



Languages for Special Purposes in a Multilingual, Transcultural World

Proceedings of the 19th European Symposium on Languages for Special Purposes, 8-10 July 2013, Vienna, Austria

<http://lsp2013.univie.ac.at/proceedings>

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Larisa Iljinska, Marina Platonova, Tatjana Smirnova

Cite as: Iljinska, L. et al. (2014). Metaphoric terms: Elusive magic of meaning transformation. In G. Budin & V. Lušicky (eds.), *Languages for Special Purposes in a Multilingual, Transcultural World, Proceedings of the 19th European Symposium on Languages for Special Purposes, 8-10 July 2013, Vienna, Austria*. Vienna: University of Vienna, 442-451.

Publication date: July 2014

ISBN: 978-3-200-03674-1

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Metaphoric terms: Elusive magic of meaning transformation

Larisa Iljinska, Marina Platonova, Tatjana Smirnova
Institute of Applied Linguistics, Riga Technical University
Latvia

Correspondence to: marina.platonova@rtu.lv

Abstract. In technical texts metaphoric terms are often used to denote notions that have not received a name yet. They perform several functions: expand the scope of information communicated at the same time compressing the information; extending the meaning of the existing linguistic items, they fix new meanings by designating new concepts. Such terms cannot be described in traditional categories due to their complicated semantic structure, and their manifold meaning potential can be revealed only in the particular communicative setting.

In the present article we analyse one of the most frequently applied mechanisms of meaning transformation, namely, semantic shift based on metaphoric meaning extension, used in creation of new terms in several technical fields, such as marine, military, civil engineering, technology, mechanics, telecommunications, and computing.

Metaphoric terms should be investigated using a combination of methods of semantic, pragmatic and semiotic analyses as they may potentially pose communication problems caused by various reasons, such as ambiguity, polysemy, and culture specific associations embodied in the meaning of a term.

Keywords. Metaphoric term, semantic change, meaning extension, term creation, polysemy, symbolic character.

1. Introduction

The advances in technological development determine the central role of technical language in contemporary information exchange, and there is a constant need for nomination of new concepts. Although technical vocabulary is considered to be an open system, i.e. there is no limit for new entries to be introduced, genuinely new terms are relatively rare. Great majority of terms are created on the basis of existing linguistic material, using derivation and compounding. Semantic change can also be considered one of the most productive methods for coining new terms (cf. Veisbergs, 2001:95). The tendency for creation of new terms by means of semantic change has always been a characteristic feature of the technical language, however, at present this tendency has become even more pronounced.

Numerous classifications of the types of semantic change comprising from eight to twelve categories have been developed (Campbell, 2004; Traugott, Dasher, 2002; Ullman, 1962). Only four mechanisms of semantic change are generally used in term building: 1) extension of meaning based on a metaphoric meaning transfer; 2) extension of meaning based on the principle of allusion, which is seen as a form of extended metaphor (cf. Skrebnev, 2000); 3) extension of meaning based on the principle of metonymy; 4) shifts between classes in hierarchical taxonomies (i.e. replacement of a hyponym by a hyperonym and vice versa). Meaning transfer may also occur through a combination of these mechanisms (cf. Iljinska, Smirnova, 2010). It should be noted that semantic change is rarely used in controlled term creation, it is rather used *ad hoc* when a necessity for a new term emerges.

The aim of the present article is to analyse one of the most frequently applied mechanisms of semantic change, namely, semantic shift based on metaphoric meaning extension, used in creation of new terms in several technical fields, such as marine, military, civil engineering, technology, mechanics, telecommunications, and computing.

Numerous classifications of metaphors have been developed (e.g. Saeed, 2004, Lipka, 2002

[1990], Lakoff and Johnson, 1980). In the present article metaphoric terms are classified in accordance with *the field of reference* (fauna, flora, human body, household items, etc), and *the mechanism of meaning transfer* (based on similarity of form, similarity of function, symbolic representation, etc).

Analysis of semantic shift based on metaphor in the language for special purposes is of considerable theoretical and practical importance, taking into consideration the fact that metaphors often reveal aspects of reality, which otherwise cannot be expressed. The metaphor establishes certain relationships between seemingly unrelated concepts, thus, it may explain the unknown in terms of the known. It can also be treated as one of the ways to enrich the word stock using existing lexical units to denote new concepts.

