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Conceptual metaphors as an organisational framework of the specialist language of IT:
An analysis of Cloud Computing Terminology

Summary

If language constantly changes and mirrors the manner in which we think, then conceptual structures – which are mirrored in language – must be under constant reconstruction as well. On the cognitive-linguistic view, human conceptual structure is organised through conceptual metaphors which may not be comprehended independently of its experiential basis (Lakoff and Johnson 1980). Accounted for by Lakoff and Johnson (2003: 203) as cross-domain mappings in the conceptual system, conceptual metaphors map our concrete experience onto abstract experiences, so as to effortlessly get hold of new emergent concepts. To phrase it straightforwardly, conceptual metaphors enable us to picture what is otherwise too abstract to be pictured, to name what is otherwise too abstract to be named, to classify what is otherwise too abstract to be classified, and to reason about what is otherwise too abstract to be reasoned about. Nevertheless, neither of these is feasible, unless closely tied to and building on our experiential basis.

Conceptual metaphors permeate the terminology of many specialist languages (Ureña Gómez-Moreno 2011; Herrmann and Sardinha 2015; Grygiel 2015a, 2017a). Within the canvas of cognitive linguistics, metaphorical mappings “are means of extending the resources of a language” (Ungerer and Schmid 1996: 128). Nevertheless, in specialist-linguistic surroundings, conceptual metaphors lay foundations not only for the purely linguistic output – i.e. specialist terminology – but are also imprinted in specialist knowledge and specialist practices. Without conceptual metaphors, specialists would be unlikely to acquire and generate specialist knowledge and arrive at an all-encompassing understanding of as impenetrable specialist fields as that of information technology.

Let us explain here that some observations and references made in this dissertation link to my personal three years’ experience of working in an IT-centred company. I have had the opportunity of observing and engaging in communication with software testers, analysts, and developers on a daily basis. My observations in this dissertation also cover specialist experience and specialist knowledge from my one year’s stay in the software testing / quality assurance

team, which jointly made me attentive to the manner in which IT specialists, manifesting all levels of specialisation, metaphorically conceptualise the specialist field of cloud computing and information technology in general. What sparked my interest in scrutinising the patterns of metaphorical conceptualisation of the specialist language of information technology, was the spectrum of anthropomorphised linguistic expressions which IT specialists used so as to refer to various technological products and processes. They talked of applications or performance that *suffer*, of machines that *experience* failures, of interfaces that are *intuitive*, *responsive* and *friendly*, and of software that is *malicious*.

The present thesis is aimed at scrutinising the cloud computing terminology, so as to investigate whether conceptual metaphors may be regarded as an organisational framework of the specialist language of information technology. Therefore, throughout the present dissertation we rely extensively on the notions of *terminology*, *specialist language*, and *conceptual metaphor* in our own argumentation concerning the conceptual metaphorisation of the specialist language of information technology. We find these notions inseparably linked to one another in contemporary debate on the conceptual structure of any specialist field, including information technology. The three notions operate as solid pillars on which further theoretical and empirical elaborations are founded. We are intentionally selective in our choice, and we resign from providing the reader with a wide panorama of notions, concepts and ideas in the realm of terminological research and conceptual metaphors. This is owing to the fact that there is a plethora of theoretical publications providing exhaustive presentation of the issues at hand. Nevertheless, an attempt is made to draw an insightful picture of our conception of specialist language which we believe that as a notion lays unexplained and merits further discussion and arrangement.

Content-wise, the present dissertation is organised as follows. Chapter 1 offers a synthesis of available approaches to terminology and a bird's eye view on accounts of theoretical terminological research, such as Wüster's *General Terminology Theory*, *Socioterminology Theory*, Cabré's *Communicative Terminology Theory*, Temmerman's *Sociocognitive Terminology Theory*, and Faber's *Frame-based terminology*. The primary purpose of this chapter is to present the cognitive and communicative shift that terminology has undergone throughout the years. The said cognitive shift rearranges the understanding of terms that are frequently treated as mere denotations of concepts, and draws more attention to their underlying conceptual structure.

