A Quantitative Study of Metaphor and Metonymy Distributions in the Naming of Global Newly Discovered Species in English and Chinese

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Abstract—**Naming as the link between words and objects has been concerned for centuries. However, little is known about the cognitive mechanism of its metaphoric and metonymic conceptual structure. To answer the question, the study conducted an across-language investigation into distributions of metaphor, metonymy and their cognitive prominent patterns in the English and Chinese naming of global newly discovered species (GNDS) over 2008-2018. This paper poses the following two questions: first, how do metaphor and metonymy distribute in naming GNDS? Second, how do they interrelate to each other in the conceptual integration, and what is actually the mechanism behind is? The statistical results show that: namings in the two languages require more accurate and diversified indications of entities by means of metaphor and metonymy determined by the homogeneity of the conceptual structure evolvement in compliance with the Principle of Least Efforts, and the highlighted categories and prominent patterns in the conceptual integration are more or less the same by demonstrating an intrinsic hierarchy in metaphorization and metonymization; the naming in English is more analytic in the conceptual structure owning to its linear structure, but in Chinese it is more synthetic determined by the default distinctive feature plus entity structure; the prominent patterns in English namings are more diversified in a wide range than that in Chinese, and the categories of Locative & Time, and Event are more easily perspectivized in English, while the categories of Component, Time & Size are more easily perspectivized in Chinese; metaphor, metonymy and their cognitive prominent patterns represent a probability distribution of universality and diversity of namings in the two languages, motivated by the complexity of natural species in the biological world.**

I. INTRODUCTION

Naming often elaborates the link between the reference and the referent by a proper name or definite description (Saul 1980). For example, the proper name *dog* refers to the four-legged mammal that barks, bites and runs fast. However, *the man over there with the champagne in his glass* is a definite description of naming the guy over there. For those human know much more, a proper name will be given; but for those human know less, a definite description is necessary. The two ways are often used to construct an identity of properties of things in the physical, mental and imagery world by naming. Nevertheless, the world, as revealed by Lakoff & Johnson (1980), is metaphorical and metonymic in nature, thus metaphor and metonymy are often employed as semantic accesses in naming. For instance, by means of metaphor, *dogleg* is not a definite referent of dog, leg or leg of a dog, but a place or road with a sudden change of direction; similarly, *ankle sock*, by means of metonymy it refers to socks that only come up to your ankle. The former's conceptual basis is similarity, while the latter one is contiguity. In the primitive world, metaphor and metonymy have been frequently used in naming things. For GNDS, they are also used in naming in two ways, a proper name and a definite description, to signify things. Meanwhile, it can be observed that the naming of new species is not always in a common way but sometimes very irregular.

The previous studies concern about the conceptual blending of categories (Fauconnier 1985;1998), the creative

metaphoric and/or metonymic N+N compounds in English (Benczes 2006), the independent frame and compound frame of English noun compounds (Zhou & Wang 2010), and the lexical and relational influences on the processing of Chinese modifier-noun compounds (Ji & Gagné 2007) etc., but seldom focus on a contrastive study of the conceptual integration of naming GNDS by means of metaphor and metonymy from the perspective of quantitative analysis.

It is known that metaphor and metonymy is the result of a special process for arriving at or construing a meaning (Croft & Cruse 2004:194). Metaphor, as it is inferred, is the conceptual mappings across domains; metonymy, however, involves in the conceptual mappings within domains. In the naming of GNDS, both metaphor and metonymy are employed to refer to the newly discovered referents, and thus emerge a probability distribution as in the creative conceptual integration of namings as that in the Chinese Dependencies Treebank (Liu 2009).

The study, on the basis of probability theory and statistics necessary to understand the analysis of the cognitive mechanisms, conducted a survey of distributions of metaphor, metonymy and their prominent patterns in namings, and the distinctive linguistic properties demonstrated by distributions in English and Chinese namings of GNDS from 2008 to 2018.

II. CORPUS DATA AND METHODS

The corpus-based study as the major empirical paradigm in cognitive linguistics takes advantages in probing into the authentic data and the empirical verification of linguistics properties of metaphor and metonymy in namings, thus a corpus database of authentic corpus was built up personally.

