminological theory means that it is, nevertheless, necessary to chart which aspects can be associated with them.

3.2 Concept formation

One way to approach the concept of 'concept' is to find out what it means in practice that one has concepts at one's disposal. Moravcsik (1992: 190 ff.) enumerates a number of steps in connection with the development of subjective concepts. Firstly, we "have" concepts when we are able to arrange and sort out. Furthermore, it is necessary to be able to calculate probabilities and handle truth-functional complexities, which means that if one has the concepts of 'hot' and 'cold' one also knows among other things 'not-hot' and 'hot or cold'. One requirement is that one can use a concept independent of the senses. The last two steps in Moravcsik's survey concern the ability to have suitable criteria for the application of the concepts and to be able to consider a concept by for example characterising it and knowing its field of application. (Ibid.)

According to McDonald (1961: 157) forming a concept is classifying or systematically organising stimuli, properties or events with common characteristics. He means the process itself, not a single stimulus or an experience based on it.

Dahlberg (1978: 9 ff.) has discussed how to form a scientific (including human sciences) concept (a unit of knowledge). Dahlberg states that an 'item of reference' (IT) can be either an individual entity (e.g. a

specific river) or a general entity (rivers in general). The first represents individual scientific concepts and the latter general scientific concepts. Scientific concepts are formed through making statements about IT (objects, phenomena, processes, operations, properties, places, periods of time etc.) and by summing up these in a verbal description.

3.2 A way to structure the world

In my description of dynamic concepts the basic idea is that human thinking is based on a priori knowledge without which systematizing and classifying operations within the different scientific fields are not possible.

If a statement holds in every situation, today, tomorrow or after a million years it is a necessary truth which can also be called a priori knowledge. With a priori knowledge I mean in accordance with Hospers (1967) and Ozeki (1987) knowledge that can be verified without being forced to repeatedly control its truth value with regard to circumstances in the world. This kind of knowledge can not, however, mean knowledge that precedes all experience chronologically. According to the rationalistic view, this means that after we have traced certain concepts from our experiences, e.g. the concepts of 'color' and ' extent', we are able to realise that they are connected. Our mind is consequently able to understand certain necessary phenomena and their mutual relations in the reality. (Hospers 1967: 179 ff.) Knowledge of this type is based on the common understanding of the world around us (see e.g. Clark 1992: 54) on the one hand, and on the traditions and principles (including e.g. systems of classification) within the actual field of science on the other hand.

The starting-point for my study can be illustrated with the following model. When drawing up figure 1 I have used Plato's model for reproduction of the cosmos as a starting-point (cf. Filosofilexikonet; Pilke 2000b).

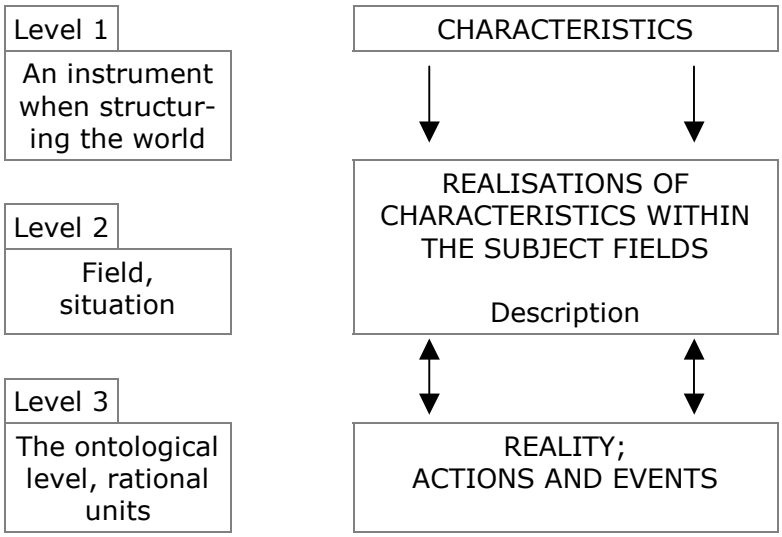

Figure 1. *The conceptual world of dynamic concepts.*

The conceptual world of dynamic concepts consists of three levels in my model. When working with field-specific concepts it is necessary to pay attention to all three levels in the presented model. At the top there is a set of characteristics which together form the model that we use in order to be able to understand the structure of existence. This level (1) is therefore *an instrument which we use to structure the world*. Characteristics form the basis of the knowledge that can be characterised as knowledge a priori. The characteristics (abstractions) can be traced in every concept (of action or event). This makes them universals in a wide sense. My classification system of characteristics includes six classes for concepts of actions *(Agent, Intention, Method, Circumstances, Location and Time)* and four classes for concepts of events *(Influencing factor, The way of happening, Location and Time)*. See Table 1.

Table 1. *Characteristics of dynamic concepts.*

The concept type	CONCEPT OF ACTION	CONCEPT OF EVENT
Characteristic	Agent (Who ?) Intention (Why ?) Method (How ?) Circumstances Location (Where ?) Time (When ?)	Influencing factor (Cause ?) The way of happening (How ?) Location (Where ?) Time (When ?)

Characteristics form the elements for thinking within the different subject fields (level 2 in Figure 1). What characteristics are being realised and how they are realised in the description of the concept depends both on the field and on the situation in which the description is needed. These two guiding factors can be said to build a net in the sense of Kant (1983). The things that are caught in the net are worked up into scientific knowledge by the current traditions within the field. Therefore it is not possible to talk about universals at this level.

An essential idea in my model is that a field-specific concept does not exist until there is a description, i.e. after the abstract characteristics have been realised within a subject field. By a description I do not mean only a standardised definition. Even a consensus on the intension of the concept within the field can be sufficient for specialised communication.

The third level in the model (Figure 1) has relevance when our instrument of thought gets into contact with the reality (cf. Popper 1989: 117). When the abstract characteristics are being realised (= expressed verbally) within a subject field, and a definition is being formulated, the intension of a concept takes one step closer to the ontological level and expresses something about how the world around can be structured into rational units.

As I see it, a field-specific concept is always a mental entity used in the professional mental activity. At the same time a field-specific concept is a unit of knowledge which includes the collected and structured scientific knowledge at some point of time. The nature of scientific knowledge entails that a field-specific concept is also an instrument, a unit of cognition, in the process that creates new knowledge.

The units studied in my investigation are field-specific actions and events. Concepts related to field-specific actions and events have hitherto received relatively little attention within terminological research. When mentioned, the matter of discussion usually is the difficulty of describing these kinds of concepts by using the principles of traditional terminology (see Temmerman 2000: 77 ff.; Sanastotyön käsikirja 1989: 53).

One interesting factor connected with field-specific actions and events is the possibility of describing them otherwise than in terms of the natural language. In my doctoral thesis (Pilke 2000b) I have only briefly discussed the role of non-verbal representations in specialised communication. The use of visual elements in combination with verbal definitions in the LSP framework has, however, proved to be a many-sided and interesting object of research, worth investigating further. In my further research work my intention is to study in more detail the way of using visuals in LSP glossaries.

Below I am going to discuss what possibilities there are of expressing a field-specific action or event by means of a static image. Furthermore, I am going to present some preliminary results from a pilot study concerning images in a medical glossary. In the study I have made an attempt to apply the system of characteristics presented in Table 1 to the non-verbal representations in my material.

The main concerns of my new research project are:

- graphic elements used in non-verbal knowledge representations in order to indicate that the description deals with an action or an event
- metastructure
- interaction between the text (definition & caption) and the visuals
- characteristics in the verbal definitions compared with the visuals representation when it comes to field-specific actions and events

4. Dynamic phenomena and non-verbal elements

Miller and Johnson-Laird (1976: 86) discuss how different concept types are realised and note that it is always possible to return to a static object and make repeated observations, whereas actions and events are

by their nature of short duration. This prevents repeated observations of one and the same action or event.

A graphic image is often the best way of describing the static aspect of concepts which are realised as material entities (cf. Picht 1996: 36 f.; 1999). Concepts which are realised as actions or events can not always be represented by an image because it can be difficult to capture the dynamic aspect – the fact that something is being done or happening – in a static picture. In spite of this fact visuals are also used as representations of actions and events because using them helps communication. The benefits of visuals compared with written text are that with them it is possible to

- give an overall picture of something independent of the language
- emphasise something by choosing a certain perspective (photographs)
- simplify the concept by choosing the most relevant characteristics (drawings)
- interpret them otherwise than linearly; the receiver can choose the relevant information for himself

Furthermore, psychological experiments have shown that the human brain processes visuals better and faster than written messages. It is possible to remember a visual for a relatively long time, and e.g. an image contains generally less inexact features compared with the corresponding verbal definition, which is bounded by the limitations of the linguistic expression. It is also said to be easier for an expert to notice errors in images than in written definitions. (Galinski & Picht 1996; Pakkala 1994.)

So far there has been relatively little research on visuals in LSP texts (cf. Gläser 1979; Kalverkämper 1993). This can be explained by the fact that linguists have been more interested in the written language. Non-verbal elements can, however, be considered as the hard core of an experimental article in science. Visuals are used to extract and rearrange the numerous experiments in laboratories etc. into illustrative figures and numbers. The graphs, tables, drawings and other visual aids tend to sum up the most important data in an article and are therefore often deciphered by experts before they decide to read the whole article. (Magnet 2001; Pettersson 2000)

Magnet (2001) has studied visual representations in research articles in the field of biochemistry. The results show that the corpus chosen is characterised by a strong presence of non-verbal elements. Visuals represent on average 28% of the articles from five different periods (1960–1990). The most common types of visuals in the corpus are tables and figures which represent at least 92 % of all non-verbal items.

Pettersson's (2000) study of lexivisions1 in Swedish encyclopedias in the 20th century shows that under 10% of the articles in the encyclopedias studied have been illustrated with visuals. The proportion of pages with an illustration lies between 40 and 72 %. Pettersson has established 22 different types of articles which are illustrated. Three of these types are connected with actions or events, namely *activities and operations*, *astronomic* and *other natural phenomena*. The most obvious limitation of the naturalistic images according to Pettersson is that they can express only a state of affairs, not a change. When it is necessary to show a process in a visual there are two alternative techniques a) using arrows or b) presentation in sequences (not necessary to use any connecting indicators).

According to Bergenholz and Tarp (1994: 165) illustrations in glossaries are commonly used to complete or otherwise clarify the written special information. The German standard *Önorm* points out that visuals can clarify difficult written definitions:

> "Als konkrete Bilder (Photographie, Zeichnung) von Gegenständen können Abbildungen schwierige Definitionen anschaulicher und verständlicher machen." (Önorm 1990: 19)

Below I am going to discuss some preliminary results of a pilot study concerning visuals in a medical glossary.

4.1 The dynamic aspect

In a pilot study I have studied non-verbal representations in a medical glossary (cf. Pilke 2000a, 2000b). The Swedish medical glossary *Medicinska Ord* includes about 13 000 main entries of which 1662 (13%) are connected with dynamic concepts.

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1 a graphical representation of a restricted subject on a limited surface (e.g. page) where information given in textual and visual form – text, headlines, captions, photographs, diagrams etc. – are integrated into an informative whole (Nationalencyklopedin).

There are 314 non-verbal representations in *Medicinska Ord*, and 35 (11%) of them concern dynamic concepts. Concepts of action are represented by 23 and concepts of event by 12 non-verbal representations. The verbal definition with the non-verbal representation forms a pair in my study. Altogether there are 35 pairs.

The graphical means used to inform the reader of the fact that a representation deals with a dynamic concept are:

- arrows which show the direction of the movement
- drawn lines which indicate that something is going on
- presentation in phases

In the case of actions also the following indicators help us to combine the phenomenon with something that is being done:

- a silhouette, the upper part of the body, the head or hand(s)

The dynamic aspect is, however, not always present in the visuals. The concept 'intubation' for example is connected with an image which represents a patient that has been intubated and the image beside the concept 'gastric banding' represents a stomach (operated). These images focus on the final result of the action or the event instead of on the process.

Ballstaedt (1996: 217) states that the best way of presenting a course of events in static images is to include the following sequences 1) initial state, 2) the event and 3) the final result. In an LSP glossary the space for visuals is always limited. Therefore, it is usually not possible to illustrate every single phase individually as in a technical instruction, for example. In the glossary studied, there are, however, some cases in which the course of events is presented in phases. For example the concept 'artificial respiration' is represented by an image that includes the two phases – blowing in and the victim's breathing out – one below the other.

4.2 Realised characteristics; written definitions – non verbal representations

Three of the in all six classes of characteristics which are realised in the definitions of the concepts of actions can be established also in the non-verbal representations. The classes which do not occur in the visuals are *intention*, *circumstances* and *time*. It can be assumed to be difficult to express e.g. a mental state like intention otherwise than by words.

There are 8 cases in which both the number and the type of the realised characteristics are the same in the written definition and in the non-verbal representation. This does not, however, mean that the two different representations convey identical facts. The tendency is that the written definition includes more information compared with the visual representation. The written definition of 'heart massage' e.g. includes information about how to act (method); "*rhythmical pressing with the palms of one's hands, 80 times per minute, the lower part of the breast-bone against the vertebral column*". The illustration on the other hand shows the right position of the hands on the breast. Both representations thus give information about how the procedure should be carried out but focus on somewhat different aspects, i.e. show those aspects that are suitable for the particular type of concept representation.

There is only one case in which the visual representation supplies information on more characteristics than the verbal one. The visual connected with the concept 'sterilisation' shows both the location and the way of doing it (the instrument used) whereas the written definition only states that the operation is carried out in order to make a person non-fertile, i.e. states the intention.

In the remaining 14 pairs there are more realised characteristics in the written definition compared with the visual. The characteristic *time* seems to be quite common in the verbal definitions, whereas visual representations of the concepts of action in my material totally lack this characteristic.

All four classes of characteristics which occur in the written definitions of concepts of events are realised also in the non-verbal representations.

There are no exactly matching definitions and visuals when it comes to realised characteristics among the 12 concepts of events studied. One of the non-verbal representations includes more realised characteristics compared with the corresponding verbal definition. The concept 'fertilization' is described by an image which shows the different phases, the location of the event and that there is an interval between the cell divisions before the fertilized egg fastens on the womb whereas the verbal definition only mentions the fusion of the two cells. The two representations therefore seem to limit the process somewhat differently. Also in this concept type the class *time* seems to be more common in the verbal

definitions in comparison with the visuals (only one occurrence).

6. Conclusion

The present paper discusses two central concepts in terminology science: the concept of 'concept' and the concept of 'object'. I explain how the two core concepts are described in terminological literature and express my own view of how they could be approached. As I see it, the key issue in terminological work is to start from the field-specific concepts for which I give a functional explanation; they are instruments which are used when structuring the field.

In my earlier study (Pilke 2000b) I have examined how conceptual knowledge is described in written definitions in LSP glossaries and have introduced classes of characteristics for dynamic concepts. In this paper I discuss the benefits and limitations of non-verbal representations in specialised communication. It is obvious that the characteristics are not realised in the same way in the verbal definition and in the visual representation. My pilot study shows that the combination of the verbal definition and the visual can be said to form a whole which represents the concept in an effective way.

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CONCEPTS AS PREDICATIONS, TERMINOLOGIES AS MULTIMEDIAL TEXTS

The interest of the terminology community in objects is primarily a consequence of terminology being a phenomenon of specialized knowledge. Baldinger (1980) quotes Coseriu who says that although 'science uses language, it is concerned with the designated things themselves in that it analyzes these things and makes a statement about them.' Terminology does not quite analyze objects; the interest in objects is indirect, as it derives from preoccupation with concepts, which are the means by which specialized spheres of activity construe reality. The foregoing seems to me to be the nature and limit of terminology's interest in objects, and to explain why concepts have continued to be on the front-burner of theoretical discourse.

