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FIGURATIVE USE OF LANGUAGE IN INFORMATION TECHNOLOGY: A CORPUS-BASED STUDY

Abstract: *New technologies have pervaded many aspects of modern life and influenced human communication, emotions and language. This close interaction between people and computers is reflected in language, in the use of computing terms applied to human emotions, relationships and everyday activities. Metaphor plays an important role in the language of information technology and it is widely used in creating new vocabulary. This paper explores conceptual metaphors in order to determine their usage in the information technology research papers, through describing similarities and differences in the conceptualisation of these metaphors within two languages. The aim of the paper is to quantitatively and qualitatively present conceptual metaphors, regarding computers and the Internet, found in ten research papers written in English and in Serbian. These expressions are compared with respect to their frequency in the papers and the degree to which metaphorical vocabulary is present in analysed research papers. The results indicate that all authors have used conceptual metaphors, although papers in Serbian include a slightly larger number of expressions than papers in English. Apart from differences and diversities, the analysis also identifies a remarkably similar structure of the mapping in both languages.*

Key words: *conceptual metaphors, conceptualisation, computer, the Internet, mapping.*

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1. Introduction

Conceptual metaphors contribute greatly to understanding the language of information technology, and this paper focuses on conceptual metaphors in the language of information technology with the emphasis on two elements: *the computer* and *the Internet*. The aim of the research is to quantitatively and qualitatively present conceptual metaphors, in order to determine their usage in information technology research papers, written in English and Serbian, through describing similarities and differences in the conceptualisation of these metaphors within both languages. These expressions are first compared with respect to their frequency and then in context in the papers examined. The study uses a corpus-driven approach to analyse metaphorical language in information technology research papers, i.e. metaphors in information technology discourse.

2. Theoretical Background

Johnson (1987: 14) characterises a metaphor as "a pervasive mode of understanding by which we project patterns from one domain of experience in order to structure another domain of a different kind", and Sweetser (1990: 8) posits that "metaphors allow people to understand one thing in terms of another, without thinking that the two are objectively the same". Since language abounds in metaphorical expressions, metaphor can be defined as one of the basic cognitive mechanisms (Kövecses 2002; Klikovac 2004; Radić-Bojanić 2020). Lakoff and Johnson (1980) claim that metaphor is used for reasoning and shaping human thought and attitudes, and define three main types of metaphors: 1) structural, where one concept is structured in terms of another; 2) orientational, where a whole system of concepts is organised with respect to another, using spatial orientation; and 3) ontological, which signifies understanding events, activities and ideas in terms of objects, substances and containers. One very common form of ontological metaphors in the language of information technology is personification; e.g., the computer *went dead* on me (Lakoff and Johnson 1980).

Conceptual Metaphor Theory (CMT) introduced the idea that metaphor is understanding of one domain in terms of another (Lakoff and Johnson 1980). The more concrete conceptual domain is the source and the target domain is the more abstract. The interconnection between these two is called mapping, i.e. the target is usually seen through the source domain. Lakoff and Johnson (1980) explain this via the example THE ARGUMENT IS WAR, where WAR is the source domain and

ARGUMENT is the target domain – hence, the argument is discussed in terms of war. They claim that numerous things people "*do* in arguing are partially structured by the concept of war. Though there is no physical battle, there is a verbal battle, and the structure of an argument—attack, defense, counterattack, etc.—reflects this" (Lakoff and Johnson 1980: 4). In addition, there are numerous expressions that include talk about argument as a war (e.g. your claims are *indefensible*; I demolished his *argument*; I've never *won* an argument with him; You disagree? Okay, *shoot;* He *attacked every weak point* in my argument...), and they represent mappings from one domain to another.

However, people use more than one metaphor to understand and transfer the meaning of a single activity or a concept. Kövecses (2002: 91) points out that "concepts in general (both source and target) are characterised by a number of different aspects. When a source domain is applied to a target, only some (but not all) aspects of the target are brought into focus". He gives the example THE MIND IS A BRITTLE OBJECT metaphor (Kövecses 2002: 91).

