Communicating with metaphors: A cross-cultural analysis of technology forums

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Abstract

Metaphor is a cognitive tool that helps create intimacy (Bowles & Katz, 2015). Lately, big data methods have enabled text analysis on a large scale, especially relevant for investigating language use on the Internet. Although several text mining techniques have been used before, the use of big data allows the development of new text analysis methods, especially those capable of sentiment analysis and lemmatization. This paper explores recent changes in cross-cultural communication with regard to metaphor use and its function in communication on the Internet, specifically about mobile phone use. Big data methods were employed to search for selected phrases in cross-cultural communication, and a list of commonly used metaphors was made. Big data technologies used in the survey permitted the identification of the phrases and collocations employed by Internet users. Text mining methods were used, including extraction of the information from unstructured data sources. The survey addressed the users of social media and mobile phone technology forums. They were profiled regarding their country and language, limiting the detailed analysis to English and Polish examples. Results show the growing scale of the creation of new metaphors in cross-cultural communication, and the importance of the cognitive functions of metaphor in a culturally and linguistically diverse environment.

Keywords: metaphor, social cognition, cross-cultural communication, discourse processing, information technologies.

Resumen

Comunicación con metáforas: Análisis intercultural de foros tecnológicos

La metáfora es una herramienta cognitiva que favorece la creación de intimidad (Bowles & Katz, 2015). Últimamente, los métodos de *big data* han permitido el

análisis de textos a gran escala, especialmente relevantes al investigar el uso de la lengua en Internet. Aunque diversas técnicas de minería de datos se habían utilizado previamente, las fuentes de *big data* permiten desarrollar nuevos métodos de análisis de textos, especialmente aquellos capaces de analizar sentimientos y lematizar. Este artículo examina los cambios recientes en la comunicación intercultural relativos al uso de metáforas y su función para establecer un ambiente cordial en Internet entre los que debaten sobre el uso de teléfonos móviles. En este artículo, se emplearon métodos de *big data* para buscar expresiones usadas en la comunicación intercultural y se creó una lista de metáforas de uso común. Las tecnologías de *big data* permitieron identificar la cantidad de expresiones y colocaciones léxicas empleadas por los usuarios de Internet. Se utilizaron métodos de minería de datos incluso para la extracción de información proveniente de fuentes de datos sin estructurar. La encuesta fue dirigida a usuarios de las redes sociales y foros de telefonía móvil. El perfil de los usuarios se hizo en base al país e idioma y el análisis detallado se limitó a los casos ingleses y polacos. Los resultados del análisis muestran la escalada de la creación de metáforas en la comunicación intercultural y la importancia de las funciones cognitivas de las metáforas en un ambiente cultural y lingüísticamente heterogéneo.

Palabras clave: metáfora, cognición social, comunicación intercultural, procesamiento del discurso, tecnologías de la información.

1. Introduction and theoretical framework analysis

The concept of metaphor has been broadly used in both scholarly and scientific discourse, since metaphors reflect ideas and concepts, while they additionally reveal thought models for language users (Lakoff & Johnson, 1980). The constant development of information and computer technology (ICT) has had a huge impact on people's communication and on the formation of new metaphors to describe those changes (Colvin & Bullock, 2014). Metaphors, in fact, define the way people perceive, think, act, and, what is more, the way they learn (Tait-McCutcheon & Drake, 2016). The aim of this paper is to analyse metaphor use among students in order to show the relevance of their awareness when using conceptual metaphors in the mobile phone era. A secondary goal is to explore the importance of conceptual beliefs about the nature of technology via metaphor analysis. Despite the large body of research into different types of metaphor, not to mention the variety of classifications provided, there still appears to be a necessity for further research, especially in developing areas, such as IS/IT,

with respect to different types of approach, such as project approach (Cornelissen, Oswick, Christensen & Philips, 2008). However, little is yet known about how language users elicit new types or classifications of metaphors (Jackson, 2016). Therefore, this paper investigates both the metaphors produced by language users and the level of comprehension of the metaphors used among participants of mobile phone forums.

Despite the broad literature and the many studies highlighting the metaphors present in everyday life, an unambiguous list of such metaphors in different fields of our lives has not yet been proposed, although a number of researchers have attempted to do so. The implementation of conceptual metaphors offers the possibility to describe and provide linguistic representation to help structure abstract concepts and show a variety of ways in which the world can be understood (Turner, 1987; Gibbs, 1994; Kövecses, 2005). Some of the most commonly used metaphors are those related to the broad field of technology. For example, there are several fields of research related to technological metaphors, such as photography (Mykytka, 2016). Other uses of metaphors may refer to the process of technological innovation, such as revolutionary or calm technology (Lindh & Nolin, 2017), which, in some cases, can be referred to as falling within the category of threats, e.g., virus (Koc, 2013), or metaphor community, which can be classified within the area of the study of virtuality (Jackson, 2016). More detailed metaphors may relate to specific devices, such as PDA – Personal Digital Assistant – which use the metaphor of a day planner (Yanga, Hana & Park, 2010), or may refer to the Internet as a medium (Firat & Yurdakul, 2012; Tanasescu, 2009). Furthermore, members of the younger generation are called "digital natives", as they use new technologies in their everyday life (Smith, 2013), where technological metaphors have been classified as those perceived in several different dimensions, i.e., people, living organisms, machines or lifestyle (Papadoudi, 2010). We can also find publications on the categorization of technological metaphors that are included as the foundation layer of CLA –Causal Layered Analysis (Carbonella, Sánchez-Esguevillas & Carro, 2016). Technology leads to the creation of metaphors of code, which include the following examples: machine, organism, brain, flux and transformation, culture, political system, psychic prison, instrument of domination and carnival (Dufva & Dufva, 2016). The examples of the current literature just mentioned show that although technological metaphors are not a new phenomenon, there are still a lot of new contributions that may be added to this research area. This article suggests a shift from the broadly researched

theoretical approach to metaphor to one that discusses the utility of metaphor as an analytic tool (Denny & Sunderland, 2005). Therefore, in this piece of research, technological metaphors have been referred to as "utility metaphors" (Lindh, 2016).

