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KNOWLEDGE RECONSTRUCTION IN DICTIONARY ENTRIES
A case of cognitively-motivated onomasiology in Microsoft Azure Glossary of need-to-know cloud computing terminology

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Abstract – The purpose of the present study is to investigate the manner in which a specialist dictionary, considered here a type of specialist text, may prove an applicable tool of knowledge reconstruction. It is suggested that the role of specialist terms is not delimited to mere denotations of concepts. Rather, terms included in dictionaries are approached as access points to conceptual structures and, as such, instantiations of specialist (specialists') knowledge. The paper seeks to account for the conceptual motivation behind the semantics of lexical items in the target domain of CLOUD COMPUTING and it is assumed that reconstructing a portion of specialist extralinguistic reality is facilitated through cognitively-motivated onomasiology. To that end, it is postulated that onomasiological CONCRETE-TO-ABSTRACT directionality may be lexicalised in dictionary entries through cognitively-motivated tools such as conceptual metaphors and image schemas. In the cognitive-linguistic view, our conceptual structure is organised through conceptual metaphors which may not be comprehended independently of their experiential basis. Therefore, the treatment of lexical items in this paper is cognitive-linguistic in spirit. Dictionary entries were checked for potential lexicalisations of cognitively-motivated onomasiology using the methodological apparatus offered by Pragglejaz Group's MIP metaphor identification procedure and Charteris-Black's CMA corpus approach to metaphor analysis.

Keywords: onomasiology; cognitive linguistics; conceptual metaphor; specialist knowledge; specialist terminology.

1. Introduction

Cognitive linguistics promises to be a framework that offers novel insights into the study of dictionary entries in that it is "interested in knowledge through the language" (Geeraerts, Cuyckens 2010, p. 4). By anchoring the investigation in cognitive linguistics, the role of specialist terms is not delimited to mere denotations of (specialist) concepts. Rather, terms included in specialist dictionaries are approached as access points to more complex knowledge structures and, as such, instantiations of specialist knowledge. The notion of specialist knowledge merits further comment. This is owing to the fact that depending on research methodology, it may be approached differently. I find my stance on knowledge reconstruction as conforming to cognitive linguistics and anthropocentrism, in that specialist (specialists') knowledge may not be transferred or acquired. Rather, in this paper I prefer to adopt an understanding that a specialist may only re(construct) knowledge themselves with the aid of specialist texts, of which specialist dictionaries are an integral part. Upon that view, specialists may reconstruct specialist knowledge, i.e. understand the codifications of conceptual mappings in dictionaries in the form of lexical items coined by earlier generations of specialists.

Within the contours of cognitive linguistics, specialists' knowledge structures are argued to have a conceptual-metaphorical basis, because "conceptual metaphor is a natural part of human thought" (Lakoff, Johnson 1980, p. 247). Bearing in mind that knowledge

and language share their nature, in that neither the former, nor the latter may be directly transferred to other people or assimilated from them, and individuals need to reconstruct knowledge on their own, within the canvas of this paper it is postulated that specialists reconstruct specialist knowledge by themselves through immersion in the subject matter and through interiorisation. Having reconstructed specialist knowledge, a specialist may, as a matter of fact, instantiate it. Such instantiations assume the form of specialist texts, either oral or written. Our experiential basis is subject to ongoing development as we engage in all sorts of interactions with the world around us. And it is through these interactions that we learn about yet unknown conceptual structures.

Conceptual metaphors assist in the process of knowledge reconstruction and reveal a view of the specialist (or specialists') micro-reality as constructed by its members. Upon that view, an analysis of conceptual-metaphorical structures is contributive to the understanding of the specialist community itself (Kövecses 2005; Lakoff 1987; Sweetser 1990). Conceptual metaphors seem particularly productive in knowledge reconstruction, owing to the fact that "an area of knowledge that is unknown or difficult to access for the layman is presented in terms of another domain that is cognitively familiar to readers, being part of their background knowledge or everyday experience" (Garzone 2021, p. 161).

2. Theoretical background

Onomasiology takes its starting point in a concept that needs to be designated (Grondelaers, Geeraerts 2003, p. 69). In this view, onomasiological studies delve into the identification of preconceived meaning by name. Within the contours of information technology (of which cloud computing is an integral part), specialists are immersed in highly abstract and arbitrary realities and due to the already high definitional complexity they are rather reluctant to change the lexis within their specialist communities. That corroborates Koch's (2008, p. 109) observations in line with which specialists "just innovate using a trope that makes communication more efficient". Name-giving processes in information technology include coining new terms for new software functionalities developed on an ongoing basis by software developers. Therefore, cognitively-motivated onomasiology seems like a natural course of action to take in specialist settings when specialists lack a readily available and obvious lexical designation at hand. Most certainly, when new technological advances need to be named, such "speaker-induced" (Koch 2008, p. 110) designation is motivated by the necessity to express an idea, rather than give the chosen expression a different interpretation. This is due to the fact that language users "use innovating tropes to designate a particular concept, not to change the meaning of a word" (Koch 2008, pp. 109-110). Contributive to our understanding of cognitively-motivated onomasiology may also be Nerlich and Clarke's (1992, p. 137) stance, in line with which novel designations are simultaneously understandable and innovative if their meaning is self-evident.

