The Role of Perceptual Simulation in L2 Vocabulary Acquisition

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Abstract

Research in embodied cognition suggests that perceptual simulation may play a role in language comprehension. In this study we use a combination of experimental and qualitative research to explore the potential of simulation exercises to improve acquisition of esoteric literary English vocabulary by English majors at a Chinese University. Through quantitative analysis of the data from one pre-test and two post-tests of the experimental and control groups, and qualitative examination of the student feedback collected from an open-ended survey and face-to-face interviews, we find that most of the students in both conditions have simulations of the learned words whether based on self-determined Chinese trigger words or given English language prompts to them, and skilled language learners intuitively adopt perceptual simulations. The research findings give teachers some enlightenment on the pedagogical strategies that might encourage less proficient learners to incorporate perceptual simulations in their study habits.

Keywords: perceptual simulation, L2, vocabulary acquisition, mnemonic device

1. Introduction

In the past two or three decades, cognitive scientists have increasingly come to recognize the role of the body in cognition, including language production and processing (Barsalou, 2008; Glenberg, 2010). This has led to a shift in research focus from canonical (disembodied) cognition to embodied cognition (Holme, 2012; Jiang, 2015). Researchers have shown that neural systems associated with perception and muscular control are partially activated (as "perceptual simulations") during language use and comprehension (see Bergen (2012) for a review). When neural systems associated with an object or action are activated, either by an actual encounter or by thinking about it, the associated language is automatically activated: Simulations are also an important part of language production (Barsalou, 2008).

Embodied approaches to language teaching try to make language more memorable by showing how a meaning has been derived from physical experience (Holme, 2012: 9). Littlemore (2009) holds that through embodied cognition, people's subjective feelings of the body and the experience of the body in action provide the basis for language and thought. She elaborates the role of gesture－an external manifestation of embodiment－in L2 learning and teaching. Based on in-depth research on L2 vocabulary teaching, Boers and his collaborators argue that the deep processing (semantic elaboration or pictorial elucidation) of vocabulary is conducive to retention of meaning (Boers & Lindstromberg, 2008; Boers, Lindstromberg, Littlemore, Stengers & Eyckmans, 2008; Boers, 2013).

In this paper, we use a combination of experimental and qualitative research to explore the potential of simulation exercises to improve acquisition of esoteric literary English vocabulary by English majors at a Chinese university. Through quantitative analysis of the data from one pre-test and two post-tests, and qualitative examination of the student feedback collected from an open-ended survey and face-to-face interviews, we try to find out the effect of perceptual simulation－an internal manifestation of embodiment－on L2 vocabulary acquisition, esp. on retention of lexical meaning.

2. L2 Vocabulary Acquisition and Perceptual Simulation

In second language acquisition, vocabulary acquisition has always been regarded as crucial (Gass & Selinker, 2001; Xu & Wang, 2015). For any language, the importance of vocabulary is just like that of bricks to a building, since they

are both the most basic components. Gass & Selinker (2001) argue that, to a large extent, language acquisition can be attributed to vocabulary acquisition, because almost no linguistic ability, skill training, learning and improvement can be separated from vocabulary as its basis. Gass (1988) points out that in the early study of second language acquisition, vocabulary acquisition has been ignored by researchers.

After entering the 21st Century, the research on L2 vocabulary acquisition is in full swing (Xu & Wang, 2015). In recent decades, cognitive linguistics (CL), research on embodied cognition has injected new vitality into it (Boers & Lindstromberg, 2008; Littlemore, 2009). Just as Holme (2012) holds that CL explores meaning as conceptualized out of the way our bodies and minds shape our perceptions, CL is oriented toward perception rather than amodal processing, and the research on L2 vocabulary acquisition has taken a turn toward perceptual simulations.

