# Research on Priming Experiments' Validity in Language Education

JI Xiaowen

University of Shanghai for Science and Technology, China

Received: November 3, 2025 Accepted: January 15, 2026 Published: March 31, 2026

**To cite this article:** JI Xiaowen. (2026). Research on Priming Experiments' Validity in Language Education. *Asia-Pacific Journal of Humanities and Social Sciences*, 6(1), 219-227, DOI: 10.53789/j.1653-0465.2026.0601.025.p

**To link to this article:** https://doi.org/10.53789/j.1653-0465.2026.0601.025.p

*This research is supported by the 2026 Project of University of Shanghai for Science and Technology for Cultivating Young Scholars in Humanities and Social Sciences.*

**Abstract:** Inconsistencies exist in the results obtained in the psycholinguistic studies of bi-/multilingualism, and contributing to this phenomenon is the lack of validity in research methods, especially the frequently used priming experiments. Given this, the effective arrangements of priming experiments for studying the conceptual representation of trilinguals are investigated, and concrete operations from such perspectives as experiment participants, materials and procedure are sorted out in a detailed way. It is hoped that scientificality, feasibility and reproducibility of priming experiments could thus be further improved, and that future relevant studies could gain insights when designing methods, so as to enhance reliability of the research results, and to enhance the effectiveness of language education.

**Keywords:** trilinguals; conceptual representation; priming; validity; language education

**Notes on the contributor:** JI Xiaowen holds a doctorate degree in linguistics, and she is now working in University of Shanghai for Science and Technology. Her major research interests lie in language cognition and processing, and interpreting studies. Her email address is jixiaowen@usst.edu.cn.

## 1. Introduction

Since 1960s, the psycholinguistics of bilingualism has attracted wide attention from scholars at home and abroad. However, its core academic issue, bilinguals' mental lexicon representation structure, has yet gained consensus from the academia, let alone other relevant issues as language understanding, processing and production. Against the background of an accelerating globalization pace, multilingualism has become increasingly prevailing, and citizens' multilingual competence has been among those common locations where governments' efforts lie. Conducting psycholinguistic studies into multilingualism will contribute its share to the

construction of a community with shared future for mankind. Nevertheless, despite the fact that relevant studies are on the increase, their results are even more varied, compared with results of studies into psycholinguistics of bilingualism. A careful investigation into the reasons enables one to discover that the methods utilized by some scholars lack validity to some extent, apart from the fact that mental lexicon representation, language understanding, processing, and production have a high degree of abstraction.

Priming experiments can be conducted to investigate many research problems in psycholinguistics, and different experiment aims call for different operations. Mental lexicon representation structure lies at the core of psycholinguistics, but varied results have been elicited from existing studies. This current paper takes mental lexicon representation structure in psycholinguistics of trilingualism as the focus. It is generally accepted in academia that mental lexicon representation consists of two different yet closely interconnected parts, namely conceptual representation and lexical representation (Schiller & Verdonschot, 2015; Schiller, 2021). Conceptual representation refers to the storage pattern of lexical meanings in mental lexicon, whereas lexical representation refers to the storage pattern of the orthographic and phonetic information of words in mental lexicon (Chen, 2006; Li, 2019).

This study probes into research methods of meaning related psycholinguistics of multilingualism, and focuses on conceptual representation of trilinguals' mental lexicon representation. Specifically, the research questions are as follows. How to improve the validity of priming experiments, when examining trilinguals' conceptual representation structure? In the following, based on a review of existing relevant studies and practical project experience (Ji & Mei, 2024), this paper sorts out detailed arrangements of priming experiments in terms of participants, materials and steps, with a view to promoting the development of conceptual representation research in psycholinguistics of multilingualism from the perspective of research methodology.