A. Corpus Data

The English namings of GNDS are extracted from the lists of the Top 10 New Species for the proceeding calendar year on the ESF website from 2008 to 2018. All the lists were announced by the IISE (International Institute for Species Exploration), an American specialized doctoral-granting institution emphasizing its distinguished programs in the biological and physical fields. The initial namings on the lists are in Latin language, but the correspondent English namings are more widely spread and accepted.

The Chinese counterparts were sorted out from the relevant official reports and Baidu Wikipedia, one of the most authoritative searching engines in China. The majority of namings in the two languages are in the form of proper names; meanwhile, just a few of them are denoted by definite descriptions.

The corpus data from the ESF are mostly N+N combination and/or chunk-based conceptual integration with new semantic constructions. In the English and Chinese naming, there also exist a minority of binominal, tri-word or multi-word names.

B. Methods

The quantitative survey of distributions was conducted in terms of: a) metaphor and metonymy, b) the metaphor and metonymy pattern and c) the prominent pattern in naming GNDS in the two languages, aiming at examining the linguistic properties of namings represented by the distribution probability.

The corpus database was self-built, and all corpus were annotated manually in the light of *Conceptual Metaphor* by Lakoff & Johnson (1980) and the *Qualia Structure* by Pustejovsky(1993). The metaphorized and metonymized component words and the metaphor and metonymy patterns were annotated at first.

In order to further explore the *similarity* category perspectivized into metaphor and the *contiguity* category perspectivized into metonymy in the naming process, the prominent patterns in namings were annotated as well.

Here is the way to deal with the metaphor and metonymy annotations. The component lexical items metaphorized in the semantic construction were annotated as Meta (metaphor), and those metonymized were annotated as Meto (metonymy). The other lexical items in namings were annotated as TII (thing-in-itself that implies entity) and Act (action) etc., according to their semantic roles in the integrated semantic construction.

To illustrate this, here is a case of *Ghost Slug*. This name alludes to the species' ghostly appearance, nocturnal, predatory behavior and the element of mysterious surroundings of its origin. The semantic construction of the name is on the basis of similarity in Feature (appearance), and *Slug* denotes its TII, thus it was annotated as Meta+TII. Similarly, its Chinese equivalent 幽灵蛞蝓 (Yōulíng kuòyú) was also annotated as Meta+TII.

Here is the way to deal with the annotations of prominent patterns in namings of GNDS. According to Pustejovsky(1993), the qualia structure of a lexical item or a noun category specifies four aspects of its meaning, i.e., a) *formal role* that distinguishes it within a larger domain (its physical characteristics, e.g. appearance, shape, size, color etc.), b) *constitutive role* that denotes the relation between an object and its constituents, or proper parts, e.g., material, element, ingredient etc., c) *agentive role* that refers to factors involved in the origin or "bringing about" of an object, e.g., process of shaping, result, motivation and source etc., and d) *telic role* that implies purpose and function of an object.

In our primary examination into metaphor and metonymy distributions in namings, it is found that sometimes the Feature (Ft) categories of species are prominent in the conceptual integration, sometimes the Function (Fn) categories of species are highlighted, and sometimes the genera of the species, defined as Property (Propt), are salient in namings.

It is thought that formal role, constitutive role and agentive role of categories demonstrate the Ft category of objects or species, while telic role perfectly denotes the Fn category of objects or species, and the genus that denotes a

thing belonging to or the concept category classified into implies the Propt category of objects or species. In this way, the annotation of prominent patterns was completed in the three aspects, feature, function and property, aiming at probing into the prominent patterns of metaphoric and metonymic namings in the two languages.

For further exploring into the feature categories that are highlighted, the sub-types of features, consisting of locative(Loc), action(Act), appearance(App), finder(Fd), color(Co), time(T), size(Sz), component(Com), origin(Ori) and event(Evt), habit of species(Hab) and abstract similarity(AS) etc., were also annotated.

For instance, *Tahina Palm* is a kind of *fan palm* found only in a remote part of Analalava district, northwest Madagascar, with a nick name of *suicide palm*. In its semantic construction *Tahina* is prominent in Ft category as the finder of the creature, and *Palm* implies the entity's property of genus. But in its Chinese equivalent 金字塔棕榈树 (Jīnzìtǎ zōnglǘ shù), 金字塔 (Jīnzìtǎ, pyramid) is prominent in the conceptual integration as the feature of similar shape, while 棕榈树(zōnglǘ shù) denotes the its property of genus, i.e. it is not anything else but a kind of *tree*. In this way, all the prominent patterns were annotated as well.

