

Toward Modeling Trilinguals' Mental Lexicon Representation in Psycholinguistics — with Educational Implications

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Abstract:

Psycholinguists have not yet drawn a consistent conclusion as to bilinguals' mental lexicon representation. Trilingualism is more complicated but less explored, let alone modeling attempts at trilinguals' mental lexicon representation in psycholinguistic research. However, bi-/multi-linguals' mental lexicon representation discussions lie at the core of psycholinguistic studies into bi-/multi-lingualism, and therefore more relevant studies are called for. In light of the above, the research questions are what roles language proficiency and instruction language play, when other factors are controlled, in trilinguals' mental lexicon representation, and what static and dynamic models can thus be drawn. This paper is a theoretical discussion and modeling article, based on two existing empirical studies, with educational implications elicited. According to the newest existing data gained and features summarized about Dutch-English-Mandarin trilinguals' conceptual and lexical representations in psycholinguistics, this article delves into the critical roles of language proficiency and instruction language, and draws figures for clearness and readiness for possible future contrasts and comparisons. The current research also maps out both static and dynamic models, to display common and developing features of mental lexicon representation of trilinguals with different L3 levels. Thorough investigations of and contrasts with previous relevant psycholinguistic results are given, followed with educational implications, which are also displayed through interaction with existing relevant studies. The three-stage hypothesis with a series of illustrations is proposed to explain the influence of instruction language over the change of mental lexicon representation structure in relation to L3 proficiency in psycholinguistics. Particularly, a parabola-shaped model is drawn to explain the role of L2 as instruction language throughout L3 learning process, and its contrast with the role of L1. Trilinguals' All-Connected Model of mental lexicon representation is elaborated from both static and dynamic perspectives. The most noticeable feature is that all possible links and routes are connected for trilinguals with varied L3 levels, with the divergences lying in the scale of L3 lexical store and link strengths. Besides further confirming effectiveness of certain existing pedagogical methods, the results also support the use of mother tongue in L3 instruction. Trilinguals' All-Connected Model of mental lexicon representation in psycholinguistics attempts to give detailed descriptions of trilinguals' mental lexicon representation from both static and developmental perspectives. Furthermore, the current research also offers the following insights. Firstly, from a psycholinguistic perspective, foreign language learning can be regarded as a process of updating

mental lexicon representation. Secondly, it is suggested that L1 serve as instruction language of L3 and that awareness should be enhanced and methods further explored to cultivate stronger direct concept-L3 link and both L2-L3 and L1-L3 lexical links. This research proposes hypotheses and models, based on empirical studies, thus bringing relevant discussions up to a theoretical height, and facilitating possible future interaction on the same scale.

Keywords: *Psycholinguistics, Mental lexicon representation of trilinguals, Instruction language, Language proficiency, Educational implications.*

I. INTRODUCTION

Investigations into tri-/multi-lingualism in psycholinguistics are on the rise. However, mental lexicon representation structure, as the fundamental research question of the flourishing psycholinguistic studies of trilingualism, has yet witnessed a consensus from academia (for reviews see [1-3]). Meantime, research of trilingualism with Mandarin as L3 of participants is rare, which is incompatible with the increasingly stronger discourse power of Mandarin nowadays. Mandarin education in many parts of the world is conducted where students have a language that is linguistically closer to their mother tongue (e.g. English; Dutch) as L2 (e.g. Spanish; English), and have Mandarin as L3 (+).

In view of the above, studies into mental lexicon representation structure and even modeling attempts of trilinguals with Mandarin as L3 are much needed, both theoretically and practically. This paper is to examine such influencing factors as language proficiency and instruction language in trilinguals' mental lexicon representation, to attempt modeling trilinguals' mental lexicon representation, and to clarify the unique factors of the model from both static and dynamic perspectives and its implications.

These insights are based on empirical studies adopting innovative research methods into Dutch-English-Mandarin trilinguals' conceptual and lexical representations [4,5]. A summary of findings in these studies is given below. Conceptual representations of the three languages are shared, with L1 having the strongest connection with the common conceptual store, followed by L2 and L3, in this order. Lexical representations of non-cognates in the three languages are separate, with L1-L2 lexical link being the strongest, followed by L2-L3 link and L1-L3 link, in this order. In the following, discussions thus generated concerning lexical representations are also restricted to non-cognates. Note that in the above empirical studies, L2 is the instruction language of L3. The shared storage in the conceptual level, the separate storages in the lexical level, and the link strength order in both levels are applicable to trilinguals regardless of their L3 level. With L3 improvement, concept-L3 link and L1-L3 link are strengthened greatly, while L2-L3 link strength does not experience too drastic a change.