An efficient way of comprehending metaphor is to understand it as source domain and target domain, that is, "understanding and experiencing one kind of thing in terms of another" (Lakoff & Johnson, 1980: 5). The source represents the original concept used to reason about the target, whereas the target is the new domain of experience one wants to deal with. In this respect, Cuadrado and Durán (2013) proposed a hierarchy of metaphorical terms based on the distance between the categories of the source and the target domains, in which the source domain categories come from the human world, and the target from science and technology. According to the authors, the distance, which appeared very high in most of the analysed cases, "can constitute a parameter to be taken into account when evaluating the level of metaphoricity of these terms" (2013: 1-14). Furthermore, the increasing role of metaphors at a regional level has also been investigated in numerous publications regarding particular countries' specific semantics (Shu, 2015; Shuk-ling & Foong Ha Yap, 2015; Su, Tian & Chen, 2016; Yingli, Rezanova & Shilyaev, 2015; Nguyen, 2016; Salahshour, 2016).

Concerning metaphor, a teacher's belief system influences the effect of technology integration upon his or her students, affecting them as language participants (Ertmer, 2005). Bearing in mind the relevance of teachers' knowledge on their specific fields, our aim was to indicate the importance of their linguistic awareness with regard to courses of English for Specific Purposes (ESP), especially in the use of metaphors in technology. Thus, in the first phase of this study, we decided to test the metaphor knowledge associated with mobile phones through an analysis of a questionnaire given to students of the Institute of English and American Studies at the University of Gdańsk (Poland) being trained to be English teachers. As such, they will teach courses that focus on developing English communication skills in a specific discipline, such as marketing, management, human resources, finance or engineering. Accordingly, extended research has been recently found with respect to a variety of ESP fields, including aeronautics (Robisco & Cuadrado, 2003), economics (Cortés de los Ríos, 2010), finance (Hoa & Cheng, 2016), geology and Information Technologies (IT) (Durán & Argüelles, 2016), and the Internet technological forums (Gauducheau, 2016; Wo, Ha & Chen, 2016).

With regard to the creation of metaphorical expressions in the field of IT, Durán and Argüelles (2016) provide examples of new electronic and computer science terms linked to already existing earth science concepts, such as *flow* as in *control flow*, *data flow*, and *traffic flow*. The authors claim "context is not only important for the comprehension of metaphor, but also necessary to understand metaphoric usage of a term in a new specific domain as well as the new meaning the word acquires" (2016: 108). This notably applies to metaphorical meaning extension, "where the convergence of form and content needs to be contextualized in both source and target scientific fields in order to understand metaphoric coinages" (2016: 110), as we shall see in section 2.1.

The importance of metaphors' cognitive functions is that they are culturally and linguistically diverse, as has been confirmed in numerous research papers (Cohen, 1978; Lakoff & Johnson, 1980, 1999; Lakoff, 1993; Clausner & Croft, 1997; Grady, 1997; Colston & Katz, 2005; Cameron, 2008; Lucke, Kostova & Roch, 2014). Moreover, metaphors help create intimacy in an otherwise miscellaneous environment (Bowles & Katz, 2015). In this work, the emphasis was placed on cross-cultural communication, which has been the subject of a more extensive study with an increasing number of foreign students arriving to study in Poland. This, in turn, justifies the need for an awareness of semantic differences that occur among native and non-native users of English. Therefore, we have studied whether the same English expression may belong to different semantic fields with regard to the language used in the process of communication; i.e. whether the same English metaphorical expression at a mobile-phone user forum might have different meanings among speakers of English from speakers of Polish.

This paper is divided into four sections. In the first part, we present a theoretical framework analysis underlying the research undertaken on technological and mobile phone metaphors. The second part is devoted to a general overview of the empirical study methodology in relation to the main goal of this paper. It starts by the first phase of the survey, its aim being to select metaphors related to mobile phones based on the literature and a website review, namely, Internet forums. It is followed by a detailed description of the second stage of the survey which shows the current usage of mobile phone-related metaphors among student young users. The third part concentrates on an analysis of the results. Finally, it concludes by showing the main contributions of this project to the research field of mobile phone metaphor expressions.

2. Data and methodology

To accomplish the main goal of this paper, we conducted a survey divided into two phases. Phase one focused on the use of big data tools to determine the popularity of metaphors once they were identified by the Metaphor Identification Procedure (Pragglejaz Group, 2007) described below. The second concentrated on preparing the questionnaire based on the results from the first phase, including all the popular metaphors identified previously. All told, this covered 32 English metaphors and 30 metaphors in Polish.

The main purpose of the first phase was to use big data methods and tools to web scrape Internet forums in which people share opinions and knowledge on the use of mobile phones. For web scraping, we used the Apache Spark with Apache Hadoop engine to execute Python scripts. Text mining methods were used to extract and process the information from unstructured data sources. The main purpose of text mining is to find patterns in unstructured data (Miner, 2012). The HTML parser used to web scrape and tokenize the text was BeautifulSoup4. We counted the number of occurrences doing WordCount analysis supported by MapReduce algorithms. Such methods are core components for efficient data analysis using big data (Hashem et al., 2016). The data was stored in a HDFS (Hadoop Distributed File System) that is a default data storage for Apache Hadoop, the core component of the Big Data ecosystem (Arias, Gamez & Puerta, 2017). The main goal of this phase was to identify which of the metaphors on mobile phones are most commonly used in a modern society. The metaphors tested by big data tools were selected based on a theoretical framework analysis underlying the research undertaken as well as their identification by deep analysis of Internet forums and other sources related to the use of mobile phones. Next, the big data tools were used to assess their popularity. In our study, we decided to use both Polish and English metaphors to gain a better understanding of their cross-cultural dependencies.