In the course of centuries a large number of metaphors have been created in the technical language and now they form an indispensable part of the contemporary technical vocabulary. Thus, the lexico-semantic, pragmatic and semiotic analyses of metaphoric terms can yield valuable findings on the mechanisms of meaning extension and transfer in the technical discourse. The results obtained may be used both as empirical data for creation and updating of mono- and multilingual terminological databases and as a medium for further study of the development of terminology in any specific technical domain.

2. Metaphor as a cognitive phenomenon

In order to analyse the terms based on metaphoric meaning shift, it is necessary to establish the theoretical framework for the study of metaphor as a cognitive phenomenon.

Based on the theory of metaphor proposed by Lakoff and Johnson (1980) *metaphor* is defined as “[...] a cross-domain mapping in the conceptual system [...]” (Lakoff 1993:203). A conceptual metaphor consists of a target, a source and a mapping between them (cf. *ibid*). The authors also stress that “Our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature” (Lakoff and Johnson 1980:3).

Tendhal and Gibbs (2008) with the reference to Lakoff and Johnson (1999) argue that “[...] metaphor is not merely a figure of speech, but a specific mental mapping and a form of neural coactivation that influences a good deal of how people think, reason, and imagine in everyday life.” At the same time, abstract notions are even more frequently mapped in language in terms of metaphors.

Following the recent findings of cognitive linguistics, in the present article we define metaphor as an essential conceptual tool, which consists in a structural mapping from a source conceptual domain onto a target conceptual domain. Using the terminology suggested by Richards (1990 [1936]:93), source conceptual domain in the article is referred to as vehicle, whereas target conceptual domain is referred to as tenor. The more features of the vehicle are used as a tenor in the process of metaphoric meaning extension, the higher is the probability that the term created by means of metaphoric meaning shift will be transparent and comprehensible for its perspective users. In technical texts, terms based on metaphoric meaning extension, further referred to as *metaphoric terms*, may potentially pose communication problems, which are caused by various reasons, such as lack of transparency, intra-disciplinary polysemy, and culture specific associations embodied in the meaning of a term.

As any other lexical items, metaphoric terms possess certain ‘meaning potential’ defined by Allwood (2003:43) as “[...] all the information that the word has been used to convey either by a single individual, or on the social level, by the language community [...]”. Meaning potential of metaphoric terms is even more many-fold, i.e. the information stored in them does not only provide reference to numerous concepts within special fields, but also to cultural, historical, and sometimes individual associations. According to Tarpey, terms based on metaphors can “[...] effectively communicate the most complex of ideas in a simple, elegant manner that transcends the boundaries of language and culture [...]” (Tarpey, 2003).

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Metaphoric terms, irrespective of their *degree of lexicalization* (i.e. live, novel, original, active or dead, stock, frozen; cf. Saeed, 2004, Lipka, 2002 [1990]) or their *status* within specialised vocabularies (i.e. *ad hoc* entry, jargonism, professionalism, standardised entry), should be studied only in context to resolve ambiguities caused by their polysemic nature. Arnold (1986:23) states that today “[...] English vocabulary, especially the part of it characterised by a high index of frequency and polysemy, constitutes a constant source for the creation of new terms. The constant interchange of elements goes both ways”.

From the point of view of pragmatic theory, the meaning of every lexical item is realised only in a certain context. Evans (2007:7) considers that construction of meaning in context “[...] is not an unpacking of stored information, as assumed in more traditional accounts. Rather, it is a constructive process, in which integration of lexical units involves differential access to the conceptual knowledge which lexical entities potentially afford access [...]”. Accepting this point of view, it may be maintained that the meaning of any metaphoric term can be understood only in context. Moreover, compound metaphoric terms create their own inner context.

The inner context of a term stores a myriad of associations represented in various meaning components, which convey a range of associative meanings when the term is used in the outer context (context of application). Metaphoric term can be applied both in non-metaphoric and metaphoric sense, denoting a particular general or special concept either provoking easily recognisable, but limited number of associations (non-metaphoric use), or inducing a whole system of multi-layered, even contrasting, associations (metaphoric use).