III. RESULTS AND DISCUSSIONS

It is assumed that the corpus-derived study is necessary for the quantitative analysis of distributions after the quantitative turn of cognitive linguistics (Zhou 2017). Therefore, the following analysis is based on annotations of corpus data.

A. Distribution of Metaphor and Metonymy Patterns in the Naming of GNDS

Based on the statistics of the metaphor and metonymy pattern (MMP) annotations, the line chart was made as "Fig. 1".

As illustrated by "Fig. 1", the metaphor and metonymy patterns in namings are classified into 8 types, i.e., TII+Meta, Meta+TII, TII+Meto, Meto+TII, Action+TII, [Meta+Meta]>Meta, [Meto+Meta]>Meta, [Meta+Meto]>Meta (Here "[ ]" denotes the semantic frame, ">" denotes a holistic semantic shift by means of metaphorization and/or metonymization in the semantic construction, and "+" implies the process of integration).
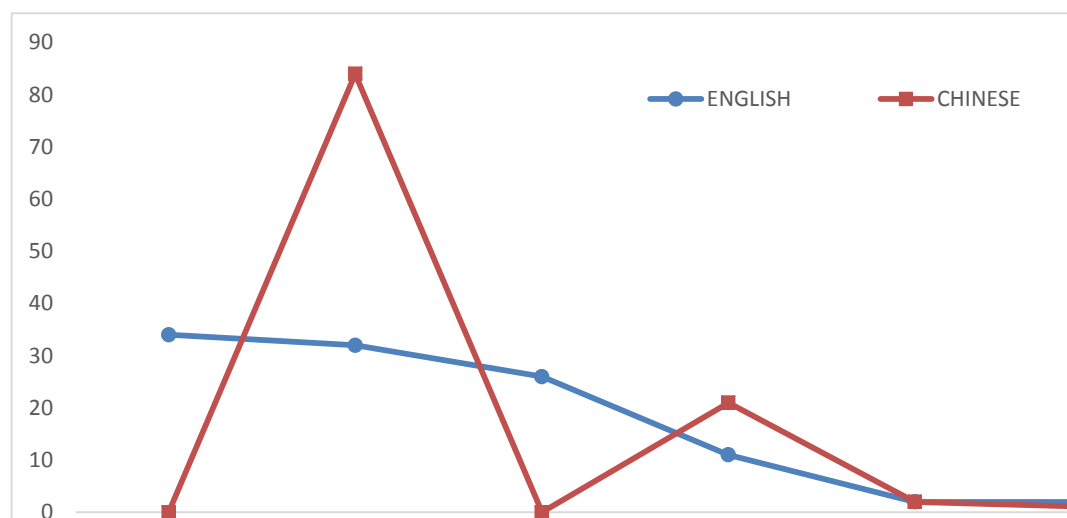

Fig. 1. Metaphor & Metonymy Patterns (MMP) in the English & Chinese Naming of GNDS.

As shown in "Fig. 1", the similarities of MMP of namings are as follows: 1) the patterns of Meta+TII, Meto+TII rank higher in both languages; 2) the patterns of TII+Meta, Meto+TII, Action+TII, Meta+Meto, Meto+Meta etc., rank lower in namings; 3) the MMP of the holistic semantic shift of the creative compounds, temporary phrases or compositions by means of metaphor and/or metonymy rank lowest in the two languages.

The patterns ranking higher implicate that in both languages namings require more accurate and diversified indications of entity/thing-in-itself. For instance, the English naming of *Devil's Worm*, and its Chinese equivalent 恶魔蠕虫 (èmó rǔchóng), both refer to a nematode from one of earth's deepest gold mines that survives the temperatures and

pressures of living almost a mile below the planet's surface. On the basis of *similarity* it vividly defines the worm as an evil surviving any harsh environment, both *evil* and 恶魔 (*èmó*) are evidently metaphorized. Another example is the common name of *Central Ranges Taipan* with its Chinese version of 中陆太攀蛇 (*zhōnglù taìpānshé*).*Central Ranges* and 中陆(*zhōnglù*) imply the inhabitation or location where what the TII represents lives in. On the basis of *contiguity* the *locative* in the chunk is metonymized.