Relying on insights from Lakoff's (1987) observations, conceptual metaphor constitutes one of the cognitive mechanisms that accompany the motivation of terminology. Motivation plays an important role in cognitive linguistics, due to the fact that "[i]t is easier to learn something that is motivated than something that is arbitrary. It is also easier to remember and use motivated knowledge than arbitrary knowledge". We are capable of understanding what lexical items in dictionary entries mean, owing to the fact that various conceptual metaphors motivate their meanings. Conceptual metaphors may be

postulated to motivate onomasiology for two reasons. Firstly, owing to the fact that the human mind works with concepts that establish links to other, structurally corresponding concepts, conceptual metaphor is crucial in our conceptualisation of the world (Kövecses 2022; Lakoff, Johnson 1980). Second, our reasoning is embodied, which means that our bodily exchanges with the world serve as a source of inferences about more abstract concepts to which these inferences are applied. Upon that view, our coherently organised and bodily-motivated knowledge about concepts such as UP and DOWN helps us to arrive at a better understanding of the phrase *I'm feeling down in the dumps,* which constitutes a lexicalisation of the conceptual metaphor SADNESS IS DOWN.

The said process of arriving at a better understanding of an abstract concept, i.e. the process of conceptual mapping that occurs between DOWN and SADNESS, is grounded in image schemas which constitute relatively abstract conceptual representations that build directly on our embodied exchanges with the surroundings (Johnson 1987). For Lakoff and Johnson (1980), our conceptual structure, i.e. the cognitive system, shapes and arranges our embodied experience in such a manner that it may serve as a basis for linguistic expression. Accordingly, semantic structure mirrors our conceptual structure that draws from our embodied experience and embraces all types of sensory-perceptual experience (Johnson 1987).

Conceptual metaphor is one of the most important conceptual mechanisms that motivates onomasiology, i.e. the process of referring to extralinguistic reality. We can understand lexical items such as *responsive*, *friendly* or *intuitive* used within the canvas of the specialist language of information technology, owing to the fact that the conceptual metaphor SOFTWARE IS A HUMAN BEING motivates their meaning. For Zabawa (2018, p. 262, 2019), there are numerous expressions based on personification. "Computers and computer programs can be described with the use of various adjectives, traditionally used only with reference to humans (…) e.g. *intelligent* or *malicious*" (Zabawa 2018, p. 262). Such manifestations of conceptual metaphors should not be viewed as merely linguistic manifestations of the mechanisms of human cognition, but as fundamental mechanisms governing onomasiology.

Conceptual metaphors motivate name-giving processes in information technology and their role is evident in computerese (Krawiec 2022). Solving onomasiological issues by having recourse to conceptual metaphorisation lies in software developers lexicalising their embodied knowledge of extralinguistic reality where insects (*bugs*) are prototypically linked to such qualities as obnoxiousness or repulsiveness, and crisp wafers with a piece of paper inside are mapped onto specialist settings as text-only data (*cookies*). In both cases, while motivated by specialist-linguistic surroundings, new specialist knowledge is reconstructed by dictionary users in that some prototypical features of bugs and cookies are lost, so as to lay emphasis on strictly denotative functions, i.e. an error and an embedded message.

3. Corpus, aims and methodology

In the foregoing I will seek to inform the debate on the role that cognitively-motivated onomasiology performs in knowledge reconstruction in dictionary entries extracted from *Microsoft Azure Glossary of need-to-know Cloud Computing Terminology*, i.e. a specialist dictionary of information technology. I have attempted to illustrate that within the canvas of a specialist dictionary, cognitively-motivated onomasiology offers productive scaffoldings to lexicalise newly-emerged conceptual structures. By having recourse to the

respective source concepts, I have ventured an attempt firstly to unveil various onomasiological pathways through which specialist concepts have been accounted for in a dictionary, and secondly to arrive at a proper understanding of how our embodied recurrent experience helps to reconstruct knowledge. Therefore in this paper I will provide evidence that cognitively-motivated onomasiology, through conceptual-metaphorical and image-schematic CONCRETE-to-ABSTRACT directionality allows us to reconstruct specialist knowledge, i.e. become acquainted with new technological advances such as, for instance, that of cloud computing.

In view of that, the working hypothesis formulated for the purpose of this paper is that instantiations of conceptual metaphors in dictionary entries may presuppose a reconstruction of specialist knowledge. Methodologically, this implies that an analysis of conceptual metaphors instantiated in dictionary entries provides an insight into the conceptual-metaphorical structures governing a given specialist field. Therefore, it is assumed that the analysis of lexical instantiations of conceptual metaphors – should there be any – in *Microsoft Azure Glossary of need-to-know Cloud Computing Terminology* in the form of lexical items will allow for a better reconstruction of conceptual-metaphorically-based specialist knowledge of information technology in the specialist community of IT professionals.

Any investigation delving into conceptual metaphors proceeds either deductively or inductively (Steen et al. 2010, p. 768). In view of the fact that I have attempted to analyse the dictionary entries without any presumption of conceptual metaphors, therefore opted for an *ex post facto* research design, this work is inductive in nature. By doing so, the analysis moves from linguistic expressions towards "a set of reconstructed conceptual structures that constitute cross-domain mappings" (Steen et al. 2010, p. 768).

