
THE DYNAMIC DEVELOPMENT OF MULTILINGUAL MENTAL LEXICON AND LEXICAL ACCESS AS THE FUNCTIONS OF LINGUISTIC DISTANCE AND SEMANTIC CHARACTERISTICS REPRESENTED FROM ORDER ENTITIES

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Abstract

The present research is aimed to investigate the influence of different levels of linguistic distance among languages on the development of multilingual mental lexicon and lexical access, to investigate the influence of different order entities on the development of multilingual mental lexicon and lexical access, and to investigate the interaction among different levels of linguistic distance and different word order entities on the development of multilingual mental lexicon and lexical access. The subjects of this study consisted of four groups as (1) 50 Thai-Lao-Cambodia speakers; (2) 50 Thai-Lao-Vietnamese speakers; (3) 50 Thai-English-Cambodia speakers; and (4) 50 Thai-English-Vietnamese speakers. The masked translation equivalent priming tasks were used as the experimental methodology. The results were analyzed using ANOVA and MANOVA. The results revealed that the effect of linguistic distance has the influence on the recognition and development of L2 and L3 and different orders of word entities produced different degree of priming effects. The analysis revealed the significant interaction among linguistic distance, word order entity, prime language status, and target language status. The implementation of results is the development of particular model mental to explain lexicon and lexical access of multilingual speakers.

Keywords: Multilingual, Mental Lexicon, Lexical Access, Linguistic Distance, Order Entity

บทคัดย่อ

การวิจัยนี้มีวัตถุประสงค์เพื่อทดสอบอิทธิพลของระยะห่างทางภาษาต่อการพัฒนาคลังคำและการนี้กรู้คำในพหุภาษา เพื่อทดสอบอิทธิพลของเอนทิตีแต่ละระดับต่อการพัฒนาคลังคำและการนี้กรู้คำในพหุภาษา และ การทดสอบความสัมพันธ์ระหว่างระยะห่างระหว่างภาษา เอนทิตีแต่ละระดับ ต่อการพัฒนาคลังคำและการนี้กรู้คำในพหุภาษา กลุ่มตัวอย่างประกอบด้วย 4 กลุ่ม คือ ผู้พูดภาษาไทย-ลาว-กัมพูชา 50 คน ผู้พูดภาษาไทย-ลาว-เวียดนาม 50 คน ผู้พูดภาษาไทย-อังกฤษ-กัมพูชา 50 คน และ ผู้พูดภาษาไทย-อังกฤษ-เวียดนาม 50 คน แบบทดสอบแบบ masked translation equivalent priming และ lexical decision task ถูกใช้ในการเก็บข้อมูล ผลการศึกษากฎวิเคราะห์ด้วยสถิติแบบ ANOVA และ MANOVA ผลการศึกษาแสดงให้เห็นว่า ระยะห่างทางภาษามีผลต่อการนี้กรู้และการพัฒนาภาษาที่ 2 และ 3 และ เอนทิตีแต่ละระดับ สร้างผลกระทบในระดับต่างกัน การวิเคราะห์แสดงนัยสำคัญของความสัมพันธ์ระหว่างระยะห่างระหว่างภาษา เอนทิตีแต่ละระดับ ต่อการพัฒนาคลังคำ ภาษาที่ใช้เป็นคำที่เกิดก่อนและคำเป้าหมาย ผลของการวิจัยนำมาใช้ในการพัฒนารูปแบบคลังคำและการนี้กรู้คำที่มีลักษณะเฉพาะสำหรับผู้พูดพหุภาษา

คำสำคัญ: พหุภาษา, คลังคำ, การนี้กรู้คำ, ระยะห่างทางภาษา, เอนทิตีแต่ละระดับ

Introduction

Presently, it is estimated that the majority of the world's population is multilingual. According to the present survey of world's population as a survey conducted by an European Union (EU) study (2012) revealed that 39 percentages of UK and 54 percentages of EU population have language communication in a language other than their mother tongue. In addition, "British and Europe: The Survey Results" published in the Guardian Newspaper (Guardian Newspaper, 2016) revealed that in EU, 54 percentages of Europeans can have a conversation in at least one additional language. These survey results are consistent with the work of Grosjean (2010), which revealed the increase of bilingual and multilingual communication in Asia and Africa. Additionally, the research concerning foreign language development in the situations of Thailand also revealed the importance of foreign language skills in the era of Thailand 4.0 (e.g. Soranastapom, 2017).