Both Polish and English metaphors identified by big data analysis were used in the second phase of the survey. This part was conducted empirically using a traditional questionnaire, which included most of the metaphors identified in the first phase. The aim was to assess the consciousness of the metaphor's meaning among students aged 19-24 studying non-technological fields. These metaphors were divided into

Polish and English. An overview of the framework of the survey consisting of two phases is presented in Figure 1.

Although there are several research methods to identify metaphor use, such as Wmatrix (Sun & Jiang, 2014), Q-methodology (Kendall & Kendall, 1993), MIP (Pragglejaz Group, 2007), our two-phase survey propelled us to choose a combined approach on Big Data (word count algorithm) and MIP, as well as a traditional survey with a questionnaire. With this approach we aimed at maximum omission of the weaknesses of particular approaches mentioned above. For instance, in Q-methodology all of the statements used represent the possible domain of opinion on a particular topic (Kendall & Kendall, 1993) while we focused our attention on the possibility of metaphor extension and the existence of new ones. It helped us to construct a sufficient framework that provides reliable data (Figure 1).

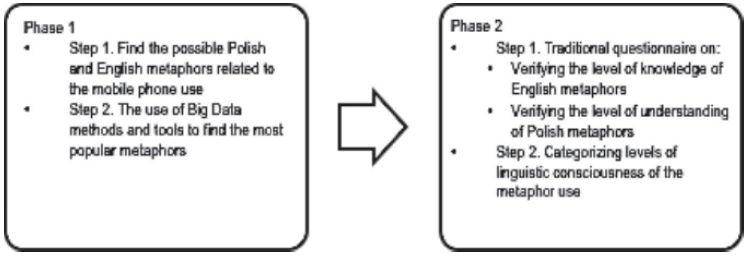

Figure 1. General overview of the framework of the survey.

As shown in Figure 1, Phase 1 was devoted to the use of big data tools in order to identify the most popular metaphors. In Phase 2 we identified the level of awareness of these metaphors to ensure that they were in common use by students of non-technological fields, aged 19-24. It was important to examine those metaphors shared by a group of users, rather than those specific to individuals.

2.1. Phase 1–analysis of the occurrence of technology metaphors on the Internet

As already mentioned in the theoretical section, there are numerous studies that identify and describe technological metaphors; thus, we limited the population of the survey to people using metaphors in technological forums related to mobile phones. To obtain good results from the survey, we decided to conduct a deep analysis of technological metaphors presented in the

literature as well as manually analyze Internet forums. The goal was to find potential metaphors that could be used in the second phase of the survey.

The survey employed big data tools and methods to web scrape and analyze instances of metaphors on Internet forums. The general methodology of this survey consisted of five steps.

1. Select Internet forums on mobile phones that have the highest number of posts.
2. Analyze selected forums and research papers on technological language to identify metaphorical expressions related to mobile phone technology.
3. Use the selected metaphors for further big data analysis to provide information on their frequency (word-count algorithms).
4. Compile a final list of metaphors related to the use of mobile phones.
5. Find cross-cultural relations between metaphors.

As noted above, the survey began with the selection of Internet forums related to mobile phone technology. We used the following criteria to ascertain the final list of the data sources:

1. the number of posts on the forum,
2. the variety of topics,
3. topics related mostly to issues of mobile phone use, not hardware issues,
4. the language of the Internet forum.

The way these criteria were formulated enabled the identification of the five English-language Internet forums on mobile phone use listed in Table 1.

ID	Website address	Number of threads (thousands)
EN1	https://www.avforums.com/forums/mobile-phones-forum.106/	ca. 17
EN2	https://www.cnet.com/forums/phones/	ca. 15
EN3	http://forums.digitalspy.co.uk/forumdisplay.php?f=1	ca. 40
EN4	https://www.thestudentroom.co.uk/forumdisplay.php?f=187&page=157	ca. 10
EN5	https://www.boards.ie/b/forum/411	ca. 25

Table 1. Selected English-language forums on mobile phones (step 1).

The number of threads on these English language forums varied from 10 to 40 thousand topics related to the different areas of mobile phone use. We did not classify any forums as more or less relevant due to the number of topics available on the forums. Because of the necessity to find various metaphors in cross-cultural communication, we also included Polish forums related to the same issues as those given in Table 1. As a result, six Internet forums on mobile phones available in Polish were added to the survey. The goal of this step was to ensure that the same metaphors were used in these two different languages. The list of Polish forums is presented in Table 2.

ID	Website address	Number of threads/posts (thousands)
PL1	http://www.telepolis.pl/forum/	ca. 50 (threads)
PL2	http://forum.benchmark.pl/forum/32-telefony-kom%C3%B3rkowe-i-smartfony/	ca. 30 (threads)
PL3	http://www.chip.pl/forum/viewforum?fid=14	ca. 1 (threads)
PL4	http://www.komorki.fora.pl/	ca. 4.5 (threads)
PL5	http://forumgsm.pl/	ca. 50 (posts)
PL6	http://forum.purepc.pl/forum/98-telefony-kom%C3%B3rkowe/	ca. 1 (threads)

Table 2. Selected Polish language forums on mobile phones.