From the accumulated research (Barsalou, 2008, Ritchie, 2006), it seems likely that language, especially words and phrases but also syntax, are both stored and accessed by a context-influenced combination of perceptual simulations and amodal links to other language, based on correlations in experience. For language learners, the primary experience of new words in the target language may initially come in the form of memorized definitions (i.e., amodal links to other language, usually L1)(Jiang, 2002), either preceded or followed by encountering the new words as they appear either in a literary context (an assigned reading in the target language) or in a classroom conversation. However, retention as well as comprehension and use require that the L2 words also become associated with relevant perceptual and motor simulations, which can be accessed directly without going through semantic translation, as empirical studies made by Zhao, Huang, Chen, Jiao, Marmolejo-Ramos, Wang & Xie (2019) on adult Chinese-English bilinguals suggest that the sensorimotor simulation in language processing occurs spontaneously to some extent and sensorimotor simulation acquired in L1 can be transferred to L2 spontaneously.

3. The Study

3.1 Hypothesis

We build our research on the studies of perceptual simulation (Barsalou, 2008; Ritchie, 2006), which shows that humans may understand language by simulating in their minds what it would be like to experience the things that the language describes (Bergen, 2012: 13). The connection between memorability and concreteness can be interpreted in terms of embodied cognition (Macedonia & Knosche 2011: 208), which prompts us to think of the close link between retention and one type of elaboration, perceptual simulation (Ritchie, 2017). So, we put forward the hypothesis that in acquiring L2 vocabulary, if learners will associate the meanings of words with their past experience (direct bodily experience, or indirect cultural experience), and use their simulated experience as a mnemonic device, it may improve the retention of meaning. We propose that perceptual simulations might be more easily activated if students are given relevant L2 trigger words or phrases.

3.2 Participants and Materials

The sample consists of 70 English majors in a Chinese University, all juniors from two classes, each taught by a separate teacher. Subjects were randomly assigned to a control group or a test group. They were required to memorize 50 esoteric literary words (see Appendix 1) from an essay entitled *Libido for the Ugly*, written by Henry Louis Mencken. This essay was selected because it is one of the most difficult articles included in the textbook of advanced intensive reading course for English majors, assigned as a subsidiary reading in the course. The majority of 50 words are 31 adjectives, with 12 nouns, 5 verbs, one verbal phrase, and one prepositional phrase. We avoid choosing the commonly used words that the majority of the students have already mastered. None of the chosen words are included in the syllabus of TEM 4 (Test for English Majors Band 4).

3.3 Experiment

Our experiment was carried out in October, 2019, lasting 2 weeks in all. Students in the control group of English majors studied the words through semantic translation with both English explanations, examples, and their Chinese equivalents. Before the experiment, students in the test group were instructed in one period of class how to use perceptual simulation to promote their memory. They were required to study the same set of words using a mnemonic device of simulated experience with English explanations and examples only, accompanied by the English language prompts to activate the simulated experience. The prompts are words or phrases with detailed descriptions of the scenarios that are activated by them as hints for perceptual simulations. For example, the prompt for the adjective *appalling* is "slum". The hint for the perceptual simulation given in the vocabulary list for the students in the experimental condition was to think about the extremely poor living conditions in the slum, which they have personally experienced or just seen in a film, as a supplement to the definition of the word: shocking; extremely bad. The process for students in both conditions to memorize these words was supervised by the teacher and the time for

both groups was limited to 1 hour.

Vocabulary knowledge was measured by one pretest and two post-tests at Post-test 1 immediately and Post-test 2 one week after the learning exercise. The pre-test was given in the form of word match, matching words with their meanings to check how well the students know these words before learning. The words were defined according to *Oxford Learner's Dictionaries* online (https://www.oxfordlearnersdictionaries.com/). The first post-test was given in the form of vocabulary selection, selecting the right word from a group of three words to complete a sentence, which was aimed at examining students' ability to understand and use a word at the appropriate context. The second post-test was a repetition of the pre-test, to see how well the subjects retain the words after a week.

