The sound level structure in Farsi speakers' mental lexicon: A priming study

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Extended abstract

1- INTRODUCTION

Every human being capable of speaking knows over 75000 words, on average. All of these words have their own phonological forms which must be distinguished from each other. These forms are stored and organized in our mental lexicon in a way that accessing each of them would not take more than fraction of a second during our daily language production and perception. Therefore, many structural models of mental lexicon have already been proposed to account for different language phenomena. There have been two major approaches for modeling the mental lexicon: holistic and distributed. In holistic models, every node include all (or a major part of) the information regarding a word. Hierarchical models and spreading activation models are examples of holistic approach. In distributed models, every node contains a single feature, thus, each word is a collection of different nodes. The present study is based on the spreading activation theory; therefore, next part is dedicated to a brief introduction of these models. The ultimate aim of this paper is to reveal how phonological forms are placed next to each other in the Farsi speakers' mental lexicon.

2- THEORETICAL FRAMEWORK

There are different models based on spreading activation theory but all of them share three main principles. First, retrieving anything from our memory is equal to activating its mental representation. Second, the activation spreads to the related concepts. And third, these indirect activations will cause a facilitated retrieval of those related concepts. The

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spreading activation models divide mental lexicon to some levels. For example, Bock and Levelt (1994) introduced a three-layered model, including a semantic level, a lemma level and a sound level. Each of these levels is a network in which every node is connected to some other related nodes by links. In the semantic level, these links are semantic in nature. In lemma level, each word is linked to its word class and sub-categorical information. Finally, in sound level, the phonological forms of words, according to literature, are linked based on rhyme and phonological similarities, especially similarities in their onsets. The most common way for identifying the nature of the links in any level is with the use of a priming experiment. The experiment used here is a masked phonological priming test which is shortly described in the succeeding part.

3- METHODOLOGY

Priming experiments have their origins in psychology. Generally speaking, priming is facilitation, caused by a stimulus called prime, in recognition of a target. In psycholinguistic studies, the prime-target pairs are mostly words which may be related to one another. A task usually paired with priming experiments is lexical decision task. In a primed lexical decision, the prime is shown to the participants and after that the target appears. Participants must decide whether the target is a word or a non-word by pressing a key and their response time (RT) is recorded. According to spreading activation theory, the target of the related pairs would be recognized sooner than the one in unrelated pairs due to spreading of the activation of prime to its related nodes. The priming experiments in which the prime is shown for less than a second are called masked priming experiments. As mentioned above, this study has made use of a masked primed lexical decision for identifying the nature of links in sound levels of Farsi speakers' mental lexicon. The prime-target pairs in this experiment were divided into 3 categories: rhyming (prime and target rhyme with each other), similar 3 initial phonemes (prime and target share the same first 3 phonemes) and control (unrelated pairs). Each category contained 10 pairs. All target words were controlled for their frequency (the frequencies were limited between 900-1400). Also, there were 30 word-non-word pairs in order to make the lexical decision task possible (non-word ratio (NR) = 0.5). 30 undergraduates, graduates or postgraduates of Ferdowsi University have participated in the experiment.

4. RESULTS AND DISCUSSION

The result of descriptive statistics showed that the RT mean for rhyming category was less than the other two (0.638 ms). After that there was control group (0.673 ms) and the RT for the similar initial phonemes was the highest (0.687 ms). The paired sample t-test was used for deciding the significance of these differences ($\alpha<0.05$). The result confirmed that the difference between rhyming group and control group is significant (0.003<0.05). However, the difference between the similar initial phonemes group and control group was not significant (0.276>0.05). In literature, whenever a primed lexical decision was used, the similarity of the prime's and target's phonemes caused a significant delay in recognition of the targets. This phenomenon is due to inhibition which is caused by two (or more) competing words during language processing. Researchers believed that if this inhibition occurs, it would mean that the target was activated by the prime, thus they are linked in the mental lexicon. As there was no significant difference between the similar initial phonemes group and control group in our results, we can claim that sound level in Farsi speakers' mental lexicon is mostly rhyme-oriented, and phonological similarities play a less active role in its structure.

5. CONCLUSIONS AND SUGGESTIONS

We can assume that the links in the sound level have been created based on similarity in rhyming and phonological forms with the same rhymes are closed and linked to each other. This can be one of the differences between Farsi speakers' mental lexicon structure and the English speakers' one, in which both rhyming and phonological similarities play active roles. However, an audio priming experiment can be useful for supporting the results achieved here. Moreover, there should be some investigations for capturing the structural differences in other levels of mental lexicon.