In Chapter 2, our attention is directed towards *specialist languages*. An attempt is made to provide a concise overview of research on the evolution of the notion of specialist language

since the 1960s. To that end, S. Grucza's (2013a) four-partite timespan serves as an inspiration for framing and arranging anew the historical classifications. Furthermore, we suggest that specialist language should be approached as a multimodal form of specialist communication and representation of a micro-reality which integrates three dimensions: specialist linguistic expressions, specialist knowledge, and professional practices.

Chapter 3 draws a broad background for the notion of *conceptual metaphor* which constitutes the central reference framework for this thesis. In Chapter 3, we succinctly present how metaphor works in language, by tracing the historical development of its conception. The original Greek metaphor underwent a real metamorphosis, starting its way from the Aristotelian *ornatus orationis* ('the ornament of speech') to become a conceptual metaphor in thought, and finally re-established its firm grounding in cognition. Within the contours of Chapter 3, also the notions of *conceptual blending* and *image schemas* are elaborated on to the extent that the scope of the analytical part allows it.

In Chapter 4, we extensively discuss the methodological guidelines that governed the investigation outlined in the analytical part. The present dissertation is corpus-driven and inductive (interpretative) in nature. In our methodological assumptions, we have settled upon analysing the corpus material without any presumption of conceptual metaphors, therefore we have opted for an *ex post facto* (after-the-fact) research design. The methodology adopted in this thesis follows a tailored three-stage and six-step combination of MIP (Pragglejaz Group: 2007) metaphor identification procedure and Charteris-Black's (2004) corpus approach to metaphor analysis (CMA), with a few modifications. The corpus texts were processed by means of *Sketch Engine*, a corpus manager and text analysis software, which aided in concordancing and KWIC ('key-words-in-context') analysis.

Finally, in Chapter 5, we have analysed the corpus texts revolving loosely around the theme of *cloud computing*, chosen as the reference base for the detection and investigation of potential conceptual metaphors cast within the specialist field of information technology. Note that in Chapter 5, information technology is understood as an umbrella macro conceptual target domain encompassing other target domains discussed in this chapter, such as for instance CLOUD COMPUTING, CLOUD COMPUTING RELATIONS, USING CLOUD COMPUTING, or VIRTUAL SPACE. Upon that note, the metaphorical expressions regarded as instantiating the CLOUD-oriented target domains are claimed to instantiate the macro target domain of INFORMATION TECHNOLOGY as well. Analysing the corpus texts we have formulated a thesis that conceptual metaphors act as an organisational framework of the specialist language of information technology. The dissertation ends with a conclusion of the entire study.

The present investigation adopts inductive (bottom-up) corpus-driven research methodology which makes minimal *a priori* assumptions that need to be employed for the corpus analysis. Therefore, in order to preserve the inductive and corpus-driven approach, only two research questions were formulated initially:

1. Is the specialist field of information technology metaphorically conceptualised?
2. Does the cloud computing terminology instantiate any conceptual mappings?

Under closer scrutiny of the corpus texts, the following research hypotheses arose:

1. Is the specialist language of information technology based on image-schematic representations?
2. What is the role of conceptual metaphors in knowledge construction in the specialist language of information technology?

The two research questions and the two research hypotheses jointly shape the following main research hypothesis:

3. Do conceptual metaphors act as an organisational framework of the specialist language of information technology?

The present study constitutes a corpus-driven approach to the analysis of conceptual metaphors. The corpus was delimited to the books on cloud computing on the grounds that no prior research on conceptual metaphors was conducted on this particular subfield of information technology. In this regard, cloud computing, as a relatively new specialist field spanning a vast array of topics, was believed to provide original insights into the conceptual structure of information technology.