- The experience *shattered* him.
- I am *going to pieces*.
- His mind *snapped*.
- He *cracked up*.

In this metaphor, the source domain emphasises one aspect of the concept of the mind, focusing on the aspect of "psychological strength". This process of emphasising some of the aspects of a target concept is called highlighting, while other aspects of the concept remain hidden.

2.1. Metaphors in Academic Language Use

The study of metaphor in authentic discourse is the subject of numerous studies (Deignan 2005; Semino 2008; Silaški, 2009), examining the use of metaphors in different areas of everyday life, such as: metaphors in political discourse (Zeng, Tay and Ahrens 2020), metaphors in Arab journalistic discourse (Chatti 2020), metaphors used for the description of women managers (Koller 2004), the journey metaphors in Brexit-related political cartoons (Silaški and Đurović 2019), metaphors in perfume reviews in four languages (Zawisławska and Falkowska 2021), metaphors in the discourse of workplace socialisation (Woodhams 2014), metaphors in advertising (Lazar 2009), etc.

Although the type of metaphor in academic discourse is fundamentally different from that in spoken English, there are authors who see it as a threat to academic

discourse, since "technical communication is still haunted by the idea of a plain style as the preferred" (Giles 2008: 41). Written academic texts are usually related to "the use of specialist vocabulary, impersonal voice and the ways that ideas are packed into relatively few words" (Hyland 2006: 13) and to the high degree of abstract information and linguistic formality (Biber 1988). The use of metaphors in academic discourse has been examined in many fields: physics (Pulaczewska 1995), medicine (Richardt 2005), sociology (Levine 1995), legal studies (Smith 2007), economics (Đurović 2007), information technology (Rohrer 1997; Grevy 1999; Meyer et al. 1997; Constantine 2001; Colburn and Shute 2008; Wu and Chen 2013), etc.

2.2. Metaphors in Information Technology

The language of information technology is "laced with metaphor" (Colburn and Shute (2008: 526). Windows, buttons, menus, folders, pages, viruses and libraries are incorporated into this specialised language. However, "the most obvious ontological metaphors are those where the physical object is further specified as being a person" (Lakoff and Johnson 1980: 33), making it possible to see the world phenomena in human terms. Johansson (1997) discusses the intelligence-centred metaphors such as "artificial intelligence" and "computer brain" and the computers' ability to communicate, think, fall asleep and die. The intelligent part of a computer is compared to the brain of a person. Meyer et al. (1997) investigated the use of the Internet metaphors from cognitive and linguistic point of view, analysing dictionaries, books and magazines with the result of classifying metaphors into two categories: fully and partly metaphorical. Furthermore, Internet traffic corresponds to the traffic on the highway, surfing the net corresponds to surfing the ocean, and online shopping can be seen in terms of shopping in the real world. Grevy (1999) examined metaphors in the Danish language, discovering that 500 metaphors out of 3000 are *highway* metaphors.

Certain aspects of everyday life are mapped on the target domains of THE COMPUTER and THE INTERNET. Therefore, a COMPUTER can be conceptualised as a HUMAN BEING, ANIMAL, BUILDING or a PLACE and WORKSHOP, while the INTERNET can be seen as a HIGHWAY, OCEAN, WAR or SUPERMARKET. One single metaphor is not sufficient to explain the complexity of THE COMPUTER or THE INTERNET, as not "one of them is sufficient to give us a complete, consistent, and comprehensive understanding of all these aspects, but together they do the job of giving us a coherent understanding" (Lakoff and Johnson 1980: 89) of what a certain aspect is.