This situation has also occurred in the region of South East Asia. Since the Article 34 of the Association of Southeast Asian Nations (ASEAN) Charter in 2009, which states that, 'The working language of ASEAN shall be English,' English becomes an important language in ASEAN countries. English becomes as a major medium of communication or lingua franca between the countries. For instance, multilingual education is supported by Vietnamese Government (Kosonen, 2009, p.36). Eventually, the use of mother tongues is supported in policy of Vietnamese Government (Kosonen, 2009, p. 37). It is also important to note that the policy of promoting minority languages in Vietnam has the ultimate aim of assimilating the minorities (Le, & O'Harrow, 2007, p.436). The decision of the Vietnamese government to open up the country to the world in 1986 led to a increased demand for English and multilingual education.

Similar to Vietnam, bilingual educational programmes are supported from Cambodia government (Thomas, 2002). According to Neou Sun (2009, p. 65), it revealed that 'teachers may conduct some instruction of the class in the minority language, and may translate key vocabulary items contained in textbooks from Khmer to the minority language as a means of assisting student learning'. In addition, English becomes important within Cambodia. It is evidenced by the fact that English is necessary for working in all foreign agencies. Cambodia's membership of ASEAN has also promoted the demand for English as is illustrated by government officials as:

"If we don't know English, how can we participate? We need to know English so that we can defend our interests. You know, ASEAN is not a kissy-kissy brotherhood. The countries are fiercely competitive, and a strong knowledge of English will help us protect Cambodian interests" (Clayton, 2006, p. 230-231).

Therefore, the research on cross-language has been more interested. The present study is interested to examine the influence and the interaction of linguistic distance (Crystal, 1987) and lexical development represented from the implementation of the notion of order entities, which is introduced by John Lyons (1977) in the multilingual mental lexicon and lexical access.

Mental lexicon and lexical access are the important components of language acquisition and language proficiency (e.g. Pinker & Jackendoff, 2005) in both monolingual and multilingual acquisition. The English, Thai, Lao, and Vietnamese words, which are used in the present study, are selected from a cross language database of Thai-English-Vietnamese-Lao-Burmese-Bahasa-Filipino languages developed by Sudasna Na Ayudhya (2017).

The results of this investigation will be used to criticize the implementation of bilingual mental lexicon and lexical access model to explain multilingual mental lexicon and lexical access, which can be extended to the issues related to multilingualism and multilingual speakers in many disciplinary as psycholinguistics, teaching and learning, sociolinguistics, and computation linguistics.

Literature Review

Multilingualism and Multilingual Speakers

With the complicated nature of multilingualism, there are many definitions of the term “multilingualism”. The term “multilingualism” is defined by the European Commission (2007, p. 6) as “*the ability of societies, institutions, groups and individuals to engage, on a regular basis, with more than one language in their day-to-day lives*”.

Additionally, the term “multilingualism” is defined by Li (2008, p. 4), as “*anyone who can communicate in more than one language, be it active (through speaking and writing) or passive (through listening and reading)*”.

In the field of psycholinguistics, the definition of multilingualism is defined as the use of three or more languages (e.g. Kemp, 2009). Kemp (2009) classified definitions of multilingualism as two types. Firstly, there are definitions deriving from the nature of individual’s use of various languages. Secondly, there are definitions deriving from various disciplinary.

For the present study, the term “multilingualism” refers to any individual who can use more than two languages.

Mental Lexicon and Lexical Access

The term “mental lexicon” refers to the cognitive system of the speaker’s language-specific knowledge in which human must have this knowledge before s/he can use a particular language (e.g. Singleton, 1999; Gonia & Libben, 2008; Roux, 2013). In addition, “lexical access” is defined as the process in which an individual finds a word representation in mental lexicon (Oldfield, 1966). According to a definition of mental lexicon and lexical access, different models in both monolinguals, bilinguals, and monolinguals were developed. In the following, the models of mental lexicon and lexical access are briefly introduced.

- a) **The Separate Storage Model** assumes that there are completely separate language-specific representational systems (e.g. Lambert, Ignatow, & Krauthamer, 1968).
- b) **The Distributed Model** assumes that there are both separate and relatively shared storages based on different types of words (e.g. de Groot, Dannenburg, & van Hell, 1994; de Groot & Hoeks, 1995).
- c) **The Concept-Mediation Model** assumes that there is a single representation for concept and both L1 and additional languages such as L2 and L3 words access this representation directly (Potter, So, von Eckardt, & Feldman, 1984).