In her paper, Pilke proposes a model of concept formation against the backdrop of what she and sources reviewed by her see as problem areas in the theoretical discussion on concepts. These problem areas include: formation of concepts; determination of what exactly a concept is a unit of; what the starting point of terminological analysis should be (concepts, or other entities); and the relationship of concept characteristics to object properties. Pilke's model, which is limited to a class of concepts ('dynamic concepts') that are typically associated with nominalizations, requires that we start with an *a priori*: there are knowledge primitives or classes of characteristics that can be found in every dynamic concept, and these primitives or abstracted classes can be pre--specified, and are generally available for disciplinary systematizing and classifying operations. For action concepts, a subtype of dynamic concepts, the primitives/characteristics are *intention*, *method*, *circumstances*, *location* and *time*. For event concepts, the second subtype, the characteristics are *influencing factor*, *manner of happening*, *location* and *time*.

These characteristics/primitives are universals, and are realized somewhat differently in the dynamic concepts of different subject fields and in different situations of analysis. In other words, a field and a situa-

tion of analysis determine what characteristics are chosen for a dynamic concept from the universe of characteristics existing prior to apprehension. These realized characteristics, which constitute predications (definitions, descriptions, etc.), then provide a given subject field its grip or handle on reality. Differently stated, these complexes of characteristics provide a means for structuring and understanding reality in a sphere of specialized activity. In the text upon which my discussion is based, Pilke writes that 'a subject field-specific concept does not exist until there is a description, i.e. after the abstract characteristics have been realized within a subject field. By a description, I do not mean only a standardized definition. Even a consensus on the intension of the concept within the field can be sufficient for specialized communication.' It is from this association of concepts with some form of predication that I derive the first part of my title.

Although Pilke's description of contentious issues in the terminological discourse on concepts does not appear to sufficiently take into account a number of unifying, pluralist frameworks, e.g. Picht (1997) on different, non-abstraction modes of concept formation, Budin (1994) on concept formation in the social sciences, Antia (2000) on status of concepts being linked to parameters like life-cycle, disciplinary interest, and domain of incidence, the model she develops against the backdrop of her premises enables her to take a position on a number of pertinent issues.

With respect to what exactly a concept is a unit of, her answer is that a concept is simultaneously a mental entity associated with mentation in a professional sphere; a unit of knowledge comprising all that is known about an item of reference; and a unit of cognition in the sense of (possibly varying but domain circumscribed) attempts to come to terms with (evolving) reality.

With respect to the relationship between object properties and concept characteristics, the question hardly arises with her kind of data, given that characteristics have become primitives that are differently employed by areas of specialized activity in apprehending reality. The changed emphasis, moving from object properties to concept characteristics, would seem quite appropriate in light of the claim I make at the beginning on the nature and limits of terminology's preoccupation with objects. One would of course be interested in a demonstration of how these frame-like primitives fare with concepts that are not dynamic.

With respect to terminology operating with an entity as unstable/ mutable as a concept, for which reason Pozzi (1999) posits definitions as a starting point for terminological analysis, Pilke's answer from the quotation above seems to be that that there is no difference between a concept seen as a realization of field-specific characteristics and some form of predication. I agree, and I might elaborate further. Pozzi (1999) brilliantly demonstrates that definitions of the concept in various terminological sources are strikingly dissimilar in the element that serves as genus. To my mind this is a tragedy if one admits of only one type of definition in terminology. Sources in terminology are, however, replete with typologies of definitions. But more substantively, changing the focus from concepts to definitions assumes that definitions are not prone to the same problems associated with concepts. Except a definition operates with a category other than characteristics, it faces the same challenges that lead prototypicalists to a characterization of entities that is based more on family resemblance than on feature specification. For appraisals of prototypicality in relation to feature specification, see Sowa (1984:17), Wierzbicka (1996) and Antia (2000:108ff). Besides, if definitions have to be 'fixed and not left to individual interpretation' as Pozzi suggests, why can the same not be done with concepts ? This is precisely what Pilke and others do when they view the concept exclusively from the standpoint of disciplinary predications or statements concerning an item of reality.

In its barest essentials, Pilke's model is quite consistent with a number of models (Felber, Budin/Galinski/Nedobity/Thaller, Shifko and Dahlberg) reviewed in Antia (2000: 86-96), to the extent that it is a discipline that provides the grid or net for selecting characteristics – whether one moves from object properties or, interestingly as Pilke does, from concept characteristics. What is particularly novel in Pilke's work is the detailed treatment of a category of concepts (dynamic concepts) slighted at the inception of terminological studies, but for reasons external to terminology: reification in scientific and technical discourse, or 'arresting life as a noun' as Halliday would put it.

Pilke takes innovation a step further by exploring visual semiotics, and how such non-verbal resources are used to represent dynamic concepts in glossaries. From the biased standpoint of one who has explored the textuality of terminology resources (Antia 1998), it is tempting for me to describe Pilke's latest effort as amounting to a view of specialized glossaries as texts which, like many scientific and technical texts, are semiotic hybrids.

Pilke's objectives in this regard are reducible to three: a) determine what (typo)graphical elements are used in non-verbal representations of concepts of action and events in glossaries; b) understand the general organization of visual semiotics; and c) analyze the relationship between the verbal definition of dynamic concepts in glossaries studied and the visual representation.

Rather than repeat her findings, I attempt to furnish some points of theory and lines of further research, both based on Lemke (1998) and cognizant of Pilke's objectives. This attempt should also build a bridge between Pilke's work and the increasingly popular research direction on visual semiotics in (non-terminological) science writing.

Textualization in science is ineluctably a case of semiotic hybridization because concepts of science, according to Lemke, are 'simultaneously and essentially verbal, mathematical, visual-graphical and actional-operational.' If this is the case, then writing scientific/technical texts (including specialized glossaries) would, depending on the nature of the specific field of specialized endeavor, amount to navigating in multi-canal or -medial waters: a verbal expression here, a drawing there; a formula upstream, a chart downstream. This is the case because verbal language is relatively inadequate in what Lemke calls the topological dimensions of meaning, that is, in the expression of non--linearity, size, shape, gradation, degree, varying proportionality, iterativity, etc. It is perhaps a lot easier to use visuals to show how to lace a shoe than to describe the process verbally.

The meaning-making process in a scientific text (including a specialized glossary) involves three aspects corresponding to three metafunctions of language. There is the presentational aspect (corresponding to the ideational or thematic metafunction) which states or specifies a set of processes and participants. In some other language function typologies, this is the declarative/informative function. Visually, this is constructed as a scene recognizable as an interaction of objects, actions and events.

Secondly, there is the orientational aspect (corresponding to the interpersonal metafunction, or the phatic *cum* evaluative in other typologies) in which the verbal and the visual meaning-making process see the originator of the text do either or both of the following: orient towards the chosen set of objects, actions and events by commenting on them, or orient the addressee by emphasizing aspects of the presen-

tation. Visually, this may be expressed in part by the notion of views/ angles/sections and by labels/legends.

There is finally the organizational/situational aspect (corresponding to the textual metafunction) in which verbal and visual meaning-making expresses relations of parts and wholes, not just of objects but also of processes. Visually, structure/organization may be expressed through the use of arrows, color and texture, sequences of visuals, etc.

The above trifunctional perspective enables one to see how meaning can be multiplied in a multimedial genre, 'how we can mean more, mean new kinds of meaning never before meant and not otherwise mean-able' (Lemke 1998: 93). This perspective also enables us to see what information goes through different media or channels in about the same volume and with near equivalent effects; it allows us analyze the complementary distribution principle as it relates to information and medium. Is there, in other words, information which, when presented in one medium, is not expressed in another ?

Pilke's research report of non-verbal representations of dynamic concepts in a Swedish medical glossary has addressed the presentational and organizational aspects of meaning-making. She has also reported on the complementary nature of the channels. Other workers may wish to join this enterprise by using data of other kinds (architecture, engineering, music, etc.) to explore further the presentational, organizational and complementary aspects which Pilke addresses, in addition of course to the orientational perspective. The latter perspective holds the promise of making possible a comparison between multidimensionality of static concepts in verbal description and multidimensionality of dynamic concepts in visual mode.

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THE 'CONCEPT' AND THE 'OBJECT' IN TERMINOLOGY SCIENCE

1. Introduction

Two of the four basic elements of theoretical terminology have been analysed and discussed in the first part of Nina Pilke's (2001) presentation: *concept* and *object*. The current problems of defining and characterising these two elements have become all too evident to ignore them. In the second part she proposes an alternative way to approach both *concepts* and *objects* depending on the specific actions or events in a given subject field.

From what she has just said in the first part of her paper, regarding the concepts of *concept* and *object* there are some issues on which most terminologists agree, others where there seems to be no consensus and others that present various degrees of theoretical difficulties. Based on Pilke's presentation, I shall concentrate on pointing them out in a fairly schematic way.

2. Concept

Without a doubt, the concept of *concept* in terminology is the most important one, since terminology deals with knowledge, and the basic element of knowledge is a concept: there is no knowledge without the underlying concept. However, the fact that concepts are relevant in terminology does not imply that the concept of *concept* is clear-cut, theoretically problem-free nor that terminologists agree on what has been said about concepts or on the specific role of concepts in terminology.

2.1 Agreements

Most terminologists accept that concepts are important in terminology:

- Regardless of different schools of thought and orientation terminologists tend to agree on the relevance of concepts in terminology. At least, no one has denied it.
- Since the main two functions of terminology are knowledge representation and knowledge communication, it may be inferred that terminology is closely related to knowledge. Knowing '*x'* implies having acquired the concept *'x'* . Therefore, knowing '*x*' when '*x*' belongs to specialised knowledge implies that '*x*' is a concept of a special field of knowledge.
- Concepts are built from objects by a process of abstraction of their properties. In particular, this statement holds true whenever a concept is being formed from an existing object through sense perception.

2.2 Disagreements

Even though terminologists agree about the existence and relevance of concepts in terminology, there are some fundamental issues on which there is no consensus. For example:

- The nature and essence of concepts are not yet known. For twenty five centuries philosophers, psychologists, logicians, neurologists and others have tried to no avail to understand what concepts are. Many theories have emerged revealing only that there are nearly as many varied and sometimes violently opposed positions as there are researchers on this field. Alarming, however, is the fact pointed out by Rey (1995:35) as regards terminology and its lack of a formal theory of concepts considering their significance for the discipline.
- As a natural consequence of not knowing its essence and nature, it is nearly impossible to define *concept* in terminology, as in any other discipline, in a unique manner and to differentiate it unequivocally from neighbouring concepts. Several distinguished terminologists and terminology committees have tried to define *concept*, and although most of these definitions refer to a mental activity (Pozzi 1999), some treat it as 'unit of thought', while others treat it as a 'unit of knowledge', and yet others as a 'mental construct' or simply as a 'set of characteristics'. As Pilke has just pointed out, those definitions emphasise different aspects of the *concept* but none of them actually expresses the 'complete and unique' set of essential characteristics that make up the concept of *concept* . So there are some questions that still remain: *what are*

concepts ? do the really exist ? how can their intension and extension be uniquely and unequivocally determined ? what is their real importance for terminology ?

- Although many researchers accept the idea that the *concept* is the starting point of all terminological activities, there is a growing concern about this issue and it has started to be questioned. Authors like Cabré (1999), Temmerman (2000) and Pozzi (1999; 2000) have stated that the only starting point of terminological activities is the term or other designation found in specialised discourse, since in order to know which concept is being dealt with it is usually necessary to have its designation and its meaning. In real life conditions this means that terms are identified from texts and not from those abstract and elusive entities called *concepts*.
- Many terminologists agree on the fact that there should be a biunivocal relation between a concept and its designation, i.e. for each concept there should be one and only one term that designates it and conversely, each term should be the designation of one and only one concept. This issue is now widely questioned as anyone doing terminography would have acknowledged the impossibility of this ideal situation. Not even after a term / concept has undergone a standardisation process, can synonyms and homonyms be completely eliminated. In fact, in accordance with real life conditions it has to be accepted that the relationship concept ↔ designation is, in general, many to many, and only in very few cases it is necessary to establish a one to one relationship, for example in air-control or the military fields. For a detailed discussion on this subject see Cabré (1999).
- Some researchers suggest that scientific and technical concepts are universal, in the sense that they should be unaffected by cultural differences. Again, terminologists working in real life conditions have realised that this seldom happens. On occasions concepts and systems of concepts differ from one language to another and from one cultural system to another. Concepts are expressed and named through language, and language, nearly always, is culture-dependent.

2.3 Theoretical difficulties about concepts

There are some intrinsic theoretical difficulties with the concept of *concept* in general and in particular, within the field of terminology:

- Since it is not known what a *concept* is, it is impossible to know which characteristics (essential and non-essential) make up the

concept of *concept* and therefore it is also impossible to define *concept* by means of an intensional definition in the strictest sense. This explains why from the many existing definitions of (in terminology) none of them could actually be considered the one that truly represents the concept of *concept*, and what is worse, there is no way to validate any of them.

- Following the above discussion and applying it to other subject fields, it cannot be expected that every single concept / term will be defined in terms of essential characteristics for these are not always known, identified or agreed upon. Even concepts built from concrete objects are sometimes difficult –if not impossible- to define by means of a unique undisputed set of characteristics. A theory of terminology should account for this and similar situations.
- Since every concept should be defined in terms of known concepts it may be assumed that specialised knowledge (the knowledge specific of a subject field) is recursive, so there should be at least one *primitive concept* in every subject field that cannot be defined in terms of known concepts that belong to the same subject field. These primitive concepts are usually defined in terms of concepts belonging to other subject fields. A theory of terminology should account for this situation.
- In practice, when writing definitions for a specialised vocabulary or other terminological product, the complete set of characteristics that make up a concept is not explicitly available. Sometimes the time needed to make an exhaustive research to gather it, multiplied by the number of concepts to be defined, would make the particular project non-viable, so a more practical solution has to be found and accounted for in a theory of terminology.

3. Object

Regarding the concept of *object*, although it has not received as much attention as the concept of *concept* from the terminological perspective, there are also some agreements and some disagreements. For example:

3.1 Agreements on the concept of 'object'

- Since *object* is a very basic and common item of everyday life, most researchers agree on its definition, which happens to coin-

cide with the general language definition: “anything perceivable or conceivable” (ISO 1087-1:2001). Objects can be material or concrete, immaterial or abstract, imagined, possible or impossible. For terminological purposes, any of these types of objects can be the object of study in terminology, even impossible objects like a regular decahedron or an imaginary one, like a unicorn.

- Terminologists do not have problems in accepting that concrete or material objects can be observed by senses or instruments and are located in space and time. Likewise, as Pilke has just stated, abstract objects exist outside this world, do not have any determination in relation to time or space and cannot be perceived by senses.

3.2 Disagreements on the concept of ‘object’

- There is a discussion on whether abstract objects are concepts, and if not, then what is the difference between them ? Are concepts themselves objects ? Abstract objects can only be differentiated from concepts at the philosophical level.
- There is also some discussion on whether it is possible to form more that one concept from a single object / class of objects or to form partial concepts from the concept that represents a single object / class of objects. When dealing with objects belonging to several subject fields, each subject field only takes the essential characteristics needed to build that concept in that particular field, ignoring the rest which may be needed to characterise the same object in a different subject field. The question is then if it is possible to build several concepts from one object /class of objects. If this is the case, then all those concepts should have different designations even though they name the same object. Or perhaps a general concept consists of a complete set of essential characteristics and when only a subset of those characteristics is needed to build that concept in a particular field, then it is not a new concept that is formed but a partial one, which may have the same designation as the general concept and other associated partial concepts.