Metaphors in the language of information technology are created from expressions in the general language and from our experiences and everyday activities. As the Internet grows relentlessly, new metaphors appear and become a part of our everyday language. These metaphors are frequently associated with certain physical experiences, with a parallel drawn between the two realms. Thus, when shopping online, people expect that a web site would work like shopping in an ordinary store, choose the product, put it in a shopping cart and finally pay for it. Therefore, "in the fast changing world of computers, these public metaphoric representations have an increasingly indispensable cognitive function" (Gibbs 1999: 160).

Also, there are metaphors related to physical structures, such as libraries, bridges, pathways, offices, etc. These metaphors help us to create the way in which we perceive the Internet as a physical space, whose "structure supports both market and cooperative approaches to finding social resources in virtual communities" (Wellman and Gulia 1999: 4). It is a place where people go shopping, travel, work and do everything they would do in real life, only, in this case, within the safety and comfort of their own homes. This description emphasises the very nature of the Internet: the global connection, a vast amount of data, speed and mobility. These metaphors create a larger system of meanings operating at the cognitive level and helping us to understand one conceptual domain in terms of another.

3. Data and method

Two corpora were analysed for the purpose of this study. The first consisted of 24.796 words and was based on five information technology research papers written in English, labeled with the capital letter E and numbers from 1 to 5. The second corpus consisted of 13.870 words and was based on five information technology research papers written in Serbian, labeled with the capital letter S and numbered from 1 to 5. The analysed articles in both languages were chosen randomly from the pool of published articles in 2016 and 2017. All articles varied in content, discussing different information technology issues. Due to a difference in length between the two corpora, the results were presented in percentages.

The methodology of research included a quantitative and qualitative analysis of two corpora. Content analysis was performed on ten articles, with the aim of identifying the metaphors according to Lakoff and Johnson's (1980) conceptual metaphor theory. First, the metaphoric vocabulary was compared in respect to its frequency in the corpora analysed and second, it was classified into categories. The aim of the study was to determine the level of mapping in both languages and the influence of the English language on Serbian in the field of information technology.

4. Results

4.1. Overall frequencies

The results of the quantitative analysis, the overall frequencies are given in Table 1. The overall number of metaphorical vocabulary items in the five research papers written in English (corpus E) was 547 or 2.206% (Table 1), while the number of items in the five research papers written in Serbian (corpus S) was 326 or 2.350% (Table 1). Surprisingly, the overall frequencies were very similar in both languages, meaning that the metaphorical expressions were present in both corpora. In corpus E, the metaphors based on COMPUTER IS A HUMAN BEING were the most numerous: 35.649%. On the other hand, in corpus S, the most numerous metaphors were metaphors based on INTERNET IS WAR: 29.755%. The least numerous metaphors in corpus E were metaphors based on INTERNET IS AN OCEAN: 2.559%, and, in corpus S, the least numerous were metaphors based on COMPUTER IS AN ANIMAL: 0.307%.

Table 1. Metaphoric vocabulary in corpora E (E1-E5) and S (S1-S5)

		Corpus E (E1-E5)		Corpus S (S1-S5)	
No.	Metaphoric vocabulary	No.	%	No.	%
1	COMPUTER IS A HUMAN BEING	195	35.649%	26	7.975%
2	COMPUTER IS A BUILDING OR A PLACE	83	15.174%	61	18.712%
3	COMPUTER IS A WORKSHOP	48	8.775%	53	16.258%
4	COMPUTER IS AN ANIMAL	19	3.473%	1	0.307%
5	INTERNET IS A HIGHWAY	23	4.205%	64	19.632%
6	INTERNET IS AN OCEAN	14	2.559%	21	6.442%
7	INTERNET IS A SUPERMARKET	100	18.282%	3	0.920%
8	INTERNET IS WAR	65	11.883%	97	29.755%
	OVERALL:	547	2.206%	326	2.350%

4.2. Metaphors in context

The analysis of the two corpora (Table 1) shows that all the authors used metaphorical vocabulary in the research papers analysed. In this section, the metaphoric vocabulary is classified and analysed within categories.