The dictionary was subjected to analysis by way of manual inspection of its entries. To that end, I have pursued a combination of Pragglejaz Group's (2007) *MIP metaphor identification procedure* and Charteris-Black's (2004) *CMA corpus approach to metaphor analysis*. As my previous research on conceptual metaphorically within the canvas of the specialist language of information technology has shown (Krawiec 2022), the methodology set forth by Pragglejaz Group proved insufficient to account for instances of conceptual metaphors that rest on the violation of selection restrictions or anthropomorphisation, which constitutes a frequent case in information technology. In view of that, I assume that preceding Pragglejaz Group's (2007) division into basic and contextual meanings with Charteris-Black's (2004) search for incongruity allows for a more painstaking search process. Hence, the process of metaphor identification involved:

1. Step one: reading of dictionary entries "to establish a general understanding of the meaning" (Pragglejaz Group 2007, p. 3).
2. Step two: manual text-mining to seek "the presence of incongruity or semantic tension – either at linguistic, pragmatic or cognitive levels" resulting from a shift in prototypical use (Charteris-Black 2004, p. 35). The incongruity may occur as a result of:
    a. *Reification* – an abstract concept is referred to using a linguistic expression that in other contexts accounts for a concrete concept.
    b. *Personification* – an inanimate concept is referred to using a linguistic expression that in other contexts accounts for an animate concept.
    c. *De-personification* – an animate concept is referred to using a linguistic expression that in other contexts describes an inanimate concept.
3. Step three: manual text-mining using MIP criteria:
    a. determining a lexical item's contextual meaning;

b. searching for a more basic (concrete) meaning of the lexical item using a standard dictionary.
c. juxtaposition of the two meanings, so as to establish the extent to which the two senses contrast.

4. Step four: grouping lexical items into conceptual metaphors.

One apparent caveat to the process of grouping metaphorical expressions into conceptual metaphors is the need to decide how many instances of a lexical item marked as a lexicalisation of conceptual metaphoricity count as an actual conceptualisation. Relying on Steen's (1999) observations and the rather miniscule size of the corpus, I have subscribed to the view that the actual conceptuality of a conceptual metaphor is not contingent upon a significant number of conceptually corresponding lexical items (Steen, 1999, pp.58-59). In view of that, I believe that even one lexical item tagged as an instantiation of conceptual metaphoricity may in fact signal metaphorical conceptualisation, as does a considerable number of such lexical items.

The corpus I have collected embraces a total of 59 entries included in *Microsoft Azure Glossary of need-to-know Cloud Computing Terminology*. The *Microsoft Azure Glossary of need-to-know Cloud Computing Terminology* was selected, firstly, due to the fact that it is a dictionary immersed in specialist settings of information technology, and secondly, owing to its authenticity and authorisation. By authenticity, it is understood that a dictionary is produced by specialists in specialist surroundings. By authorised, it is understood that a dictionary is issued by accredited cloud-computing-oriented providers, such as Microsoft Azure.

Worthy of comment in this regard is the fact that this paper constitutes a pilot study, and as such it may aspire only to signal the complexity, rather than offer an all-encompassing study into the issue in hand. Owing to the fact that linguistically information technology (of which cloud computing is an integral part) constitutes a rather under-researched area, my research may, to some degree, fill this apparent gap. In this regard, an interface is therefore proposed between conceptual metaphors and lexicography.

4. Discussion

4.1. CLOUD COMPUTING IS A PERSON conceptual metaphor

The CLOUD COMPUTING IS A PERSON conceptual metaphor is one of the most conspicuous conceptual metaphors detected in dictionary entries provided by *Microsoft Azure Glossary of need-to-know Cloud Computing Terminology*. As couched within the specialist settings of information technology, conceptual metaphors are approached as the major mechanism underlying the development of lexical meaning (Krawiec 2022). This is owing to the fact that conceptual metaphors are contingent upon the conceptualizers' perception of the extralinguistic reality they are immersed in. By anchoring the analysis in onomasiology, an investigation into the rationale behind a given development results in a detection of "cognitively salient" (Geeraerts 2010) elements of the extralinguistic world. And it is these elements that contribute to the conceptualisation of conceptual-metaphorical sense.

Relying on the insights from the dictionary entries, conceptual metaphorisation occurs most frequently when the meaning of lexical items in the dictionary builds on the conceptual elements whose cognitive salience is so considerable that they may be rendered conceptual-metaphorical in a target domain. It may be observed that onomasiological

paths leading lexical items into the lexical fields (and its counterpart conceptual target domain) of CLOUD COMPUTING, mostly adhere to THE CLOUD COMPUTING IS A PERSON conceptual-metaphorical formula. Probing into the above-mentioned lexical field of PERSON (and its counterpart conceptual domain) reveals that it is an important instance of an onomasiological source to consider. Certain onomasiological paths – of which conceptual metaphors are an essential part – are particularly interesting, especially if linguistic evidence in the form of dictionary entries suggests that these paths are repeatedly followed in a dictionary. This is owing to the fact that the said repetition of paths points to the presence of cognitively salient elements in the entries that correspond to the conceptual metaphor PERSON which, in turn, realises a more generic-level conceptual domain HUMAN BEING.