In phase two, we conducted a text analysis of metaphors presented on topics available from the forums listed in Tables 1 and 2. An additional data source was a theoretical framework analysis underlying the research undertaken related to technological metaphors. We compared our results with the results from research papers to ensure that our identified metaphors overlapped. This was done in the first stage of this research. To find possible metaphors, posts from Internet forums were selected from different topics according to the popularity of each post. It was not possible to search through all the posts and topics because web scrapers could be blocked by forum administrators. Therefore, only selected items were analysed in depth to find the popularity of potential metaphorical expressions. This was consistent with the strategy of this survey, which assumed manual identification of possible metaphors as the second step of the research phase. The method used to accomplish this task was consistent with the Metaphor Identification Procedure (MIP) developed by the Pragglejaz Group (Pragglejaz Group, 2007). In accordance with MIP we decided to determine the lexical units in the entire text (Internet forums). After that, we established the meaning of the metaphor in contrast to basic meaning. If the meaning was different to the basic meaning, we identified that lexical unit as a metaphor. Examples of

English metaphors selected from English language forums are presented in Table 3.

Posts	Metaphor	Meaning
"it hasn't affected the battery life at all"	*Battery life*	This means the duration of the efficient work of a battery; similar to Application Life (up to date application).
"upload my files to a cloud"	*Cloud*	Remote location, Remote storage
"tried to get some shots"	*Shot*	Take a photo with a mobile phone
"The worst *phishing* email"	*Phishing*	An attempt to obtain sensitive information
"our mobile virtual community"	*Virtual Community*	A group of people for whom a meeting place is virtual

Table 3. Identification of possible metaphors on Internet forums.

From the analysis of possible metaphors, we may conclude that people on Internet forums use a limited range of metaphors in their posts. Because numerous posts on Internet forums are written by users with different language levels, there appear numerous language mistakes, such as misspellings or grammar mistakes, which also pertain to metaphorical phrases. It is important to note that the basic set of metaphors presented in this study was prepared not only based upon the forum analysis but also from the theoretical framework analysis underlying the research undertaken. This precipitated the conclusion that some of the mobile phone-related metaphors are the same as those found in any technological domains. For example, the word phishing is mostly related to the phenomenon of information security. The pronunciation of the word itself is a homophone of the word fishing, which describes an act of catching fish as prey; therefore, the metaphorical "prey" are the victims whose data has been stolen. The word shot (in the meaning of taking a photo) is related to photography. Even though it is used by mobile phone users, it was long-ago adopted from the set of photography-related metaphors.

The third step of this phase was to conduct a word count analysis to ensure a metaphor's popularity among Internet users of forums related to mobile phone technology. To accomplish this task, a basic big data framework was used to web scrape the web page. Then, an analysis of word occurrence was made using traditional MapReduce algorithms for the word count analysis. Since the technology used is not an issue for this paper, we will not concentrate on technological aspects of the big data framework. The word-count analysis resulted in a final set of metaphors, which was prepared in the fourth step of this phase. The results of this procedure are briefly described

in point 4.2. As mentioned above, this third step aimed to discover whether the list of metaphors selected in the previous step of the survey was relevant and worth including in the traditional survey to determine the overall understanding of the topics by students. This resulted in the preparation of a final set of metaphors related to mobile phones, whose final list is in Appendix 1.

From the final list of metaphors, we suggest the following classification of mobile phone-related metaphors in terms of their source area: Nature, People, Technology, Food. The most popular way is to construct metaphors based on phenomena related to nature, be it biological, environmental or otherwise. For example, in *application life* (nature), IT specialists borrow the term "life" from biology to name the length of time when an application is up to date. In *fat finger* (people), the metaphor refers to a situation of accidental, inaccurate typing on a computer or smartphone keyboard. A popular form based on people-related metaphors is *community*. Another frequently used metaphor, *sweet photo*, related to food, has become one of the best-known ones when smart phones first came into common use. The final list of mobile phone related metaphors (see Appendix 1) correspondingly refers to technological metaphors, which were adopted to fulfill mobile phone users' expectations. Such metaphors enable the creation of a common language with technological experts as well as computer geeks also using mobile phone technology. The basis of the relationship between mobile phone metaphors and technology is that modern smart phones have the functionality of a computer, tablet and camera. Some of the metaphors relate to the specific functionality of a mobile phone, such as access to social media. Linguistically, it means that users of a particular language consider all those technology devices semantically coherent and overlapping. Therefore, the metaphors that refer to mobile phones simultaneously apply to other similar devices.

The next step in our research aimed at discovering whether the same metaphors are used in different languages and different cultures. For this reason, we decided to test the sample keywords in other Internet forums, such as those listed in Table 2. The main conclusion we reached demonstrates that every English metaphor from the list was adapted to Polish. However, this process may respond to five different methods of adaptation.

1. by the use of an English word (e.g. phishing)

2) by direct translation /loan translation (e.g. cloud – *chmura*)
3) by translation with some minor changes (e.g. application life – *czas życia aplikacji*)
4) by using a completely different word, but with the same meaning (e.g. shoot – *cykać*)
5) by using a phonologically similar word (e.g. like – *lajk*, photo – *fota*)

The final list of English and Polish metaphors enabled the planning of the second phase of the survey described in this paper. These lists became the source for producing a questionnaire used to identify the level of knowledge of metaphors among the selected population.

2.2. Phase 2 – Survey and the analysis underlying the research

A traditional survey was conducted in 2016 on a population cohort of two hundred respondents. We decided to have a population of students ages 19-24 whose field of study was unrelated to technology. The method used to select respondents was a non-probability sampling, and we considered it especially important in the description of social processes that occur in a changing society due to the use of new technologies. The decision to select respondents ages 19-24 was made for two reasons. Firstly, young people use mobile phones for different purposes, and contrary to more mature users, are usually more familiar with metaphorical expressions related to various fields of technology. Moreover, young users are more familiar with international forums and social media, which means that they have better knowledge of English metaphors. Although many English metaphors have been adapted directly into Polish, there are still metaphors that have been translated instead of being used in their original English form.