The complete corpus of ten textbooks on cloud computing with a total word count of 889.716 is analysed for conceptual-metaphorical content. A central justification for the construction of such a comprehensive corpus lies in our aim at arriving at an illustrative number of cognitive-linguistic patterns instantiating the conceptual-metaphorical structure of the specialist language of information technology. The corpus encompasses the following books on cloud computing:

1. Exam Ref 70-532 Developing Microsoft Azure Solutions
2. Exam Ref 70-533 Implementing Microsoft Azure Infrastructure Solutions
3. Exam Ref 70-535 Architecting Microsoft Azure Solutions
4. Exam Ref 70-765 Provisioning SQL Databases
5. Exam Ref AZ-900 Microsoft Azure Fundamentals
6. Microsoft Azure Security Center
7. Microsoft Azure Security Infrastructure

8. Microsoft Azure Sentinel Planning and implementing Microsoft's cloud-native SIEM solution
9. Exam Ref 70-487: Developing Windows Azure and Web Services
10. Exam Ref AZ-103 Microsoft Azure Administrator

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Step one: reading of corpus texts

Step two: in search of incongruity: manual text-mining

Step three: KWIC analysis

Step four: MIP criteria for conceptual metaphoricity: contextual and basic meaning

Step five: grouping into conceptual metaphors

Step six: how conceptual metaphors organise a specialist field

Following the MIP/MIPVU guidelines, Macmillan Dictionary was regarded as our primary point of reference for basic meanings. In contestable cases, reference was made to Longman Dictionary of Contemporary English Online and Longman Business English Dictionary. Although the MIP/MIPVU procedure recommends only two dictionaries for sense mining, in order to establish contextual senses we decided to incorporate specialist dictionaries into our study. The dictionaries referred to in this dissertation include:

- Macmillan Dictionary available at <https://www.macmillandictionary.com/> (MD)
- Longman Dictionary of Contemporary English Online available at <https://www.ldoceonline.com/> (LD)
- Longman Business English Dictionary (LBD)
- Computer Hope available at <https://www.computerhope.com/> (CH)
- Barron's Dictionary of Computer and Internet Terms (BDCIT)
- Oxford Dictionary of Computer Science (ODCS)

Using cognitive-linguistic methodological apparatus, we have identified an appreciable number of metaphorical expressions that realise conceptual metaphors in the specialist language

of information technology at different levels of granularity. Progressing from the coarse-grained and scattered lexical instantiations of conceptual mappings to the fine-grained schematic and intertwined conceptualisations, we have gradually arrived at an illustrative conceptual metaphorisation framework that organises the specialist field of information technology.

We have arrived at a conclusion that information technology is conceptualised by 13 main and 19 lower-level conceptual metaphors. The 13 main conceptual metaphors encompass:

1. CLOUD COMPUTING IS A PERSON
2. CLOUD COMPUTING IS AN ANIMAL
3. CLOUD COMPUTING IS COMPETITION
4. CLOUD COMPUTING IS COMBAT
5. CLOUD COMPUTING IS COMMITTING A CRIME
6. CLOUD COMPUTING IS DEFENCE
7. CLOUD COMPUTING IS ESPIONAGE
8. CLOUD COMPUTING IS INTRUSION
9. CLOUD COMPUTING IS OUTER SPACE/THE COSMOS
10. CLOUD COMPUTING IS A MACHINE WITH MODES OF OPERATION
11. CLOUD COMPUTING IS FOOD/COUISINE
12. CLOUD COMPUTING IS VOGUE
13. VIRTUAL SPACE IS PHYSICAL SPACE

The 20 lower-level conceptual metaphors encompass:

1. CLOUD COMPUTING IS A PERSON WITH EMOTIONS
2. CLOUD COMPUTING IS A PERSON WITH ROLES /OCCUPATIONS
3. CLOUD COMPUTING RELATIONS ARE KINSHIP RELATIONS
4. CLOUD COMPUTING LIFECYCLE IS HUMAN LIFECYCLE
5. CLOUD COMPUTING IS HUMAN ACTIVITY
6. INTERACTING WITH THE CLOUD IS CONVERSING WITH A PERSON
7. USING THE CLOUD IS OUTSOURCING SERVICES
8. USING THE CLOUD IS RENTING A WAREHOUSE
9. THE CONDITION OF THE CLOUD IS THE HEALTH OF A PERSON
10. PARTS OF THE CLOUD ARE PARTS OF A LIVING ORGANISM
11. THE FUNCTION OF THE CLOUD IS THE FUNCTION OF A PERSON
12. VIRTUAL SPACE IS AN INHABITABLE AREA