Keywords: Mental lexicon, Sound level, Spreading activation, Phonological priming, Rhyming

References (in Persian)

1. Bijankhan, M., & Mohseni, M. (2013). *Frequency Dictionary: Based on Today Persian text corpus*, Tehran: Tehran University Press *In Persian.*

References (in English)

1. Anderson, John R., (1976); Language, memory, and thought; Cambridge, MA: Harvard University Press.
2. Bock, Kathryn, & Levelt, Willem, "Language production: Grammatical encoding", Morton Ann Gernsbacher, (1994), Handbook of psycholinguistics, San Diego, CA: Academic Press, 945-984.
3. Bowers, Jeffrey S., Vigliocco, Gabriella, & Haan, Richard, "Orthographic, phonological, and articulatory contributions to masked letter and word priming", Journal of Experimental Psychology: Human Perception and Performance, 24, 1998, 6: 1705-1719.
4. Carroll, David, (2008); Psychology of language (5th ed.); Toronto, Canada: Thomson Wadsworth.
5. Collins, Allan M., & Loftus, Elizabeth F., "A spreading-activation theory of semantic processing", Psychological Review, 82, 1975, 6: 407-428.
6. Collins, Allan M., & Quillian, M. Ross, "Retrieval time from semantic memory", Journal of Verbal Learning and Verbal Behaviour, 8, 1969, 2: 240–247.
7. Ferrand, Ludovic, & Grainger, Jonathan, "Phonology and orthography in visual word recognition: Evidence from masked non-word priming, The Quarterly Journal of Experimental Psychology: Section A, 45, 1992, 3: 353-372.
8. Grainger, Jonathan, & Ferrand, Lodovic, "Masked orthographic and phonological priming in visual word recognition and naming: Cross-task comparisons", Journal of memory and language, 35, 1996, 5: 623-647.
9. Kiefer, Markus, "The N400 is modulated by unconsciously perceived masked words: Further evidence for an automatic

spreading activation account of N400 priming effects", Cognitive Brain Research, 13, 2002, 1: 27-39.

10. McNamara, Timothy P., "Priming and constraints it places on theories of memory and retrieval", Psychological Review, 99, 1992, 4: 650-662.

11. McNamara, Timothy P. (2005); Semantic priming: Perspectives from memory and word recognition; New York, NY: Psychology Press.

12. Neely, James H., Keefe, Dennis E., & Ross, Kent L., "Semantic priming in the lexical decision task: Roles of prospective prime-generated expectancies and retrospective semantic matching", Journal of Experimental Psychology: Learning, Memory, and Cognition, 15, 1989, 6: 1003–1019.

13. Oldfield, Richard Charles, "Things, words and the brain", The Quarterly Journal of Experimental Psychology, 18, 1966, 4: 340-353.

14. Peirce, Jonathan W., "Generating stimuli for neuroscience using PsychoPy", Frontiers in Neuroinformatics, 2, 2009, 1-8.

15. Posner, Michael I., & Snyder, Charles R. R., "Attention and cognitive control", Robert Solso, 1975, Information processing and cognition: The Loyola symposium, Hillsdale, NY: Lawrence Erlbaum, 55-85.

16. Quillian, M. Ross, "Word concepts: A theory and simulation of some basic semantic capabilities", Behavioral Science, 12, 1967, 5: 410-430.

17. Radeau, Monique, Morais, Jose, & Dewier, Agnles, "Phonological priming in spoken word recognition: Task effects", Memory and Cognition, 17, 1989, 5: 525-535.

18. Ratcliff, Roger, & McKoon, Gail, "A retrieval theory of priming in memory", Psychological Review, 95, 1988, 3: 385-408.

19. Slowiaczek, Louisa M., Nusbaum, Howard C., & Pisono, David B., "Phonological priming in auditory word recognition", Journal of

Experimental Psychology: Learning, Memory, and Cognition, 13, 1987, 1: 64-75.

20. Sternberg, Robert J., & Sternberg, Karin, (2012); Cognitive psychology (6th ed.); Belmont, CA: Wadsworth.

21. Tanenhaus, Michael K., Flanigan, Helen P., & Seidenberg, Mark S., "Orthographic and phonological activation in auditory and visual word recognition", Memory and Cognition, 8, 1980, 6: 513-520.

22. Tulving, Endel, "Concepts of memory", Endel Tulving & Fergus I. M. Craik , 2000, The oxford handbook of memory*,* New York, NY: Oxford University Press, 33-44.