The theory of metaphoric interaction formulated by Richards in 1936 was developed and modified by Black, who referred to a vehicle as to a “system of associated commonplaces” (Black 1962:40), asserting that the vehicle is normally represented by a *system of associations* and related phenomena rather than by an individual concept. It means that a metaphoric term forms a complex system of shared senses (both metaphoric and non-metaphoric) and related meanings (associative, etymological, folk, cultural, historical, etc.), which can be evoked simultaneously causing polysemy.

For example, the term *beaver tail* (Example 1) may be realised both in non-metaphoric and metaphoric sense. In biology it would literally denote the tail of the beaver. In arms manufacturing *beavertail* (beavertail grip) designates a fore grip. In automotive industry this term denotes an auto trailer, whereas in technology it is used to refer to the main jack. In all three cases metaphoric meaning shift occurred based on the similarity of form, whereas in the latter case it is also the similarity of function.

The associations to the shape and movements of the tail of the beaver induced by the term *beaver tail* create the inner context of this term. In the outer context the field of application would determine the exact meaning of the term and the system of associations it triggers.

It is interesting to note that the term under discussion can be used as a constituent in even more complicated compounds. For instance, in meteorology the term *beavertail* is a part of the term *beavertail antenna* (Example 2), which means a type of radar antenna that forms a beam having a greater beam width in azimuth than in elevation, or vice versa¹. The metaphoric meaning shift has occurred based on the similarity of form.

Metaphoric polysemy is based on the apparent/obvious or obscure/hidden, but still well-known and understandable similarity between two concepts that belong to different conceptual domains (semantic or thematic fields). Gibbs argues that “metaphor [...] plays a major role in our understanding of individual words, especially in making sense of how a single word can express a multitude of related meanings (i.e. polysemy)” (Gibbs 1999:35).

Temmerman notes that language “[...] has a tendency to increase the polysemic character of lexical items [...]” (Temmerman 2000:138), thus, polysemy is viewed as a result of meaning evolution, in the process of which many terms acquire additional layers of meaning. Meaning shift based on metaphor occurs on the basis of analogy/similarity ascribing additional meaning

to everyday objects or frequent phenomena either by omitting or adding one of the meaning components (cf. Platonova 2011:42-53).

Metaphors make the language more complex, and the more complex and the more symbolic is the metaphor, the more polysemous its interpretation is and the more difficult it is to interpret it outside the context. This problem is particularly topical in terminology, where the possibility for numerous interpretations should be limited to the degree possible.

Pustejovsky (cf. 1996:27-28) distinguishes between contrastive polysemy, which is a fully context-dependent phenomenon that can be decoded in the particular communicative setting (context of situation), and complementary polysemy, which relies mainly on the background knowledge of the user.

The most common type of complementary polysemy is metaphoric polysemy, which “[...] derives in most cases from metaphor as a diachronic process [...]” (Blank in Nerlich et al, 2003:268). In general, polysemy is considered to be a diachronic process. For example, Temmerman (2000:153) states that “[...] polysemy appeared to be the synchronic result of diachronically increased informational density”.

In the present article two types of polysemy of metaphoric terms are considered, namely, intradisciplinary and cross-disciplinary polysemy. The latter does not pose significant difficulties in communication provided the text belongs to only one technical field. At the same time, intradisciplinary polysemy may be the cause of several other problems such as ambiguity, term doublets, and, eventually, intra-field term synonymy.

The challenges associated with the interpretation of metaphoric terms as well as mechanisms of their creation will be discussed in more detail in the next section.

3. Terms based on metaphoric meaning extension

The meanings of metaphoric terms in the present article are analyzed using a) semantic approach (considering the semantic field and thematic field for concept placement and cross-referencing; componential analysis to identify meaningful components and their role); b) pragmatic approach: the analysis of the context-sensitive lexical items, considering the linguistic and extra-linguistic aspects of their application; c) semiotic approach: (investigating the symbolic meaning hidden within a particular metaphoric term) (cf. Platonova 2010:345).

Metaphoric terms can be classified in a variety of ways, depending on the aspect being considered. In the present research terms based on metaphoric meaning extension are classified in accordance with *the field of reference*, and *the mechanism of meaning transfer*. The semantic and/or thematic fields of reference, namely, *fauna*, *flora*, *human body*, and *household items*, which have been selected for the research, are used as a basis for metaphoric meaning extension in technical language more frequently than others. They represent the most universal systems of symbols inherent in any language, and thus provide a perfect medium for analysis.