Participants in these empirical studies were carefully recruited, screened and selected, and they fall into two groups with beginner and advanced Mandarin levels. Participants in each group were regarded homogeneous in terms of language proficiencies of the three languages, contexts of acquisition and use of

the three languages, ages of acquisition of the three languages, and instruction languages for English and Mandarin; participants of the two groups were considered homogeneous to each other concerning all the above aspects except Mandarin-related proficiencies and experiences. Furthermore, Dutch, as L1 and English, as the instruction language of L3, are orthographically similar; participants are proficient in both languages in numerous contexts. These situations are advantageous for the contrasting roles of mother tongue and instruction language in L3 acquisition and in dynamic shifts in trilinguals' mental lexicon representation with L3 improvement. For further information about participants and more details of the studies, based on which the current paper derives discussions of influencing factors, build static and dynamic models and draw implications, refer to Ji and Mei [4] and Ji and Schiller [5].

II. INFLUENCING FACTORS

A number of factors may influence mental lexicon representation, such as language proficiency, orthographic similarity, context of language acquisition, and context of language use, summarized by Pavlenko [6], age of acquisition [7], and instruction language [8,9]. The following discussion focuses on language proficiency and instruction language. According to the results from the empirical studies summarized above, storage pattern, namely shared conceptual store and separate lexical stores and the existence of all concept-name and lexical links in trilinguals' mental lexicon representation are immune to both factors, and the two factors mainly find their sway in link strengths.

2.1 Language Proficiency

Several findings point to the role of language proficiency in trilinguals' mental lexicon representation. Order of concept-name link strengths is consistent with order of language proficiency; lexical link between L1 and L2, the two most proficient languages, is the strongest among all the lexical links; with Mandarin improvement, link between the concept and Mandarin lexical items and L1-L3 lexical link strengthen.

The first two findings may not qualify as effective evidence, as many other factors may also have influence over the results. Orthographic similarity, context of acquisition and use, and age of acquisition of Dutch and English, and the status of Dutch as the instruction language of English may, besides language proficiency, also contribute to a strong lexical link between the two languages and links connecting the concept and each of the two languages. The third finding, generated from the contrasts of the performances of the two groups with the only difference lying in Mandarin-related experiences and proficiencies, supports strongly the role of language proficiency in consolidating concept-name links and lexical links.

It is in agreement with such previous studies as Kroll and Stewart [10]. Nevertheless, English-Mandarin link does not get improved much, as Mandarin level increases. This undermines the role of language proficiency and calls for investigations into the role of instruction language.

2.2 Instruction Language

The persistently stronger L2-L3 link than L1-L3 link, when L1 and L2 mainly differ in whether or not it is the instruction language of L3, signifies the vital role of instruction language. It is in agreement with some previous studies, such as Cui and Zhang [8,9], and Wang and Kong [11].

As participants with beginner Mandarin level already display a strong L2-L3 connection, it is assumed that this lexical link is created in the very onset of Mandarin learning process and that it is strengthened in a very quick fashion since its establishment. Meantime, the lexical link strength experiences such a trivial difference between the two groups, which indicates that the strong link will persist and experience a much slower change as regards its strength with Mandarin improvement. These observations lead to the following hypothesis, as shown in Fig 1, about L2-L3 link strength development, when L2 serves as the instruction language of L3.

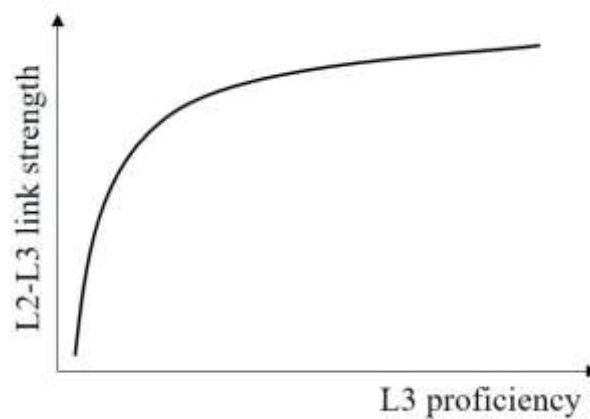


Fig 1: Hypothesized L2-L3 link strength developmental trajectory with L3 improvement.

