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A Theoretically Psychological Analysis of Semantic Representation of Bilinguals' Mental Lexicon

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Abstract;

Due to the limitations of the existing research methods per se, studies probing into the semantic representation of bilinguals' mental lexicon from the dimension of metrology yield no convincing results. This paper explores the semantic representation of bilinguals' mental lexicon by analyzing the relationship between language and thoughts, the production of language from a theoretically psychological perspective. Such a conclusion can be drawn that 1) there is but one semantic system shared by natural languages and 2) the semantic information of mental lexicon is not attached to one specific vocabulary but stored separately in the cognitive system. The study of the semantic representation of bilinguals' mental lexicon is conducive to the investigation into the universality and particularity of language itself and to the exploration of the nature of language, thought and human behavior.

Key words: bilinguals' mental lexicon, semantic representation, language production, language and thought

Since the 1950s, scholars at home and abroad, have made a great deal of researches on the semantic representation, lexical access and cerebral cortical representation of bilinguals' mental lexicon with the aid of metrological methods and the construction of many theoretical models is not unexpected. There is, however, no consensus reached by scholars adopting different research methods and some research conclusions are even contradictory (Kroll et al., 2012, Ma et al., 2017). This paper begins by discussing the problems existing in metrological methods, then moves on to the analysis of the relationship between language and thoughts, the mechanism of language production to further explore the semantic representation of bilingual' mental lexicon.

1. Problems of Metrological Research Methods

Researches adopting metrological methods to investigate the semantic representation of bilinguals' mental lexicon are either behavioral or neurological. Behavioral studies focus on word processing by presenting visual stimulus and collecting response time and accuracy data, while neurological studies concentrate on sentence processing with the help of such advanced techniques as event-related potential (ERP) and functional magnetic resonance imaging (fMRI). There are many reasons for the inconsistencies and even contradictions in the research conclusions obtained by using metrological methods, of which the most important one is the limitations of the research methods per se.

Priming experiments of different paradigms, since the 1980s, have been employed by behavioral studies to investigate the semantic representation of bilinguals' mental lexicon, which can be divided into long-time repetition priming and short-time fast priming according to the presentation and time interval of priming and target stimulus. By means of categorical judgement task and word decision task, the long-time repetition priming includes a learning phase and a test phase. If the translation equivalents of the words appeared in the learning stage are responded faster and more accurately in the test stage compared with unlearned words, it indicates that these words are activated in the learning stage and a translation priming effect is expected, thus the mental lexicon of two languages are stored together, otherwise, they are independently stored. At present, this paradigm has become one of the most widely used behavioral measures to probe into bilingual lexical representation at home (Li, 2018), but Kessler and Moscovitch (2013) argue that additional processing strategies affect the long-term repetition priming effects.

Aided by such tasks as translation recognition, semantic categorization and lexical decision, the short-term fast priming does not discriminate between learning and testing phases, and the prime and the target are presented one after another with the stimulus onset asynchrony (SOA) lasting from zero to several seconds in length. In the translation recognition task, subjects must clearly capture primes and extract their semantic information, therefore SOA is typically between 750 and 800 ms, which makes it possible for participants to translate at least part of the primes into the target language before the appearance of the target words, meaning that this paradigm theoretically cannot exclude the possibility of adopting translation processing strategies by subjects. Ma et al. (2017) shortened SOA to 300 ms in order to minimize the effect of translation strategies and ensure sufficient time for subjects to recognize primes at the same time. There is an obvious case of paradox: if SOA is too short, subjects cannot accurately recognize the primes; if SOA is long enough for participants to identify primes, the adoption of processing strategies is inevitable. It can be concluded from the above discussion that the translation recognition task is inherently flawed.

The semantic categorization and lexical decision task in short-time fast priming typically involve only one SOA test. Li and Pu (2014) pointed out that SOA single test is defective for too short SOA makes it impossible for the primes to activate the targets and too long SOA invites conscious strategic processing. Even if SOA is long enough, the effect of conscious strategy processing can be excluded and the primes are less semantically correlated with the targets, the cross-language semantic priming effect is still beyond capture.