4.2.1. COMPUTER IS A HUMAN BEING

Source domain: PERSON

Target domain: COMPUTER

The analysis of the two corpora shows that this metaphor was the most numerous metaphor in corpus E (35.649%). The corresponding frequency of this metaphor in corpus S was 7.975%.

People use computers in almost every aspect of their lives. As a result of a such close interaction, much of the language of the information technology refers to humans. Personification allows us to see the world phenomena in human terms, and, since "computers seem almost human in many ways, . . . an inevitable result of that similarity is that much of the language describing computers seems to refer to humans" (Barry 1993: 134). Hence, computers have brains (CPU) and memory (hard disk), they can think, read, sleep and die. Relationships between two processes correspond to family relationships (example 8). According to Hänke (2005), the metaphor COMPUTER IS A HUMAN BEING encompasses metaphors that map psychological qualities like intentions, emotions, memory, and intelligence on the computer, as well as body and its functions. However, only certain aspects of the body are mapped on the computer. The brain is usually mapped on the CPU (examples 3 and 5), memory on the hard disk (example 5), but other parts of the body like eyes, ears, teeth or internal organs are not mapped onto the computer. Certain aspects are highlighted, while others are hidden.

The analysis of the corpora shows that the structure of the mapping in both languages is similar and that the metaphor COMPUTER IS A HUMAN BEING encompasses:

1. metaphors that map psychological qualities onto the computer:

▸ **Communication** - transferring files between computers corresponds to the verbal communication between people, e.g.

(1) *... računar dobija podatke o stvarnom svijetu, npr. lokacija predmeta, posmatrača i slično.* (S4)

(2) *This aforementioned core embeds a Wishbone interface that is in charge of the communication with other screen components (e.g., video memory).* (E2)

▸ **Thought and intelligence –** In metaphorical mapping the brain of a human being is mapped on CPU, and when we talk about the brain of a person, we think of thought and intelligence. Therefore, when the brain of a human being is mapped on CPU, thought and intelligence are also mapped on CPU. e.g.

(3) *We wanted to create an artificially intelligent agent that could learn to play this game.* (E5)

(4) *... it is very likely that machine learning/artificial intelligence (AI) algorithms will play a big role in solving the problems mentioned in this paper*. (E4)

▸ **Memory –** data stored on a hard disk correspond to human memory, e.g.

(5) *Glavne komponente game engine-a su: .... komponenta za vještačku inteligenciju, komponenta za mrežu, komponenta za upravljanje memorijom...* (S4)

2. metaphors that map body or bodily functions on the computer:

▸ **Life and death –** The functioning of the computer corresponds to the human life and malfunctioning corresponds to the death, e.g.

(6) *Model Vodopada je praktično najstariji oblik modela razvoja životnog ciklusa softvera ali se i danas primjenjuje širom IT industrije.* (S1)

▸ **Illness –** viruses are mapped onto harmful programmes which can harm computers; computer malfunctioning corresponds to people being ill; computers catching a virus corresponds to people catching a virus; spreading the virus from one computer to another corresponds to spreading the virus between people, e.g.

(7) *Uprošćen primjer imenovanja rizika u registru (katalogu) rizika za scenario nedostatka implementiranog antivirus rješenja je prikazan u Tabeli 3*. (S2)

3. metaphors that map family relationships on the computer:

▸ **Family –** relationships between two processes correspond to family relationships, e.g.