It is believed that the L2-L3 connection strength is on a continuum. It increases sharply in the initial stage of L3 learning, and becomes stable in later stages, as shown by the above figure.

Meantime, L1-L3 link strength is greatly lifted, when contrasting participants with the two Mandarin levels. L1-L3 link strength is assumed to be a linear function of L3 level until trilinguals achieve a relatively high L3 proficiency, when the strength improvement will be stable. A tentative attempt has been made to illustrate shifts of both L2-L3 link and L1-L3 link strengths in the following Fig.

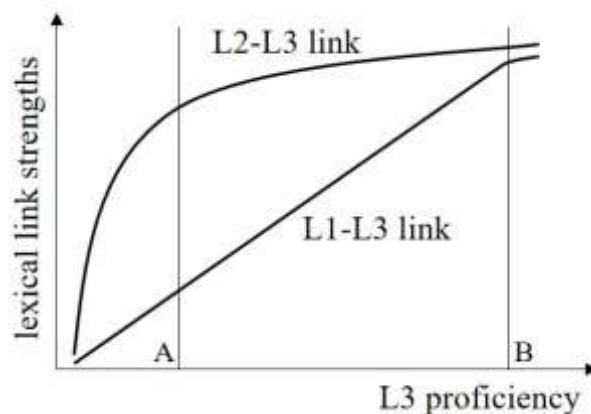


Fig 2: Hypothesized developments for L1-L3 and L2-L3 link strengths with L3 proficiency improvement.

Fig 2 shows the three-stage shifts for the two lexical link strengths. In the initial stage of L3 learning, till point A in the figure, L2-L3 link strength surges dramatically, whereas L1-L3 link strength is improved much more slowly. In the second stage of L3 learning, from point A to B, L2-L3 connection strength only goes through a slightly upward development, while L1-L3 link still gathers great improvement momentum. In the third stage when trilinguals have a high L3 proficiency, after point B in the figure, the two lexical links are already very strong, and may experience the slightest strength growth, as trilinguals further increase their L3 level. It is supposed that the two groups of participants in Ji and Mei [4] and Ji and Schiller [5] locate between points A and B in the figure. Specifically, participants with beginner Mandarin level are highly likely to be positioned to the right of point A, and participants with advanced Mandarin level may find their place to the left of point B, as illustrated by the Fig 3.

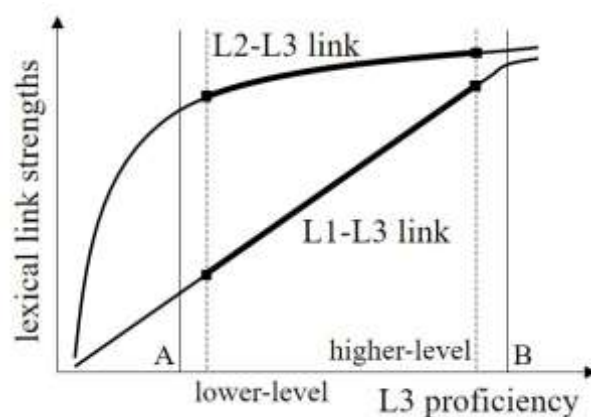


Fig 3: Two lexical link strength changing trajectories for participants with two Mandarin levels.

Based on the above hypothesis, strength difference between the two lexical links can also be mapped out, in the following parabola-shaped model in Fig 4.

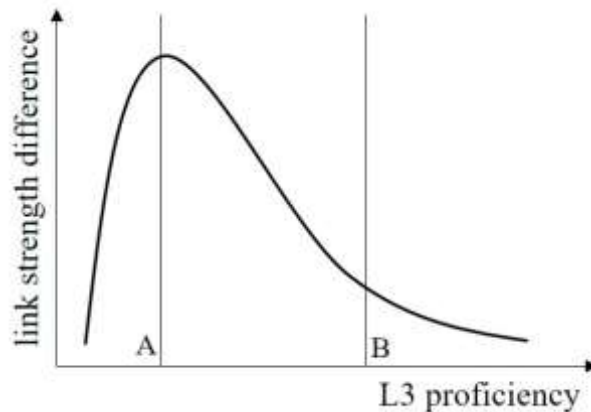


Fig 4: A parabola-shaped model of the two lexical link strength difference.