13. VIRTUAL SPACE IS A RESIDENTIAL BUILDING
14. MOVING TO THE CLOUD IS RELOCATING TO A NEW PLACE
15. VIRTUAL PROCESS IS PHYSICAL PROCESS
16. VIRTUAL MOVEMENT IS PHYSICAL MOVEMENT
17. VIRTUAL SPACE IS A SURFACE
18. VIRTUAL SPACE IS A CONTAINER
19. VIRTUAL SPACE IS A PATH

We have concluded that the total ratio of metaphorical expressions amounts to 28.61%. According to the number of metaphorical expressions identified and the frequency of the conceptual metaphors' occurrence in the corpus texts, we have proposed that CLOUD COMPUTING IS A PERSON and VIRTUAL SPACE IS PHYSICAL SPACE constitute the most conspicuous conceptual metaphors. Furthermore, we argue that these conceptual metaphors act as the principal conceptualisations that lay foundations for a coherent conceptual structuring of the specialist field of information technology.

Following this observation, we have argued that the CLOUD COMPUTING IS A PERSON and VIRTUAL SPACE IS PHYSICAL SPACE conceptual metaphors are not only conducive to the emergence of other conceptualisations, but constitute the backbone of the entire conceptual-metaphorical framework discussed in this dissertation. Seen from this perspective, we regard the VIRTUAL SPACE IS PHYSICAL SPACE conceptual metaphor as a conceptual reference point for any metaphorical conceptualisation instantiated by the specialist language of information technology. Correspondingly, conceptual metaphors such as e.g. MOVING TO THE CLOUD IS RELOCATING TO A NEW PLACE, VIRTUAL MOVEMENT IS PHYSICAL MOVEMENT, or VIRTUAL PROCESS IS PHYSICAL PROCESS derive from viewing virtual space as a physical construction, and rely on image-schematic representations of our embodied interactions with the physical world. By the same token, the occurrence of the lower-level conceptual metaphors such as e.g. CLOUD COMPUTING LIFECYCLE IS HUMAN LIFECYCLE, or CLOUD COMPUTING ACTIVITY IS HUMAN ACTIVITY is contingent upon the presence of the CLOUD COMPUTING IS A PERSON conceptual metaphor which produces an overall humanised image of information technology by attributing human characteristics and qualities to it.

The anthropomorphically-profiled conceptual metaphorisation of information technology that we are proposing in this dissertation, lays solid foundations for our interactions with computers. In our view, within the specialist scenery of information technology, anthropomorphisation paves the way towards an authentic realisation of the human-to-

computer interaction, where computers and software are conceptualised not as mere conduits or channels, but rather as equal participants of communication. This is why the CLOUD COMPUTING IS A PERSON conceptual metaphor turned out as central for our discussion, with its anthropomorphic value highlighted so often throughout this dissertation.

We have also attempted to investigate whether cloud computing terminology is based on image-schematic representations. Our concrete bodily experience accumulated as we interact with the PHYSICAL SPACE, evokes image schemas which give us a sense of spatial orientations, such as UP-DOWN, IN-OUT, and FRONT-BACK. Although the collection of image schemas that mirror human's bodily experiences is wide, having scrutinised the corpus data, we have arrived at a conclusion that cloud computing terminology instantiates only three of them, i.e. SURFACE, CONTAINER, and PATH. Upon a thorough investigation of the corpus texts, we argue that the SURFACE image schema is the most general of the three image schemas mapped from the source domain of PHYSICAL SPACE to bound and structure the target domain of VIRTUAL SPACE. Following the concept of space presented in Aristotle's *Physics*, we have proven that also in information technology, the SURFACE image schema functions as a backdrop for smaller locations, places and other overlapping surfaces.