(8) *At least one of the nodes will have no parents... One or more of the nodes will have no children.* (E3)

4.2.2. COMPUTER IS A BUILDING OR A PLACE

Source domain: BUILDING/PLACE

Target domain: COMPUTER

The analysis of the two corpora showed that the overall number of metaphorical expressions regarding the metaphor COMPUTER IS A BUILDING OR A PLACE was 83 or 15.174% in corpus E. On the other hand, in corpus S, the overall number of these metaphorical expressions was 61, i.e. 18.712%. The parts of the concept BUILDING/PLACE that were used to structure the concept COMPUTER are windows, gates, residents, offices, desktops, libraries, keys, folders, files, etc. The roof, foundation, staircases, houses, swimming pools, etc. were parts of the concept BUILDING/PLACE not used to structure the concept COMPUTER. Therefore, the metaphor COMPUTER IS A BUILDING OR A PLACE has used parts (windows, office, library...) and unused parts (foundation, houses etc.). Windows and folders resemble the real windows and folders in a real office (examples 9, 10, 11, 12 and 13), which users can open, minimise or move to access its content. A folder contains files and documents which users can copy, move or delete. Also, an online library corresponds to the real-life library (examples 15 and 16). Online material is organised into numerous categories and different forms and users can search for information just as they can search for a book in an ordinary library.

The analysis of the corpora showed that the structure of the mapping in both languages is similar and that the metaphor COMPUTER IS A BUILDING OR A PLACE encompasses:

Windows – the access to information on the computer corresponds to the opening of the windows in a real office; windows are mapped on user interface of the computer;

(9) *In order to overcome some reliability issues in connection with activation mechanism, we have specified some parameters related to the screen: resolution... maximisation or not of the browser window...*(E2)

(10) *Nakon što korisnik ove aplikacije pređe sve nivoe otvara se prozor iz koga je moguće odabrati dvije opcije... (S4)*

Office – virtual files, folders and desktop correspond to the files, documents and desktop in an ordinary office; access to the stored information on the computers corresponds to reading the files in the office; organising the information on the computer corresponds to organising the folders in a real office;

(11) *But if we would normalise the URL structure in the way so that we replace each web folder name in the URL with string...* (E4)

(12) *This shows that as transitive depth increases in genealogy, the ration of similarity decreases between different versions of the program file.* (E3)

(13) *...posjeduje niz alata za bezbjednosnu provjeru sistema ranjivosti kao i najprimijenjenije dokumentacije...* (S2)

(14) *Za druge informacione sisteme se koriste kombinacije raznih alata...(operativni sistemi, baze podataka, mrežni uređaji itd.). (S2)*

Library – an online library corresponds to a real life library; searching for online material corresponds to searching for a book in the real library; information is organised like pages in a book;

(15) *For experimenting with this algorithm for game 2048, we used library ANJI (Another Java NEAT Implementation).* (E5)

(16) *Osim opreme (...)potrebna je dodatna biblioteka, tj. paket za pomenuti alat, Vuforia. (*S4)

Inaccessible data are locked – making data inaccessible corresponds to locking the offices and keeping them safe; to enter the system or access the data one must use a password or a specific key on a keyboard just as one needs a key to unlock the office;

(17) *Even strong passwords, which cannot be easily guessed, are under threat due to existing password attacks.* (E2)

(18) *Transformacioni parametri i-te etape...predstavljaju ključeve za kriptovanje... (S3)*

4.2.3. COMPUTER IS A WORKSHOP

Source domain: WORKSHOP

Target domain: COMPUTER

The analysis of the two corpora showed that the overall number of metaphorical expressions regarding the metaphor COMPUTER IS A WORKSHOP was 48 or 8.775% in corpus E, while the corresponding frequency of this metaphor in corpus S was 16.258%. This metaphor encompasses metaphors that generally map physical objects, such as tools and hardware on the computer. Computer users use different tools to install, remove or repair the components within their computers

just like people do in an ordinary workshop (see examples 19-25). The analysis of the corpora showed that the structure of the mapping in both languages is similar and that metaphor COMPUTER IS A WORKSHOP encompasses:

Tools and activities – installing, removing and repairing the components of the computer correspond to the work done in a real workshop; ordinary tools and everyday activities from the workshop are mapped on the computer;

(19) *The third step can be done manually or automated by using various tools.* (E4)

(20) *They are constantly being updated/changed, often by a large number of developers, which makes it hard to keep an overview of all the cogwheels.* (E4)