As evidenced in the dictionary entries, instantiations of conceptual metaphors grounded in anthropomorphisation rest on the similarity of behaviour, rather than appearance and underlie many names coined for technology-oriented activities. The CLOUD COMPUTING IS A PERSON conceptual metaphor that conforms to the CONCRETE-to-ABSTRACT onomasiological directionality of sense development proceeds in two directions of two intricately structured frames or scenarios, that is the frame or scenario of PERFORMING INTELLECTUAL TASKS and the frame or scenario of INTERPERSONAL CONTACTS, both anchored in the encyclopaedic knowledge of extralinguistic facts. Compatible with the former case, that is the frame or scenario of PERFORMING INTELLECTUAL TASKS, are the lexical items *capability of a computer system, intelligent, to complete tasks on their own, to handle, to develop their own intelligence, to perform tasks, performance, to interpret, to identify, to make decisions, to imitate, to analyze, to emulate, to use,* and *to learn*. An instantiation of the latter case, that is the frame or scenario of INTERPERSONAL CONTACTS, includes lexical items such as *integrity*, *to act together, to respond to, to rely on, to help do sth, to behave like, to enable, to host, to protect, to let,* and *to allow.*

Fundamental to the construal of the frame or scenario of PERFORMING INTELLECTUAL TASKS within the confines of computerese, is the presence of cognitively salient elements of the extralinguistic reality that may be easily transferred onto conceptual-metaphorical applications. These seem to include a HUMAN BEING who is MENTALLY CAPABLE and is PUTTING IN MENTAL EFFORT to complete a task, whose COGNITIVE FACULTIES become sharper as that HUMAN BEING evolves and who is PROCESSING INFORMATION as it comes and RESPONDS to it. Therefore, extralinguistic reality needs to be taken into account: people are subject to conscious and unconscious mental processes, are of low or high intelligence, they interact by responding to what they experience etc. – and this knowledge is (being) lexicalised, through conceptual metaphors in the entries offered by *Microsoft Azure Glossary of need-to-know Cloud Computing Terminology*, and subsequently reconstructed by its users.

Most certainly, software and hardware applied within the contours of cloud computing constitute inanimate, fully-programmed machines completely subject to human control. Nevertheless, through conceptual metaphorisation we approach them as independent actors with intentionality. This line of thinking is mirrored in the following dictionary entries:

lexical item(s)	**specialist term**	**dictionary entry**
to complete tasks on one's own	***artificial intelligence (AI) vs. machine learning (ML)***	"Intelligent" computers use AI to process information like humans do and complete tasks on their own. Machine learning—which is an application of AI—uses algorithms to enable computer systems to learn without human

		instruction and develop their own intelligence.
a capability	***artificial intelligence (AI)***	The capability of a computer system to imitate human intelligence. Using math and logic, the computer system simulates the reasoning that humans use to learn from new information and make decisions.
to handle	***NoSQL***	NoSQL is a set of nonrelational database technologies developed with unique capabilities to handle high volumes of unstructured and changing data. NoSQL technology offers dynamic schema, horizontal scaling, and the ability to store and retrieve data as columns, graphs, key-values, or documents.

Within the framework of information technology, specialists impute human characteristics to things naturally, hence "make use of one of the best source domains we have – ourselves" (Kövecses, 2010, p.39). Therefore, lexical items such as *intelligent*, *capability* and *to handle* became part of specialist-linguistic machinery within the canvas of information technology. The adjective *intelligent* is of particular interest to this investigation, as it may be termed theory-constitutive. This is due to the fact that the lexical item *intelligent* motivated by a specialist context expresses theoretical claims that are inexpressible in literal terms and constitutes an irreplaceable part of the lexis.

The frame or scenario of INTERPERSONAL CONTACTS emerges from the lexical items quoted above, and includes a HUMAN BEING who is BEHAVING in a certain way, ENGAGING IN A CONVERSATION with another HUMAN BEING. The verbs *to act together, to make decisions, to respond to, to rely on, to help do sth, to behave like, to enable, to host, to protect, to let,* and *to allow* map out conceptualizers' awareness of the extralinguistic reality pertinent to processes governing socialisation, which is usually marked by the necessity to interact with other people. Consider the following example:

lexical item(s)	**specialist term**	**dictionary entry**
to act together	***computer grids***	Groups of networked computers that act together to perform large tasks, such as analyzing huge sets of data and weather modeling.

In the definition of computer grids, *groups of networked computers* are being conceptualised as HUMAN BEINGS that act together and are therefore capable of COOPERATING, which in turn entails some degree of DECISION MAKING. The conceptual metaphor CLOUD COMPUTING IS A PERSON involves a personified perception of software elements and pieces of hardware. Owing to the fact that source-domain knowledge of HUMAN BEINGS is mapped onto the target domain of COMPUTERS, we have much less difficulty understanding the dictionary entry. This is due to the resultant understanding that we arrive at while building on the knowledge about humans in general, because we are, as a matter of fact, building on knowledge about our own selves. This type of self-knowledge constitutes a subconscious scaffolding for induction about target-domain elements of software. In seems particularly the case in the following example:

lexical item(s)	**specialist term**	**dictionary entry**
to behave	***virtual machine***	A computer file (typically called an image) that behaves like an actual computer. Multiple virtual machines can run simultaneously on the same physical computer.

Similarly to people who act in certain ways, preceding *a computer file* with a verb *to behave* imputes certain human characteristics onto software. In specialist settings, the primary role of anthropomorphisation is explanatory. Through the process of inductive inference about hardware and software and imputing human-like qualities onto them, we "think of them, react to them, and treat them as [...] a person with such traits" (Lakoff, Turner 1989, p. 194).