The sample selected for this survey enabled the identification of the overall phenomenon of familiarity with such metaphors in modern society. To sum up, in this survey a typical sampling unit was a person aged 19-24 involved in a non-technology related field of study. The sample characteristics are in Table 4.

Specification	Total	Completed
Number of questionnaires with Polish metaphors	200	157
Number of questionnaires with English metaphors	200	156

Table 4. Characteristics of the traditional survey.

As the table above shows, we collected one hundred and fifty-seven questionnaires with Polish metaphors along with one hundred and fifty-six questionnaires with English metaphors. The way each questionnaire was constructed allowed conclusions to be drawn based on their familiarity. The qualitative character of the survey led to the goal of presenting how metaphors are perceived in a cross-cultural society.

The traditional questionnaire was constructed upon the assumption that a student must complete it in less than twenty minutes. Therefore, it consisted of four parts:

1. knowledge of thirty two given English metaphors
2. the level of certainty (from 1 to 5)
3. knowledge of thirty given Polish metaphors
4. the level of certainty (from 1 to 5).

In the first part, we asked respondents about their general understanding of selected English metaphors. They could choose their answer from the following options: "Yes", "No", or "Not sure". In the second part of the survey, subjects were asked to assess their level of understanding of selected metaphors. The scale ranged from 1 to 5, where "5" indicated a good understanding of the metaphor and "1" indicated not being sure what a specific metaphor actually meant. In the third part, the survey was repeated with Polish metaphors. These were randomized, to see whether respondents were more familiar with Polish equivalents. As in the second step, the fourth step was to identify the level of the respondents' comprehension.

3. Discussion of results

The survey results show that students aged 19-24 enrolled in non-technological fields of study have a good understanding of English metaphors. Of the thirty-three selected metaphors, fifteen were chosen by more than 90% of the cohort as well-known metaphors (see Figure 2).

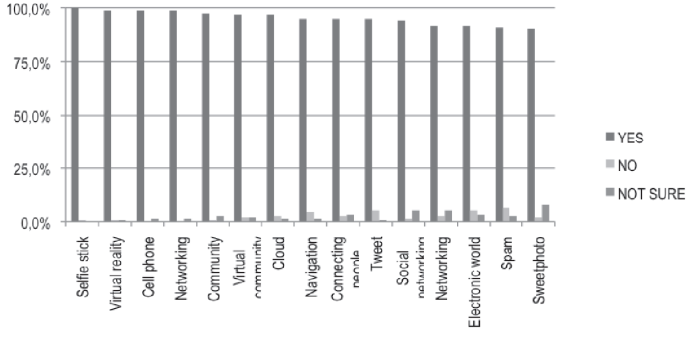

Figure 2. Understanding of English metaphors.

The most common and well-known metaphor is *selfie stick*. It is worth noting that it is used in other languages as a loan expression. The second most well-known metaphor is *virtual reality*, a basic one to describe the digital era. *Cell phone*, a metaphor used to describe mobile phones within the field of cellular technology, was one of the most familiar terms for Polish students. Even though the word *cloud* has a different name in Polish, it is also very well-known in its English form. Finally, we included the frequently used expression *sweet photo*, which refers to a picture usually taken with the front camera of a mobile phone. On the other hand, the least well-known metaphors were presented in Figure 3.

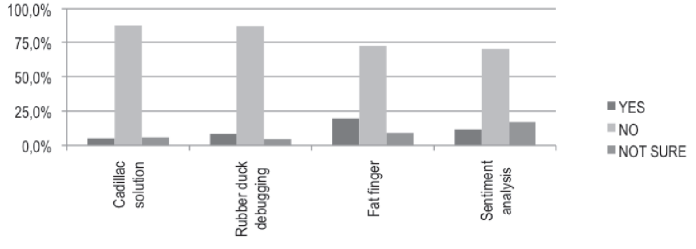

Figure 3. Unfamiliar English metaphors

Metaphors that proved obscure, although they are often used by more experienced users of Internet forums, are: *Cadillac solution*, *rubber duck debugging*, *fat finger* and *sentiment analysis*. The first metaphor, whose meaning is to describe something very expensive, has a self-defining nature – usually Cadillacs are very expensive cars. Nonetheless, some students are not certain about the meaning of the given metaphor. The second metaphorical expression, *rubber duck debugging*, evolved mostly from communication among

programmers and IT experts. The meaning is to explain something very carefully, step by step, to someone who knows very little or nothing about computers and programming. Another one, *fat finger*, refers to mistakes made on a phone while typing on the keypad. Because most mobile phones have touchable screens now, it is quite easy to understand that a *fat finger* will make mistakes on the keypad. For some people, this metaphor may appear offensive or negative. The last one, *sentiment analysis*, indicates the process of trying to understand the general meaning and tenor of a text message. Its meaning may sometimes be difficult to understand, especially when used sarcastically.

To gain a better overview and reconfirm all the results mentioned above, we decided to show metaphors that were difficult to understand (see Figure 4). Respondents indicated five different metaphors as not easy to identify, which shows that their general meaning may be considered somewhat ambiguous.