The improvement rate of each post-test (the score gap between post-tests and pre-test divided by the pre-test score) and the one-week time forgetting rate (the score gap between two post-tests divided by the score of Post-test 1) were analyzed by Analysis of Variance (ANOVA) to compare the retention rate at either Post-test 1 or Post-test 2 and the forgetting rate between the test-control groups. The final sample for ANOVA consists of 25 students from the test group and 27 students from the control group. After three tests and interviews, we eliminated 18 students, either because the pre-test showed that they had already mastered at least 30 of the 50 words (60% or higher) or because we learned through the interviews that they consulted the dictionary while doing the tests.

3.4 Results and Discussion

The results show no distinguishable difference in improvement rate at either Post-test 1 ($F_{(1,50)}=.026$, $p>.05$) or Post-test 2 ($F_{(1,50)}=.418$, $p>.05$) and in forgetting rate ($F_{(1,50)}=2.218$, $p>.05$) for the two groups(See Table 1). Our hypothesis is not supported by the ANOVA. Whether prompts are provided in English or Chinese equivalents makes no detectable difference in the retention of meaning. The results do suggest that the two methods for memorizing English words have essentially the same effect on retention.

Table 1. ANOVA of improvement and forgetting rates among English majors

Measure		Sum of squares	df	Mean squares	F	Sig.
Post-test 1 improvement	Between groups Within group Total	1.495 2885.727 2887.221	1 50 51	1.495 57.715	.026	.873
Post-test 2 improvement	Between groups Within group Total	8.733 1044.026 1052.758	1 50 51	8.733 20.881	.418	.521
Forgetting rate	Between groups Within group Total	.063 1.412 1.474	1 50 51	.063 .028	2.218	.143

After the three tests, we conducted an on-line survey of the subjects by means of SOJUMP, getting 35 valid answers from each of the test group and control group. Both of them were given the same questions in the survey (See Appendix 2). We found some differences and unexpected outcomes in the answers from the students in the two conditions. 82.85% (Yes: 57.14%, Maybe: 25.71%) of the students in the test group have the habit of semantic translation in learning English words. The percentage is higher for the control group, that is, 97.14% (Yes: 68.57%, Maybe: 28.57%), and the difference is significant ($t_{(57.544)}=-4.544$, $p=.000$). 94.28% (Yes: 28.57%, Sometimes: 65.71%) of the students from the test group reported forming a simulation upon seeing the meaning of an English word, compared to 97.14% (Yes: 45.71%, Sometimes: 51.43%) of the control group; the difference is not significant ($t_{(68)}=-1.177$, $p=. 243$). Virtually all students in both the control group and the test group already have the habit of forming perceptual simulations as part of learning vocabulary. The last question of the survey is open-ended, concerned with other mnemonic devices they have ever used in vocabulary acquisition. Both groups offered a range of methods, like word-building, association, semantic links, and context. However, the methods offered by the test group are more related to perceptual simulation, such as combining English words into a story (6 responses), imagining the scenario of words (4 responses); the methods offered by the control group are more traditional, for example, repeated reading and writing (6 responses), making sentences (4 responses).

To gauge the students' cognitive process at the moment of memorizing the words, we also conducted a semi-structured face-to-face interview of the students who achieved either the highest or the lowest improvement in

vocabulary knowledge.

The student from the test group who achieved the highest improvement in Post-tests 1 and 2 is a male student (Pre-test score: 2, Post-test 1 score: 68, Post-test 2 score: 42). His improvement rates in Post-tests 1 and 2 were thirty-three-fold and twenty-fold respectively. He excelled at the skill of cramming for the test. He used to have the habit of semantic translation when learning English vocabulary and liked to repeat writing the words when memorizing them. But this time he tried perceptual simulations. He thought it really worked for him and the English prompts guided him to imagine his experience associated with them. Although he remembered the words quickly, his memory could not last long. When asked about the detailed information of his simulations, he was unable to answer. His simulations were shallow without much detail. This might explain his relatively high forgetting rate (38%).