4. Properties and characteristics

An object has properties that distinguish it from other objects. The abstraction of a property constitutes a characteristic. A unique set of characteristics make up the corresponding concept. As ‘property’ and

'characteristic' are two important concepts in terminology, it is worth mentioning the main agreements and inherent difficulties posed by these two concepts:

4.1 Agreement

- Terminologists agree that a characteristic is an abstraction of a property of an object or a class of objects. This implies that the set of properties of an object or a class of objects are abstracted into the set of characteristics of that object or class of objects, and this set of characteristics constitute a concept.

4.2 Difficulties

- As pointed out by Pilke, it is not always possible to differentiate properties from characteristics, as these, in turn, are themselves concepts corresponding to an object / class of objects with particular properties and characteristics. Even more, for centuries philosophers were not able to differentiate properties from concepts. It was until the end of the 19th century that Frege insisted in differentiating them. Nowadays, most philosophers accept the difference between property and concept.
- Regarding properties and characteristics, the main problem in terminology is the selection of characteristics (that represent properties) used to characterise a concept in a unique way. Given a set of characteristics of an object belonging to a specialised field of knowledge, there is only a very dim probability of two or more specialists selecting exactly the same subset of essential characteristics that identify the concept unequivocally, i.e. this selection is always subjective and is affected by several factors including cultural and linguistic heritage, personal experience, school of thought, etc. This means the concept in question will be characterised in more than one way. Here is where prototype and stereotype theories come in hand. It must not be forgotten that 'essential' (including delimiting) characteristics are used to define concepts. The point to be made here is that any two definitions of the same concept within the same subject field and drafted for the same purpose should be equivalent (by equivalent here it is meant that, except for individual stylistic variation, they should all convey the same information). This obviously does not happen in practice. In particular, the characterisation of concepts representing abstract objects belonging to the social sciences or the humanities is highly

unlikely to coincide with any other characterisation made by someone else. Again, a theory of terminology should account for this and similar situations.

- Objects that are not properly understood or known cannot be characterised by a unique set of properties and characteristics, simply because these are not known, even though the object is known to exist. The implication of this situation for drafting (intensional) definitions is overwhelming. However, this does not mean that those objects cannot be defined, it only proves that different types of definitions other than intensional and extensional should be formally accepted in a theory of terminology.
- A concept consists of a unique set of characteristics. This implies that once a set of characteristics has been put together a concept is formed. On the other hand, when a concept is conceived for the first time a number of characteristics are associated to it. Therefore, in this case, the concept is conceived before or at least at the same time as the set of characteristics are associated to it.

5. Knowledge

Considering that terminology is mainly concerned with knowledge representation and knowledge communication, it is surprising that there is almost no available literature on the subject of knowledge from the terminological perspective. There is not even a definition of knowledge in any terminological document, vocabulary or standard.

6. Concluding remarks

These presentations show that the two basic concepts of terminology dealt with this afternoon are far from being straight forward both from the theoretical and the practical points of view. There are only a few points on which most terminologists agree, many on which there are varied and opposed views and all of the basic concepts of theoretical terminology present various degrees of theoretical difficulties.

Finally, table 1 at the end of this paper contains a brief, but by no means exhaustive, list of the elements on which there is certain consensus, where there are varied and opposed views and some of the difficulties involving the basic concepts of theoretical terminology.

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	AGREMENTS	DISAGREEMENT	THEORETICAL DIFFICULTIES
CONCEPT	• Concepts are relevant in terminology • Concepts are fundamental to terminology and to knowledge • Concepts are built from objects by a process of abstraction	• Nature and essence of concepts are not known • Impossible to determine in a unique way its characteristics • Concepts are / are not the starting point of terminological activity • Concepts are / are not in a biunivocal relationship with terms • Concepts are / are not universal	• Concepts cannot always be defined by means of intensional definitions • It is not always possible to determine always a unique and undisputed set of essential characteristics of a concept • If concepts are defined in terms of known concepts within the same subject field and assuming knowledge is recursive, there is at least one concept that cannot be defined in terms of known concepts within that subject field • Research time to find an exhaustive list of characteristics make project non-viable
OBJECT	• Definition of *object*:: anything conceivable or perceivable • Concrete objects are observed by sense perception while abstract objects have no determination in relation to time and space and cannot be perceived by senses	• Are abstract objects identical to concepts ? If not, how exactly do they differ ?	• Is it possible to have more than one concept for an object / class of objects ? or is it possible to build partial concepts for objects belonging to several subject fields ?
PROPERTIES AND CHARACTERISTICS	• Characteristics are abstraction of properties ob objects		• It is not obvious the set of essential characteristics that make up a concept. Their selection at any given time is influenced by numerous factors such as cultural and linguistic heritage, personal experience, school of thought, etc. • Objects that are not properly understood or known cannot be characterised by a unique set of properties and characteristics • Are concepts conceived and then a set of characteristics is associated to it or a set of characteristics is put together and then the concept is formed ?

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REPRÄSENTATIONSFORMEN IN DER TERMINOLOGIE

Wenn heute von Repräsentationsformen gesprochen wird, so ist dies eine von neueren Ansätzen ausgehende, zusammenfassende Einteilung von traditionellen sprachlichen und anderen, ebenfalls bekannten nichtsprachlichen Formen der Gegenstands- und Begriffsrepräsentation, die jedoch im Rahmen der Terminologie nur selten zusammengedacht wurden. Die Notwendigkeit, einen weiteren Rahmen für eine zweckmäßige Einteilung zu schaffen, ergibt sich aus der Erkenntnis, daß ein Begriff oder ein Gegenstand grundsätzlich auf zweierlei Weise repräsentiert werden kann: sprachlich und nichtsprachlich. Dieser übergeordnete semiotische Ansatz hat auch in den Begriffsapparat einiger theoretischer terminologischer Ansätze Eingang gefunden.

Eine Analyse der neueren Literatur erlaubt es, folgende Übersicht aufzustellen:

Repräsentationsformen für Gegenstände und Begriffe

sprachliche	***nichtsprachliche***
Name	Fotographie
Benennung	Porträt
Paraphrase	Zeichnungen verschiedener Art
(Formel/Symbol)	Graph
Fachwendung	Piktogramm
Definition	Notation
Erklärung	Formel/Symbol
Beschreibung	

Wir sind uns durchaus bewußt, daß diese Aufstellung nicht vollständig sein kann, da neue Techniken heute nichtsprachliche Repräsentationsformen – man denke z.B. nur an mehrdimensionale Formen ver-

bunden mit lautlichen Repräsentationen - erleichtern oder erst ermöglichen, die früher nicht oder nur mit großem Aufwand realisierbar waren. Sie werden in Zukunft in die terminologische Forschung einbezogen werden müssen. In dieser Darstellung soll jedoch von Repräsentationen, die nur durch die Sinne Geschmack, Geruch, Gehör (abgesehen von Sprache) und Tastsinn wahrnehmbar sind und von Kombinationen, abgesehen werden, da sie z.Z. in der Terminologie noch keine dominierende Rolle spielen und wenig erforscht sind.

Sprachliche Repräsentationsformen

Name:

Der Name als Repräsentationsform für Gegenstände wird in den meisten terminologischen Ansätzen vernachlässigt, doch hat die letzte Version der einschlägigen ISO-Normen hier Abhilfe geschaffen. Geht man davon aus, daß eine Grundfunktion der Terminologie der Wissenstransfer ist, kann nicht davon abgesehen werden, den Gegenstand in die Wissensrepräsentation einzubeziehen, da in einer ganzen Reihe von Wissenschaften Gegenstände ein fester und unabdingbarer Teil des fachlichen Wissen sind, z.B. ist die Geschichtswissenschaft ohne Gegenstände nicht denkbar.

Benennung:

Es herrscht weitgehend Übereinstimmung darüber, daß eine Benennung einen Begriff repräsentiert und daß eine Benennung aus einem oder mehreren Wörtern bestehen kann.

Was eine Benennung darüber hinaus ausmacht, wird von verschiedenen Ansätzen unterschiedlich aufgefaßt.

In einem spanischen Ansatz unterscheidet man z.B. zwischen Benennungen (términos) und Parabenennungen (paratérminos). Der Unterschied besteht darin, daß das Substantiv einer Benennung eher der Gemeinsprache zugerechnet wird, wogegen das Adjektiv eine klare fachkommunikative Bindung hat, z.B. 'problema asmático'.

Nach diesem Ansatz werden Nomenklaturen als nicht zur natürlichen Sprache gehörend aufgefaßt und fallen somit nicht unter die Benennungen. Ferner werden Verbalsubstantive zur Gruppe der Fachwendungen gerechnet.

Andere Ansätze folgen dieser Einteilung nicht. In der Regel werden Nomenklaturen als besondere Unterart der Benennung betrachtet. Die Frage, was zur natürlichen Sprache gehört, spielt in diesen Ansätzen eine untergeordnete Rolle. Auch ist es wohl kaum möglich, eine klare Trennung zwischen natürlicher und kontrollierter Sprache vorzunehmen.

Die Länge bzw. die formale Komplexität einer Benennung ist aus pragmatischer und formaler Sicht interessant. Weitgehende Einigkeit besteht darüber, daß die Benennungsgrenze in Texten durch den repräsentierten Begriff bestimmt ist. Aus einem pragmatischen Gesichtswinkel werden zunehmend alle Wörter und Wortverbindungen als Benennung angesehen, wenn sie nur einen zu einem Fachgebiet gehörigen Begriff bezeichnen. Dies gilt auch, wenn dieser Begriff und seine Benennung in der Gemeinsprache - wie diese auch immer definiert und abgegrenzt werden mag - bekannt ist oder zu mehreren Fachgebieten gehören kann, was oftmals bei übergeordneten Begriffen der Fall ist.

Synonymie als Manifestation verschiedener Ebenen der Fachkommunikation ist weitgehend anerkannt und steht nicht im Gegensatz zur Normung im weitesten Sinne. Die Bedeutung, die heute den pragmatischen Elementen einer Benennung beigemessen wird, läßt sich leicht aus den Informationen ersehen, die zu einer Benennung in eine moderne terminologische Datenbank aufgenommen werden.

Paraphrase:

Die Paraphrase als terminologische Repräsentationsform für Begriffe ist noch wenig erforscht, doch liegen erste Arbeiten vor, die darauf hinweisen, daß Paraphrasen als Repräsentationen von Begriffen auftreten und aller Voraussicht nach texttypenabhängig sind. Die Paraphrase übernimmt somit in einem Text die Funktion der Benennung, was sie folglich zu einer Form der Begriffsrepräsentation macht.

Formel / Symbol:

Die Anwendung von Formeln bzw. Symbolen ist nicht neu. In einem Text haben sie die Funktion von Benennungen und können zumindest in der mündlichen Wiedergabe durch sprachliche Zeichen repräsentiert sein. Ob sie dadurch jedoch zu einem sprachlichen Zeichen werden, ist fraglich, da die gleiche Formel bzw. Symbol ohne Veränderung der graphischen Form in verschiedenen Sprachen unterschiedlich mündlich wiedergegeben wird. Die graphische Form kann also nicht einer bestimmten natürlichen Sprache zugeordnet werden. Der

graphischen Form nach gehören diese Repräsentationsformen zu den nichtsprachlichen Zeichen, ihrer Funktion nach jedoch sind sie Benennungen. Sie nehmen eine Zwitterstellung ein und treten oft als Synonyme auf und werden als solche behandelt.

Ferner sollte nicht vergessen werden, daß gerade Symbole einerseits normbar sind - z.B. in den Naturwissenschaften und deren Anwendungen - andererseits aber auch stark kulturabhängig sein können, was besonders auf die Gesellschaftswissenschaften zutrifft.

Fachwendung

Die Fachwendung wurde lange Zeit vorwiegend als rein linguistisches Phänomen betrachtet und weniger aus der Sicht der Begriffsrepräsentation behandelt. Das läßt sich deutlich aus der Klassifizierung solcher Daten in terminologischen Datenbanken ablesen, wo die Fachwendung in der Regel zur Gruppe der Sprachdaten und nicht der der Begriffsdaten gerechnet wird. In neueren Studien wird dafür argumentiert, die Fachwendung als Begriffsrepäsentation aufzufassen, da sich hinter dieser Repräsentationsform definierbare Fachbegriffe verbergen, die bei der terminologischen Analyse wie Begriffe bearbeitet werden sollten. Die Diskussion über den Status der Fachwendung als Begriffsrepräsentation ist noch nicht abgeschlossen. Es ist jedoch absehbar, daß eine Statusänderung der Fachwendung auch Änderungen im theoretischen und anwendungsbezogenen Bereich erforderlich macht. Eine Fachwendung wie 'Sperrmüll entsorgen' repräsentiert einen eigenen Begriff und kann, wenn man dem Prinzip 'ein Begriff - ein Eintrag' folgt, weder unter dem Eintrag 'Sperrmüll' noch 'entsorgen' angeführt werden.

Definition

Die Definition als Begriffsrepräsentation ist unumstritten. Es gibt Regeln für das Formulieren von Definitionen und im übrigen eine umfangreiche terminologische Literatur zur Definition. Vorgelegte Einteilungen weichen zwar voneinander ab, haben in ihrer Grundsubstanz jedoch zwei Wesenszüge gemeinsam:

1. die wissensvermittelnde Funktion
2. die wissensordnende Funktion, d.h. die Angabe der Begriffsbeziehung zu übergeordneten Begriffen.

Einigkeit besteht auch darüber, daß

- Definitionen Texte sind, die pragmatischen Gegebenheiten unterliegen,

- sie immer nur einen Ausschnitt des Gesamtwissens über einen Begriff bieten können,
- sie eine begriffsunterscheidende Funktion haben,
- sie in der normenden Arbeit auch eine begriffsfestlegende Funktion erfüllen können.

Sie sind in allen Fällen Texte, die nach der terminologischen Analyse für einen bestimmten Zweck erstellt werden und formalen Anforderungen entsprechen sollen. Sie sind in gewissem Sinne kontrollierte Sprache.

Erklärung

Die Erklärung ist eine weniger formalisierte Form der Begriffserklärung, die den strengeren Regeln der Definition nicht genügen muß. Ihrer Funktion nach ist sie ebenfalls wissensvermittelnd, doch nicht notwendigerweise begriffsordnend. Oft ist sie wortgetreu aus dem Dokumentationsmaterial, das die Grundlage für die terminologische Analyse bildet, entnommen und somit ein Textteil, der ursprünglich für einen anderen Zweck formuliert worden war, für die terminologische Analyse jedoch wesentliche Wissenselemente enthält. In Erklärungen fehlt oft die Angabe von übergeordneten Begriffen. Erklärungen finden sich oft auch als für einen Eintrag direkt formulierte Texte in Verbindung mit punktuellen Untersuchungen. Neuere, noch nicht veröffentlichte Untersuchungen haben ergeben, daß Erklärungen in Fachtexten offensichtlich weit häufiger vorkommen als Definitionen.

Beschreibung

Unter Beschreibung verstehen wir die verbale Repräsentation eines Gegenstandes. In der terminologischen Literatur finden sich nur wenige Hinweise auf diese Repräsentationsform. Da Wissenstranfer sich jedoch auch auf Gegenstände bezieht, muß eine geeignete Repräsentationsform, die in der Praxis bereits seit langem besteht, auch in den Begriffsapparat der Terminologie aufgenommen werden.