Neither long-time repetition priming nor short-time fast priming paradigms cannot theoretically avoid the conscious strategy processing effect, which is never easy to eliminate such defects by improving the experimental design. It is generally agreed by existing studies that SOA less than 200 ms can exclude the effect of conscious strategy processing to the maximum extent. Considering that the subjects need to successfully capture the primes within 200 ms, SOA single-point test can be modified to SOA multi-point test (Li & Pu, 2014). To put it more specific, multiple SOA conditions can be set up within the range of 0-200ms, such as 50, 100, 150 200 ms, and the priming effect obtained in any SOA condition indicates that the primes promote the cognitive processing of the target words. Although SOA multi-point test is a successful attempt, it is never invulnerable, for all behavioral researches without exception face the problem of reaction time, which determines the reliability and validity of experiment results. The reaction time recorded in actual behavioral experiments is the sum of the time for subjects to identify primes based on the lexical or semantic information and that for subjects to make decisions about the primes, thus the so-called reaction time measured by the experiment is not the time participants actually make decisions (Zhao, 2012). Besides, external factors such as the sensitivity of experiment instruments and participants' proficiency in experimental operation also have an effect on the accuracy of reaction time.

fMRI and ERP techniques used in neurological studies provide a more direct methods for the study of bilingual lexical representation. Although the brain regions activated by lexical processing can be located with the help of fMRI, its poor temporal resolution makes it difficult to continuously measure the mental process of lexical and semantic processing (Wang & Cai, 2010), to determine whether the cortical activity is activated processing or inhibited processing and to distinguish between the lexeme and concept of lexical stimulus (Zhang & Liu, 2007, Dong & Gui, 2002). ERP technology can deepen the understanding of brain mechanism of language processing with different ERP components revealing specific cognitive processing, there is, however, no consensus on the cognitive processing reflected by each ERP components.

Based on the above discussion, it can be seen that drawing a fully convincing conclusion on the semantic representation of bilingual lexicon by means of metrological methods is never possible. This paper attempts to make a further investigation of bilingual lexical representation by analyzing the relationship between language

and thoughts, the production of language and the storage of semantic information of mental lexicons from a theoretically psychological perspective

2. The Relationship Between Language and Thoughts

One of the hot topics that psychology is concerned with is the medium through which people think before they complete communication by expressing their thoughts through language. Fodor (1975) proposed that people are born with an inherent ability to think in a public language, the nature of which is the representation of meaning, that is, the mental representation of concept and proposition. Taking places in a representational system similar to a natural language, the mental representation consists of universal words and sentences with much simpler grammatical structure and richer information. The process of mental representation works like a machine with no meaning involved. Although Fodor's public-language hypothesis has been widely recognized in cognitive science, it has also been questioned and criticized by scholars in philosophy, psychology and linguistics. Jackendoff (2002) pointed out that concepts do not directly represent the external world as a whole, but are generated by smaller concept elements, which can not be further subdivided. Other scholars believe that people can think in natural languages (Li, 2018).

Given that the main form of modern human thinking is conceptual, is it possible that the medium of conceptual thinking is Fodor's public language? This question is worth discussing. Scholars such as Vygotsky (1997) and Li (2008) have analyzed the possible process of thinking converting from conceptual to verbal. According to Vygotsky, thinking is first in inner language, then in meaning, and finally in speech. Li believes that man's thinking begins with the expression of a certain intentional meaning, and verbal thinking is the integration of generation and expression of meaning. Based on the above discussion, conceptual thinking may go through three stages: 1) the perception of meaning. The subject gets the fuzzy overall meaning without the intervention of words; 2) the integration of meaning. The mental representation of concept and proposition is activated and integrated; 3) the expression of meaning. The conceptual representation is further refined and referred with the help of natural language. It should be noted that in the first stage, conceptual thinking begins without the participation of language, which is a process for individuals to directly perceive meaning based on their conscious experience. The second stage is the core of conceptual thinking, in which the representation of concept and conceptual relations is activated by subjects based on their acquired experience without grammar involvement. The characteristics of the first two stages show that meaning itself is dynamic and does not necessarily involve language. The third stage is about the linguistic expression of conceptual thinking, that is, the verbal thinking. In this stage, the conceptual and propositional representation activated are transformed into the conceptual lexicon of natural language, which combined with conceptual relation are embedded into appropriate syntactic structure to convey meaning. In this process, language provides materials for thinking, adjusts its content and further promotes its development, which does not mean that language is a tool of conceptual thinking. As a matter of fact, language is only an intermediary between thinking and the objective world, and it can be seen as a tool for understanding and expressing meaning.