Upon closer scrutiny, the postulated anthropomorphisation of information technology may also be argued to be anchored in a reversed version of Lakoff and Turner's (1989, pp. 167-168*) Great Chain of Being Metaphor*. The Great Chain of Being Metaphor is characterised by mapping patterns that share a hierarchical classification of conceptual domains. To put it straightforwardly, within the contours of the Great Chain of Being Metaphor, humans are conceived as beings that are located at a higher level than inanimate objects such as technological artefacts, therefore it is the technology that is subordinate to human manipulation. The postulated reversal lies in a rearrangement of traditional roles, in that it is technology, in the form of software, that has authority over human beings. This line of thinking is mirrored in the following dictionary definitions of *virtual desktop infrastructure*, *database sharding* and *Microsoft Azure*:

lexical item(s)	**specialist term**	**dictionary entry**
to allow sb to do something	***virtual desktop infrastructure***	IT infrastructure that allows you to access computer systems from almost any device (such as a personal computer, smartphone, or tablet).
to let somebody do something	***database sharding***	A type of partitioning that lets you divide a large database into smaller databases, which can be managed faster and more easily across servers.
to enable somebody to do something	***Microsoft Azure***	(…) Azure enables you to build, run, and manage applications across multiple clouds, on-premises, and at the edge.

Most conspicuously, it is the repetitive assignment of agency through the violation of selection restrictions that governs the conceptual-metaphorical rendition of verbs. The verbs *to allow*, *to enable* and *to let* are preceded by non-human agents, such as *infrastructure*, *partitioning* and *Azure,* and followed by the pronoun *you*. With the three verbs violating the predicate-argument structure, *Microsoft Azure Glossary of need-to-know Cloud Computing Terminology* draws a conceptual picture of cloud computing and its elements as wilful agents capable of making decisions to grant someone permission to do or have something, or to make something possible. For Dorst (2011, p. 117), an agent is always specified at a conceptual level, therefore the criteria of selection restrictions seem to play a crucial role in reconstructing a portion of specialist knowledge for which no better paraphrase is available, but more importantly, the attribution of human skill to inanimate objects reinforces the perception of the presence of another human being behind a device. What is more, the stronger the conceptualisation of such a presence, the more successful users' exchanges with technology might be. The application of the Great Chain of Being Metaphor to the study of knowledge representation in dictionary entries enables us to arrive at a better understanding of less comprehensible aspects of the nature of technology in terms of better-understood human qualities. Instantiations of conceptual metaphoricity grounded in a reversed version of the Great Chain of Being Metaphor provide an accurate understanding of roles, tasks and challenges typical of the cloud computing scenery.

The superordination-subordination dependency is also noticeable between items of hardware and elements of software that are conceptual-metaphorically construed as

cooperating or managing one another:

lexical item(s)	**specialist term**	**dictionary entry**
to establish, to create	***virtual private network***	A virtual private network that establishes a connection between your computer and a remote server owned by a VPN provider. This connection creates a point-to-point tunnel that encrypts your personal data, masks your IP address, and lets you get around website blocks and firewalls.

The entry for *virtual private network* allows us to comprehend less well-understood aspects of the nature of software and hardware in terms of better-understood human characteristics. Later on in the definition, *a connection* is conceptual-metaphorically anthropomorphised as a wilful agent who makes something exist. Accordingly, an onomasiological path may be identified that leads downwards from PERSON to the level of CLOUD COMPUTING. It concurs with Krzeszowski's (1997, p. 80) viewpoint, maintaining that we "have a great tendency to ascribe higher values to various things and concepts at lower levels on the Great Chain of Being".

Relying on insights from the corpus material, it was observed that the target-domain conceptual-metaphorical interaction between human beings and technological artefacts involves activities building on actual human-to-human conversation. As couched in the specialist settings of information technology, of particular interest to us are the verbs *to respond to* and *to interpret* detected in the dictionary entries. Note that instead of offering a one-to-one reflection of the human-to-human interaction, the INTERACTING WITH THE CLOUD IS CONVERSING WITH A PERSON conceptual metaphor focuses on the purposes that human-to-human conversation may serve. Consider the following examples:

lexical item(s)	**specialist term**	**dictionary entry**
to respond to	***deep learning***	(…) It's often used to analyze large, complex datasets, complete nonlinear tasks, and respond to inputs faster and more accurately than humans.
to interpret	***computer vision***	(…) Computer vision uses algorithms and automation to enable computers to identify and interpret the people and objects that appear in images and videos.

The conceptual-metaphorical anthropomorphisation of technology instantiated by the verbs *to respond to* and *to interpret* in the two dictionary entries is manifested by way of the violation of selection restrictions and through the impersonal construction of agency. In both definitions, an inanimate agent is being placed in the subject position. Also, in the first definition, concerning deep learning, an inanimate patient is being applied (the noun *inputs*) instead of an animate one. In the target domain of CLOUD COMPUTING, it is frequently the case that software is approached conceptual-anthropomorphically as an individual with cognitive faculty able to engage in social interaction with other elements of software. The conceptual metaphor INTERACTING WITH THE CLOUD IS CONVERSING WITH A PERSON draws on a higher-level conceptual metaphor, that is ABSTRACT-TO-ABSTRACT INTERACTION IS HUMAN-TO-HUMAN INTERACTION. Upon that view, in terms of knowledge reconstruction, by having recourse to inherent human qualities, the ABSTRACT-TO-ABSTRACT INTERACTION IS HUMAN-TO-HUMAN INTERACTION serves as a bridge to arrive at a better understanding of how software elements are architectured and interdependent.