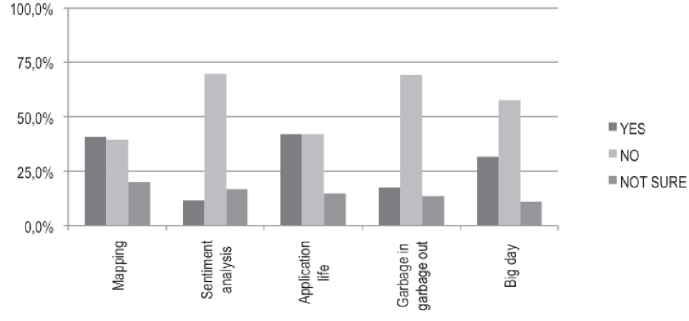

Figure 4. English metaphors that were difficult to identify for language users.

The list of metaphors that appear dubious for speakers of Polish include expressions such as *mapping*, *sentiment analysis*, *application life*, *garbage in garbage out* and *big day*. The word *mapping* was well known for 40% of the respondents, 39% of them did not know what *mapping* in mobile phone terminology was, while 20% remained uncertain about the meaning of this metaphor. Even though the word *life* is used very often in various metaphors, not only in the context of technology, it was quite difficult for 15% of students to correctly identify it. The metaphor *big day*, used to describe the time of the release of new software or a new mobile phone, is also used in other activities of our life. However, about 10% of respondents were not able to define this metaphor correctly and more than 50% of them did not know the meaning of this word.

The second part of the survey aimed at determining whether respondents were able to define each metaphor precisely. The question was asked as a self-assessment concerning knowledge of the correct definition of each metaphor. Metaphors marked with the maximum amount of certainty by the first and third quartile of the population are presented in Table 5. The column "average" is a mean of the level of certainty marked by respondents on a scale of 1 to 5. The column "sum of points" shows the total of all marked levels. "Number of collected answers" shows how many people completed this point of the questionnaire without making a mistake.

Metaphor	Average	Median	Sum of points	Number of collected answers	Quartile 1	Quartile 3
Selfie stick	4.92	5	645	152	5	5
Cell phone	4.81	5	630	152	5	5
Sweet photo	4.70	5	588	146	5	5
Spam	4.58	5	563	144	5	5

Table 5. Metaphors easy to define in respondents' opinion.

As presented in Table 5, respondents claimed to be certain about only four metaphors they had identified, namely *selfie stick*, *cell phone*, *sweet photo*, and *spam*. All those were also specified as easy to define in terms of their meaning (a firm positive answer to the question: "Do you clearly understand the meaning of the following metaphors?").

On the other hand, metaphors that were very hard to define and understand correctly are presented in Table 6.

Metaphor	Average	Median	Sum of points	Number of collected answers	Quartile 1	Quartile 3
Garbage in Garbage out	2.26	2	138	82	1	3
Sentiment analysis	2.05	1	121	80	1	3
Fat finger	2.03	1	124	82	1	3
Rubber duck debugging	1.62	1	89	76	1	2
Cadillac solution	1.30	1	73	77	1	1

Table 6. The most difficult metaphors to define by respondents.

Among the list of metaphors, five of them have an average level of certainty below 2.5: *Garbage in garbage out*, *sentiment analysis*, *fat finger*, *rubber duck debugging* and *Cadillac solution*. It is consistent with the answers included in the first part of this survey (the answer – "not sure").

To gain a better understanding of cross-cultural communication and the adaptation of different metaphors, we decided to design a similar questionnaire, but include only Polish metaphors. Figure 5 shows well-known Polish metaphors.

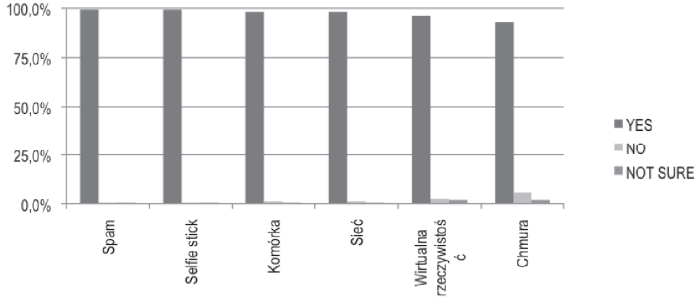

Figure 5. Understanding of Polish metaphors.

Compared to Figure 2, these metaphors are almost the same and include:

1. *Spam* (the same in English)
2. *Selfie stick* (the same in English)
3. *Komórka* (Cell phone)
4. *Sieć* (Network)
5. *Wirtualna rzeczywistość* (Virtual reality)
6. *Chmura* (Cloud).

This means that there is both a direct influence upon, and adaptation of, new metaphors to different languages.

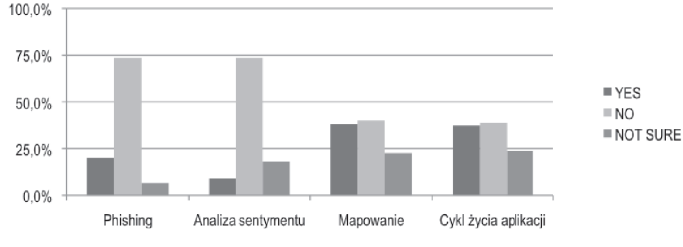

Figure 6. Unfamiliar Polish metaphors.

Polish students did not understand the following metaphors in the Polish questionnaire: *Phishing*, *analiza sentymentu (sentiment analysis)*, *mapowanie (mapping)* and *cykl życia aplikacji (application life)*. Three additional metaphors were also included in the list of those which are considered as obscure, and, thus, difficult to identify among Polish language users (see Figure 7).