## 2. Literature Review

Some studies at home and abroad can be found concerning the scientific operations of priming experiments. Dong (1998) proposed the validity conditions of priming experiments for exploring bilingual mental lexicon, from such perspectives of the interference process, the relatedness ratio, the ratio of non-words, semantic relations, interpretations of repetitive priming, masking measures et al. Chen (2001) held that problems with methods of studying bilingual semantic representation cannot be neglected, and pointed out at least three of them, namely low validity of methods, inconsistent choices of participants, insufficient attention paid to selection of experiment tasks. Bodner & Masson (2001) indicated that the masked repetition priming effect in lexical decision tasks are influenced by the validity of primes (the ratio of repetitive primes to non-related primes). Necessity of collecting baseline reaction time data in priming experiments is also empirically investigated (Dong & Yuan, 2008); Ihrke & Behrendt (2011) clarified that the presentation pf stimulus words in a totally randomized way exerts huge influence over gaining reliable results; the traditional semantic priming test methods using a single SOA were questioned and improved (Li & Pu, 2014); Tytus & Rundblad (2016) pointed out some differences of existing studies in terms of data analysis and language proficiencies of the bilingual participants.

Although previous studies have put forward some concrete operable practice regarding material selection, avoidance of interference, SOA arrangements et al., and that necessity of selection of participants and tasks,

collection of baseline reaction time and material presentation has been highlighted in existing research, the remaining problems still await being addressed. First, some relevant studies only emphasized or proved the importance of the effectiveness of priming experiments and pointed out the potential improvements of some existing studies, but little or no concrete consideration was sorted out. Second, some research with concrete consideration only involved the exploration of one singe operation, rather than in a systematic fashion. Third, prior studies mainly focused on the investigation into validity of priming experiments to study bilingual mental lexicon, whereas inadequate attention was paid to experiment validity to delve into trilinguals' mental lexicon.

In light of the above, the current study aims to construct a validity framework of priming experiments for exploring trilinguals' conceptual representation, with concrete operable practice sorted out in a systematic way, from such perspectives of participants, materials and process.

## 3. A Validity Study into Experiment Participants

When trilinguals' conceptual representation is the research aim, participants need to first conform to the two following standards. The language proficiency order of the participants should be fixed. Participants are capable of accomplishing word naming tasks in all three languages. The first point is the fundamental condition in terms of the homogeneity degree, and all the participants can only be the same type of participants when they meet this standard. The second point is related to experiment tasks, which is to be discussed later in this article.

Besides, participants at best meet these two other criteria. It is better if the participants speak fewer languages apart from the three, and have lower proficiency in any additional languages. This is a further screening concerning homogeneity, as the knowledge of another language is not only a change regarding the number of languages known to a speaker, but also brings about essential transformations to the language system (Herdina & Jessner, 2000, 2002; Jessner, 2013).

The higher degree of homogeneity of participants, the better. Homogeneity can be demonstrated from such factors as proficiency of the three languages, the acquisition and using environments of the three languages, the ages of acquisition of the three languages, and the durations of staying in relevant countries or regions. This goes another step further in selecting the homogeneous participants.

If a study is to investigate the dynamic developments of conceptual representation with L3 improvement, groups of participants with the only between-group difference being L3 level should be recruited. This is conducive to the observance and description of the dynamic trajectories, and to the accumulation of knowledge of understanding the impact of L3 proficiency on trilinguals' conceptual representation.

In order to recruit participants who best suit the above conditions, qualitative and quantitative methods can be combined to obtain information and do the screening. First, conduct interviews with teachers of potential participants, so as to gain necessary information about the educational projects and potential participants, narrow the selection range, and design appropriate and targeted language learning history questionnaires. Second, design the "language learning history questionnaires". The questionnaires should at least include basic information, language learning and using experiences (modes, ages, durations of staying in relevant countries or regions, conditions of gaining certificates, relevant work experiences, contexts of using different languages etc.), self-ratings of all using languages (self-ratings of the overall language proficiencies, self-ratings of the word

recognition and naming capabilities involved in word naming tasks), etc. In addition, to explore dynamic development of conceptual representation, necessary adjustments should be made to the questionnaires according to the concrete situations of different groups. Third, distribute the questionnaires, make data analysis and contrasts based on questionnaire information, and select participants who best meet the above criteria.