Consistent with what is shown in Fig 2, the two lexical link strength difference can also be explained in three stages. The difference is obtained by subtracting L2-L3 link strength by L1-L3 link strength, and as the former is persistently greater than the latter, the parabola is always above zero.

The first stage features quickly strengthened L2-L3 link and a slowly growing L1-L3 link, which results in an enlarged difference between the two lexical link strengths. In the second stage, when L2-L3 link strength does not go through a quick increase, L1-L3 link is stably strengthened, as trilinguals are increasingly proficient in L3. The third stage marks very strong lexical links, and the difference between the two lexical link strengths is thus the smallest, and experiences the slightest decrease as L1-L3 link strength is gradually approaching L2-L3 link strength with L3 level improvement.

The positions of the two groups of participants in Ji and Mei [4] and Ji and Schiller [5] are shown in Fig 5 below.

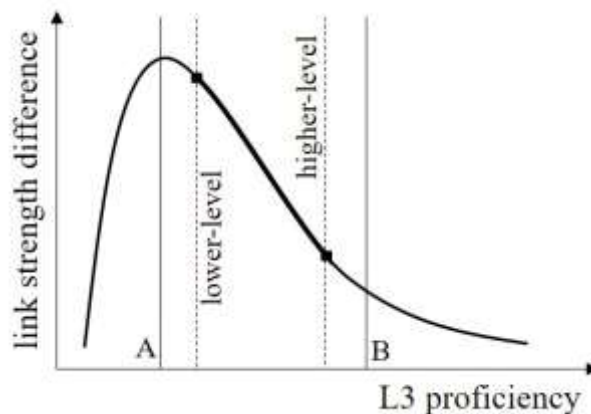


Fig 5: Positions of the two groups of participants with different Mandarin levels.

As participants with beginner Mandarin level in Ji and Mei [4] and Ji and Schiller [5] are believed to be to the right of point A already, it is held that point A should not be too far away from the onset. The whole parabola is, therefore, positively skewed or skewed to the right.

A large number of previous relevant studies (e.g. [12,13]; for a review, see [2]) do not describe their proficient and non-proficient participants in great details. Thus, comparisons and contrasts of these studies for a greater picture of trilinguals' mental lexicon representation are highly risky, as participants are not placed on the same proficiency continuum. In face of this situation, the three-stage hypothesis of L3 learning and lexical link strength changes as a function of L3 proficiency is able to offer a general framework, in which relevant previous and future studies that are to be compared can fit, for a more reasonable and convincing communication of results from different studies.

III. MODELING ATTEMPTS

Both static and dynamic models of trilinguals' mental lexicon representation are depicted.

3.1 A Static Model

Based on the features found and summarized above, concerning shared storage of conceptual elements and separate storages of lexical entries of different languages, as well as existence of all concept-name links and lexical links, a static model is proposed to display these general characteristics, as illustrated in Fig 6.

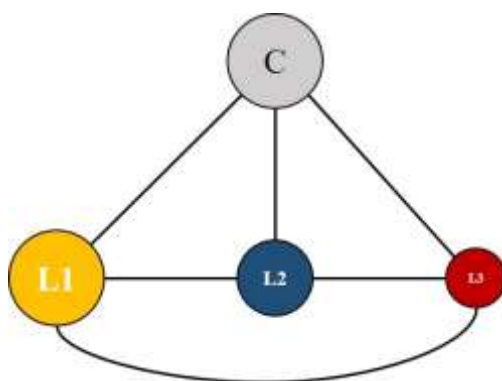


Fig 6: Trilinguals' mental lexicon representation -- A static model.

“C” in the model represents the common conceptual store, while “L1”, “L2” and “L3” stand for the lexical entries of the three languages. It is also held that the size of the lexical representation of a language is consistent with the language proficiency level, and it is shown by the differed dimensions of the circles,

which stand for the three lexical storages.