- d) **The Word Association Model** assumes the meanings of additional language words are accessed via their L1 translation equivalents (Potter, So, von Eckardt, & Feldman, 1984).
- e) **The Revised Hierarchical Model** assumes that there is the link between the shared concept and words of L1 and the additional languages. However, the link between words of L1 and the shared concept and is stronger than the link between the shared concept and other languages (Kroll & Stewart, 1994).

Measuring Linguistic Distance

A widely used approach for quantitative measure of linguistic distance has been introduced by Chiswick and Miller (1998, 2001), who implied data on the average test score of U.S. American language students after a given time of a certain foreign language instruction. The assumption is that if the average score is low, the linguistic distance between English and another language is high. Even though, this data is obtained from the measure of the distance to English, this measure can be used for a comprehensive comparison of languages across different dimensions.

Regarding to the quantitative measure of linguistic distance (Chiswick & Miller, 1998, 2001, p. 6), the assumption is as.

“individuals who know language A to learn languages B1 through Bi, where there are i other languages. If it is more difficult to learn language B1, than it is to learn language B2, it can be said that language B1 is more “distant” from A than language B2.5 Language B3 may be as difficult to learn as is language B1 for a language A speaker, but that does not mean that language B3 is close to language B1. Indeed, it may be further from B1 than it is from A”.

In this present research, the quantitative measure of linguistic distance of Chiswick and Miller (1998, 2001) will be used to represent the linguistic distance among the stimulus languages used in this study. This quantitative measure of linguistic distance is obtained from the data from the 1990 U.S. Census, which includes a measure of linguistic distance based on test score of languages. This measure has been used in the following analysis as in the 1991 Census of Canada (Chiswick & Miller, 2001), the 2000 U.S. Census (Chiswick & Miller, 2007), and a report entitled “Linguistic Distance: A Quantitative Measurement of the Distance between English and Other Languages” (Chiswick & Miller, 2004).

Using this ordinary data by Hart-Gonzalez and Lindemann (1993) reports language scores for 43 languages with their matching Census of Population Public Use Microdata Sample (PUMS) language codes for the 1990 and 2000 Censuses using the Ethnologue Language Family Index published by Grimes and Grimes (1993). The linguistic scores for 43 language are ranged is from a lowest score (1.00) to a highest score (3.00).

These scores are used to rank linguistic distance from English among these languages and from one language to another language, not only focused on the distance from English. The data on language scores of 43 languages is also extended to a much longer list of languages using “direct code” of the Ethnologue Language Family Index published by Grimes and Grimes (1993).

Based on Chiswick and Miller (2004), the linguistic distance from one language to another language rather than English language is measured as the inverse of the linguistic score (LS) using ordinary least squares regression analysis (OLS) and reduces the probability of being proficient in English.

In conclusion, the present investigation will examine the influence of different levels of linguistic distance among languages and different order entities on the development of multilingual mental lexicon and lexical access.

Aims

1. To investigate the influence of different levels of linguistic distance among languages on the development of multilingual mental lexicon and lexical access.

2. To investigate the influence of different order entities on the development of multilingual mental lexicon and lexical access.

3. To investigate the interaction among different levels of linguistic distance and different word order entities on the development of multilingual mental lexicon and lexical access.

Materials and Methods

The subjects of this study consisted of four groups as (1) 50 Thai-Lao-Cambodia speakers; (2) 50 Thai-Lao-Vietnamese speakers; (3) 50 Thai-English- Cambodia speakers; and (4) 50 Thai-English- Vietnamese speakers. The subjects were asked to respond to lexical decision task with masked priming technique.

With the lexical decision task (Chen, & Ng, 1989; Barca, & Pezzulo, 2012; Chen, Zhou, Gao, & Dunlap, 2014), participants are typically presented with a sequence of stimuli including both existing words or real words in a particular language that are relevant to the primes (such as a word “*table*”) and non-existing words or *pseudo words*, which are not real words in a particular language and are constructed based on the lexical rules of the language (such as “*urtle*”). Stimuli can be presented as orthographics on a computer screen (visual lexical decision) or as auditory over headphones (auditory lexical decision).

The participants are asked to decide whether each stimulus is a word or a nonword, by pressing one of two response buttons as quickly and accurately as possible. The response latency or reaction time and the accuracy of the lexical decision are measured to represent information about the processing of different kinds of words.