## 4. A Validity Study into Experiment Materials

Selection of appropriate materials is of vital significance to the validity of experiments, as well. Great attention is paid to the determination of semantic relations in prime-target pairs, verification of whether the conceptual level of participants' mental lexicon is activated, and the concrete sources of materials.

First, concerning the semantic relations between the prime words and the target words, commonly adopted are word associates, category membership, and relations based on Jackendoff's (1990) semantic theories. Dong et al.'s (2005) viewpoints that word associates can't meet the function of diagnosing semantic priming, and that category membership can't be effectively carried out, are agreed upon. Jackendoff's (1990) semantic categorization of verbs and other words are operable, but whether the six categories contained can all diagnose the conceptual representation structure still remains undetermined. "First response questionnaires" can be distributed, to invite potential participants to give the first associative words of the prime words. Associative strength (the number of expected responses divided by the total number of collected responses) can be calculated, and if the strength for any type of prime-target pairs exceeds 50% (which is the associative strength for word associates according to de Groot and Nas (1991), that pair should not be included in the experiments. Otherwise, it would make no difference from using word associates as prime-target pairs. However, Dong et al. (2005) still included this type of materials, which may raise the possibility of participants noticing the semantic relations of prime-target pairs, thus increasing the hopefully avoidable attentional priming.

Besides, as to check whether the prime-target pairs are able to activate the conceptual level of participants, two types of prime-target pairs can be added, namely word associates and similar-form pairs. As associative priming may arise from both lexical and conceptual levels, and that form priming can only come from lexical level activation, if associative priming is no smaller than form priming, the effectiveness of the materials for exploring trilinguals' conceptual representation is proved.

Concerning the selection sources of the materials, the first step is to interview teachers of potential participants, which can help with mastery of participants' word naming capabilities (especially L3 proficiency), the commonly used textbooks, the appropriate writing and presentation form of words, etc. Only materials selected based on this information can aid the accomplishment of experiment targets. For instance, if participants with a low L3 level are invited to finish word naming tasks, consideration should be given to select materials from the most frequently adopted textbook in their L3 learning process; if the materials are written in Chinese, the sequence of learning simplified form and traditional characters should also be taken into account, to better control variants in terms of material selection and presentation.

# 5. A Validity Study into Experiment Procedure

## *5.1 Paradigm*

In real operation, there can be various types of the cross-language priming paradigm, whether semantic priming, form priming or repetition priming, whether masked or unmasked, etc.

In priming experiments targeting at trilinguals' conceptual representation, semantic priming paradigm (Zeelenberg & Pecher, 2003; Tytus & Rundblad, 2016) should be utilized. Additionally, Gollan et al. (1997) found that masked priming paradigm is more insensitive to semantic factors than unmasked priming paradigm; Dong (1998) indicated that attentional priming can be discarded through keeping appropriate non-word and relatedness ratios and proper stimulus onset asynchrony (hereafter SOA for short), and that masking measures are not only unnecessary, but may interfere with the priming experiments exploring conceptual representation structure. A combination of a critical review of existing studies and the current research aim leads to the adoption of the cross-language unmasked semantic priming paradigm.

## *5.2 Tasks*

Participants are required to accomplish such tasks as lexical decision, category verification, word naming, etc. Among these three most commonly seen and discussed task types, word naming is the most appropriate for the aim set for this research.

According to many studies (Potter et al., 1986; Kroll & Stewart, 1994), word naming does not involve conceptual access, and this offers good conditions for delving into the possible priming effect in conceptual level. Controlling the associative strengths between prime words and target words can minimize the priming amount in the lexical level, thus prompting the thought that the priming effect detected during experiments is mostly from the conceptual level.