Nichtsprachliche Repräsentationsformen

Diese Repräsentationsformen sind ebenfalls nicht neu, sie wurden in der Terminologie, dort wo sie eine erklärende Funktion erfüllen konnten, schon immer angewendet. Diesen Repräsentationsformen wurde in den meisten terminologischen Standardwerken lediglich eine Hilfsfunk-

tion zugewiesen.

Diese Auffassung hat sich in den letzten 10 Jahren, zumindest in einigen terminologischen Ansätzen, die in einem breiteren semiotischen Rahmen arbeiten, geändert, was sich auch in der einschlägigen Literatur widerspiegelt. In den neueren terminologischen Grundsatznormen ist diesen Ansatz ebenfalls sichtbar.

Die sich abzeichnende Statusänderung der nichtsprachlichen Repräsentationsformen beruht vor allem auf der Erkenntnis, daß in einer Reihe von Fachbereichen ein besserer, sichererer und schnellerer Wissenstransfer durch diese Repräsentationsformen erreicht werden kann. Wenn wir z.B. Wüsters Wortmodell betrachten, wird durch die visuelle Dimension die Perzeption wesentlich erleichtert und beschleunigt. Dies gilt auch für eine ganze Reihe von nichtsprachlichen Darstellungen in anderen Fachgebieten. Dazu kommt, daß diese Darstellungsformen in einigen Fachbereichen die einzigen funktionalen und pragmatisch akzeptierten Wissensrepräsentationen sind, z.B. technische Arbeitszeichnungen oder Bauzeichnungen. Für eine Baugenehmigung ist eine Zeichnung unerläßlich; sie ist fester Bestandteil der amtlichen Dokumentation.

Fotografie

Die Fotografie kann nur als Repräsentation von Gegenständen dienen, die obendrein fotografierbar sein müssen. Bilder dieser Art können lediglich eine Beispielfunktion haben, nicht aber eine Begriffsrepräsentation ersetzen. Zwar haben moderne Techniken den Anwendungsbereich der Fotografie stark erweitert, z.B. dreidimensionale Luftaufnahmen, Fotomontagen und –manipulationen, Blickwinkelveränderungen etc., doch bleibt die Fotografie prinzipiell auf die Wiedergabe von Gegenständen beschränkt. Einen gewissen Übergang kann man jedoch dort feststellen, wo ein Foto der Ausgangspunkt für eine computererzeugte Zeichnung ist, die nicht mehr den Charakter einer Gegenstandsrepräsentation hat und vom Betrachter als Begriffsrepräsentation aufgefaßt wird.

Porträtähnliche Wiedergaben

Auch diese Repräsentationsform ist nur auf Gegenstände anwendbar. Ihre Präzision kann von der Sichtweise des Malers oder Zeichners subjektiv beeinflußt sein. Neben plastischen Wiedergaben ist diese Re--präsentationsform vor der Erfindung der Fotografie die einzige gewesen, die uns Wissen über Gegenstände und deren Aussehen in graphischer Form vermitteln konnte. Da das subjektive Element jederzeit vorhanden

ist, ergibt sich daraus auch die kulturelle und perzeptionelle Abhängigkeit dieser Darstellungsform, die obendrein auch eine diachronische Dimension haben kann.

In bestimmten Fachbereichen ergänzen sich Fotografie und Zeichnungen, z.B. in der Archäologie.

Zeichnerische Wiedergabe von Begriffen soll hier im weitesten Sinne verstanden werden. Hinsichtlich der Formen sind mehrere Klassifikationen vorgelegt worden. Sie umfassen zumeist technische Zeichnungen und Diagramme verschiedener Art, Piktogramme etc., aber auch sehr stark figurative Darstellungen.

Als relativ gesichert kann angesehen werden, daß
- Formen nicht an bestimmte Fachgebiete gebunden sind,
- bestimmte Formen von gewissen Fachgebieten bevorzugt werden,
- die Anwendungshäufigkeit nichtsprachlicher Repräsentationsformen in den verschiedenen Fachgebieten sehr unterschiedlich ist,
- diese Repräsentationsformen Abstraktionsgrade haben können,
- die meisten nichtsprachlichen Repräsentationsformen zusammen mit verbalen Formen auftreten.

Diese Art der Repräsentation eignet sich sowohl für Begriffe als auch für materielle und immaterielle Gegenstände.

Notationen in Klassifikationen, Begriffssystemen, Katalogen (z.B. in Museen) etc. gehören ebenfalls zu den nichtsprachlichen Begriffs- und Gegenstandsrepräsentationen. Sie treten in Texten auf und sind in der Regel sprachunabhängig.

Konklusion

Zusammenfassend kann festgestellt werden, daß es zwar verschiedene Auffassungen darüber gibt, wie Begriffs- und Gegenstandsrepräsentationen klassifiziert werden sollten, wobei zwischen engeren, eher linguistisch-traditionellen Ansätze und weiter gefaßten, semiotischen Ansätzen unterschieden werden kann. In terminographischen Produkten werden jedoch nach wie vor sprachliche und nichtsprachliche Repräsentationsformen verwendet, da die Fachkommunikation sie einfach erforderlich machen.

Zweifellos gibt es eine Reihe von sprachunabhängigen Repräsentationsformen, z.B. in der Mathematik und Logik. Dem steht jedoch die überwiegende Mehrzahl von kulturabhängigen konventionalisierten nichtsprachlichen Repräsentationsformen gegenüber, deren Bedeutung einfach erlernt werden muß, um sie als Kommunikationsmittel anwenden zu können – auch die Abbildungen der Höhlenmalerei waren schon Konventionen unterworfen. Darstellungen, die diesen Konventionen nicht folgen - oder im Falle des Verlusts des Wissens über diese Konventionen – sind nicht zu dekodieren.

Im Rahmen eines erweiterten Linguistikkonzeptes, wie wir es in unserem ersten Vortrag angesprochen haben, erscheint es daher sinnvoll, einem semiotischen Ansatz den Vorrang zu geben und Repräsentationsformen in ihrer kommunikativen Gesamtheit und Interdependenz zu erforschen und zu behandeln.

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Margaret Rogers

'CLINES' AND BOUNDARIES: FORMS OF REPRESENTATION IN TERMINOLOGY

Introduction: Basic questions and proposed answers

The relations between concepts, the world and language have long been of interest to a wide community of scholars including philosophers, psychologists, linguists, artificial intelligence researchers and terminologists. For many terminologists, language is regarded as a form of representation for not only concepts, but also on occasion for objects. However, working as they do from the perspective of specialist knowledge and specialist language, terminology researchers must also account for non-linguistic signs within any analytical framework, since these are by no means peripheral to specialist communication, particularly in certain domains. It is this task which Laurén & Picht set themselves in their paper 'Repräsentationsformen in der Terminologie', relating these forms of representation to the issue of what is being represented.

Laurén & Picht's paper therefore consists of a systematic attempt, based on recent studies in Terminology, to relate what is represented (concept or object) to how it is represented (linguistic or non-linguistic means) within a semiotic framework. The paper clearly shows that these two questions are inter-related but not in any straightforward way, since concepts and objects cannot be associated exclusively with either linguistic or non-linguistic forms. It is, for instance, not possible to say that objects are represented by non-linguistic and concepts by linguistic forms. Furthermore, the use of non-linguistic forms of representation is seen as domain-related, allowing for a further dimension.

The main associations made in the paper are shown in Tables 1 and 2. Table 1 highlights what Laurén & Picht consider to be areas of general agreement; Table 2 focuses on cases of ambivalence.

Table 1: The relationships as proposed by Laurén & Picht between objects and concepts and their representational forms (no ambivalence indicated)

	LINGUISTIC FORMS	NON-LINGUISTIC FORMS
OBJECT	Name description	Photograph representational painting or drawing
CONCEPT	Term paraphrase definition explanation	

Table 2: The relationships as proposed by Laurén & Picht between objects and concepts and their representational forms (ambivalence indicated)

	LINGUISTIC FORMS	NON-LINGUISTIC FORMS
OBJECT		technical drawing diagram graph pictogram notation
CONCEPT	formula/symbol (functionally as synonyms for terms) LSP collocation (*Fachwendung*)	formula/symbol (orthographically as language independent items) technical drawing diagram graph pictogram notation

Tables 1 and 2 indicate that there is greater agreement for what is represented by linguistic forms than by non-linguistic forms, with some doubt expressed about the conceptual underpinnings of LSP collocations. Most discussion therefore seems likely to arise in connection with non-linguistic representation forms. However, while only formulae and symbols are presented as ambiguous with respect to their linguistic/non-linguistic status, we shall see that this boundary, as well as the concept-object boundary, is also less clear than the given binary division implies.

Elaboration

My comments on the case presented by Laurén & Picht can be summarised in ten points, many of which indicate that the binary distinctions underlying their analysis – and as physically represented in the 4-way matrix in Tables 1 and 2 – are better understood as cline-like structures This is already implicit in some aspects of their argument and presentation of ideas.

1. Is the distinction between linguistic and non-linguistic forms of representation well motivated ? Laurén & Picht's own ambivalence with respect to formulae and symbols suggests that the distinction is not a clear-cut one, depending on the aspect of the sign which is being considered, i.e. graphical form (non-linguistic) or function (linguistic). From a practical point of view, however, it is not clear where the question leads since modern tools for the representation of terminological data combine various media (e.g. written forms – sound – diagrams – photographs), as also indicated in Laurén & Picht's paper. From a theoretical point of view, a case can be made for degrees of belonging to linguistic and non-linguistic forms of representation. Names are an interesting case, since they are clearly (proper) nouns and therefore linguistic, but are distinguished both formally in writing in many European languages (by the use of initial upper case) and semantically by their ability to refer, even when they do not occur as part of an utterance, e.g. as an encyclopaedic dictionary entry. Another way of saying this, is that they represent objects, as Laurén & Picht indicate. Morphologically, they are less tractable than common nouns, but sometimes form part of a compound, e.g. *Ottomotor*. They may also enter into the full inflectional paradigm, as in Russian2. Formulae and symbols are less clearly linguistic in nature, but formulae are similar to well-motivated terms in so far as they indicate the intension of the concept e.g. H_2O (two atoms of hydrogen combine with one atom of oxygen). Symbols, on the other hand, are conceptually much less transparent with little if any apparent connection between form and meaning, e.g. *h* for *Planck's constant*. The nominal character of both formulae and symbols is acknowledged by Laurén & Picht, in so far as these can be substi-

2 I am grateful to Dr Dunstan Brown, University of Surrey, for information on Russian proper nouns.

tuted by terms, although the extent to which they enter into the full panoply of nominal categories in language use – case, number and gender – is an empirical issue. Within texts, the linguistic nature of such items is further consolidated by their participation in textual phenomena such as lexical cohesion. Although they do not enter into cohesive relations, pictograms and notations may also be distinguished from clearly non-linguistic forms such as diagrams and technical drawings, since both can be verbalised, pictograms being of a propositional nature (cf. point 2) and notations of a classificational nature with some parallels to systems of terms. The remaining forms can be more clearly classified as non-linguistic, their potential for ambivalence resting more in what is being represented than how.

2. The point is made that photographs and representational paintings represent objects. Another way of saying this is that photographs and representational art represent objects because they are specific. Even here, we may ask how 'specific' a photograph of a standardised object such as a particular type of screw is. Or a photograph of a human cell nucleus. Any distinctions may be at a forensic level in both cases. It is argued that technical drawings, diagrams, graphs and pictograms may represent either concepts or objects, depending on the *level* of abstraction. Hence, we can say that a technical drawing is specific, showing how to construct a particular artefact, although there is no reason why several identical artefacts should not be produced from the same drawing. Diagrams, on the other hand, may represent processes, ideas, periods of history, and so on, as well as objects and the relations between them. Pictograms can represent what might otherwise be expressed in a phrase or a clause (cf. also Wright this volume), as in the following examples which indicate 'rinse this item': the left-hand pictogram is from ISO, the right-hand one from a Cornell Research Group (Source: http://ergo.human.cornell.edu/iconxcise/pictogram.htm, Cornell Human Factors & Ergonomics Research Group, Cornell University, site visited 14 September 2001). Each pictogram is visually different, showing different degrees of abstraction, while at the same time indicating the difficult balance between clarity and cultural specificity:

3. The boundary between concepts and objects can be considered problematic from particular perspectives which are highlighted by

some of the questions raised in the paper, such as the nature and role of a technical drawing in obtaining building permission (cf. also point 2). It is suggested that such drawings are a more efficient means of representation for purposes of this kind than verbal representations. Let us imagine that the plan is to build a house. What would a drawing of this house represent ? It would be hard to argue that the drawing represents the object which is to be built, since it does not yet exist, so it must represent a unique concept, possibly without a name or other unique designation. But what about after the house is built ? That unique house, in its visual representation in the technical drawing and in its reality as an object, is made up of many smaller representations and objects. In the case of the drawing, the representation of these objects – the whole and its parts – has been scaled. So the scaled drawing represents both many objects and one object, which are distinguished by their degree of abstraction, the smaller parts having to be even more schematically represented than the whole or larger parts, and therefore more generically and in a sense more conceptually.

4. Within the set of linguistic forms of representation, we have already seen that names, as proper nouns, may in some respects be distinguished from terms, as common nouns. They are generally more easily identifiable in running text than terms in so far as their boundaries – both conceptually as unique items and linguistically as labels – are more clearly defined, when compared with the range of other linguistic forms of representation. The boundaries of single-word terms are also clearly easier to identify than those of multi-word terms, paraphrases and LSP collocations (*Fachwendungen*), which also raise issues at the conceptual level.

5. The issue of matching concepts with particular linguistic units such as LSP collocations is discussed by Laurén & Picht, who question the representational status of these forms, since a phrase(me) such as 'Sperrmüll entsorgen' cannot appear in a term base either under the concept SPERRMÜLL or the concept ENTSORGEN. This touches on a more general problem in the onomasiological approach: since concepts are mental entities, there can be no direct relationship with particular linguistic realisations, for which the possibilities are several, even in LSPs. And concepts, as we can see from the example given, may consist of combinations of other concepts. So there is a two-fold problem here. On the one hand, the notion of

what a concept is is broad: there are many types of concept and attempts at establishing typologies sooner or later enter the domain of the *ad hoc*. On the other hand, the possibilities for natural language expression are many. Given these two factors, it is unsureprising that difficulties emerge when working from the conceptual to the linguistic level. Certain types of concept – such as that presented in the given example – are not representable in terminology collections by nouns or verbs alone, but by phrase(mes), realised in various ways in running text: *Hinweise zur Entsorgung von Sperrmüll; Was ist Sperrmüll und wie wird er entsorgt ?* So what is the boundary of the concept and what is its linguistic representation ? Working at text level, the linguistic representation is a string of word forms which are bound together in morphological and syntactic relations with the potential for reference. Working at the system level, the linguistic representation is most straightforwardly a single-word or multi-word term (noun) as lexeme with denotation, and more problematically a phrase which must be extracted from its embedding in a linguistic structure. In the first case, i.e. the nominal term, the lexeme may or may not vary in its form from the particular word form which occurs in the text, depending on inflectional patterns. In the second case, the difference between the codified form and its textual embedding may be striking. So 'entsorgen' and 'Sperrmüll' as lexemes show little or no variation from their use in text: *entsorgt* and *Sperrmüll*, but this is not the case for the verb phrase (NP + V) 'Sperrmüll entsorgen', which in the example shown must be extracted from a compound sentence with co-reference between the nominal and pronominal subjects of a copula structure and a passive clause respectively. The two levels of linguistic representation, system and use, are highlighted by such phrasemes, whereas nominal terminology shows less radical differences and hence in some cases may produce the illusion of identity where morphological variation is not apparent. The differentiation between system and use, already a part of Wüster's four-part *word* model, may further be considered as a distinguishing characteristic of linguistic and non-linguistic forms of representation.