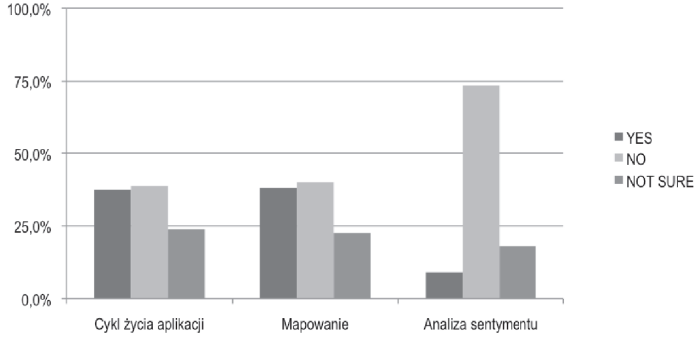

Figure 7. Polish metaphors that were difficult to identify for language users.

Among the list of Polish metaphors, four were tough to define and these were almost the same as in English: *Cykl życia aplikacji (Application Life)*, *Mapowanie (Mapping)* as well as *Analiza sentymentu (Sentiment analysis)*. If we compare Figure 4, three English metaphors were almost the same.

4. Conclusions

The present paper has aimed to confirm the occurrence of a variety of metaphors in the discourse of mobile phone users on the Internet forums as an extension for specialized language analysis. We have attempted to highlight the fact that the language of Internet forums is filled with metaphors related to mobile phones as well as other technological devices, e.g., cameras, which have not as yet been subject to extensive study. Our analysis showed that the majority of these metaphors are used cross-culturally and in different languages, based on English-Polish adaptation. English language forum users are both speakers of English as a first and as a second language. Thus, our findings have proved that the semantic fields for particular metaphors may differ with regard to whether English is the first or the second language for the speaker. Forum users tend to use the same metaphors; however, when they are presented in English their meaning may vary from their loan word in Polish.

This analysis allows us to reach several conclusions related to the utility of metaphorical expressions concerning mobile phones. The adaptation of the Conceptual Metaphor Theory as well as the Metaphor Identification Procedure (MIP) gave an insight into the identification and categorization of novelty in the process of metaphor formation among mobile phone language users. Then, a theoretical framework analysis underlying the research undertaken showed that technology metaphors can be classified into different semantic domains and categorized by different dimensions. For instance, they can be used as a service description (e.g. *cloud* that comes from cloud computing) or a development (e.g. *revolutionary* or *calm technology*). Empirical studies have confirmed that metaphor meaning depends on different levels of understanding, namely that users of mobile phones classify these themselves as either well-known, completely unfamiliar or partly identified. Well-known metaphors, such as *selfie stick*, are commonly used even by inexperienced users posting on Internet forums with basic mobile phone problems. On the other hand, less frequently used metaphors, such as *big day* (the time of release of a particular type of software) remain incomprehensible, as their meaning seems hazy for most mobile phone users.

Secondly, the literature analysis resulted in the conclusion that most mobile phone metaphor expressions were adopted directly from other fields of technology and other technology-related metaphors, such as *camera shot* or *phishing*. Metaphors adapted from technology directly into the field of mobile phone language are related to both concepts and activities, as could be observed in section 2.1.

Lastly, Polish native-speaking respondents proved to be more familiar with the Polish equivalents of the metaphors, even though the difference in their knowledge of Polish and English metaphors was similar. Metaphor comprehension has proved to be culture-dependent, i.e. speakers of Polish understand particular metaphors differently than speakers of English. This could be found by our extensive study with *big data* tools, which have a high potential in metaphor identification, considering previous attempts made by researchers using, e.g., Wmatrix or word frequency approach, which have not proven satisfactory enough.

We hope to be able to extend our research on the use of metaphors in specialized discourse such as with mobile phone forum users, and offer further analyses of other metaphors, which have indicated significant

differences in the semantic analysis of the corpora. The results could not be included in this paper due to space limitations; however, such results will probably offer a broader perspective on the issue.

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Appendix 1

English metaphors related to mobile phones

No.	Metaphor	Meaning	Classification
1.	Rubber Duck Debugging	Explaining a programming problem to someone else, possibly even to someone who knows nothing about programming, and then hitting upon the solution in the process of explaining the problem. In describing what the code is supposed to do and observing what it actually does, any incongruity between these two becomes apparent. (Silicon Valley Dictionary, 2017)	Technology
2.	Application Life	Application life cycle management (ALM) is the combined coordination of various development life cycle activities, including requirements and modeling development, built and tested by: • Proper enforcement of processes that cover these activities. • Managing relationships between development artifacts	Nature

		used or produced by these activities. • Creating progress reports of the complete development cycle. Application life cycle management is also known as software life cycle management. (Technopedia TM, 2017)	
3.	Big Day	The day that something important happens <Tomorrow is *the big day*.> (Merriam-Webster Dictionary and Thesaurus, 2017); the date of release of a new mobile phone/application	People
4.	Fat Finger	To accidentally press a button or key adjacent to the desired one. —a situation in which you press the wrong button by accident when you are using a computer keyboard (Cambridge English Dictionary, 2017) —used to refer to clumsy or inaccurate typing, typically resulting from one finger striking two keys at the same time: 'the programming problem turned out to be a case of fat finger' (Oxford English Dictionary, 2017)	Nature
5.	Garbage in Garbage out	Bad input data produce bad output (wrong application should be deleted). —something you say that means that something produced from materials of low quality will also be of low quality (Cambridge English Dictionary, 2017) —garbage in, garbage out (GIGO), in the context of information technology, is a slang expression that means regardless of how accurate a program's logic is, the results will be incorrect if the input is invalid. —while the term is most frequently used in the context of software development, GIGO can also be used to refer to any decision-making systems where failure to make right decisions with precise, accurate data could lead to wrong, nonsensical results. (Technopedia, 2017)	Nature
6.	Cadillac Solution	—an application or phone which is too expensive. A high-priced solution to a problem that may require only ingenuity/diligence (Solarwinds, 2017)	Technology
7.	Tweet	—a post made on the Twitter online message service (Merriam-Webster Dictionary and Thesaurus, 2017) —to post a message, image, etc. on Twitter; Communicate with (someone) on Twitter (Oxford English Dictionary, 2017)	Nature
8.	Cloud	A remote storage location. —the computers and connections that support cloud computing <storing files in the cloud> (Merriam-Webster Dictionary and Thesaurus, 2017) —cloud computing: the practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer (Oxford English Dictionary, 2017)	Nature
9.	Spam	Unwanted e-mail or Short Text Message. —irrelevant or unsolicited messages sent over the Internet, typically to a large number of users, for the purposes of advertising, phishing, spreading malware, etc. (Oxford English Dictionary, 2017)	Food