Lexical decision task is not appropriate for conceptual semantic priming investigations. Research (e. g. Zeelenberg & Pecher, 2003; Liu & Liu, 2005) clarified that the source of the priming effect detected through lexical decision tasks is unclear, as it may activate mostly the conceptual level or the lexical level. Besides, de Groot et al. (2002) pointed out that lexical decision is not only a task involving word recognition, but more importantly one involving differentiation. Differentiation is influenced by a range of variants, which means that an effect thus arisen may not reflect the actual process of word recognition. These variants include the frequency of stimulus words, participants' familiarity with the words, the meanings of the words, etc. Meantime, for research that aims to discover the dynamic trajectories of semantic priming, participants with lower language levels need to take part; however, in lexical decision tasks, these participants may feel hard to distinguish whether it is a non-word or a word that hasn't been learnt, and this factor also influences the validity of relevant data.

Category membership is also not applicable. It may take many specific forms, such as inviting the participants to decide on whether it is a living organism or a kind of furniture. In this process, it is easy for participants to discover and get accustomed to this task pattern, thus generating expectations even before words

appear, and this kind of attention and the possible adoption of strategies are what researchers hope to avoid.

Additionally, lexical decision and category membership are tasks that involve making judgments, and these tasks involve explicit memory, which should be avoided to the greatest extent in conceptual representation investigations, as conceptual representation by nature is implicit (Pavlenko, 2009).

### *5.3 Procedure and Operations*

In terms of the experiment operations on the macro level, priming experiments should involve several stages of tests, with the following being the aims: test whether the experiment materials are within the word naming abilities of the participants and adjust materials accordingly; gain data under priming paradigms; obtain baseline data without priming; differentiate between the conceptualizing stage and the production stage in word naming, to make further validity checks on experiment validity. Name the above four stages as pre-test, priming test, baseline test, and post-test, respectively (as shown in Figure 1).

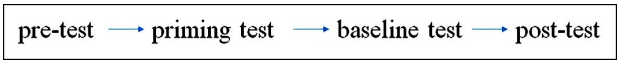


Figure 1: The flowchart illustrating different test stages in priming experiments

First, concerning the word naming task, whether the participants are capable of it directly influences the validity of the data gained, especially when the participants have low language proficiencies. Therefore, the pre-test is of utmost significance. Second, priming test is the most important among all these stages, as it is dictated by the experiment aims. Third, priming effect is calculated from some baseline data, which means that collecting the same group of participants' baseline data of the same batch of materials is the prerequisite of calculating the priming effect. Some earlier studies matched the material frequencies (e. g. Schiller, 2004; Elston-Guettler & Friederici, 2005) or chose materials that matched each other regarding baseline reaction time (e. g. Dong et al., 2005). However, these two methods should be questioned in terms of their scientificality and feasibility. Dong & Yuan (2008) revealed that there are other factors that influence reaction time data of behavioral experiments, apart from word frequencies. Selecting materials that match each other concerning baseline reaction time can't be accomplished satisfactorily, given its feasibility and reproducibility, for two specific reasons. The first is that materials that match each other for one group of participants may not show the same tendency for another group of participants, thus reducing the reliability of the research results, and the second is that determining materials from two languages that have similar baseline data is a difficult task, especially when a large quantity of stimulus words are needed, or when three or more languages are involved, or when participants with different language levels are recruited. Comparatively speaking, recording the same group of participants' baseline data, and then making one-on-one calculations with data from priming tests, have stronger operability and validity, when the individual differences of participants can be considered and balanced. Fourth, as the word naming task involves conceptualization and production stages, post-test is needed to differentiate between the two and determine the source of the priming effect. Delayed naming can be adopted. Participants are invited to accomplish word naming after the conceptualization stage, and cross-language differences can be calculated to see whether they are significant. If the cross-language differences are not significant, the priming effect is from the conceptualization stage, thus reflecting the conceptual representation structure. Balota & Chumbley (1985) advocated that when

exploring the conceptual level through word naming, this step should be included in the experiment, which, however, has not received due attention from some other studies.