Tab. 1 presents a selection of metaphoric terms from various technical fields that are based on similarity of the referent with the form and/or function of some plants.

Metaphoric terms based on floral imagery are mainly formed based on the similarity of form. Tab. 1 could be supplemented with a great number of terms (e.g. *apple-ring fender*, *shower rose*, *fly reed*), but only a few were chosen to illustrate this tendency.

No	Term	Field	Definition ²
Similarity of form			
1.1.	Tulip valve	Technology	an intake valve (as on an engine) with a cup-shaped to trumpet-shaped head (MW)
1.2.	Daisy wheel	Computer science	a component of a computer printer in the shape of a wheel with many spokes (FDF)
1.3.	Pine-tree array	Electromagnetism	array of dipole antennas aligned in a vertical plane (FDF)
Similarity of function			
1.4.	Daisy chain	Computer science	a means of connecting devices to a central processor by party-line input/output buses which join these devices by male and female connectors. (FDF)

Table 1: Metaphoric terms based on floral imagery

The concepts that are familiar and are characterised by a wide scope of associative meanings are more frequently used in metaphoric term creation. For example, the concept DAISY is often used in metaphoric term creation (*daisy clipping* (aviation), *daisy cutter bomb* (military), *daisy tip* (medical technology)). The term *daisy chain* is very frequently used in numerous technical fields, for example, technology, mechanics, network technologies, oil and gas technology, electronics, etc. moreover, it has become a source for secondary term formation, that is, it is used in a great number of compounds, e.g. *daisy-chain structure* (security), *daisy chain mine pattern* (military), *daisy chain bus*, *daisy chain logic*, *daisy chain network*, *daisy chain topology* (computer science). It should be kept in mind that the term daisy is generic (umbrella term), it does not denote only one particular species of plants. According to Encyclopedia of Life, the item *daisy* can be used with the reference to 2,770 different plants³.

Tab. 2 lists metaphoric terms based on the concept BODY. It is one of the most ancient cognitive concepts, that is why it is frequently and extensively used as a vehicle in the process of meaning extension. The extension occurs based on similarity of function, similarity of form, or similarity of both form and function. It may be argued that metaphoric meaning extension may be based on symbolic perception of human body as the pattern for nomination of parts of natural objects, structures or pieces of equipment (*foot of the mountain*, *face of the building*, *leg of the tower*, *cantilever arm* (of the bridge), *finger bit*, etc.) (see Iljinska, Smirnova, 2012 for discussion).

No	Term	Field	Definition
Similarity of form			
1.1.	Cheese head	Technology	<i>of a screw or bolt</i> : having a raised cylindrical head (MW)
1.2.	Mushroom head	Technology	obturator spindle plate (M)
1.3.	Cheek plate	Civil Engineering, Mechanics	anchor wall (M)
Similarity of function			
1.4.	Hazardous shoulder	Civil Engineering	roadside, which does not ensure safe traffic (M)
1.5.	Leg of the tower	Civil Engineering	each of the supports of a structure (OD)

Table 2: Metaphoric terms based on the concept BODY

The semantic field BODY is one of the most productive fields for metaphoric meaning shift. For example, the term *head* is widely used in technical language both as an independent unit and as an element in a great number of compounds. Dictionary of Terms in Civil Engineering (DTCE)

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lists 16 meanings and more than 100 compounds which contain the component *head*. The main meaning is *top, upper part of a tool or construction*.

The nomination of a term *mushroom head* is based on two fields of reference, both flora and human body. It is used in many fields to denote a mushroom shaped upper part of some detail or mechanism. The term is also used in secondary term formation and has become a constituent of a number of compounds (e.g. *mushroom head bolt*, *mushroom head rivet*, *mushroom head buttress*, etc).

In general, the more ancient is the field of human activity in which a certain phenomenon occurs, the greater number of stock metaphors are used as terms. For example, the thematic field *household items* is a rich source for both primary and secondary term formation because metaphoric terms created extending the meaning of the concepts in this field are based on human perception of the surrounding environment, everyday experience and traditions.