6. A further textual perspective on the classification of representation types is that of their combinability and what that means from a communicative point of view for their 'power' of representation (cf. also Pilke, this volume). The idea comes to me from translation, where it is common to represent new concepts by so-called 'dou-

blets' or 'couplets' (or even triplets in some cases), mixing loans or calques, neologisms and paraphrases. Translation has through the ages contributed significantly to the transfer of knowledge: translators have always had to find textual solutions for conveying new concepts to new audiences. Kelly (1979:136) gives the example – from the 14th century French translator Oresme – of the doublet *passions ou qualitez* for the Latin *passio*, itself based on the Greek *pathi.* Solutions of this kind reflect a recipient-oriented view of text creation which aims to aid the reader's comprehension of specialised concepts. This perspective can be investigated for terminology through text-based studies on the interaction of various representations of the 'same' or related concepts.

7. The term is the most investigated type of representation form, but even here new perspectives are emerging which present representational problems. Laurén & Picht point out that the pragmatic aspects of term variation (synonymy) according to level of communication can be dealt with satisfactorily in well-conceived and well-constructed representation systems such as term bases, presumably through a well-designed term record format. The point about synonyms, certainly within a term base, is that they share the same denotation – or, put another way, they designate the same concept (one entry/one concept). Even if we skate over the conceptual differences which we could assume characterise the different levels of specialist knowledge reflected at the linguistic level through the synonymic variation (the concept as unit of thought, cf. Picht 1997: 164-5), there are many other cases where concepts are perspectivised for functional reasons, such as the re-ordering of elements within a compound: *colour handheld scanner* versus *handheld colour scanner* (Bowker 1998), and where the immediate genus is different in each case: handheld scanner *versus* colour scanner, with implications for any system of definitions. In other cases, the phraseological context of a term may influence its interpretation in text (cf. Rogers 1999). This takes us back to the slipperiness of the concept and its linguistic expression in texts (cf. point 5). How can this be represented – or indeed should it be ? Part of this kind of variation can be accounted for by the creativity which is available to the text writer, including the translator: can this be anticipated or represented ?

8. The interrelation between synonymy and polysemy in texts, and

how this is to be represented in term bases, presents further problems. It is common in texts, for instance, for compound terms – the most frequent linguistic type – to be clipped or sometimes modified on subsequent mentions, leading to an array of synonyms, as an example from Schmitt (1999:306) illustrates: *Lichthauptschalterhalteblech* → *Lichtschalterhalteblech* → *Schalterhalteblech* → *Schalterhalterung* → *Halterung*. In turn, the final form is often polysemous: *Halterung*, without any supporting context, is *any* kind of support or mounting, not a retaining plate for a main light switch. The issue of how much of such patterns should be recorded in a terminology collection remains unresolved since they are text-driven: representing text-driven information at system level is problematic. We could add that entering all the clippings in a single field for textual synonyms would contravene good practice in data management, since the inclusion of several data items in a single field reduces the automatic processability of the data. Creating an iterative field of 'textual synonym' for each item in the chain would also not satisfactorily solve the problem because their successive and interrelated nature would be lost. A practical solution would be to include a text field for a text extract containing all the clippings (as in our example above), but such extracts may be hard to locate. This would also not solve the problem of a user attempting to enter the term base through the search term *Halterung* or any other of the intermediate variants.

9. The linguistic types of representation form include paraphrases, as well as the term, both representing the concept. As indicated in point 6, translators have used paraphrase as a textual strategy to cover new concepts through the long history of knowledge transfer across linguistic boundaries. But the line between paraphrase and term is not a clear-cut one, as implied. Paraphrases have an important expedient function in filling terminological gaps in texts, but they also have a regular terminological function if viewed from a language-typological perspective. Compare, for instance, the following:

10.

cold start valve	*Kaltstart-Ventil*	*électrovanne de commande de régime de ralenti*
idle speed valve	*Leerlauf-Ventil*	*électrovanne de commande de démarrage à froid*

The structure of one language's paraphrase or pre-term, e.g. *car fitted with a catalytic converter (cat car)*, may be the structure of another language's term.

1. Practical experience from term extraction has shown me that identifying term boundaries is not as straightforward as suggested in the paper, where the problem is resolved by reference to the concept. But the concept itself is very slippery in texts, as we have seen, and functionally so in many cases. The paper acknowledges that even a formal definition (at system level) only represents a particular view of a concept. The representation of concepts in texts is therefore problematic for the establishment of systems, although in a sense it is the text which is real rather then the aimed-for system, which is actually a kind of model, not a kind of reality.

Conclusion:

The semiotic approach is certainly promising for bringing some coherence into the representational problem since it can deal with linguistic and non-linguistic phenomena within a theory of signs. But the main problem for me is how to accommodate cline-like structures which, as presently expressed, not only realise various degrees of precision (which may or may not be well-motivated when viewed communicatively) but also show some ambiguity with respect to what is being represented: the concept or the object (assuming these are in themselves acceptable concepts). The concept of 'representation' itself has been accepted as a given – in both the original paper and in the present exposition – whereas in certain recent approaches to the study of terms and their meanings such as cognitive semantics, it is rejected. But such approaches are firmly placed within a linguistic framework and have not been concerned with non-linguistic signs, which are an integral part of many terminological studies. Finally, the issue of system and use needs to be added to the discussion of representational issues; again, this may be a further distinguishing factor within the binary categories proposed.

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Sue Ellen Wright

FORMS OF REPRESENTATION IN TERMINOLOGY

The following paper is not conceived so much as an opposing view with respect to the original paper on *Representationsformen in der Terminologie* by Christer Laurén and Heribert Picht as it is a measured response that attempts to document current trends and other situations that go beyond the positions stated in the Laurén-Picht paper (cited as L-P below). The following discussion presents points of departure for further study, with a view to pragmatic trends in the language industry.

Semantic vs. non-semantic forms of representation

L-P commences by listing both verbal and non-verbal representations of concepts. In computerized environments such as metadata registries or quasi-ad hoc termbanks (quasi-semasiological systems), these semantic representations are augmented by the non-semantic assignment of non-mnemonic identifiers to terminological entries or data category descriptions (Figure 1).3 The decoupling of unique, permanent identifiers from, for instance, traditional position-related notations allows the user to create and maintain registries, taxonomies, ontologies, or concept systems for dynamically changing environments without compromising the need to ensure the immutability of address labels or the dependability of mapping routines devised for data interchange. Thus individual term entries and data category descriptions can be accessed and interchanged even if new items are added, subtracted, or moved in the taxonomy, and multiple taxonomies can be devised for the same group of terms or data categories in order to meet the needs of different user philosophies or system views.

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3 Reference to records in a terminological database (termbase) will be called *terminological entries*, and references to records in a metadata registry will be called *data category (datcats) descriptions*. The current ISO 12620 uses the term *data category specifications*.

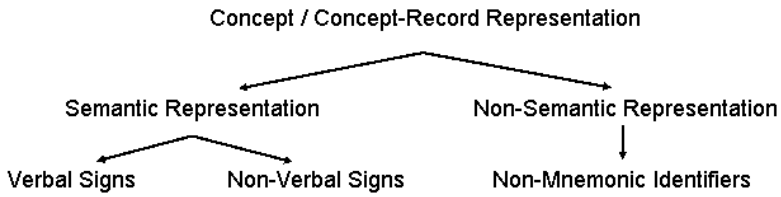

Figure 1: Types of concept representation

In this schema, notations that represent logical position numbers in a concept system contain or reference semantic content, whereas non-mnemonic, arbitrarily assigned unique identifiers do not, although they are specifically associated with a given concept. This feature becomes all the more important as we see a growing tendency in industry to move away from the strictly text-oriented, semasiological approach of recent years toward the rediscovery of onamasiological principles for application in ontologies and taxonomies designed for enhanced information retrieval within enterprise systems as well as in the global Semantic Web. It is indeed ironic that some branches of terminology theory are currently touting the semasiological approach (Temmerman, Cabré) to the exclusion of onamasiological functionalities at the same time that pragmatic applications in the language industry are moving rapidly toward a linkage between terminology data management and both enterprise-specific taxonomy management and evolving high-level ontologies. A significant difference between the new-style ontologies and earlier concept systems lies in the fact that knowledge ordering systems are now open and dynamic in comparison to the closed concept systems used in many earlier printed dictionaries.

Comparison of verbal and non-verbal forms of representation

L-P lists both verbal and non-verbal forms of representation, without implying any analogous links between the two lists, which would indeed be inappropriate because rigid analogies are difficult to support. Nevertheless, it is valuable to compare the different forms with an eye to the terminological role played by graphic forms in communication.

The equation of *names* with *photographs* makes sense so long as a photograph is used as the unique representation of an individual object, as it usually is. In other situations, however, photographs used to dem-

onstrate prototypical behaviors, body types, etc., such as may be used in psychological testing or to document medical conditions take on the kind of typological character of terms rather than names. One may well argue that portraits (either painted or photographic) also function as representations of unique objects and therefore should both be equated to *names.* Graphical elements used in such resources as electrical diagrams and schematics, however, function more in the manner of terms because 1) they represent individual concepts, i.e., they have specific semantic content, but 2) they are also used within the syntactical framework of drawing conventions to produce meaningful proposition-like complex representations. Thus a single element such as a power transmission symbol (Figure 2) combines with other elements to form a complex communicative document (Figure 3)4 that functions much the same way as a sentence or paragraph in spoken discourse, e.g., it has propositional character. The same observation can be made of the architectural drawings cited in L-P.

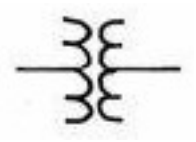

Figure 2: Power transmission symbol

Figure 4: Elevator

Figure 5: Intel logo

The correlation of pictograms with terms or possibly technical expressions depends on the function of the individual pictogram in context. Pictograms are graphical symbols used as icons and signs in public places such as airports, train stations, and other public places where one cannot anticipate that everyone speaks a common language, but they can also be used to represent processes in industrial environments. They appear on a wide variety of international products, such as automobiles and entertainment equipment. In their function as signage elements, they do indeed perform the role that words might perform on signs used in monolingual environments. The elevator pictogram in Figure 4 is commonly used as a symbol on a sign pointing to an "Elevator" in a public place

4 See the end of the paper for Figure 3.

and could be replaced by a term, e.g., “Elevator”, “Lift”, “Hiss/Hissi”, or “Aufzug”, provided everyone who sees the sign can read the appropriate word in the language in question. To the average “user” of the pictogram, the pictogram simply communicates the message “follow this sign to find an elevator” or “the object/architectural feature next to this sign is an elevator”, but the pictogram itself incorporates the entire propositional notion, “This sign points to a box where men and women can move up and down.” Thus pictograms, like some strings and collocations, can encompass both the function of a single term or that of a more complex sentence. It could be argued, however, that this propositional content becomes so conventionalized over time that viewers no longer consciously intellectualize the entire propositional content of the image. Thus pictograms come to function in much the same way that Han characters do in Asiatic languages, representing both simple and complex concepts without the reader always stopping to dissect the radicals that make up the complex character, any more than the speaker of a European language stops to sort out the morphemic, etymological components of a familiar complex term.

Another variation on the name/pictorial image analogy is that of the corporate logo, as illustrated in Figure 5. Often a combination of both letters and graphic elements, the logo plays a special role as a name-like representative of the entity it symbolizes. Although logos usually incorporate the letters of a trademarked name or acronym (e.g., IBM™, LuK™, etc.), the registered logo incorporates both graphic and glyph-related elements to produce a unique protected image. One critical aspect of this convergence is the fact that logos, although they incorporate characters, are generally represented in computer environments by binary graphics files. An exception might be a case where a company co-opts a code point above the common universal plane in Unicode to create a logo symbol for use in a proprietary character set. As implied above, logos represent trademarked names.

Figure 6: Symbols and pictograms treated as font characters (Microsoft Webdings)

The above evaluation reflects a further distinction that can be made in modern computer environments: although binary objects are

usually used to represent a graphical image (e.g., any of the .gif or .jpg files used to produce the graphics in Figures 2-5), it is also possible to incorporate symbols into character sets. Although seemingly trivial, the condition whereby a single character can have terminological or even propositional significance, and the fact that such a single character may actually be machine-parsable (or not) lends an extra dimension to computerized terminology management. Furthermore, new characters, although rare, can undergo a transition from the status of a graphics file to a standard, universally recognized character, as has been the case in the evolution of the new Euro symbol, €. Endless debate and design competitions aside, the new symbol conforms to a kind of etymological, symbol-formation rule that applies to certain important currency symbols by combining a significant letter (here a stylized letter E) or quasi-letter with horizontal, vertical, or even diagonal strike-through lines as in: $, ¢, £, ¥. Thus even symbols are subject to etymological conventions for "neologistic" formation.

Plastic (three-dimensional) representation of objects

Figure 7: Glass flowers from the Harvard-Peabody collection

With respect to photographs and drawings, the tradition of the botanical or anatomical drawing stands out as a conscious representation of real objects according to precisely defined scientific principles. Usually incorporating both graphic and textual information, such drawings were designed to provide a virtual view of living structures, especially in an age before the evolution of high-quality color photography. Although these representations appear to be the rendition of an individual object, they generally encompass characteristics of a number of similar objects of a specific class and can thus be viewed as prototypical in nature and more akin to terms representing object classes rather than names representing unique objects. The Harvard-Peabody collection of glass flowers constitutes a remarkable example of three-dimensional, plastic representation of real objects according to precisely imposed scientific principles, as do the kinds of models frequently built in the manufacturing industry, particularly for automotive design. With the advent of interactive com-

puter modeling in industry, many of the time-consuming activities involved in clay modeling have been rendered overly expensive and unnecessary. Computerized simulation of real objects expands the representation of the characteristics defining that object to such a finely nuanced statistical detail that many of the steps involved in real-life engineering testing can be eliminated from the design process.

Using graphic objects to document terminological entries

As noted in L-P, the use of drawings and photos in order to illustrate terminological entries is well established, from Wüster's *Machine Tool* to the latest terminology management tools, which allow not only the embedding of binary objects showing still (static) drawings and photos, but dynamic images and videos as well (CATS). In future XML environments, we should be able to use bitmap graphics in order to link overview drawings (such as those familiar from Freeman and other terminological and technical lexicographical resources) to create live hypertext links from meronymic representations to, for instance, specific concepts in the same collection or possibly even to external resources. In this way the simple explanatory or descriptive function cited in L-P will be augmented by a taxonomical or ontological characterization of multiple interrelated concepts. Since the actual technology underlying such drawings is based on arbitrary bit-map coordinates, this kind of representation could be achieved with either a "drawing" of whatever origin or by using a photograph.