The patterns that rank lowest or lower in both languages verify the *Principle of Economy* (Quirk et al. 1985) or the *Principle of Least Efforts* (Zipf 1949) in languages. For example, in the patterns of Act+TII and Loc+TII, the first lexical item is not metaphorized or metonymized, because it

is unnecessary to make it more difficult to construe. This can also be proved by namings of *Leaproach*, *Sneezing Monkey*, with *leap* and *sneezing* implying *Action*, and 艳丽灌木植物 (*yànlì guànmù zhíwù*), referring to a shrub growing to two meters with emerald green, slightly glossy, foliage and beautiful dense clusters of small magenta flowers in South America, New Caledonia and Madagascar.

The holistic semantic shift in naming rarely happens, because it will increase the difficulty of information processing of new species. Prior to knowledge of the unknown, the cognizer has known more about the similar existing species; only for the species people know less about, the naming could be semantically constructed by means of metaphor and metonymy. Undoubtedly, it is subject to the Principle of Least Efforts in languages.
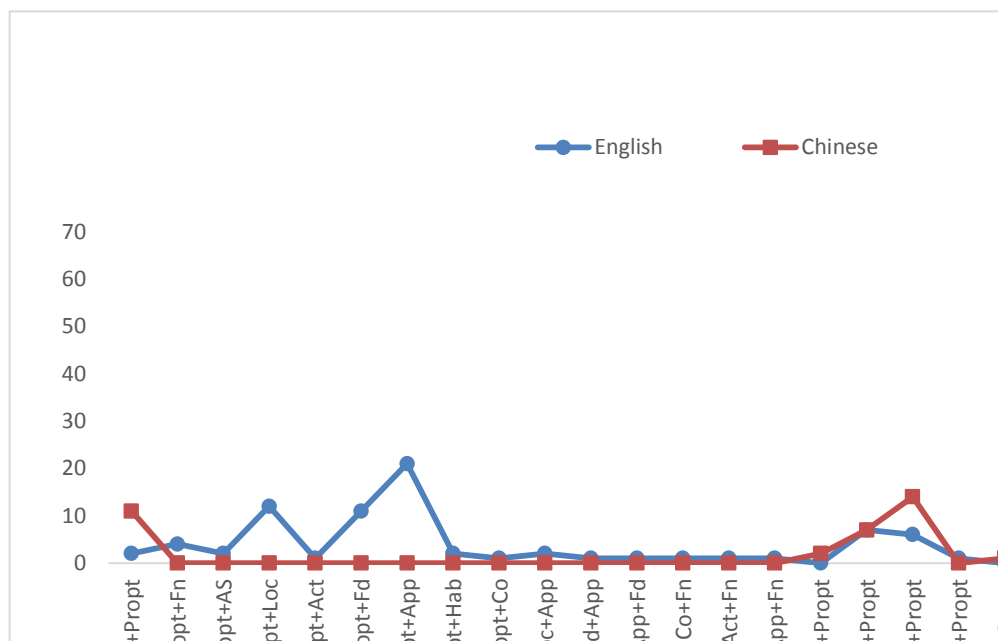

Fig. 2. Prominent Patterns in the English and Chinese Naming of GNDS.

a.
Notes: All categories highlighted were shortened as in Fig.2, e.g., Fn=Function, Propt=property, Ft=Feature, App=Appearance, Loc=Locative, Fd=Finder, Hab=Habit of Species, AS=Abstract Similarity, Act=Action, Co=Color, Com=Component, T=Time, Sz=Size, Evt=Event

Nevertheless, there are also some differences between MMP in English and Chinese namings, i.e., 1) the MMP in English emerges 8 types including TII+Meta, Meta+TII, TII+Meto, Meto+TII, Action+TII, [Meta+Meta]>Meta, [Meto+Meta]>Meta, [Meta+Meto]>Meta, whereas in Chinese it emerges only 6 types mentioned above with an exception of TII+Meta and TII+Meto; 2) The MMP that ranks highest in English is TII+Meta, but in Chinese it is Meta+TII that ranks highest. Moreover, the MMP in the English naming is more widely distributed than that in Chinese.

What does it mean? It is assumed that the naming in English is more analytic, and the mental storage of namings is not possibly influenced by the semantic transparency of component words. In contrast, the naming in Chinese is possibly more synthetic in the semantic construction. This is in full compliance with the typological features of the two different languages.