No	Term	Field	Definition
Similarity of form			
1.1.	Scissor platform	Civil Engineering	a work platform which can be moved into place, then raised and lowered to various heights ⁴
1.2.	Water-table	Civil Engineering	a projecting ledge, molding, or stringcourse along the side of a building, designed to throw off rainwater. (FDF)
1.3.	Liquid dashpot	Technology	hydraulic shock absorber (M)
Similarity of function			
1.4.	Apron wall	Civil Engineering	in an exterior wall, a panel which extends downward from a windowsill to the top of a window below. (FDF)

Table 3: Metaphoric terms based on thematic field 'Household Items'

The examples presented in Tab.3 illustrate different mechanisms of meaning shift. The terms *scissor platform* and *water-table* are based on similarity of form and are relatively transparent, whereas the term *liquid dashpot* is the least transparent term in the selection. It is based on three concepts, namely, LIQUID, DASH and POT, and two of them, i.e. liquid and pot, are used for meaning shift. Technically, the dashpot is not liquid, but rather contains liquid, thus meaning transfer occurred by means of metonymy, and it is not a pot, but rather a glass envelope, thus meaning extension also occurred as a result of metaphoric transfer.

A vast body of research is dedicated to the study of animal symbolism in folklore, literature and visual arts. Human perception of fauna as an important part of the world has culturally and symbolically determined the extensive use of *animal imagery*, which is one of the major source domains for a great number of metaphoric terms.

Although the use of animal imagery is quite a universal pattern of naming new concepts, metaphoric terms based on one and the same concept can be interpreted differently in various linguistic communities, as metaphors map the images, feelings, values and thought patterns embodied in the culture of the users (cf. Mittelberg et al, 2007:34). However, it may be argued that in technical vocabulary the symbolic aspect of the meaning of faunal metaphors is not always explicit, and the meaning of technical metaphoric terms is less culture dependent.

The most frequently used mechanism of meaning transfer in case of animalistic metaphors is based on the similarity of form: *snake waveguide* (electronics), *bent tail dog* (technology), *camel-back truss* (CE). Similarity of function is also used frequently, but such terms are not always as transparent as the terms based on similarity of form. For example, the meaning of the term *bear punch* (metallurgy), which denotes a portable spot perforator (M), may appear rather vague. Other terms that are based on the similarity of function include *dog anchor*, *bulldog clip*, and *rivet dog* (technology).

No	Term	Field	Definition
Similarity of form			
1.1.	Camel-back truss	Civil Engineering	a truss having a broken outline for the upper chord, composed of a series of straight segments, taking the humped shape of a camel's back (FDF)
1.2.	Butterfly wall ties	Civil Engineering	wall ties. Twist central is used to prevent moisture travelling across cavity (R&J Builders Hardware)
Similarity of function			
1.3.	Cat's eye	Civil Engineering	small pieces of glass or plastic that are put along the middle and sometimes the sides of a road, to reflect the lights of a car, in order to show the driver where to drive when it is dark (CDO)
Similarity of form and function			
1.4.	Crocodile shears	Technology	shears constructed on the principle of the lever (MW)
1.5.	Spider trunnion	Engineering	Steel trunnion suitable for mounting on any object that must be turned or rotated ⁵
Symbolic representation			
1.6.	Spider	Computer science	an automated program that reads Web pages from a Website and then follows the hypertext (HTTP) links to other pages. Spammers use spiders to sift through Web pages to look for (that is, harvest) email addresses (WNWHD)
1.7.	Ant colony optimization	Computer science	a population-based metaheuristic that can be used to find approximate solutions to difficult optimization problems (S)

Table 4: Metaphoric terms based on animal imagery

Metaphoric terms may display features of both cross-disciplinary and intradisciplinary polysemy. For example, the term *cat's eye* is polysemic as it is used to denote different phenomena in different domains such as road building, automotive, wood processing, military, etc.

The term *cat's eye*, which is a road reflective safety device, establishes a clear reference to the ability of cats to see in the dark. The other three meanings used in military slang refer to this quality of a cat as well. This is a good example of approach to research known as biomimetics. Schatten and Žugaj (2011: 39) consider biomimetics to be both “...*the art and science of imitating nature and life for technological solutions...*”. Biomimetics is the source of human inspiration for many innovations. Engineers copy the functions and characteristic features of the animals in developing scientific innovations in different fields of engineering and medicine.