What comprises a term

The various manifestations of terms as different types of terminological units can be arrayed on a cline:

- single-word terms (technical terms consisting of one word)
- multiword terms (technical terms consisting of more than one word)
- technical collocations (combinatory units possessing notional character, but involving the required co-occurrence of, for instance, a noun and a verb, or verbs with certain prepositions)
- technical phrases or expressions
- string (software string)
- standard text

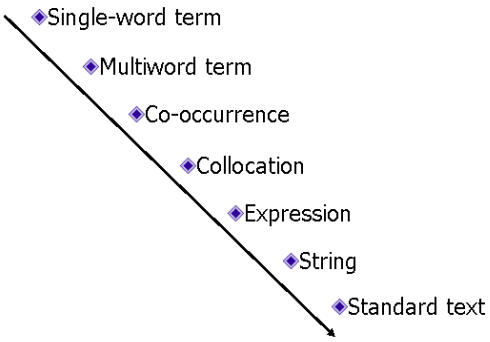

Figure 5: Types of terminological units seen as a cline

Traditionally, terminology management has involved the documentation of single and multiword terms as well as collocations (and other technical expressions or phrases), with some attention paid to standard texts, i.e., whole text chunks that are replaced with "equivalent" text chunks when creating parallel documents in multilingual environments. The argument can be made that such text chunks pragmatically reflect broad conceptual units, such as "contract preamble" or "steel specification", which are complex textual representations in their own right, but which can be treated as discrete self-contained components used and reused for generating new documents. The practice of storing such text modules as if they were terms has become less prevalent, however, with the introduction of translation memory and single-source text production tools. Nevertheless, integrated localization tools frequently treat single terms, collocations, and software interface strings along side each other in integrated data management environments where terminological information is but one of several views on the data collection. In such localization-oriented systems, terms may actually incorporate embedded non-linguistic elements such as hotkeys or other escape sequences. Although not specifically a function of traditional terminology management, this feature points to the kind of transformation that is taking place and will take place as terminology becomes more and more a functional component in the transition to global information management both on local area networks and in the Semantic Web.

Recognizing terms: *paratérminos* and quasi-terms

L-P cites the concept of *paratérminos,* free-formed lexical sequences that function in the manner of terms, but that are not traditionally viewed as terms in the formal sense. I agree with Laurén and Picht that the criteria apparently defined for *paratérminos* are arbitrary and

unconvincing. Distinctions of this nature that appear to be linked to term formation patterns in a single language or language family are suspect as criteria for universal distinctions that might be applicable to broader environments. Nevertheless, recognizing compound terms as opposed to free-formed lexical sequences or frequent co-occurrences is a perennial problem. The rule that a term designates a single concept is only useful up to a point. We can, for instance, easily make a case for a string such as *bronchial asthma* being a term in English because only this combination of lexical components forms a term that adequately covers a clearly definable concept. Other combinations, in this case of a general language adjective and a noun which is a term, such as *mild asthma* or *severe asthma,* may be interesting even from a clinical point of view, and they do have a terminological character. It can also be argued that these items could be viewed as individual concepts that might be fit into a concept system, and may indeed be specifically defined as a preferred term, e.g., *acute asthma* instead of *severe asthma*. Nevertheless, it does not seem immediately appropriate to document these items as independent terms (unless they are indeed part of a clearly defined system), but rather to view them as free-occurring combinations of a term — in this case a noun — together with "ordinary" adjectives taken from general language. This is true because any user of the language can split the strings and reconstruct them without danger of losing the semantic content. These formulations become interesting, however, in natural language processing, where such free-formed quasi-terminological strings repeatedly occur in special language corpora and play a role from the standpoint of knowledge management, term frequency, co-occurrence, and automatic term extraction from embedded contexts.

Much of the difficulty involved in designating a given combination of words as a term arises on the translation interface between two different languages. Viewed monolingually in either Spanish or English, *problema asmático* is not a technical term per se, although *asmático* certainly is, provided that we allow adjectives, which is totally appropriate in terminology management. The apparent English equivalents for this concept, *asthma problem* or *problem with asthma*, are also free-formed strings and would also be unlikely additions to a list of technical terms. A problem arises, however, with respect to defining terminological units in a multilingual context because *problema asmático* cannot be translated by the fairly obvious, but incorrect, *asthmatic problem*. Only a *person*, and not a *problem* can be *asthmatic*: the valence of *asthmatic* encompasses only individuals (people or animals) suffering from asthma,

or possibly metaphoric references (e.g., *my asthmatic accordion*), but *not* abstractions like *problem*. Hence it becomes necessary to document *asthma problem* or *problem with asthma* in order to cue a translator or multilingual writer to make a correct choice. In this regard, it is useful to separate the theoretical designation of *what a term is* according to systematic treatment of terms and *what a user of a terminologically oriented database needs* in order to produce reliable texts in a multilingual environment. Consideration for user needs also dictates the documentation of such "terms" even when they are fairly new formulations because translators and technical writers do not generally enjoy the luxury of waiting for a new formulation to become fully "lexicalized" by virtue of frequent usage or formal specification in a standard.

A similar difficulty in recognizing term boundaries occurs when different languages set different limits for compound term formation. In German, one can easily argue that *die Anlaßfarbe der Tellerfederzungenspitzen* consists of two freely combined independent concepts and does not need to be given its own entry in a termbase, so long as *Anlaßfarbe* and *Tellerfederzungenspitze* are defined. English, which actually allows for much longer, more compacted noun strings (while at the same time retaining word boundaries), covers this same concept with: *diaphragm spring fingertip annealing color*, so there is no recourse to declaring this a single concept in a multilingual termbase and documenting it accordingly.

This situation is a function of what one industrial work group dubbed the "blue bicycle" syndrome: Japanese translators in a multilingual language service insisted to the frustration of their North American and European colleagues that they needed a term entry in the enterprise database for the term *blue bicycle*, which speakers of European languages argued, not surprisingly, was a free-formed string and not any kind of technical term. The Japanese colleagues insisted that they needed to document which of several possible representations for the term they felt was most appropriate in the context of the resources that were being created in a particular project. Lest this argument sound silly (which, alas, it does at first glance), a very common example from European languages may be more illustrative. The Spanish and German terminologists in the same work group became upset with each other over a similar problem. For a series of compounds involving the word *process* in English, the Spanish group argued that the multiword terms were in effect free-formed strings and did not need to be documented, maintain-

ing that all of the items followed the same predictable pattern: *x process = processo de x* in every case. The German speakers maintained, however, that English *process* has the equivalents *Prozeß, Verfahren,* and *Vorgang*, and that the choice of one over the other in any given situation is not necessarily predictable and depends on macrocontextual, historical, and other factors. In many cases here, there is no particular argument that the strings produced are terms, but rather that they are strings that must be documented in termbases because the transfer procedures for at least one language in the multilingual mix require documentation. One solution might be to leave out documentation in Spanish on the grounds that it is superfluous, but if one does this, termbase users may inappropriately conclude that the termbase is deficient in this regard.

Paraphrase and periphrasis

L-P cites paraphrases as one form of concept representation. Certainly, variant paraphrases do occur in scientific and technical texts and they can play havoc with natural language processing algorithms, but it is also important to note that they are highly discouraged in well-structured English technical writing and disallowed in controlled language. Furthermore, great care must be exercised by technical writers and translators working in multilingual environments not to resort to inappropriate-sounding paraphrase in cases where well-established concise terms exist. Again, this is particularly true in English technical texts, where concision and precision are valued over variation in carefully written technical and scientific texts.

Term formation patterns in different language families also play a role in determining the acceptability of paraphrase in special language texts. New terms are most frequently formed as either neologisms, novel combinations of existing terms (modifiers + noun strings), or paraphrases, i.e., combinatory elements including prepositional phrases in addition to adjectival modifiers and noun strings. In Germanic and Slavic languages, there is a tendency to agglomerate nouns and modifiers to form single long nouns or noun strings, with some variation in orthographic convention, i.e., with some languages creating single long nouns and others retaining word breaks. Romance languages tend to be much less abstract than Germanic ones, requiring explicit prepositions as linking elements between many of the term components used to create multiword terms. As a result, the formation or identification of legitimate term

equivalents when working from Germanic languages to Romance languages, for instance, will in many cases require periphrasis, the appropriate elaboration of less compact formulations in order to represent concepts. By the same token, neologistic patterns have evolved particularly in French that allow the formation of very concise semantic units, such as *terminotique*, which require paraphrase when creating or identifying English equivalents. This practice stands in contrast to the undesirable use of paraphrase as a circumlocution technique in cases where technical writers and translators are unfamiliar with the more concise terminology anticipated by a target audience made up of experts. Thus care should be exercised in relegating any given solution to a definition of paraphrase vs. periphrasis, undesirable vs. desirable paraphrase. If a viable, succinct term is current in a language, it should be used, but many factors can combine to require the use of paraphrase/periphrasis in order to express full semantic equivalence.

Paraphrase with formulas and symbols

P-L cites the tendency of symbols to be expressed as paraphrases rather than as terms or (in the case of the symbol shown on the left) as names. Here, a musician has rather petulantly claimed the symbol as his own because he chose to abandon his own given name as a result of a copyright dispute with a record company to which he was under contract. Despite his efforts not to use any name at all, the media rapidly and humorously (if not maliciously) dubbed him *The Artist Formerly Known as Prince* and even created an acronym in his honor, *TAFKAP*. Incidentally, *TAFKAP* has since settled his dispute and has gone back to his own not entirely prosaic name. The symbol itself, apart from discussions of its origins, is interesting because it exemplifies the tendency of symbols and graphic images to display the same combinatory features seen when morphemes are joined to create neologisms, in this case melding male and female symbols to create an androgynous image.

Definitions

Despite recognition that other kinds of "definitions" or defining contexts exist (Sager 1990, de Bessé 1997) the classic genus and differentia form of definitions is widely accepted in terminology management,

along with minor variations across specific cultural traditions (i.e., repetition of the defined term in German definitions and disagreement over the use of the definite and indefinite articles between English and French). Future applications will, however, be capable of utilizing the power of definitions to represent knowledge structures that are even machine parsable. The tools that we currently have at our command are but blunt instruments when it comes to intuiting knowledge based on the parsing of semantic content within texts. Definitions that are marked up according to inferential rules defined in XML/RDF schemas in order to differentiate broader concepts and specific characteristics, and then linked to taxonomies or ontologies containing such rules, hold promise as a major functionality designed for information retrieval in the future Semantic Web. Similar markup to identify head words (nucleus elements) and determiners in multiword terms will provide further support for the automatic retrieval and processing of information in terminologically, conceptually sound ways that will, one can hope, render obsolete the kind of noise-laden word-oriented information retrieval currently available on the Wordwide Web. The classical form of the definition remains adequate, but additional markup is required in order for these resources to achieve full effectiveness in computer environments.

Controlled language

It is true that technical or special language is not clearly separable from general language because technical terminology, i.e., terms and terminological expressions, is always embedded in general language. Nevertheless, *controlled language* as we now know it is much more clearly distinguishable. For instance, *controlled English* is defined as a given subset of English with a restricted grammar and a domain-specific vocabulary, which allows domain specialists to interactively formulate requirements specifications in domain concepts (Controlled English: 2001). Grammatical and vocabulary restrictions imposed on controlled language rigidly impose a one-term/one concept constraint that facilitates both technical writing and multilingual documentation. These restrictions also limit the grammatical and syntactic structures that are considered “legal” for given applications. The linkage of controlled language vocabularies to parsable taxonomies marked up with inference rules according to ontological principles provides access for technical writers to terms based on conceptual reference and enables them to create and reuse high-quality text modules in single-source systems. It also facili-

tates translation, automatic translation in particular, and enables intelligent information retrieval in local environments and across the evolving Semantic Web. Thus the implementation of controlled language, like the use of marked-up definitions, will enhance the reusability of textual material and the power of terminology as a tool for information management and retrieval in global computerized environments. The identification of superordinate and subordinate concepts and the automatic generation of conceptual structures will further enhance our ability to create texts that are not only meaningful to humans, but also have semantic significance for computers and automatic processing.

Future trends

In his 1999 description of the Semantic Web, Tim Berners-Lee implies that the next stage of the knowledge-based communications revolution will require the definition of language in a way that not only humans, but machines as well can infer semantic meaning from the information streams that reside on the Web (and in enterprise-based systems). Berners-Lee writes about "terms", when in many respects he *may* also mean data element names in the sense of ISO 11179. In either case, XML markup that goes beyond the range of traditional terminology data management, particularly with respect to the representation of terms and definitions, as well as with regard to various types of contexts, will provide the essential link that will be desirable to facilitate the convergence of lex/term resources (e.g., lexicons, terminologies, ontologies, and the like), meta information residing in the Web itself.

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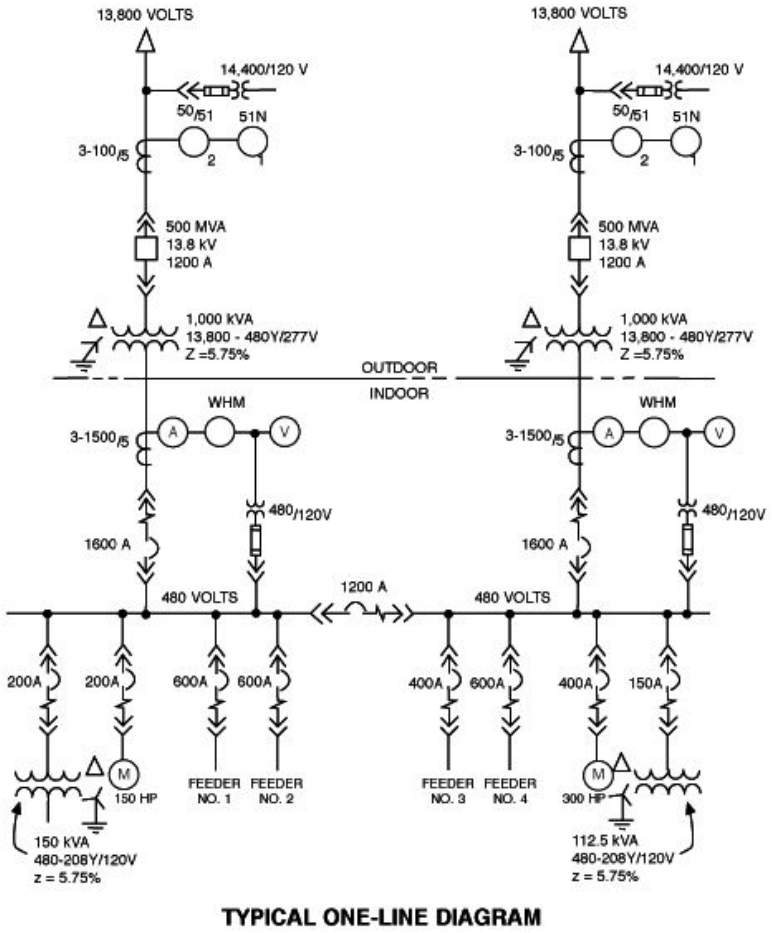

Figure 3: Complex electrical diagram (also called a single-line diagram) with propositional character

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SYSTEMS OF CONCEPTS AT A CROSSROADS ?

As I have not been dealing with systems of concepts as such in my research in recent years, I should like to deal with the subject at hand from the point of view of some of the subject areas with which I have been dealing. Two of those are

(1) Modern systems theory and
(2) Modern enactive cognitive science/cognitive linguistics

Gerhard Budin and Rita Temmerman, respectively, are among those who have introduced the above points of view into the theory of terminology. I shall deal mainly with (1), which to my view is of the most fundamental interest to the theoretical discussion in the area, but may also have considerable practical implications.

As for (2), I shall just briefly indicate how some of the insights of cognitive science might influence our entire way of looking at conceptual structuring as a special type of modelling, based on so-called image-schemata.

I have been very much inspired by Anita Nuopponen's doctoral thesis on conceptual systems from 1994, and I shall refer a good deal to this during my presentation.

Modern systems theory and conceptual systems

I Nuopponen's words, Wüster combined structural linguistics and engineering, and in so doing he transferred his engineer's way of thinking and working 'naturally' with systems to his analysis of the terminologies of various subject areas (Nuopponen 1994: 26).