Interestingly, the conversation that is rendered conceptual-metaphorical in the specialist scenery of cloud computing is not narrowed to human-to-computer instances of

interaction, but also covers examples of computer-to-computer interaction, software-to-software interaction, computer-to-software interaction and software-to-computer interaction. Based on the two dictionary entries we may observe that the CLOUD COMPUTING IS A PERSON conceptual metaphor proves that the onomasiological path starting in the lexical field of HUMAN BEING may proceed in two directions, one CONCRETE (COMPUTER HARDWARE), and one ABSTRACT (COMPUTER SOFTWARE). Clearly, mixed instances are also possible. The CONCRETE-to-ABSTRACT onomasiological directionality whose emergence is motivated by the similarity of BEHAVIOUR seems to be highly productive in technological contexts of name-making.

4.2. Image schemas

Conceptual metaphors are motivated by mental imagery or patterns that we unconsciously manipulate on a daily basis. The mental imagery or patterns, otherwise referred to as image schemas, are approached as embodied preconceptual and prelinguistic structures of experience that constitute the premise upon which the whole conceptual system is based. For Lakoff (1993, p. 215), metaphorical mappings preserve the image-schema structure, so that the structure of the source domain may correspond to the structure of the target domain. Through metaphorical mappings, "imagistic reasoning patterns" (Lakoff 1993, p. 215) are mirrored in abstract reasoning patterns via metaphorical mappings, hence our abstract reasoning constitutes a conceptual metaphorical version of image-based reasoning.

Relying on insights from our corpus, instantiations of three image schemas, that is CONTAINER, SURFACE and (SOURCE-)PATH(-GOAL), were detected in *Microsoft Azure Glossary of need-to-know Cloud Computing Terminology*. Image schemas instantiated in dictionary entries in the form of prepositions such as *from… to…*, *in*, *between… and*, *over*, *across*, *within* and *on* conform to the onomasiological CONCRETE-to-ABSTRACT directionality of conceptual-metaphorical sense development. This is owing to the fact that our understanding of spatiality and boundedness of concrete (i.e. tangible) source-domain elements as well as boundedness and unboundedness of concrete source-domain areas is governed by the use of prepositions. Through our embodied experience, the said understanding has been mapped and lexicalised in the construction of target-domain virtual space. Upon that view, the CONTAINER, SURFACE and (SOURCE-)PATH(-GOAL) image schemas are argued not only to accompany the conceptualisation of cloud computing, but to lay solid foundations for knowledge reconstruction in dictionary entries.

Furthermore, I subscribe to the idea that any conceptualisation of information technology (of which cloud computing is an integral part) involves a tri-dimensional perception of VIRTUAL SPACE through the lenses of our everyday recurrent bodily exchanges with the world that follow an UP-DOWN and BACK-FORTH movement. Hence, while we are capable of navigating across vast spatial expanses, in the target domain of CLOUD COMPUTING we are equally capable of imagining mental scenarios of movement that unfold along multiple trajectories - horizontally, vertically, uni- or bi-directionally or across/over diverse SURFACES and CONTAINERS.

4.2.1. VIRTUAL SPACE IS A SURFACE

The spatiality of the SURFACE image schema may be conceptual-metaphorically likened to unbounded space that unfolds across numerous vertical and horizontal trajectories and spans smaller places. Relying on Aristotle's conception of space in *Physics*, the idea of

SPACE, presented image-schematically, functions as a backdrop for smaller locations. In dictionary entries, lexical instantiations of SURFACE image-schematic conception of space involve predominantly prepositions such as *across*, *over* and *on*. As demonstrated by the lexical data, the preposition *across* in the dictionary definition of *container* facilitates the process of knowledge reconstruction in terms of inter- and intra-relations governing various software elements, data management and the use of clouds. Consider the following dictionary entry:

lexical item(s)	**specialist term**	**dictionary entry**
across	***container***	(…) Containers allow IT teams to deploy applications across different environments with minimal adjustments.

Interestingly, the construal of space governed by a preposition is context-dependent, which means that one preposition may entail different interpretations along different contexts. By having recourse to dictionary entries offered by *Longman Dictionary of Contemporary English*, two senses seem appropriate to the analysis of *across* in IT-oriented scenery. To illustrate the point, the phrase *across different environments* detected in the corpus is clearly underlain by the SURFACE image-schematic nature since it follows the sense of 'every part of a country, organization etc'. By way of comparison, a CONTAINER image-schematic structure lexicalised by *across* is manifested in the sense 'from one side to the other of something with clear limits'; however, no such examples were found in Microsoft's dictionary entries. Therefore, in this case it seemed insightful to resort to the Google search engine as a fairly representative language corpus, and the search returned a phrase *across a server farm* which draws a more vivid and illustrative picture of a cloud computing-related conception of a bounded area, viewed through the lenses of a CONTAINER image schema. Unlike *across a server farm*, the phrase *across the internet* (undetected in the corpus) seems to be motivated by a SURFACE image schema, due to its unboundedness.

Similarly, the preposition *over* as applied e.g. in *over the internet* at first glance seems to be motivated by the same image-schematic patterns as *across*. Nevertheless, relying on insights from our corpus, it may be noticed that this is not always the case. Consider the following dictionary definitions:

lexical item(s)	**specialist term**	**dictionary entry**
over	***platform as a service (PaaS)***	A computing platform (operating system and other services) delivered as a service over the internet by a cloud provider like Azure. (…)
over	***private cloud***	Cloud computing services offered over the internet or over a private internal network to only select users and not the general public.