The fact that the MMP of TII+Meta ranks highest in the English naming but it does not emerge in Chinese is possibly attributed to the linear structure of the English language, which often presents the entity first with details in the semantic construction of naming. However, that fact that the MMP of Meta+TII ranks highest in the Chinese naming possibly results from the emergence of the most frequent

conceptual structure of compounds or conceptual integration in other forms represented by distinctive feature + entity, as illustrated by Dong (2004: 133). In fact, a language can reflect a unique paradigm of how a nation looks at, perceives and understand the physical world (Wang 2013).

In order to further explore why these categories can be highlighted in conceptualization, the distribution of prominent patterns of metaphor and metonymy in naming GNDS was examined as well.

B. *Distribution of the Prominent Patterns in the Naming of GNDS*

The quantitative analysis of the prominent patterns of namings in the two languages is also based on annotations.

As illustrated by "Fig. 2", the prominent patterns in English namings emerge 6 types, including Fn+Propt, Propt+Fn, Propt+Ft, Ft+Ft, Ft+Fn and Ft+Propt, and 23 sub-types with exceptions of such types as Fn+Propt and Propt+Fn.

Firstly, in the type of Propt+Ft, the Ft category emerges in the order of frequency as a hierarchy consisting of 7 sub-categories: App (21), Loc (12), Fd (11), Hab (2), AS (2), Act (1) and Co (1). Secondly, in the type of Ft+Ft, there are 3 sub-types, i.e., Loc+APP (2), Fd+APP (1), App+ Fd (1).

Thirdly, in the type of Ft+Fn, there are 3 sub-types, i.e., Co+Fn (1), Act+Fn (1), APP+Fn (1). Fourthly, in the type of Ft+Propt, there are 10 sub-types, namely, APP+Propt(18), AS+Propt(7), Loc+Propt(6), Fd+Propt(5), Sim+Propt (3), Act+Propt(3), Co+Propt(2), Loc &T+Propt(1), T+Propt(1) and Evt+Propt(1).

However, the prominent patterns in Chinese namings emerge only 2 types, namely, Fn+Propt and Ft+Propt, and 12 subtypes. In the first type, there is no sub-types; nevertheless, in the second types, there are 11 sub-types, i.e., APP+Propt(59), Loc+Propt(14), AS+Propt(7), Fd+Propt(4), Act+Propt(3), Hab+Propt(3), Co+Propt(3), Com+Propt(2), T+Propt(2), Sz+Propt(1) and Loc &APP+Propt(1).

It can be found that the *property category* is the basis of the conceptual integration in namings. Whatever the other category is in the prominent pattern, it will be highlighted instead of the *property category*. For example, *Dracula minnow* is a kind of *Fanged Fish*. The species name *Dracula* alludes to the long tooth-like fangs in the jaws in males of the new species, and its naming was inspired by *Count Dracula* in Bram Stoker's novel. Therefore, *Dracula* implies its appearance, and *minnow* denotes its genus. The appearance category is highlighted, but the property category is suppressed in the naming.

In general, the prominent patterns in English namings are more diversified in a wide range than that in Chinese, and the Fn and Ft categories are more widely distributed in English and less distributed in Chinese. The distribution of patterns demonstrates a hierarchy in metaphorization and metonymization of categories in namings.

Interestingly, however, in any prominent pattern of namings concerning with the property category of genus, the property category will be suppressed while the other categories in the same pattern will be highlighted.

Then, another question arises: what is the feature of the distribution of highlighted categories? In the English naming, 10 feature categories are highlighted, i.e., the categories of Appearance, Locative, Finder, Function, Habit, Abstract Similarity, Action, Color, Locative & Time, and Event. But only 1 Function category is highlighted.

While in the Chinese naming there are 11 highlighted categories, including Appearance, Locative, Function, Abstract Similarity, Finder, Action, Habit, Color, Component, Time and Size.

In the two languages the most prominent categories in the conceptual integration are more or less the same, but the differences between distributions of highlighted categories in the two languages lie in: a), the category of Locative & Time combination (e.g., *Nepalese Autumn Poppy*, an autumnalis to reflect the autumn season when the plant flowers) is uniquely prominent in English; b) the categories of Component (e.g., 胶结质有孔虫，*Jiāojiē zhì yǒu kǒng chóng*, with an English common name of *Amoeboid Protist*), Time (e.g., 夜兰, *Yè lán*, with *Yè* referring to the night time. It is the first night-blooming orchid to be described and growing in a primeval tropical forest.) and Size (e.g., 极小热带鱼, *Jí xiǎo rèdàiyú. J í*

xiǎo means a very small size.) are uniquely prominent in the Chinese naming.