From the above analysis, it can be concluded that neither Fodor's public language nor natural language serves as the medium of conceptual thinking. Humans can master multiple natural languages and have multiple sets of mental lexicons, but they share but one set of meaning system. Various psychological operations are carried out according to this unique system of meaning and meanings are verbalized in multiple natural languages. Many studies have shown that the conceptual thinking revolves around meaning, which indirectly reflects that the lexical and semantic representations are separate, but the semantic representation of bilinguals' mental lexicon is shared.

3. The Mechanism of Language Production

Language production refers to the process of organizing communicative intention, activating relative concepts, extracting semantic, syntactic and phonetic information, and controlling the sound produced by articulators. To put it more succinctly, language production is the psychological process of people using language to express their thoughts (Li et al., 2006). Existing studies generally divide the process of language production into three levels (Zou & Ding, 2014). The first layer is the formation of expressive intention and relative concept, i.e., the meaning to be conveyed should be clarified; the second layer is about the language organization, i.e., the clarified meaning should be conveyed in verbal form with the grammatical structure and phonological coding established; the third layer concerns with the articulation of the chosen words. The organization phase covers lexical generation and grammatical coding, the latter referring to the word selection and ordering of syntactic framework.

The key to language production is lexical access, that is, the conversion of thought into word expression, and further into sound. A large number of studies have reached a consensus that lexical access involves word extraction and phonological coding (Schmitt et al., 1999). Word extraction refers to the process of semantic activation and selection of specific words. Specifically, semantic representation in mental lexicon is first activated and then diffuses to the entry level, which shares the semantic and syntactic characteristics. At the stage of phonological coding, the activation at the entry level extends further to the phonological level of specific words. Dell (1986) proposed the Sperading-activation model, which holds that lexical access goes through two stages: the activation of semantic nodes first spreads to corresponding lexical nodes, and then to phoneme nodes. It is also pointed that activation diffusion is bidirectional, that is, the activation can either go from lexical level to phonetic level or feedback from phonetic level to lexical level. The item highest activated is the target term to be accessed, then a tailored pronunciation plan is assigned for that specific item. Levelt (1999) put forward Independent-activation model to counter Dell's idea that word extraction and phonological coding are independent by themselves and do not share activation. In other words, after concept activation, the semantic representation of both the target term and the semantically related terms are co-activated, but only the target term survives after lexical selection, leaving only the target term coded phonetically. Although the two models are at odds with each other on the interaction between two stages of lexical access, both admit the primacy of conceptual activation, indicating that meaning is a prerequisite for word access.

Previous studies suggest that when bilinguals extract lexicon in one language for speech production, the words of both languages are co-activated by the semantic system, that is, the semantic system can simultaneously activate mental lexicon of two languages (Costa et al, 2000, Colome, 2001). From the above analysis, it can be inferred that meaning serves as the prerequisite for language production, which at the very beginning is abstract concept, and then lodged in the words already existing in the mind with natural language as the carrier. That is to say, no matter how many different natural languages mastered by a speaker to express his thoughts, there remains only one meaning system. Meaning and its linguistic form are separate.

4. Conclusion

This paper begins by discussing the problems existing in metrological methods, then moves on to the analysis of the relationship between language and thoughts as well as the mechanism of language production to further explore the semantic representation of bilingual' mental lexicon. The above analysis demonstrates that 1) there is but one meaning system shared by all natural languages and 2) the semantic information of mental lexicon is not attached to one specific vocabulary but stored separately in the cognitive system. Such a conclusion is confirmed by most metrological studies that bilinguals' mental lexicons share semantic representation. The

study of the semantic representation of bilinguals' mental lexicon is conducive to the investigation into the universality and particularity of language itself and to the exploration of the nature of language, thought and human behavior.

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