Upon closer scrutiny of the three dictionary entries, it is the verb that dictates the conceptualisation and motivates the image-schematic nature of a noun. In *platform as a service*, the verb *to deliver* foregrounds the aspect of moving across from one side to another, hence highlights the physical span of an expanse accompanying the SURFACE image schema. On the other hand, a different reading is contributive to interpreting *across* through the lenses of the (SOURCE-)PATH(-GOAL) image-schematic structure, with the *delivery* of a *computing platform* having a start and an end point. A similar case is visible in the definition of *private cloud*, with *services* being offered *over the internet*, which brings to the fore our mental imagery that builds on SURFACE, whereas *over* in *over private*

networks draws on the sense of 'through' or 'using', therefore is conceptually closer to CONTAINER.

Solving name-giving issues by having recourse to cognitively-motivated onomasiology is a course of action taken in cases revolving around concepts of space. The last preposition that may be investigated as representing the SURFACE image-schematic structure is *on*:

lexical item(s)	**specialist term**	**dictionary entry**
on	***Java programming language***	A multiplatform, object-oriented programming language that powers applications, smartphone operating systems, enterprise software, and many well-known programs on billions of devices worldwide.
on	***quantum computing***	The use of quantum mechanics to run calculations on specialized hardware.

As far as the semantics of *on* are concerned, this preposition is prototypically linked to forces operating along a vertical axis and it motivates the sense of closeness or getting closer to make contact (Konieczna, 2020, p.231). Nevertheless, in the dictionary entries adduced above, the preposition *on* guides us in conceptualising *devices* and *hardware* through the lenses of the scope of its scalability and connectability on the outside, rather than its receptacle-like features and integrity. By way of comparison, preceding some of the nouns with a preposition *in*, immerses them in a different context:

lexical item(s)	**specialist term**	**dictionary entry**
in	***cloud bursting***	(…) If 100 percent of the resource capacity in a private cloud is used, overflow traffic is directed to the public cloud using cloud bursting.

The use of *in* presented above narrows the conceptualisation down to internal properties that are integral parts of a technology, rather than their possible integrational features (Author, 2022).

4.2.2. *VIRTUAL OBJECTS ARE CONTAINERS*

Our concrete bodily experience accumulated as we interact with the PHYSICAL SPACE is mapped onto the VIRTUAL SPACE through image-schematic projections. Having analysed the dictionary entries, it was observed that the source-domain-embodied knowledge of material objects is conceptual-metaphorically projected onto the target domain of VIRTUAL SPACE and underlies the conceptualisation of software elements and pieces of hardware as bounded containers located within boundless SURFACE. That knowledge has been lexicalised in the dictionary entries in the form of prepositions *in*, *into* and *within*. Consider the following dictionary entry:

lexical item(s)	**specialist term**	**dictionary entry**
within	***machine learning***	(…) Machine learning works by identifying patterns within data, building an analytical model, and using it to make predictions and decisions. (…)

The definition of *machine learning* as provided in the dictionary offers an instantiation of image-schematic illustration of our embodied experience with receptacles, lexicalised by a preposition *within* which evokes the CONTAINER image schema. Lexically, *within* entails

insidedness, i.e. the state of being inside and not further than determined by the borders. The noun *data* conceptualises perhaps the smallest target-domain containers in which even smaller chunks of information are carried, and reconstructs a portion of knowledge for which no better paraphrase is available. Quite interestingly, *Cambridge Dictionary*, which was used for lexical reference, defines *data* as 'information in an electronic form that can be stored and used by a computer'. In that view, target-domain data are stored in other image-schematic CONTAINERS, whereas at the same time, they are – in conceptual terms – containers themselves. The conceptual metaphoricity lies, again, in an onomasiological CONCRETE-to-ABSTRACT directionality which takes its starting point in our embodied knowledge of source-domain receptacles. This line of thinking is also mirrored in the preposition *in*, which is grounded in our bodily experience of being inside a place or area closed off by borders:

lexical item(s)	**specialist term**	**dictionary entry**
in	***caching***	The process of storing important data in temporary memory more quickly and efficiently than conventionally stored data. Caching helps to optimize database costs, improve throughput, reduce latency, and boost app performance.
in	***cloud bursting***	A configuration between a private cloud and a public cloud to manage demand for cloud resources. If 100 percent of the resource capacity in a private cloud is used, overflow traffic is directed to the public cloud using cloud bursting.

In the dictionary entries above, both *a cloud* and *memory* are conceptualised by way of the CONTAINER image schema. In the specialist settings of information technology, the use of *in* before a CONTAINER-like noun points out to its integrity as a whole, rather than its external connectability.

4.2.3. VIRTUAL MOVEMENT IS PHYSICAL MOVEMENT

The (SOURCE-)PATH(-GOAL) image schema that is deeply ingrained in our bodily experience maps source-domain trajectories into target-domain trajectories. This type of image schema emerges from recurrent patterns of our bodily or sensory-motor experience and is mapped onto the target domain as a process of moving along a trajectory in multifarious directions – horizontally, vertically, uni- or bi-directionally or across/over diverse SURFACES and CONTAINERS. In the dictionary entries the span of movement is lexicalised through motion verbs, i.e. lexical items which firstly draw a conceptual picture of a trajectory, and secondly (in most cases) conceptually necessitate starting and end points.

Perhaps the most obvious denotations for the concept of *transferring data from on-premises data centres to an online location* i.e. to the cloud, are the verbs *to move* and *to migrate*:

lexical item(s)	**specialist term**	**dictionary entry**
to move	***cloud migration***	The process of moving some or all of a company's resources to one or multiple locations in the cloud. Although cloud migration often entails moving resources from on-premises locations to a cloud provider's servers, it can also entail moving resources between clouds.
migration	***data migration***	Transferring data from one storage location, like an on-premises server, to a different location, like

		the server of a cloud provider. Data migration encompasses selecting, preparing, extracting, and transferring data from one computer storage system to another.