The student from the test group with the lowest forgetting rate (7%) is a female student (Pre-test score: 14, Post-test 1 score: 84, Post-test 2 Score: 78). She thought the mnemonic device of simulated experience was very effective and she could grasp it well. She might have the habit of semantic translation, but she did not always try to translate English words into their Chinese equivalents. For some words like technical terms or very abstract words, she said she had to turn to Chinese. She was good at making use of semantic links such as synonymy, antonymy, hyponymy to assist the memory of words. The method of simulated experience made the words more impressive to her. For example, the prompt "atomic bomb" of *desolation* created the images of a big mushroom cloud, burning fire, then ruins, which made the meaning of the word "the state of a place that is ruined or destroyed and offers no joy or hope to people" vividly displayed on her mind as if she were on the spot. In her advanced intensive reading course, she once studied a text entitled "Hiroshima－the 'Liveliest' City in Japan." The teacher offered her the background knowledge of atomic bombing of the city during the World War II, and a video of this tragedy was shown to her, so the prompt very easily reminded her of the text she had studied, by reminding her of the cultural experience she had simulated.

The student from the test group who achieved the lowest progress in Post-test 1(120%) is also a female student (Pre-test score: 20, Post-test 1 score: 44, Post-test 2 score: 36). The student said she was always poor at memorizing English words and she did not possess effective methods. What she used most was rote memorization. She did not think the mnemonic device of simulated experience suited her, so she relied on semantic translation to recall the words. The prompts were of no use to activate her past experience. She especially mentioned the prompt "caricature" of *allude to*, which was very confusing, and even "caricature" was unfamiliar to her, so how could she make any simulation? Our initial purpose is to remind students of their experience of appreciating a political caricature that indirectly criticizes a politician like Trump so as to deepen their understanding of its meaning "to mention something in an indirect way." However, it does not work for all students.

The student from the test group with the lowest progress in Post-test 2 (0%) and highest forgetting rate (94%) is a male student (Pre-test score: 2, Post-test 1 score: 36, Post-test 2 score: 2). He usually didn't deliberately memorize English words; he gradually grasped them through a lot of listening, speaking, reading and writing. His approach is to learn words by the incessant use of them. So, what he could remember was just those words of high frequency. Esoteric literary words were his Achilles heel. He was not interested in learning vocabulary for its own sake. However, he thought simulated experience was of help to promote his memory of those esoteric words, and without it, he could not recall any of them.

The student from the control group who achieved the highest progress in Post-test 1 (forty-one-fold) and Post-test 2 (twenty-three-fold) is a male student (Pre-test score: 2, Post-test 1 score: 84, Post-test 2 score: 48). The student with the least forgetting rate (2%) is a female student (Pre-test score: 24, Post-test 1 score: 88, Post-test 2 score: 86). They reported similar strategies for learning words by heart. They do not always resort to Chinese for the memory of English words. If the English explanation of the word is very lucid, they will immediately understand it by creating mental pictures on their mind instead of thinking about its Chinese version. But if the explanation of English words is ambiguous, their Chinese equivalents do greatly help to promote their memory. One of the students gave us an example, the word *mellow*, and its English explanations "to become, or make a color become less bright, especially over a period of time; to become or make somebody become less extreme in behavior, etc., especially as a result of growing older." Although she found this explanation unclear, the Chinese version helped her develop simulations based on some key words of Chinese "rouhe" (soft color), "laocheng" (mature). She thought of her brand-new red jacket which was somewhat dazzling, but after it was worn for some time, its color became softer and more pleasing to the eyes. She also thought of the setbacks she had ever experienced and with this painful experience she was no longer childish and became sophisticated. The students from the test group we interviewed did not have such detailed simulations. The prompt "lavender" might not be the right one to arouse their simulations.