The stimuli used in the masked translation equivalent priming tasks can be divided as eight sets of controlled and experimental tasks consisting of using first language as primes and second language as targets, using first language as primes and third language as targets, and using second language as primes and third language as targets. Each set consists of 200 prime-target pairs. Half of prime-target pairs as the task filter employed pseudo words as the targets and another half of prime-target pairs were the cross translation equivalent words selected from Thai-English-Vietnamese-Lao-Burmese-Bahasa-Filipino languages of common base concepts of 1st – 3rd order entity developed by Sudasna Na Ayudhya (2017), which got the funding from

Thailand Research Council. Each group of multilingual speakers was assigned Prime-Target experimental and controlled sets, totally 1800 prime-target pairs.

Results

The results are presented based on the research aims as followed.

a) The influence of different levels of linguistic distance among languages on the development of multilingual mental lexicon and lexical access

The $2 \times 2 \times 2$ analysis converged for the RTs and error analysis. For the RTs analysis, the main effect of linguistic distance was significant ($F(1,148)=47.52, p<.05$). The main effect of prime language status was significant ($F(1,148)=59.11, p<.05$). Whereas, the main effect of target language status was not significant ($p=0.66$). For the error analysis, the main effect of linguistic distance was significant ($F(1,148)=28.61, p<.05$). The main effect of prime language status was significant ($F(1,148)=31.79, p<.05$). Whereas, the main effect of target language status was not significant ($p=0.71$). The interaction among linguistic distance, prime language, and target language was marginally significant ($F(1, 148)=17.52, p<.05$).

The results revealed that the effect of linguistic distance has the influence on the recognition and development of L2 and L3. The results obtained in the condition of prime language and target language with low linguistic distance represented the positive priming effect in which accessing primes facilitates accessing targets.

b) The influence of different order entities on the development of multilingual mental lexicon and lexical access.

In the $3 \times 2 \times 2$ analysis, For the RTs analysis, the main effect of word order entity (1st, 2nd, and 3rd) was significant ($F(2,147)=51.09, p<.05$). The main effect of prime language status was significant ($F(1,148)=42.50, p<.05$). Whereas, the main effect of target language status was not significant ($p=0.75$). For the error analysis, the main effect of prime word order entity was significant ($F(2,147)=24.51, p<.05$). The main effect of prime language status was significant ($F(1,148)=21.50, p<.05$). Whereas, the main effect of target language status was not significant ($p=0.81$). The interaction among word order entity, prime language, and target language was marginally significant ($F(2, 147)=24.80, p<.05$). For the analysis of errors, the interaction among word order entity, prime language, and target language was marginally significant ($F(2, 147)=12.50, p<.05$).

The results implied that different orders of word entities produced different degree of priming effects. The interaction among word order entity, prime language, and target language was significant. The implication is that the priming effects obtained from accessing different orders of word entity are influenced from the languages of primes and targets.

c) The interaction among different levels of linguistic distance and different word order entities on the development of multilingual mental lexicon and lexical access.

The response times and accuracy of responses were analyzed using 2x3x2x2 Multifactor Analysis of Variance (MANOVA). The analysis of interaction among linguistic distance, word order entity, prime language status, and target language status revealed the significant effects of interaction in both the analysis of RTs ($F(2,148)=44.70$, $p<.05$) and the analysis of error rates ($F(2,148)=35.82$, $p<.05$).

Conclusions and Discussion

The explanation of the model will be begun from the explanation of mental lexicon and how the words in multiple languages are access from the mental lexicon.

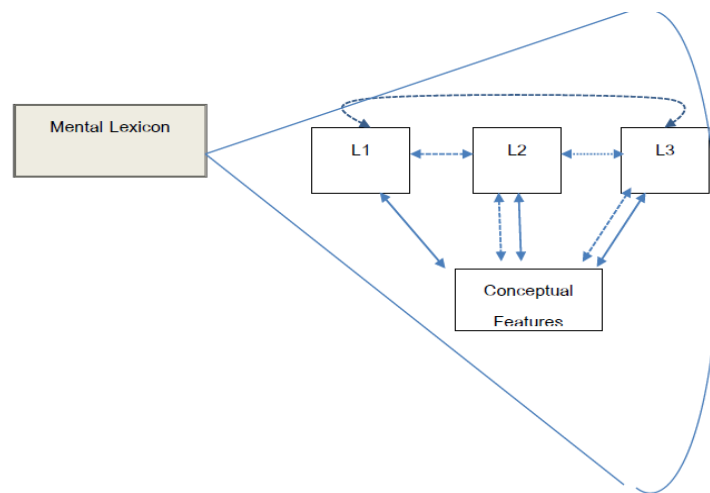


Figure 1 The Access of Multiple Languages in the Mental Lexicon

The results revealed the significant of main effects and interaction among the main effects of linguistic distance, order entity, and the development of second and third language mental lexicon and lexical access. The revised hierarchical model in bilingualism (Kroll & Stewart, 1994) is extended to explain the storage and access of words in multilingualism and multilingual speakers.