Having analysed the cloud computing terminology, we have concluded that the image-schematic conceptual metaphorisation is most frequently lexicalised by prepositions such as *on*, *at*, *in*, *onto*, *into*, *over*, *across*, *out of*, *inside*, *outside*, *from*, *to*, *towards*, and *between*. One specific observation that may be formulated upon a closer scrutiny of the corpus texts in STEP THREE and STEP FOUR, is that the same metaphorical expression may exhibit different image-schematic nature, dependably on the context in which it is immersed. In view of the linguistic evidence, we believe that our preferability for the preposition preceding a noun such as *hardware*, *network*, *Azure*, or *Windows* seems to be grounded in our subconscious conceptual metaphorical perception that helps to shape its meaning that we want to express.

We have also attempted to find out what role conceptual metaphors perform in knowledge construction in the specialist field of information technology. We find our own stance on knowledge construction close to anthropocentrism, in that specialist's knowledge is *sensu stricto* not transmittable or acquirable by other specialists. Instead, every specialist needs to (re)construct – i.e. create it – themselves. We have concluded that specialist linguistic expressions couched within the contours of information technology serve as a means of the construction and reconstruction of specialist knowledge. Upon that note, owing to their reciprocity, specialist knowledge may not be studied irrespective of specialist linguistic

expressions used in the context of specialist practice. As a matter of fact, in turn, specialist knowledge need to be included in the study of specialist linguistic expressions as well.

Drawing upon our explorations in the realm of specialist linguistic expressions in the specialist language of information technology, we judge the aspect of knowledge construction to be inherently conceptual-metaphorical. This is owing to the fact that, in our view, conceptual metaphors emerge as a cognitive tool that enables specialists on the one hand to interpret the specialist scenery of information technology and long-established specialist practices cultivated there and, on the other hand, to advance new hypotheses and theories within that specialist scenery. As evidenced by our extensive collection of data, conceptual metaphors identified in the corpus texts convey theoretical insights in the form of specialist linguistic expression not otherwise expressible or, in fact, expressible in an ineffectual manner.

Information technology specialists work with highly abstract and arbitrary realities, therefore a wide array of specialist concepts may not have a readily available and obvious designation in the form of a specialist linguistic expression. We have attempted to illustrate that within the canvas of the specialist language of information technology, conceptual metaphors act as productive scaffoldings for new conceptual structure. In view of the linguistic evidence under scrutiny, we argue that conceptual metaphors facilitate the verbalisation and articulation of specialist concepts and theories couched within the framework of information technology, therefore contribute to the production of new specialist content. In other words, we suggest that conceptual metaphors allow to create, account for and become acquainted with new technological advances such as, for instance, that of cloud computing.

Furthermore, there is a body of conceptual metaphors that may be plausibly termed not only knowledge-constitutive, but theory-constitutive. As a matter of fact, each theory-constitutive is knowledge-constitutive, but not necessarily the other way round. Delving into the corpus texts have unveiled that there is a specific and coherent assemblage of conceptual metaphors such as e.g. CLOUD COMPUTING IS AN ANIMAL or THE CONDITION OF CLOUD COMPUTING IS THE HEALTH OF A PERSON that may be claimed theory-constitutive. This is due to the fact that conceptual metaphors on the one hand play a major role in the teaching or explanation of theories and, on the other, reconstruct a portion of specialist knowledge for which no better literal paraphrase is available. Seen in this way, we argue that a great number of metaphorical expressions instantiating theory-constitutive conceptual metaphors, constitutes an irreplaceable part of the linguistic machinery of information technology.

Conceptually, cloud computing terminology is also fundamentally pre-theoretical. This is owing to the fact that many specialist linguistic expressions gained its specialist sense in

information technology before any theoretical assumptions were assigned to them in that specialist field. We propose that initially they were used as conceptual shortcuts to define activities, processes and elements of software and have later developed into fully-fledged or even-theory-constitutive specialist linguistic expressions, acting as parts of irreplaceable linguistic machinery of the specialist language of information technology.

Taking all these observations into account, we have arrived at the conclusion that the specialist language of information technology is imbued with vivid lexical instantiations of conceptual metaphorisation. From the frequency of occurrence point of view, we have therefore concluded that the extent to which conceptual metaphors permeate the confines of the specialist field of information technology is notable enough to consider them as the organising framework of the specialist field in question.

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