Besides, the time arrangements for participants should also be appropriate. To let the same group of participants avoid being tested frequently, so that accuracy of data can be ensured without the interference of strategic priming, participants who meet the above criteria can be divided into two groups. As the data gained from the priming test are compared with the data gained from the baseline test, the same group of participants should take part in both; the other group of participants are invited to participate in pre-test and post-test. The two test steps that one group of participants take part in should have a time interval of at least two weeks, to avoid interference of participants' memory; the two groups of participants should not display significant statistical differences concerning language proficiencies, capabilities related to word naming, language learning histories, etc.

In terms of the experiment operations on the micro level, as three languages are involved, the balance and presentation processes are more complicated than in the bilinguals' case. Given that the prime-target pairs concerning three languages can form nine language pairs (AA, AB, AC, BA, BB, BC, CA, CB, CC, with the first letter indicating the language of prime words and the second letter indicating the language of target words), and that the participants may easily experience fatigue and attentional priming if they were invited to practice word naming of the same material under nine language conditions, it is feasible to divide the group of participants who take part in priming and baseline tests into three sub-groups, namely AB sub-group, AC sub-group and BC sub-group. Each sub-group contains four language conditions involving two languages, and Latin Square design can be used to balance the presentation sequence of the four types of prime-target pairs in each sub-group, listed as follows in Table 1.

| | AB sub-group | AC sub-group | BC sub-group |
|---|---|---|---|
| 1 | AA BB BA AB | CC AA AC CA | BB CC CB BC |
| 2 | BB AB AA BA | AA CA CC AC | CC BC BB CB |
| 3 | AB BA BB AA | CA AC AA CC | BC CB CC BB |
| 4 | BA AA AB BB | AC CC CA AA | CB BB BC CC |

**Table 1 The Latin square design for language conditions of the prime-target pairs**

## 6. Further Educational Implications

Priming experiments and their arrangements offer us a window into language education. Foreign language learning has been approached from a wide array of perspectives, and this research is from a psycholinguistic angle. It is held that learners have their mental lexicon representation restructured throughout the learning process, and that the reshaping can take place in both conceptual and lexical levels of mental lexicon representation.

Given the wide use of priming experiments, their scientific use is of paramount significance. All steps of priming experiments may exert influence over the data gained, and data processing and analysis offer direct

answers to research questions concerning how languages are learnt and taught. Some earlier disagreements of previous studies may be attributed to differing experiment setups and operations. Thus, meticulous consideration should be given to each and every arrangement of priming experiments, and relevant research is hugely crucial.

A further step is to design relevant language teaching and learning activities that accelerate the process. Further studies need to be carried out in this regard, to assist with designing the activities and with testing their validity, so that language education can be better achieved.

## 7. Conclusion

Arrangements of the priming experiments for studying trilinguals' conceptual representation are discussed from the perspectives of participants, materials, and procedure. Future relevant investigations include further improvement of the above-mentioned validity conditions, more detailed discussions of validity conditions for the same research aim, investigations into validity conditions of priming experiments for exploring other research questions in psycholinguistics. It is hoped that relevant research methods can be gradually improved to increase the reliability of research results.

### References

Balota, D. A., & Chumbley, J. I. (1985). The locus of word-frequency effects in the pronunciation task: Lexical access and/or production? *Journal of Memory and Language*, 24(1), 89-106.

Bodner, G. E., & Masson, M. E. J. (2001). Prime validity affects masked repetition priming: Evidence for an episodic resource account of priming. *Journal of Memory and Language*, 45(4), 616-647.