When the systems theorist Niclas Luhman remarked in 1971 that the traditional conception of a system as simply **entities and relations**

between them still survives in various definitions (1971: 10), he may not have been aware for how long it did so and still does, e.g. in terminology. Of course, this simple definition holds for some systems, e.g. those called static conceptual systems in **figure 1** on the next page. The figure provides an impression of the highest levels of the hierarchy of systems hypothesised, with the categories I shall be dealing with marked in boldface type.

According to general systems theory, real systems encompass absolutely anything existing in the universe, and one of the main objects of the above figure is to illustrate how they are distinguished from abstract systems.

In theory, no real system can be regarded as closed because that would mean we could not observe it or know anything about it. But for practical purposes, we have to assume that systems can temporarily be regarded as closed, simply in order to allow the observer to use fixed concepts and terms, as Dürr puts it (1986: 11). This is of course what we do in terminology when forming conceptual systems modelling real systems.

I have indicated in the figure that like many conceptual systems, some real systems can for practical purposes be regarded as **static**, though in theory not as closed. Such static systems, e.g. wholly mechanical systems, can be clearly distinguished from self-organising or dynamic systems, of which living systems are the largest category.

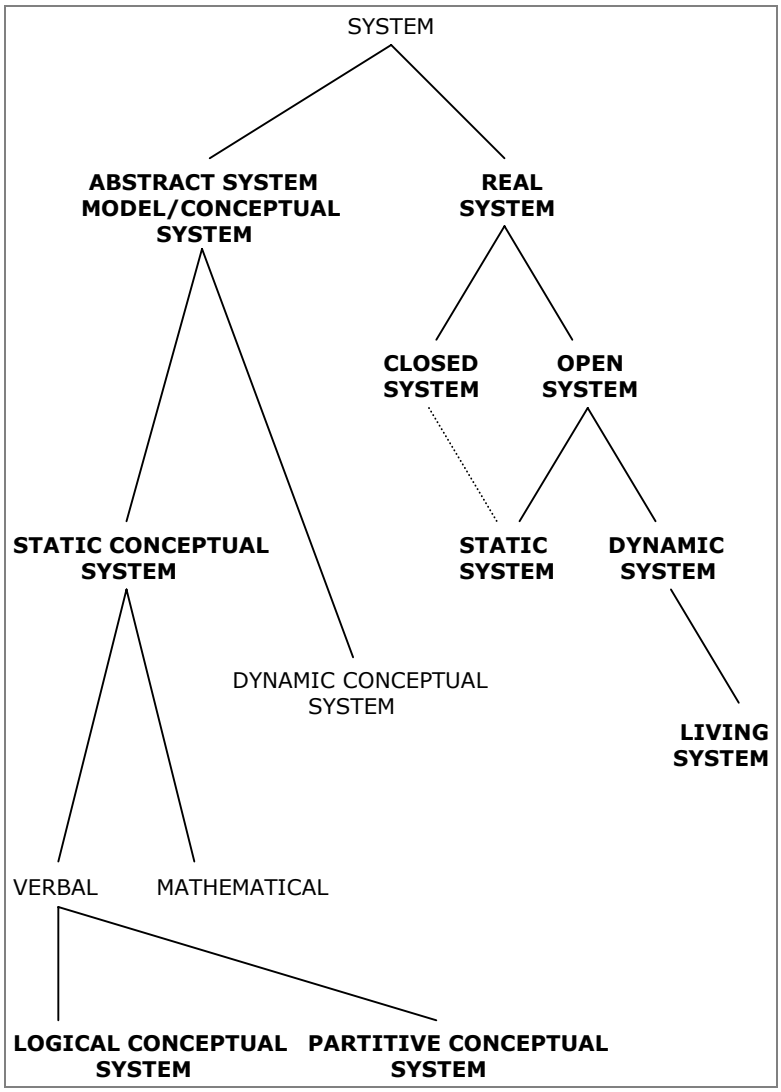

Figure 1

According to the theory of **integrative levels**, real systems are arranged in a sort of hiearchy of embedded systems, the integrative levels being cumulative upward and the complexity increasing with each new level (Feibleman 1954: 59-60). I have illustrated this in **figure 2**.

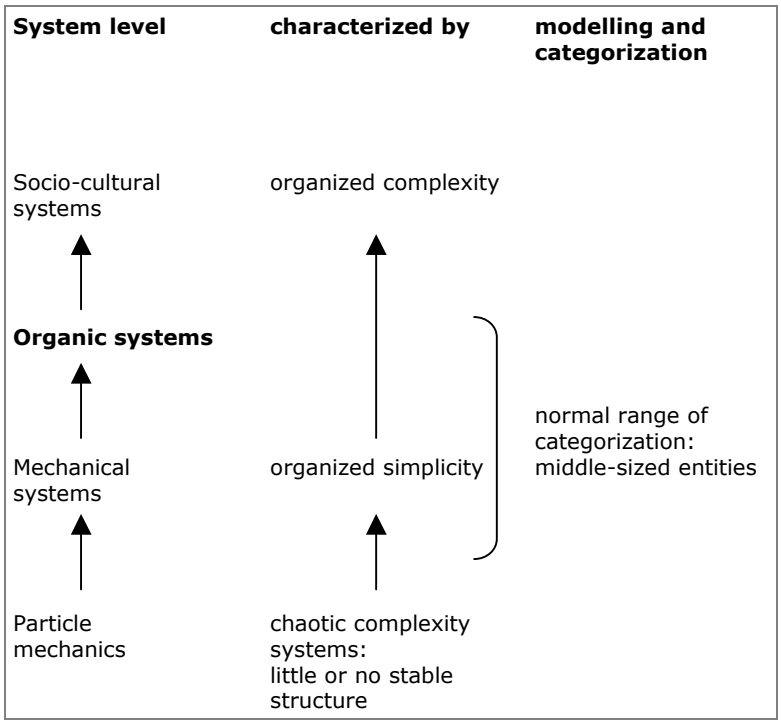

Figure 2: The hierarchy of embedded real systems (based in part on Rapoport & Horvath 1959: 87 ff.)

Mechanical systems are found at a rather low level, characterised by organised simplicity and thus comparatively or wholly static. At the higher levels, systems are **dynamic** and **adaptive**. This means that they interact with their environment and that they change their internal organisation both as a result of the interaction and as a result of internal forces operating, e.g. genetic ones in living systems.

Non-mechanical, organic and socio-cultural systems cannot be freely disintegrated or re-integrated in the way machines can be assembled or disassembled without permanent change or detrimental effects. In short, systems at higher levels must be regarded as wholes not reducible to their component parts. Each new higher level is defined by the emergence of level-specifying properties, and if a higher level system is split up into its component parts, those properties will no longer exist.

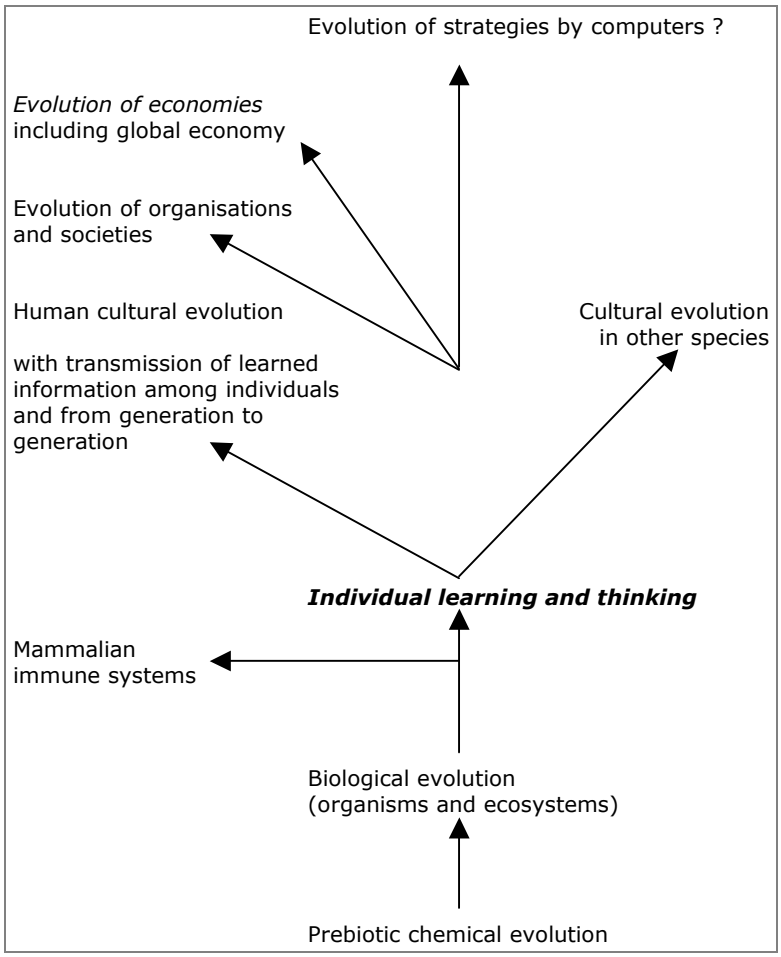

Figure 3: Some complex adaptive systems on earth (Gell-Mann 1994: 20)

Figure 3 has been taken from the Nobel laureate Murray Gell-Mann's book about 'The Simple and the Complex' (called 'The Quark and the Jaguar'). It shows the impact of evolution and the emergence of increasingly complex adaptive systems such as living beings, societies, markets, etc.

It is assumed that abstract systems can **model** real systems, includ-

ing systems as complex as those indicated in figure 3. How modelling or representation may take place is as you know a hotly disputed issue in philosophy, particularly in the philosophy of language.

In modern systems theory — as in enactive cognitive science — it is assumed that 'modelling' of the outside world is possible because living systems must have become structurally coupled with their environment during the evolutionary process, or they would not have survived. This is not to say, of course, that one can assume there to be exact **mapping** of external objects as assumed in so-called 'objectivist epistemology', a term used extensively in modern cognitive science, notably by Lakoff & Johnson in their recent book.

Figure 4 illustrates the dichotomy between the degree of **disorder** which must necessarily characterize dynamic, adaptive systems, and the attempt to create **order** which characterises models, including conceptual systems.

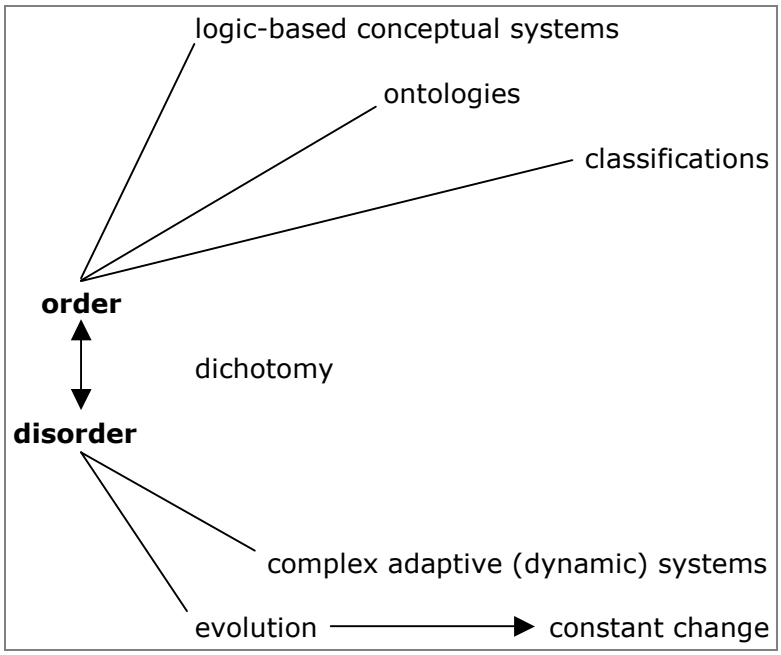

Figure 4: The dichotomy between order and disorder (inspired by R. de Beaugrande)

In parallel, **figure 5** illustrates the difference between **structure** and **structuring**, the former denoting the static aspect of systems, the latter denoting the dynamic one, i.e. the process leading to relatively stable structures. **Order** is at the base of both structure and structuring, but it is important to note that a balance must be maintained between order and disorder for any dynamic or adaptive real system to persist.

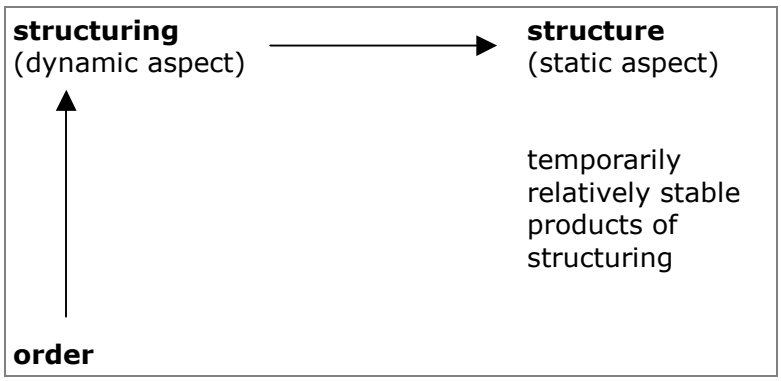

Figure 5: Based on Bohm & Peat: Science, Order, and Creativity (1987: 141)

But what about order in abstract systems ? We know that Wüster regarded **order**, **structure** and **logic** as absolutely essential to any proper terminology work. However, he applied the concept of order in a way that differs a good deal from the way it is applied in systems theory.

Wüster's concept of order is of the kind that may be observed in mechanical systems — to all extents and purposes closed and static — and which can be reflected in ontological conceptual systems. Another Wüsterian kind of order can be obtained by abstracting away from prototypicality in concepts and from conceptual fuzziness to form logical conceptual systems, which are pure abstractions in more than one respect.

This kind of order is indeed artificial and does not reflect any actually existing order, but it works of course for many practical purposes, particularly in the range of 'middle sized entities' as illustrated in **figure 2** above. My point is that if we stick to the traditional **order-first** view of conceptual systems, we shall not be able to model all complex

adaptive systems.

No doubt Gerhard Budin was thinking along the same lines when he concluded in 1996 that the traditional systems concept, dealing almost exclusively with logical and partitive relations, did not account for the fact that 'any terminology constitutes a system, no matter what relations exist among its elements'. Thus he called for a modification of the systems concept normally applied in terminology science (Budin 1996: 119).

As I see it, Anita Nuopponen had already partly achieved this modification in her thesis in 1994, in which she treated the subject of conceptual systems in an extremely lucid and all-embracing way.

First, she supplemented and exemplified the typology of conceptual systems described by Wüster and in the international standards. Secondly, she provided new, more consistent and virtually all-encompassing classifications of conceptual relations and systems according to 3 criteria: **qualitative**, **quantitative** and **structural** (formal), which had been overlapping in many existing classifications, including those of the standards.

Her formal (structural) classification in **figure 6** is particularly enlightening as it comprises a group of **heterarchic** conceptual systems, a new category proposed by herself to cover a group of conceptual systems which cannot clearly be defined as either hierarchical or sequential.

Conceptual systems according to formal structure (systems relations)

1) **Hierarchical**
   - logical systems of concepts
   - systems of concepts in contact relation (except temporal systems)
   - hierarchical 'mixed' conceptual systems
2) **Sequential** (concepts in sequence or in parallel alternative or co-ordinated rows)
   - temporal conceptual systems
   - causal conceptual systems (causal chains only in part)
   - conceptual developmental systems
3) **Heterarchical** (different concepts may form point of departure according to point of view)
   - causal conceptual systems
   - functional conceptual systems
   - conceptual systems of interaction
   - satellite systems

Figure 6: Formal classification of conceptual systems (Translated from Nuopponen 1994: 233)

The term **heterarchy** has been borrowed from mathematics, denoting 'a formal organisation of connected nodes, without any single permanent uppermost node' (1994: 233). Nuopponens notes that particularly when systems are represented in computational form, the choice of 'uppermost' or 'starting' node may be or at least seem arbitrary from the point of view of the user.