3.2 Dynamic Models

Dynamic changes with L3 improvement is mainly embodied by strengthening of links existent in the model of mental lexicon representation, as well as enlargement of L3 lexical store. In the following figures, the above changes are reflected by thickness of the lines and the size of L3 circle, respectively. Based on the results generated of the two groups of participants with differing L3 levels in Ji and Mei [4] and Ji and Schiller [5], a number of figures are hypothesized to picture the transformation of trilinguals' mental lexicon representation, as displayed below.

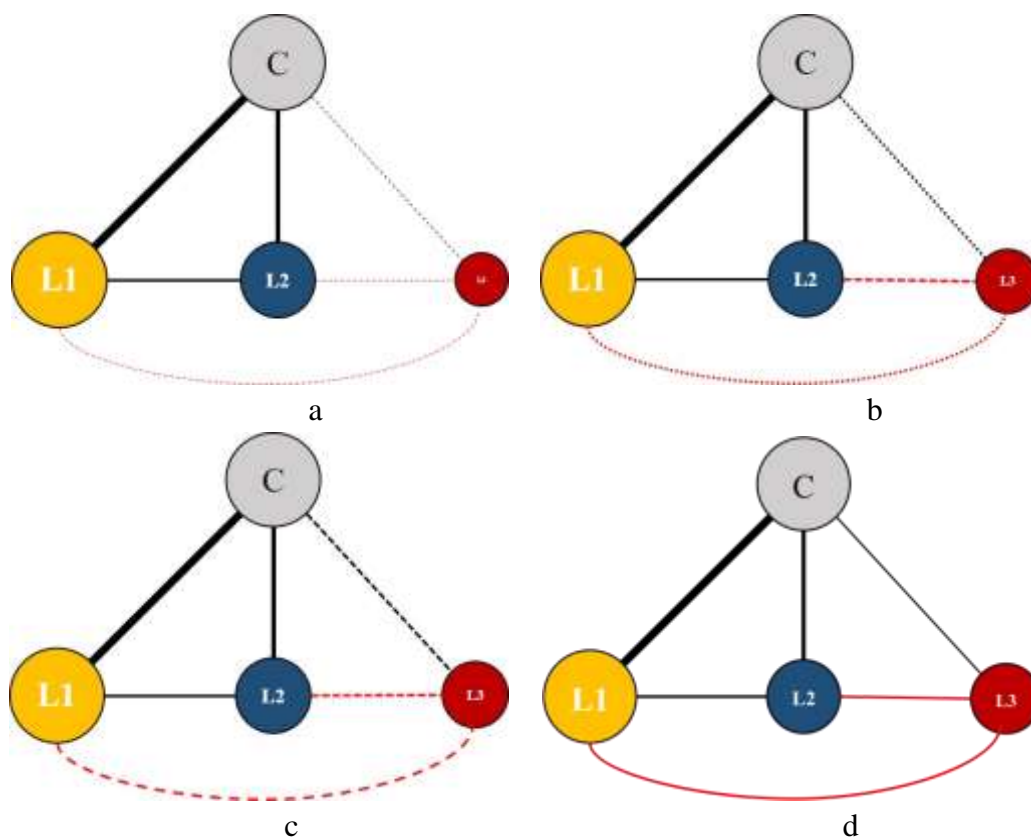


Fig 7: Trilinguals' mental lexicon representation – A dynamic model.

Fig 7 give very direct display to trilinguals' mental lexicon representation when L2 serves as the instruction language of L3.

Fig 7(a) indicates that in the initial stage of L3 learning illustrated in Figure 2, such lexical links as L1-L3 link and L2-L3 link, and concept-L3 link are all very weak, and of the two lexical links, L2-L3 link is a bit stronger than L1-L3 link.

Fig 7(b) shows that as trilinguals reach the beginning phase of the second stage of L3 learning, illustrated in Fig 2, all three links mentioned above are strengthened, with L2-L3 link being much stronger than L1-L3 link.

Fig 7(c) signifies that as trilinguals further improve their L3 to the later phase of the second stage of L3 learning, illustrated in Figure 2, concept-L3 link and L1-L3 link are increasingly stronger, whereas L2-L3 link strength improvement rate is much lower.