(21) *All of the experiments were implemented on following hardware...* (E5)

(22) *Ugradnja vodenog žiga u frekvencijske podopsege HL i LH predstavlja kompromis... (S3*)

(23) *Ovaj alat se koristi prevashodno za izradu igara.* (S4)

(24) *Alati poput Nessus-a se koriste za testiranje internet aplikacija i internet stranica na sigurnosne propuste...* (S2)

(25) *SVD dekompozicija se koristi kao alat za umetanje vodenog žiga...* (S3)

4.2.4. COMPUTER IS AN ANIMAL

Source domain: ANIMAL
Target domain: COMPUTER

The overall number of metaphorical expressions regarding the metaphor COMPUTER IS AN ANIMAL was 19 or 3.473% in corpus E, and, in corpus S, the overall number of these metaphorical expressions was only 1, i.e. 0.307%.

Animal metaphors are common in the language of the information technology, e.g. *mouse, bug, spider, to hibernate,* etc. The pointing device is named a mouse (example 28 and 29) because it looks like a mouse (its shape and the tail). The spider is a programme that automatically fetches Web pages and it is used to feed pages to search engines. It is called a spider because it 'crawls' over the Web. In English, the noun bug denotes an insect and the verb bug means to annoy. Therefore, a bug in computing is usually an error, imperfection or a fault in functioning, which can be annoying (example 27), and this term was first used as early as 1947, in an account by Grace Hopper, who described the cause of a malfunction in an early computer (Pearson 2013).

The analysis of the corpora showed that the word bug did not have an appropriate translation in Serbian and it was used in its transcribed form - "bag", or the derived "zabagovati".

Animals – animal characteristics are mapped on the computer; annoying bugs correspond to annoying software problems; spiders are generally seen as engineers and builders and these characteristics are mapped on the computers;

(26) *Although our algorithm was quite effective…it was not completely autonomous because we still have to provide the link depth parameter to the spider.* (E4)

(27) *They often try to improve security by starting bug bounty programs…* (E4)

(28) *…the early versions of malware disclosed passwords by capturing the coordinates of the mouse on each click.* (E2)

(29) *Loptice se ispaljuju lijevim klikom miša…* (S4)

4.2.5. INTERNET IS A HIGHWAY

Source domain: HIGHWAY

Target domain: INTERNET

The overall number of metaphorical expressions regarding the metaphor INTERNET IS A HIGHWAY was 23 or 4.205% in corpus E, and the corresponding frequency of this metaphor in corpus S was 19.632%.

The Internet is usually perceived as Information Highway. When this phrase was used by U.S. Senator Al Gore in 1991 (Wiggins 2000), it created a metaphoric image of a highway with a vast amount of data, Internet traffic and network of pathways. In 1997, the U.S. Department of Education published a booklet entitled *Parents Guide to the Internet*, in which Internet was called the Information Highway. They used expressions such as: "*starting your engine*", "*having a safe trip*", "*getting on the information superhighway*", "*sites along the way*" (U.S. Dept of Education 1997). Thus, the Internet traffic corresponds to traffic on a real highway (example 34), while data on the Internet correspond to vehicles on a highway, and sometimes, the data can be detoured, just as vehicles can be re-routed (example 31). Also, traffic on a highway can be slow or fast, and, given that the Internet defines traffic, Internet traffic can be slow or fast as well.

The analysis of the corpora showed that the structure of the mapping in both languages is remarkably similar.

Highway – the longer one searches the Internet, the more data are accessed; this metaphor highlights transport, destination and speed. Rohrer (1997) points out that the vehicle is mapped on the computer, the engine on the operating system and the steering wheel on the software application.