		—unsolicited usually commercial e-mail sent to a large number of addresses (Merriam-Webster Dictionary and Thesaurus, 2017)	
10.	Navigation	Application Menu —the science of getting ships, aircraft, or spacecraft from place to place; the method of determining position, course, and distance traveled (Merriam-Webster Dictionary and Thesaurus, 2017); the action of moving around a website, the Internet, etc. (Oxford English Dictionary, 2017)	Technology
11.	Community	A group of people sharing mobile phone knowledge. —a unified body of individuals: such as people with common interests living in a particular area; broadly : the area itself <the problems of a large community> —a group of people with a common characteristic or interest living together within a larger society <a community of retired persons> <a monastic community> (Merriam-Webster Dictionary and Thesaurus, 2017)	People
12.	Virtual Community	A group of people sharing the same virtual meeting place. — a community of people sharing common interests, ideas, and feelings over the Internet. (Oxford English Dictionary, 2017)	People
13.	Virtual Reality	A world which exists only in electronic form. —the computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors. (Oxford English Dictionary, 2017) —an artificial environment which is experienced through sensory stimuli (as sights and sounds) provided by a computer and in which one's actions partially determine what happens in the environment; also: the technology used to create or access a virtual reality (Merriam-Webster Dictionary and Thesaurus, 2017)	Nature
14.	Cell Phone	—a portable usually cordless telephone for use in a cellular system (Merriam-Webster Dictionary and Thesaurus, 2017) —a telephone with access to a cellular radio system so it can be used over a wide area, without a physical connection to a network. (Oxford English Dictionary, 2017)	
15.	Connecting People	To establish emotional connection with a person via a mobile phone.	People
16.	Networking	A group of people. —the exchange of information or services among individuals, groups, or institutions; specifically : the cultivation of productive relationships for employment or business < … networking remains the No. 1 cause of job attainment … — Hal Lancaster> —the establishment or use of a computer network <He has extensive experience in computer networking and information security.> (Merriam-Webster Dictionary and Thesaurus, 2017)	People
17.	Social Networking	A group of people using social media as a communication medium. —the creation and maintenance of personal and business relationships especially online (Merriam-Webster Dictionary and Thesaurus, 2017)	People

		The use of dedicated websites and applications to interact with other users, or to find people with similar interests to oneself. (Oxford English Dictionary, 2017)	
18.	Mapping	To fit something into a specific pattern. —the activity or process of creating a picture or diagram that represents something. (Cambridge English Dictionary, 2017) —an operation that associates each element of a given set (the domain) with one or more elements of a second set (the range). (Oxford English Dictionary, 2017)	Technology
19.	Cellphone Era	A world in which we are using mobile phones. —a period of time typical for cell phone development (authors' definition)	Nature
20.	Network	The Internet. —a large system consisting of many similar parts that are connected together to allow movement or communication between or along the parts, or between the parts and a control centre, 2. a number of computers that are connected together so that they can share information (Cambridge English Dictionary, 2017) —an interconnected or interrelated chain, group, or system <a *network* of hotels> —a system of computers, peripherals, terminals (see 2 terminal 5), and databases connected by communications lines; 5: usually informally interconnected group or association of persons (as friends or professional colleagues) <a support network available to single mothers> <a network of bird watchers> (Merriam-Webster Dictionary, 2017)	Nature
21.	Selfie Stick	A stick to facilitate taking the photo of oneself, usually taken with the front camera of the mobile phone. —a long device that you can attach to your mobile phone and use for taking a selfie (= a photograph of yourself) from a distance, so you can fit more people or things into the picture (Cambridge English Dictionary, 2017)	Nature
22.	Sweetphoto	The same as selfie, with the person being photographed smiling (authors' definition)	Food
23.	Electronic World	A world in which we communicate via mobile phones or computers. —(digital world) electronic spectrum of data creation, storage, retrieval and synchronization (Reverso Dictionary, 2017) —the use of digital media (Facebook, Twitter, Instagram) in order to socialize via digital technological devices, i.e. cell phones, computers; also the use of technology for professional purposes, e.g. power point presentations or more advanced multi-media technologies (authors' definition)	Nature
24.	Sentiment Analysis	Analysis of people's opinions and emotions. —the process of computationally identifying and categorizing opinions expressed in a piece of text, especially in order to determine whether the writer's attitude towards a particular topic, product, etc. is positive, negative, or neutral: *("Companies have key lessons to learn about harnessing the power of social media and sentiment analysis" (*Oxford English Dictionary, 2017*)*	People

25.	Phishing	A way sensitive data are obtained, such as user names/passwords, addresses etc. —a scam by which an e-mail user is duped into revealing personal or confidential information which the scammer can use illicitly (Merriam-Webster Dictionary and Thesaurus, 2017) — an attempt to trick someone into giving information over the internet or by email that would allow someone else to take money from them, for example by taking money out of their bank account (Cambridge English Dictionary, 2017)	Nature