The students from the control group who achieved the least progress in Pro-test 1 (124%, Pre-test score: 34, Post-test 1 score: 76, Post-test 2 score: 66) and Post-test 2 (50%, Pre-test score: 28, Post-test 1 score: 88, Post-test 2 score: 42) are both females. The latter one also got a high forgetting rate (52%). Both of them relied very much on semantic translation to learn English words. They had few methods for learning new words besides rote memorization. The girl who achieved the least progress in Post-test 1 had simulations when she saw some familiar English words or the Chinese equivalents of some unfamiliar English words. For example, when she saw the word *apple*, she immediately associated it with the fruit rather than the Chinese word "pingguo." In our word list, she would associate the Chinese equivalent "xinkude" of *laborious* with her part-time job as a home tutor of a small boy since he was too naughty to be disciplined. However, for most of the time, she just remembered the English words through semantic translation without any deeper processing. Whether she would have simulations depended on whether the word would resonate with her experience or emotion. The girl who achieved the least progress in Post-test 2 totally rejected perceptual simulation and she didn't have any simulated experience when seeing any English word or its Chinese equivalent. Although she realized her method for the memory of word was not effective, she still thought it was indispensable to know the Chinese equivalent of an English word before she grasped it.

4. Conclusion

Our experiment yields no significant results regarding the effectiveness of simulation in vocabulary acquisition, apparently because the manipulation failed to differentiate students in the test group from those in the control group. With virtually no variance between groups, it is impossible to detect the hypothesized effect of simulation on learning. However, the qualitative interviews suggest that skilled language learners intuitively adopt perceptual simulations, including story simulations, as part of their vocabulary acquisition strategy and sometimes a Chinese trigger word or phrase may activate their simulated experience, while the English language prompts might not elicit simulations as expected due to individual differences which, to a large extent, are concerned with one's personal experience (bodily or cultural), one's knowledge of English, personality, mood, etc.. This might explain why the test group performs no better, even a bit worse than the control group. The ambiguous experimental results do not necessarily show that adding prompts is of no use, but in some way tells us that the selection of prompts is of vital importance. After all, based on students' feedback, some prompts, whether they are English or Chinese, appear to work. Here, we summarize the regularities for the use of prompts: (1) to ensure that the English prompts are familiar to students, if not, use Chinese prompts instead; (2) to ensure that the simulated experiences activated by English prompts are shared by students, or at least, the majority of students; (3) to ensure that English prompts are able to activate clear and detailed simulations, and if one prompt fails to do so, use a series of prompts that can be combined to form a story. The research findings give teachers some enlightenment on the pedagogical strategies that might encourage less proficient learners to incorporate perceptual simulations in their study habits so as to improve their idiomatic and automatic use of L2 vocabulary, which merit further exploration.

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Appendix 1

50 esoteric literary words

1. appalling 2. desolation 3. lucrative 4. hideous 5. bleak 6. forlorn 7. aspiration 8. macabre 9. abominable 10. disgrace 11. filth 12. allude to 13. lacerate 14. pretentious 15. leprous 16. misshapen 17. shabby: 18. uncomely 19. grime 20. gully 21. dingy 22. preposterous 23. perpendicular 24. precarious 25. streak 26. peep 27. patina 28. sightly 29. trimming 30. laborious 31. incessant 32. whirl 33. incomparable 34. titanic 35. aberrant 36. uncompromising 37. inimical 38. grotesquery 39. in retrospect 40. diabolical 41. concoct 42. insensate 43. deface 44. inadvertence 45. unfathomable: 46. enigmatic 47. dogmatic 48. appreciable 49. mellow 50. depravity

Appendix 2

Questionnaire for the test group and the control group

1. Do you think the mnemonic device you used to memorize the given words is effective or not? [single choice question]

A. Very effective

B. Somewhat effective

C. Not effective

D. I don't know

2. Is it your habit to translate the meaning of English word into its Chinese equivalent? [single choice question]

A. Yes

B. Maybe

C. No

3.When you see the meaning of English word, will you form simulation, that is, imagine what is described by the word in your mind? [single choice question]

A. Yes

B. Sometimes

C. No

4. If you do not translate English words into Chinese, will you memorize the meaning of words or not? [single choice question]

A. Yes

B. Maybe

C. No

5. Will you apply the mnemonic device of simulated experience in your English study? [single choice question]

A. Yes

B. Maybe

C. No

6. What are the other mnemonic devices you use to memorize English words? [filling in the blanks]