(30) *...these reserved locations cannot be accessed by the system.* (E2)

(31) *In order to keep the same place and route, we have created a Hard-macro containing...* (E2)

(32) *GMSAT pripada klasi invertibilnih haotičnih mapa (engl. Chaotic Maps)* (S3)

(33) *Pružanje bezbednosti u mreži je proces primene...sa ciljem da se mrežna infrastruktura i resursi zaštite...* (S5)

(34) *Prikazano je RTBH rešenje za filtriranje saobraćaja, kao primer tehnike za mitigaciju DoS napada.* (S5)

4.2.6. INTERNET IS AN OCEAN

Source domain: OCEAN

Target domain: INTERNET

The overall number of metaphorical expressions regarding the metaphor INTERNET IS AN OCEAN was 14 or 2.559% in corpus E. On the other hand, in corpus S, the overall number of these metaphorical expressions was 21, i.e. 6.442%.

Surfing the Internet corresponds to surfing the ocean. For example, the amount of online data is vast, like on ocean, which is deep, with numerous creatures living in it. Similarly, the Internet is endless, deep (e.g. deep web) and limitless (example 37). Surfing the ocean can be dangerous, and, similarly, surfing the Internet can be dangerous as well, especially if one ventures "deep into the web".

The analysis of the corpora showed that the structure of the mapping in both languages is similar.

Surfing - Surfing in the sea of information corresponds to surfing the ocean;

(35) *Unlikely, virtual keyboards are vulnerable to shoulder surfing ...* (E2)

(36) *This research addressed customers' preferences during an experience with surfing business software...* (E1)

(37) *In our tests, we spidered 5 links deep.* (E4)

(38) *FlowSpec predstavlja metod za distribuciju informacije o toku podataka (flow)...*(S5)

4.2.7. INTERNET IS A SUPERMARKET

Source domain: SUPERMARKET

Target domain: INTERNET

The analysis of the corpora showed that the overall number of metaphorical expressions regarding the metaphor INTERNET IS A SUPERMARKET was 100 or 18.282% in corpus E, but only 3, i.e. 0.920%, in corpus S.

Online shopping corresponds to shopping in the real world, and "this effect is a direct result of the metaphorical description of the target concept, namely ONLINE SHOPPING, in terms of the source concept, namely ORDINARY SHOPPING" (Colburn & Shute 2008: 529). Therefore, one can buy something online (example 40), pay for it, see advertisements online, promote and sell something (example 40), stimulate the customer's behaviour (example 39), etc.

The analysis showed that the structure of the mapping in both languages is remarkably similar.

Shopping - online shopping corresponds to shopping in the real world;

(39) *The online experience using business software with game features can positively stimulate the customer's behaviour, increase usage, and induce users to purchase more products.* (E1)

(40) *Websites are a key success factor for most organisations to promote and sell their products.* (E1)

(41) *The web design's objective is to influence positively, overall customer satisfaction, the perceived service quality, and to affect the purchase intention in a positive way* (E1)

(42) *Scrum je okvir koji je namijenjen razvoju kompleksnih softverskih proizvoda.* (S1)

4.2.8. INTERNET IS WAR

Source domain: WAR

Target domain: INTERNET

The analysis showed that the overall number of metaphorical expressions regarding the metaphor INTERNET IS WAR was 65 or 11.883% in corpus E, and the corresponding frequency of this metaphor in corpus S was 29.755%.

In many ways, the Internet corresponds to war. People can defend themselves, be a target or under attack (examples 43, 44), find a Trojan horse or other malicious

viruses (example 46), need a password (example 43) or take some countermeasures. In real life the consequence of war is the loss of life and territory, while in a war on the Internet, a computer can be harmed (i.e. lose data) or even die (i.e. stop functioning). Therefore, the data on a computer correspond to a territory in a real war and computer functioning corresponds to human life.