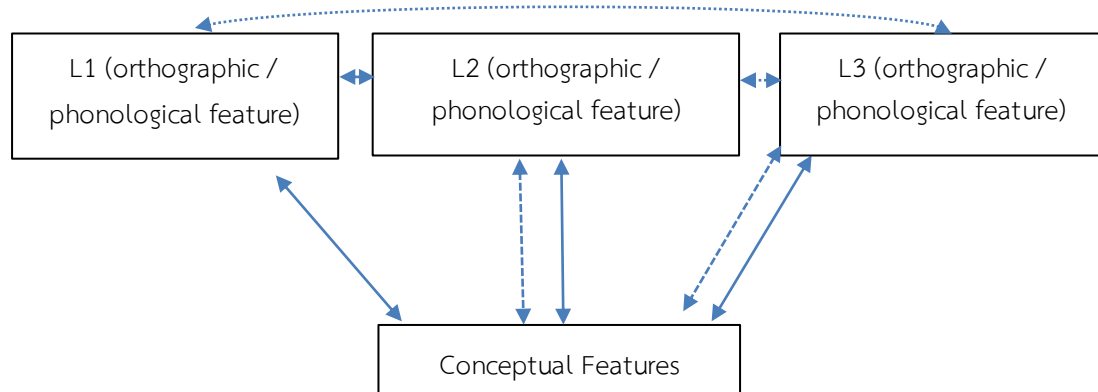


Figure 2 The Implementation of Revised Hierarchical Model in Multilingualism

As in Figure 1, there are language specific word form lexicons of L1, L2, and L3. L1 words' lexical information is directly accessed from the storage of concept via the *conceptual link* and is represented by solid line with two sides of arrows, which implies that accessing can be occurred from both directions as from L1 word form to concept and from concept to L1 word form. The accessing of words in L2 and L3 or the other languages, which will be used can be occurred via either conceptual link between word form lexicon of each specific language and the storage of concept or via lexical link between L2 words and L1 words.

The strength of conceptual and lexical links among specific language word form lexicons and the concept and the facilitation or inhibition among accessing L3 words via L1 and L2 words can be changed as a function of linguistic distance and order entity.

According to the results of the present study, comparing the degrees of priming effects among the condition of accessing L3 targets via L1 and L2 primes revealed that accessing L3 targets via L1 primes with lower linguistic distance using 1st order entity words significantly produced stronger priming effects rather than accessing L3 targets via L2 primes with lower linguistic distance using 1st order entity words, and accessing L3 targets via L1 primes with lower linguistic distance using 2nd order entity words significantly produced stronger priming effects rather than accessing L3 targets via L2 primes with lower linguistic distance using 2nd order entity word. This implied that in the conditions of prime-target languages with lower linguistic distance, accessing target language is facilitated from priming language and in this study, accessing L3 targets are facilitated from L1 primes rather than L3 primes.

However, the priming effects obtained from the conditions of prime-target languages with higher linguistic distance showed the contradictory effects as L1 prime-L3 targets pairs produced negative priming effects in the 1st, 2nd, and the 3rd order entities and the negative effects were stronger in the conditions using the 3rd order entities, followed by the 2nd and the 1st order entities. Whereas, the conditions of prime-target languages with higher linguistic distance using L1 primes and L2 targets showed non-significant priming effects.

The implication of the above finding is that accessing L3 words can be occurred via either L1 words or L2 words via lexical link as well as directly accessed the concept via conceptual link. The results of recent study implied that in the condition of primes and targets with lower linguistic distance, accessing L3 words via L1 words is more facilitated than accessing L3 words via L2 words. On the contrary, in the condition of primes and targets with higher linguistic distance, accessing L3 words via L1 words is more inhibited than accessing L3 words via L2 words.

Recommendations

(1) The related effects influencing the development of language proficiency in both linguistic and non-linguistic dimensions.

(2) The testing of the proposed model using the other psycholinguistic techniques, which focused on the investigation of different linguistic aspects.

(3) The extension of the proposed model in the related issues of multilingualism and multilingual speakers.

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