Both verbs represent a crucial portion of specialist knowledge and motivate a conceptual mapping upon which the very essence of cloud computing builds. Furthermore, the verbs *to move* and *to migrate* perform the role of conceptual shortcuts for the idea of relocating to a different (better) place. Worthy of comment in this regard is the fact that both verbs may be referred to as pre-theoretical in nature, in that they acquired their specialist sense within the canvas of cloud computing before any theoretical background was prepared for them. Accordingly, the verbs as used in the phrases *to move to the cloud* and *to migrate resources to the cloud* are now well-established parts of the irreplaceable linguistic machinery of the specialist language of information technology and constitute prime examples of cognitively-motivated onomasiology.

Whereas the verbs *to move* and *to migrate* require a starting point and an end point, there are also lexical items describing movement approaching the DESTINATION from multiple directions. Consider the following example:

lexical item(s)	**specialist term**	**dictionary entry**
to integrate	***business analytics tools***	Tools that extract data from business systems and integrate it into a repository, such as a data warehouse, where it can be analyzed. Analytics tools range from spreadsheets with statistical functions to sophisticated data mining and predictive modeling tools.

The source-domain knowledge of mixing with other people or joining society is mapped onto the target domain to metaphorically conceptualise software elements that form, coordinate, or blend into a functioning or unified whole. Similarly to people who might have to change to suit the way of life and customs of other individuals they want to conform to, also certain properties of data – such as their format – might have to undergo some changes, so as to be incorporated into a larger unit.

Drawing from the most basic and human-oriented sense of the lexical item *network*, it is a group of people whose members exchange information with each other. That knowledge has been lexicalised in the target domain as a group of software elements or pieces of hardware that are connected together so that they can share information:

lexical item(s)	**specialist term**	**dictionary entry**
over a network	***private cloud***	Cloud computing services offered over the internet or over a private internal network to only select users and not the general public.

In view of that, in the corpus the lexical item *network* is motivated primarily by a (SOURCE-)PATH(-GOAL) image schema, or sometimes by an interplay of a (SOURCE-)PATH(-GOAL) image schema and a CONTAINER image schema. Also the following dictionary entry for *virtual private network* contributes to our target-domain understanding of a network by having recourse to human relations:

lexical item(s)	**specialist term**	**dictionary entry**
a network	***virtual private network***	A virtual private network that establishes a connection between your computer and a remote server owned by a VPN provider. This connection creates a point-to-point tunnel that encrypts your

		personal data, masks your IP address, and lets you get around website blocks and firewalls.
a network	***cloud***	A metaphor for a global computing network of remote servers that run applications, store data, and deliver content and services. The cloud enables data to be accessed online from internet-enabled devices, rather than solely from local computers.
networked	***computer grids***	Groups of networked computers that act together to perform large tasks, such as analyzing huge sets of data and weather modeling. Cloud computing lets you use vast computer grids for specific time periods and purposes, paying only for your usage, and saving the time and expense of purchasing and deploying the necessary resources yourself.

Interestingly, a *network* between a *computer* and a *remote server* as presented in the dictionary entry for *virtual private network* is also argued to span conceptual-metaphorically across unbounded space that links the PHYSICAL SPACE to the VIRTUAL SPACE. Within the canvas of the dictionary entries for *cloud* and *computer grids*, the lexical items *network* and *networked* lexicalise a portion of extralinguistic reality in line with which elements within a network are conceptual-metaphorically treated as parts of a larger and bounded CONTAINER. Most certainly, the (SOURCE-)PATH(-GOAL) structure is not lost in those cases, yet it clearly recedes into the background.

5. Concluding Remarks

In the foregoing I have sought to inform the debate on the role that cognitively-motivated onomasiology performs in knowledge reconstruction in the dictionary entries extracted from *Microsoft Azure Glossary of need-to-know Cloud Computing Terminology*, i.e. a specialist dictionary of information technology. My investigation into cognitively-motivated onomasiology in dictionary entries constitutes merely a pilot study, therefore I have only signalled the complexity of cognitively-motivated onomasiological patterns that allow for, and in fact seem to underlie, knowledge reconstruction in dictionary entries. Consequently, so as to confirm the universal occurrence of postulated onomasiological CONCRETE-to-ABSTRACT directionality, further in-depth investigations would be indispensable.

Nevertheless, based on the investigation conducted so far, I have concluded that a great number of lexical items detected in the dictionary entries may be postulated to serve as means of reconstruction of specialist knowledge. Our ability to interpret lexical items in specialist dictionary entries that we are already acquainted with draws from our subconscious use of our past embodied experience. Similarly, specialists' thinkability and ability to reconstruct knowledge is anchored in interpreting the unfamiliar in terms of the familiar. Therefore, the CLOUD COMPUTING IS A PERSON conceptual metaphor is one of the most conspicuous conceptual metaphors detected in dictionary entries provided by *Microsoft Azure Glossary of need-to-know Cloud Computing Terminology*. This is owing to the fact that while imputing characteristics to things, humans, as a matter of fact, make use of a source domain they are most familiar with – i.e. themselves. Reconstructing knowledge based on dictionary entries or other specialist texts helps us to adapt conceptually and linguistically to specialist practice.

Bionote: Madgalena Krawiec is … (max 150 words)

Author's address: email address

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