INTERNET is partially understood in terms of WAR. This metaphor is reflected both in English and Serbian in a wide variety of expressions:

War – Internet malicious attacks correspond to the real battles in war;

(43) *In user-based attacks, an attacker can gather passwords by observing the target screen from a distance.* (E2)

(44) *... a comparator simply implemented with a bank of AND-gates could be used to detect the webpage under attack.* (E2)

(45) *Web sites/applications are no exception of that and are often the favourite target of attackers.* (E4)

(46) *... virtual keyboards are vulnerable to shoulder surfing and malicious software-based attacks such as malware and Trojans.* (E2)

(47) *Pristupne liste (Access Control List-ACL) predstavljaju jedan od najčešće korišćenih rešenja u borbi protiv DoS napada.* (*S5*)

(48) *Zatim se izvorna IP adresa napadača preusmerava na null0 interfejs... (S5*)

All these examples have vocabulary that is used in discussing war, i.e. *an attacker, target of attackers, Trojans, battle, under attack,* with the expressions being transferred from the topic of war to the discussion of the Internet.

5. Conclusion

As Kent (2001: 361) points out, "to understand something as dynamic and abstract as WWW is difficult or impossible without the aid of a metaphor for contrast", which is especially true for understanding the language of information technology. Certain aspects of everyday life are mapped on the target domains of COMPUTER and INTERNET, with one single metaphor not being sufficient to explain their complexity. Thus, COMPUTER can be conceptualised as a HUMAN BEING, ANIMAL, BUILDING or A PLACE AND WORKSHOP, while INTERNET can be seen as a HIGHWAY, OCEAN, WAR and SUPERMARKET. Metaphors in the language of information technology are created from expressions in general language and from daily experiences and activities.

The analysis of the two corpora has shown that all the authors used metaphorical expressions in their research papers, although the articles in Serbian included a slightly larger number of expressions than the articles in English. However, no major differences have been noticed in the structure of the mapping between the English and the Serbian language. These results were not unexpected, due to the global influence of English on other languages, especially in the field of information technology. Owing to the rapid changes in this area, people tend to adopt English words for new technological terms in their native languages. In addition, sometimes it can be difficult to translate the emerging vocabulary, and it is more convenient to use the existing English terms.

Finally, in both corpora, metaphorical vocabulary was more frequent in the introduction and discussion section of the research papers and was less frequent in the conclusion section. What can be concluded from this research is that metaphors are widely used in academic discourse in the field of information technology and the mapping is highly similar in both languages due to the large influence of English in this area. This research represents a small step towards examining the presence and the use of metaphorical expressions in information technology research papers, and, due to a relatively small corpus analysed, further research would be needed for a more detailed assessment of these results.

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ФИГУРАТИВНА УПОТРЕБА ЈЕЗИКА У ИНФОРМАЦИОНИМ ТЕХНОЛОГИЈАМА: СТУДИЈА ЗАСНОВАНА НА КОРПУСУ

Резиме

Нове технологије прожимају многе аспекте савременог живота и, током времена, утицале су на људску комуникацију, емоције и језик. Ова блиска интеракција између човека и компјутера огледа се у језику, у употреби рачунарских термина који се примењују на људске емоције, односе и свакодневне активности. Метафора игра важну улогу у језику информационих технологија и нашироко се користи у стварању новог речника. Овај рад истражује концептуалне метафоре како би се утврдила њихова употреба у истраживачким радовима информационих технологија, кроз описивање сличности и разлика у концептуализацији ових метафора у оквиру два језика. Циљ рада је да квантитативно и квалитативно прикаже концептуалне метафоре у вези са рачунарима и интернетом, које се могу наћи у десет одабраних истраживачких радова написаних на енглеском и српском језику. Ови изрази се пореде узимајући у обзир њихову учесталост у радовима и степен заступљености метафоричког речника у анализираним истраживачким радовима. Резултати показују да су сви аутори користили концептуалне метафоре, иако радови на српском језику садрже нешто већи број израза него радови на енглеском језику. Осим разлика и различитости, анализа такође идентификује изузетно сличну структуру мапирања у оба језика.
▸ ***Кључне речи***: концептуалне метафоре, концептуализација, рачунар, интернет, мапирање.

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