Among the heterarchic systems, Nuopponen's own invention, called **satellite systems** and based on the mind map concept, is particularly promising because of their flexibility, which has indeed been proved in practice by some of my students, who have found them very useful, particularly at a macro systems level.

Figure 7 shows an example from their recently prepared thesis on domain loss and language planning in relation to Danish IT terminology (Petersen & Bruchhaus 2001). The central node of the satellite system is the main theme of their terminological analysis: NETWORK.

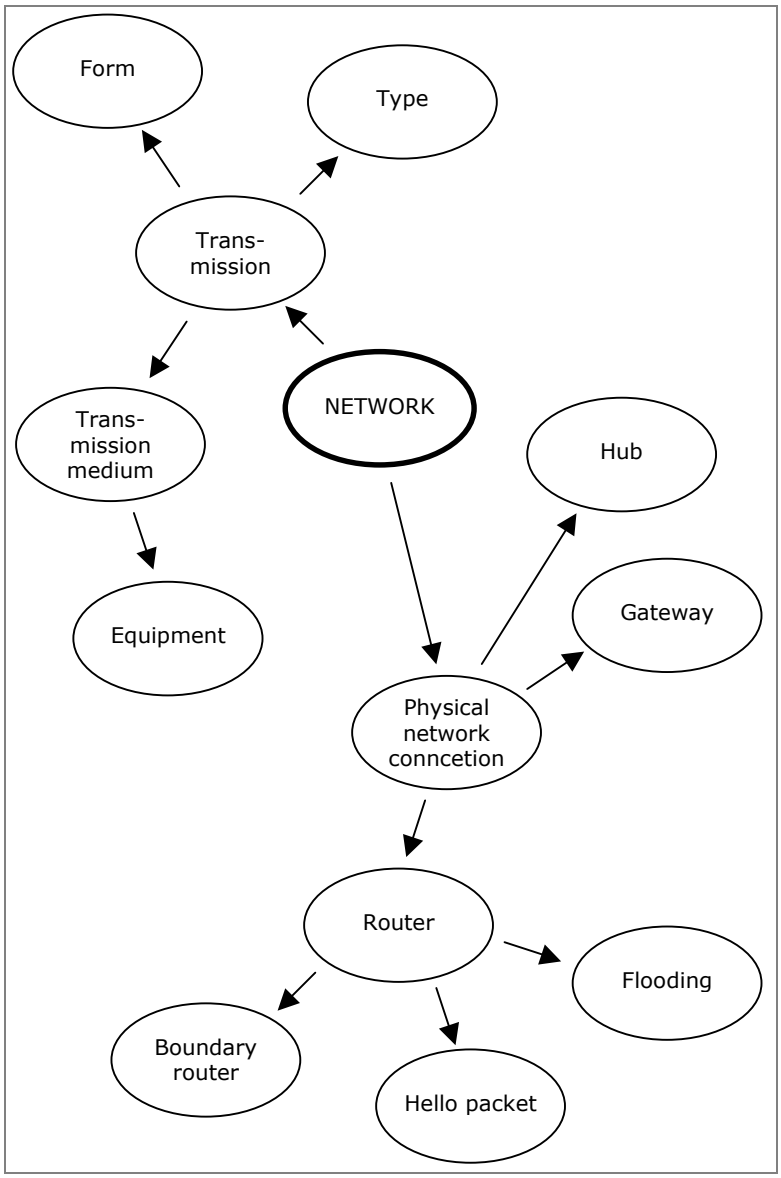

Figure 7: Satellite system illustrating conceptual relations at the highest level within the subject of IT networks. Based on Bruchhaus & Petersen 2001: 93.

Conceptual systems and enactive cognitive science

Anita Nuopponen devotes a section of her book to conceptual systems regarded as models or as an important component in the process of model building. According to what I have said up to now, conceptual systems are indeed models, i.e. abstract or mental models formed by human beings who are living systems in dynamic interaction with their environment. But how do models come about, and why do they look the way they do ?

Wüster would probably answer that they are another link in an ancient tradition from Aristotle via nomenclatures to classification systems, etc., all of them ultimately based on conceptual logic. But what does logic build on, and why — to name just a single question that could be asked — does it dictate systems in which the broader concepts are at the top of a 'ladder' of concepts, and not the other way round ?

No doubt modern so-called enactive cognitive science will be able to tell us why. According to this branch of cognitive science, which overlaps of course with cognitive linguistics, no understanding or meaning can come about without bodily experience. This is the basis of all our cognitive activities, including language. 'Our capacities of understanding are rooted in the structures of our biological embodiment', as Varela et al. put it in 'The Embodied Mind' (1991: 149).

Lakoff and Johnson have written extensively on how this process of meaning and understanding via bodily experience takes place (see e.g. Lakoff and Johnson 1999), so I shall just briefly summarize some main points.

In very early childhood, we form so-called **basic image-schemata** while we move over a surface, experience the contact between our body and the surface, grasp and manipulate objects, eat some of them, drink from them, etc. All our subsequent mental models – including our concepts — are formed via metaphorical mappings from those very flexible image-schemata.

Lakoff also claims that like categorisation, many of the most basic concepts in semantics are understood metaphorically; i.e. they are metaphorical projections of basic image-schemata. They include time, quantity, state, change, action, cause, purpose, means, etc. (1990: 51).

A well-known example is the **container image schema**: we experience bodily the fact that something can be inside something else (a container). Categorisation is an example of abstract phenomena which are understood metaphorically, not by virtue of any logical deduction, but by virtue of the topological properties of containers (1990: 52), as illustrated in **figure 8** on the next page. Note also that **set theory** must be based on this image schema.

This means that even extremely abstract models, such as generic conceptual systems, will in the last resort be based on several basic image-schemata, not directly, but via metaphorical mapping. Thus in graphic representations of generic conceptual systems, superordinate concepts are almost invariably placed above subordinate concepts, which reflects the image-schema '**more is up, less is down**', to mention a simple example.

Lakoff claims that a great many, if not all, abstract inferences are actually metaphorical versions of **spatial inferences** that are inherent in the topological structure of an original image-schema (1990: 54). This implies that the role of logic in human cognition is not as fundamental as that played by basic image-schemata. Logic comes in later and is not conceivable without a bodily basis.

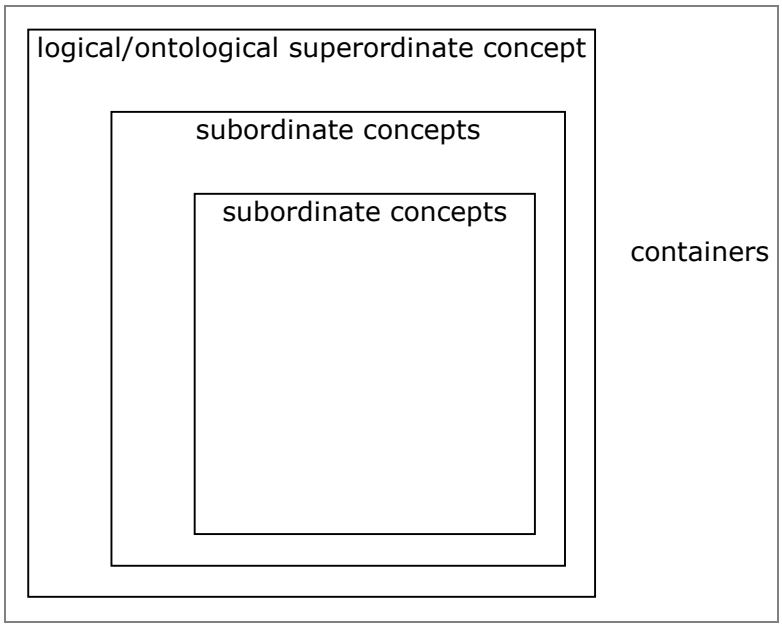

Figure 8: Image-schematic basis of categorisation and part-whole relationships

How can we integrate these basic insights of enactive cognitive science and cognitive linguistics in terminological theory as far as systems of concepts are concerned ?

All I can say at present is that it may teach us an important lesson: conceptual systems are one type of conceptual model among many others, including scientific models as described e.g. by Mary Hesse and Rom Harré in the 60's and 70's.

According to Harré's and Hesse's neo-realistic school of philosophy of science, models are not just 'tools' in theory building, to be discarded as soon as the theory has been developed. On the contrary, they form the dynamic core of any theory, and they always involve some kind of analogy, which means that they are metaphoric in nature (Harré 1970, Hesse 1966).

In **figure 9** I have indicated my view of the basic relatedness of various types of conceptual models.

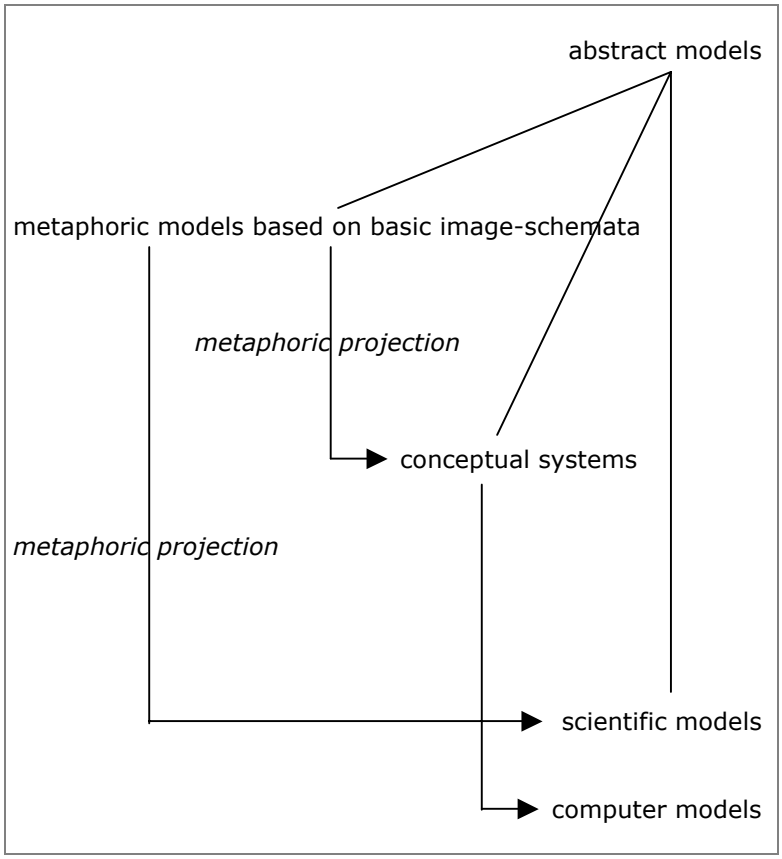

Figure 9

My point is that we should use any method that is available for modelling, in science as well as in information science, which I have not mentioned, but which of course is as important. They all build on the same metaphoric basis, and the differences are probably not as important as we used to think.

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Øivin Andersen

COMMENTS ON BERTHA TOFT'S CONTRIBUTION

It is very difficult to give a survey of different terminological conceptual theories in the course of 10 or even 20 minutes. Toft has made a sound decision in selecting two topics for discussion: modern systems theory and modern enactive cognitive science/cognitive linguistics.

My comments will not take the form of opposition to any considerable degree because I can readily subscribe to many of her points, although I have a few reservations.

I basically agree with her description of higer level open dynamic and adaptive systems. An excellent example of such systems is language itself. Language is an open, dynamic system changing through time to adapt to other open socio-cultural systems. Still we need to describe language in static, closed systems syncronically. This also includes the description of lexicon and terminological concept systems. The price we have to pay is contiuous updating of these systems, a notorious problem in practical terminology work.

The problem of emergent properties from lower to higher levels of systems is difficult to explain away for those who want to reduce higher level systems to lower level systems. Still, there is disagreement among scholars as to which disciplines belong to the same level or different levels. Psychology is a notorious case: Is the level of psychology a separate, irreducible level ? Can the mind be studied independently from the brain ? This is the view of scholars such as Piaget and Fodor, and in linguistics, those functionalists who regard communication as the basic function of language.

Or, alternatively, can psychology be reduced to neurophysics ? Is the workings of the mind a direct reflex of the structure of the brain ? This is basically Chomsky´s view (i.e. Chomsky´s biological universal grammar). This is also shared by the formalists who tend to regard the

most important function of language to be that of information-processing, and view the communicative function of language as secondary and derivative.

The point is that the evaluation of what counts as an emergent property may differ, and this will have considerable consequences for how facts are structured into conceptual systems.

A few words about Wüster´s ”pure abstractions”. Toft says that ”This kind of order is indeed artificial and does not reflect any actually existing order”. I think that this statement is somewhat on the strong side, depending on what is meant by ”existing”, at least if applied to Wüster´s logical generic systems. In these systems meaning postulates such as logical transitivity and asymmetry seem to be valid in principle. From the point of view of cognitive linguistics, Johnson-Laird (among others) has pointed out that a taxonomy (or generic system) allows for relatively simple meanings of words that can be encoded as schemata and can be readily acquired by children. Several phychological priming experiments have indicated that children are predisposed to taxonomize. Linguistic structures of languages of the world strongly indicate that we tend to think in terms of hierarchies. No doubt they have proved successful in information retrival systems as well. This should indicate that we might at least ascribe some kind of psychological existence to taxonomies, and I don’t think that Wüster was unaware of these aspects.

If we want to develop a psychological semantics for terminology we have to show how language and the world are related to one another in the human mind, i.e. to show how mental representation of terms is related to the mental representation of the world.

Traditional terminological concept theory has several properties in common with lexical decomposition semantics, i.e. the linguistic theory which held that the semantic representation of a word primarily comprises a structured set of elements, ”semantic markers”, which decompose its meanings into more primitive semantic constituents. These markers function like characteristic features of terms in classical terminology theory. The difference is that the former is onomasiological and the latter is semasiological.

Nuopponen´s satellite systems, on the other hand, seem to have several properties in common with the theory of semantic networks, or

”mental maps” developed in psycholinguistics. As has been pointed out (by Rosch and others), very few features, even in terminology, can be said to be necessary and sufficient. Some lexical studies have indicated that the lexicon of different languages of the world seem to form both generic hierarchies (taxonomies) and prototype structures. So prototype theory should be a supplement to the classical theory, not a substitute for it.

Nuopponen´s satellite systems have proven useful for many pracical terminological purposes. An interesting question would be what causes their usefulnes. One problem with these systems seems to be an absence of any principled constraints on the processes that can be employed in setting up the systems. Consequently, the empirical basis of the system is unclear. We might consider several alternative ways of structuring a certain domain by using satellite systems. Will all these alternatives have an equal status, or do we have any means of eliminating some of them ? There seems to be a need for an evaluation procedure for this.

I do agree with Toft that the role of logic in human cognition is not as fundamental as that played by basic image-schemata, but only ontologically in that it comes first in acquisition, being based on bodily experience. But basic logic does play an important role in the way we tend to reason and conceptualize as mature adults, as has been pointed out by several psychologists and linguists.

Toft proposes to use ”any method that is available for modelling, in science as well as in information science”. Again I agree, but, as Johnson-Laird has pointed out, we construct practical, partial working models of the world around us in order to grasp the complex real systems around us. Some of these models are very useful because they enable us to understand better, others are less useful because they do not provide increased understanding. So we discard the useless ones and construct new or modified ones in our quest for understanding. As far as I can see, we do much of the same thing in science as well, but if progress is to be made we have to evaluate which models are useful for a specific purpose and which are not.

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