Fig 7(d) displays that when L3 level of trilinguals is extremely high, into the third stage of L3 learning, concept-L3 link strength has grown to a very high level and is constantly approaching concept-L2 link strength. Meantime, L1-L3 link and L2-L3 link are also very strong, with strength difference between the two being the slightest. As trilinguals further hone their L3 proficiency, their L1-L3 link strength is continuously drawing itself closer to L2-L3 link strength and L2-L3 link strength is approaching L1-L2 link strength.

3.3 Uniqueness of the Modeling Attempts

Both the static and dynamic models built in this paper are to describe trilinguals' mental lexicon representation when their L2 serves as the instruction language of L3. When the two are taken as different aspects of one model, the model has the following unique features.

To begin with, it is comprehensive, with storage pattern of both conceptual and lexical information and existence and strengths of concept-name links and lexical links all under discussion.

Furthermore, it incorporates both general static features and dynamic development stages. Roles of the two factors of language proficiency and instruction language and the three L3 learning stages are hypothesized and modeled in details, e.g. with varied rates of link strength improvement.

In addition, all possible links are supposed to be existent and connected in the model, regardless of L3 proficiency. Developmental trajectories are displayed via L3 lexical representation enlargement and changing strengths of some links, instead of via whether or not certain links exist.

This model, therefore, is characterized by comprehensiveness, combination of static and dynamic elements, and all-connectedness, and is dubbed as Trilinguals' All-Connected Model of mental lexicon representation by the author.

Different from many models previously proposed (e.g. [14-18]), which assume whether or not existence of some links is related to L3 proficiency, or indicate that development of trilinguals' mental lexicon representation lies in change from non-existence of some links to their existence, the current model, however, hypothesizes existence of all possible links, irrespective of L3 proficiency, and attributes

development of link strengths and their different speeds to such factors as language proficiency and instruction language. For a detailed review of previous relevant models, see Ji [2].

IV. EDUCATIONAL IMPLICATIONS

The foreign language learning process is pondered over from a psycholinguistic view. Based on the insight, concrete educational implications and deeds are discussed for better foreign language education results.

4.1 Foreign Language Learning Process Examined

Foreign language learning has been studied from a wide array of perspectives, and this paper is approaching it from a psycholinguistic angle. The process is believed to be essentially one in which learners have their mental lexicon representation gradually restructured. The restructuring can take place in both conceptual and lexical levels of mental lexicon representation as well as in concept-name link and lexical link strengths.

While this paper mainly delves into two factors, namely language proficiency and instruction language, in the restructuring process, a host of factors have been recognized as having their sway over the process, as mentioned in Section 2. Therefore, different people with different language backgrounds may experience different restructuring processes. The current paper mainly supports that for trilinguals whose L3 is orthographically distinct from L1 or L2, and whose instruction language of L3 is L2, once L3 learning process starts, the main changes lie in L3 lexical store enlargement, a stronger concept-L3 link, and growing strengths of the two lexical links connecting L3, with different change rates.

A further step based on this view is to design new language teaching and learning activities that accelerate the process and improve existing ones, to assist with L3 learning of this type of trilinguals. Relevant discussions are as follows.

4.2 Concrete Pedagogical Implications

The above theoretical modeling and discussions have at least three concrete pedagogical implications for L3 learning when L2 is the instruction language of L3.

First, mother tongue is suggested to be the instruction language of L3. Theoretical discussions reveal that the role of instruction language is not to be downplayed. Meantime, mother tongue is in most cases the dominant language. Advantages of both statuses of instruction language and mother tongue can be combined to bring L3 learning outcome to the fullest play. This implication drawn from a psycholinguistic study is supported by many existing studies (e.g. [11,19-25]) that have been finished in a number of other fashions, such as from such perspectives as second and foreign language acquisition, cognitive linguistics,

and teacher development.

Many countries, in their language policies, also stress the importance of mother tongue in their foreign language education. Canada, as an example, exercises the principle of mother tongue priority, and stipulates that students' mother tongue should be used as the instruction language for foreign language education [11]. This can be of referential value when it comes to language education for ethnic groups in a country, who are more likely to have their own unique languages instead of the prevailing language of the country as their mother tongue. This can also provide food for thought for language education for foreigners who are already capable of speaking two languages. More insights are that development of language teachers and textbooks should also give due attention to fostering of more language pairs, so that language education with more mother tongue options as the instruction language can be achieved.