Surprisingly, however, in the naming of *Charrier Coffee*, *Charrier* is the finder of the species, and *coffee* denotes the category of genus of the entity. In contrast, in its Chinese naming, the same referent was named 无咖啡因的咖啡植物 (*Wú kāfēiyīn de kāfēi zhíwù)*, among which 咖啡因 *(kāfēiyīn)* refers to caffeine, the component of the entity; hence the component category is highlighted for the same referent.

In English the feature categories of Appearance, Locative, Finder, Function, Habit, Abstract Similarity, Action, Color, Locative & Time, and Event are highlighted, while in Chinese namings, the feature categories of Appearance, Locative, Function, Abstract Similarity, Finder, Action, Habit, Color, Component, Time & Size are highlighted. The facts imply that the categories of Locative & Time, and Event in English are more easily pespectivized in the semantic construction of namings, and in Chinese the categories of Component, Time & Size are more easily perspectivized into the conceptual integration. The Locative & Time and Event categories in English namings are highlighted owning to the temporality of the English language, and the Component, Time & Size categories in Chinese namings are highlighted owning to the spatiality of the Chinese language (Wang 2013).

The findings of the distribution of prominent patterns and highlighted categories mean that the prominent patterns in the English naming seem to be more complex than that in Chinese, but the diversity of prominent patterns in both English and Chinese are all motivated by the biological diversity of species. Does it mean that the Chinese naming is not diverse at all? No. The differences in prominent patterns, in fact, are possibly determined by the different perspectivized categories in the semantic construction of namings in the two languages.

These results show that the motivations for similarities in distributions of metaphor, metonymy and their prominent patterns lie in the universal homogeneity of cognitive mechanisms, and the motivations for differences lie in the heterogeity represented by different prominent patterns in both languages. To put it another way, cognizers in the English and Chinese language lay different emphasis upon different properties, features and functions of entities in the physical world, represented by different metaphorical and metonymic patterns in naming. As Langacker (2000) argued, the linguistic meaning is seen as the product of mental activity on the part of physically embodied, socio-culturally grounded human minds.

Wherever the species comes from, it is always in the category of species and interrelates to the other species in the biological network; however, the referent of the species has to construct a relation with other referents of species in the linguistic representation of the complex network of species. Thus, apart from the linguistic factors and individual biological features of species, the local features of naming are also restricted by the global features of namings and the genera of species.

IV. CONCLUSION

Based on the survey from the perspective of quantitative analysis, it can be found that namings in the two languages all require more accurate and diversified indications of entities by means of metaphor and metonymy in compliance with the Principle of Least Efforts, and the highlighted categories in the conceptual integration are more or less the same. However, there are also some differences as follows: first, the naming in English is more analytic in the conceptual structure determined by its linear structure, but in Chinese it is more synthetic in compliance with the default distinctive *feature plus entity* structure. Second, the prominent patterns in English namings are more diversified in a wide range than that in Chinese namings, and the categories of Locative & Time and Event in English are more easily perspectivized in the semantic construction of namings, and the categories of Component, Time & Size in Chinese are more easily perspectivized. Both the highlighted categories and prominent patterns demonstrate a hierarchy in metaphorization and metonymization of categories in the semantic construction of namings. Third, the similarities are determined by the homogeneity of conceptual structure in namings in the two languages in spite of their different language typology, since to name is to construct the node of species in the complex network of species. However, the differences are motivated by different perspectivization of metaphoric and metonymic categories in the two languages. Fourth, the universality and diversity represented by namings of GNDS in the two languages are probably determined by the complexity of natural species in the biological world.

In short, the metaphor, metonymy and their patterns in namings represent a probability distribution of universality and diversity of namings, and the diversity is an important strand of the adaptive-selected evolution tapestry of languages, since the naming is a micro-variation within the macro-variation across languages.

As Baayen (2016: 1) noted, the sample size crucially determines a great many measures that have been proposed as characteristics of constants; however, the sample size of the study is a bit limited, and the findings of the survey need further studies of a larger size. More importantly, the naming does not only construct the relation between reference and referent, but also construct a node in the complex network of namings, which still needs more examinations into the linguistic system.

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