The concept SPIDER has been a vehicle for metaphoric meaning shift in many fields of human communication. The terms based on this concept may be both neutral and connotationally loaded. Tab. 4 presents two terms based on this concept. The term *spider trunnion* denotes a spider-shaped detail, and it is neutral and comprehensible with minimum outer context.

Depending on the culture of the users, the concept SPIDER is perceived as having many different sometimes even contradictory connotations. For example, spider might symbolise either patience and persistence, or malice and evil. In many pagan cultures (e.g. Ancient Egypt, Ancient Greece, the Vikings) spider was associated with the goddess(es) weaving the destiny of humans and gods, whereas in Christianity spider often possesses a negative connotation (cf. Cooper, 2004:156).

The metaphoric term *spider* used in the field of computing and network security, is based not just on similarity of form or function, but rather on the symbolic representation of the concept SPIDER. The term under discussion is connotationally loaded having an implicit negative connotation. The source conceptual domain or the vehicle of this metaphor is not only *modus operandi* of the spider in nature, i.e. patiently hunting for pray following the signals passed by the cobweb, but also the symbolic perception of the spider as an evil venomous creature capturing unaware pray, typical of the Western cultural tradition. It may be argued that this term is extremely complicated both semantically and symbolically because it maps numerous similar features between the tenor and the vehicle. For example, certain parallels can be established between spider venom and spam, spider web and hypertext links, and spiders and spammers. Thus, it is not always easy to distinguish between a cultural (extended) metaphor and a symbol. Arutjunova (cf. 1990:22-24) states, “Metaphors and symbols are both based on similarity, however, symbols complement language by replacement, they do not compare but identify notions (in Kalve and Načisčione 2010:124)”. The term *spider* indeed serves to identify or nominate a new notion rather than simply to establish certain similarities.

Ant colony optimisation, also known as *ant colony optimisation algorithm* is another connotationally loaded term that is based on symbolic representation of a complex concept with a complicated semantic structure. In order to comprehend this term the user not only has to possess the knowledge of the concept ANT, but also to be aware of the principles according to which the colony of these insects is organised. For example, the Chinese identify the ant as “the righteous insect” and attribute orderliness, virtue and even patriotism to it; an alternate symbolism is subordination, especially that of the tireless and dutiful servant (cf. Werness 2006: 9). The connotation of a term *ant* is rather positive than negative, and it is conditioned by a universal perception of an ant as of an industrious orderly creature.

4. Conclusions

The study of metaphoric terms is of considerable theoretical and practical importance, taking into consideration the necessity to investigate the principle of linguistic economy. Metaphoric terms perform several functions: they expand the scope of information communicated and at the same time compress the information. Furthermore, extending the meaning of the existing lexical items, they formalise and fix new meanings by designating new concepts.

Due to their polysemic nature, many metaphoric terms can be interpreted only in the context of application. At the same time, some metaphoric terms create their own inner context, which may trigger a wide range of associations encoded in various components of their meaning.

Metaphoric terms based on different types of imagery (flora, fauna, etc.) possess different connotations, features and properties, and provoke different associations in different religions, cultures and communities. The symbolic systems chosen for the present research are complex in their nature, as they are simultaneously universal and culture-dependent.

Metaphoric meaning extension is a continuous process that promotes the development of the technical vocabulary. However, despite being one of the most productive methods of term creation, metaphoric meaning shift may potentially pose problems in comprehension, standardisation and alignment of terms across the languages.

5. Notes

1 http://glossary.ametsoc.org/wiki/Beavertail_antenna - Accessed on 8 October, 2013.

2 Definitions of all the terms analysed in the present paper are taken from the sources provided in the list of references.

3 <http://eol.org/search?q=daisy&search=Go> - Accessed on 8 October, 2013.

4 <http://www.mediacollege.com/glossary/s/scissor-platform.html> - Accessed on 8 October, 2013.

5 http://www.downscrane.com/products/drum/Belt_and_Spider_Trunnions.htm - Accessed on 8 October, 2013.

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