Second, in mental lexicon representation structure, strength development of both lexical links connecting L3 is salient. Thus, no role of L1 or L2 should be neglected in L3 learning process. This finding from a psycholinguistic research is supported by some previous trilingual studies (e.g. [21,26]) done through L1 and L2 role contrasts, language transfer, and language error analysis. As a matter of fact, many studies (e.g. [27,28]) have lent support to the belief that the number of languages learnt and the levels of these languages are positively related to the ability and facility in learning an additional language. These arguments are supported by the threshold and interdependence hypotheses [29] and studies into metalinguistic awareness [30,31]. Therefore, measures that are conducive to growing L1-L3 and L2-L3 lexical link strengths should be preferred in L3 education.

Pavlenko [6] incorporated a list of methods to strengthen L1-L2 lexical link, such as translation from L1 to L2, L2 production tasks, recall of L2 words, and metaphoric extensions of given words. These methods can also be transferred to cultivating stronger L1-L3 and L2-L3 lexical links in trilinguals. Besides, other interaction activities between L3 and L1 or L2 are also encouraged, such as exposing students to bilingual materials compiled in L3 and L1 or L2, interacting with bilinguals, and tri-(multi-)linguals who can also speak L3 and L1 and (or) L2, and cultivating habits of thinking with language transfers between L3 and L1 or L2.

Third, concept-L3 link strength is closely associated with L3 proficiency, and this conceptual access is swifter and more direct, which calls for more methods to facilitate strengthening of this route. It means that despite the second point of implication, it is also crucial to require language learners to associate directly the language being learnt and the real world, without relying on other more proficient languages. Back in the beginning of the last century, Epstein (1915, cited from Pavlenko [32]) advocated the Direct Method. Since then, many relevant language teaching methods for the same aim have been proposed, practiced and studied, such as natural approach [33], and Total Physical Response [34]. Such methods have been proved effective, as in Cenoz [35, p.47], using English to teach subjects with substance, one of those direct immersion approaches, "provides the opportunity to increase the limited time devoted to English" and thus is useful in improving English proficiency of students who speak Spanish and Basque and are learning

English as L3.

The second and third points raise the question of how to balance these two types of methods. Jiang [36, p.426] maintained that in the early stage of L2 instruction, “there is no reason not to use L1 as a means of semantization or as a tool for checking and validating learners’ understanding of word meaning”. Tytus [37] supports the view by arguing that the total elimination of L1 in L2 learning or L1 and L2 in L3 learning suits more advanced learners better. Therefore, according to the existing studies, proportions of these methods should be relevant with L3 proficiency.

V. CONCLUSION

Trilinguals’ All-Connected Model of mental lexicon representation in psycholinguistics is put forward, elucidated and illustrated. Storage pattern, including common conceptual storage and separate lexical storages, and the existence of all concept-name links and lexical links, apply to trilinguals, irrespective of language proficiency or any other factor. The dynamic change is mainly displayed through enlargement of L3 lexical store and strengthening of concept-L3 link and the two lexical links connecting L3, as L3 proficiency increases. Instruction language exerts its influence over lexical links’ rates of getting strengthened across the three stages of L3 learning, and thus different trajectories can be outlined for L1-L3 and L2-L3 lexical links. Theoretically speaking, this offers a possibility and an attempt of uniformity, so that myriad psycholinguistic studies on trilingualism can be approached and assessed within one framework, which is conducive to pooling together wisdom of more researchers. The pedagogical implications are also multi-fold. This study adds to evidence of usefulness of some existing teaching and learning notions and methods, and contributes to proof of effectiveness of the utilization of mother tongue in L3 instruction.

Future studies can examine the first and third stages of L3 learning mentioned in this paper, and have trilinguals in these two stages as participants to further check the validity of the three-stage hypothesis proposed. Different types of trilinguals, with different combinations of such factors as instruction language, orthographic similarity, age of acquisition, etc. also call for more studies to come, to delve into their mental lexicon representation structure as well as to what extent existing models, such as the one put forward in this paper, fit them. Apart from the above possible further psycholinguistic studies, still, language policy studies, language acquisition studies, and cognitive linguistics, among others, may have future studies based on the results and implications gained. Further studies may also adopt neuro-imaging research methods.

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