CHEN Baoguo. (2001). Theories and methods of bilingual conceptual representation. *Journal of Research on Education for Ethnic Minorities*, (1), 83-89.

CHEN Shifa. (2006). Semantic representation in bilingual mental lexicon and SL vocabulary acquisition. *Foreign Language and Literature Studies*, (1), 6-11.

De Groot, A. M. B., Borgwaldt, S., Bos, M., & Van den Eijnden, E. (2002). Lexical decision and word naming in bilinguals: Language effects and task effects. *Journal of Memory and Language*, 47(1), 91-124.

De Groot, A. M. B., & Nas, G. L. J. (1991). Lexical representation of cognates and noncognates in compound bilinguals. *Journal of Memory and Language*, 30(1), 90-123.

DONG Yanping. (1998). On the experiment methods of bilingual mental lexicon in psycholinguistics: Validity conditions of priming experiments. *Journal of PLA University of Foreign Languages*, (5), 1-8.

DONG Yanping, GUI Shichun, & MacWhinney, B. (2005). Shared and separate meanings in the bilingual mental lexicon. *Bilingualism: Language and Cognition*, 8(3), 221-238.

DONG Yanping, & YUAN Yuan. (2008). The necessity of collecting baseline reaction time in priming experiments. *Psychological Science*, (1), 192-194.

Elston-Guettler, K. E., & Friederici, A. D. (2005). Native and L2 processing of homonyms in sentential context. *Journal of Memory and Language*, 52(2), 256-283.

Gollan, T. H., Forster, K. I., & Frost, R. (1997). Translation priming with different scripts: Masked priming with cognates and noncognates in Hebrew-English bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 23(5), 1122-1139.

Herdina, P., & Jessner, U. (2000). The dynamics of third language acquisition. In J. Cenoz & U. Jessner (Eds.), *English in Europe: The Acquisition of a Third Language* (pp. 84-98). Clevedon: Multilingual Matters.

Herdina, P., & Jessner, U. (2002). *A dynamic model of multilingualism*. Clevedon: Multilingual Matters.

Ihrke, M., & Behrendt, J. (2011). Automatic generation of randomized trial sequences for priming experiments. *Frontiers in Psychology*, 2, 225.

Jackendoff, R. (1990). *Semantic Structure*. Cambridge, MA: MIT Press.

Jessner, U. (2013). Dynamics of multilingualism. In C. A. Chapelle (Ed.), *The Encyclopedia of Applied Linguistics* (pp. 1798–1805). Chichester: Wiley-Blackwell.

JI Xiaowen & MEI Deming. (2024). Research on Dutch-English-Mandarin trilinguals' L3 conceptual representation features. *Journal of Xi'an International Studies University*, (1), 14–19.

LI Ming. (2019). An ERP study on the influence of L2 proficiency and part of speech on the semantic representation of bilingual mental lexicon. *Technology Enhanced Foreign Language Education*, (2), 90–96.

LI Ming, & PU Maohua. (2014). On the semantic representation of bilingual mental lexicon: Based on semantic priming test method using several SOAs within the 0-MinLCLASP interval. *Foreign Languages and Literature*, (4), 76–80.

LIU Weizhi & LIU Mingbo (2005). The priming effects experiments of the accessing mechanism of Chinese-English bilinguals. *Psychological Exploration*, (4), 40–44.

Kroll, J. F., & Stewart, E. (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, 33(2), 149–174.

Potter, M. C., Kroll, J. F., Yachzel, B., Carpenter, E., & Sherman, J. (1986). Pictures in sentences: Understanding without words. *Journal of Experimental Psychology: General*, 115(3), 281–294.

Schiller, N. O. (2004). The onset effect in word naming. *Journal of Memory and Language*, 50(4), 477–490.

Schiller, N. O. (2021). *The mental lexicon*. In M. Aronoff (Ed.), *Oxford Bibliographies in Linguistics*. Oxford: Oxford University Press. https://www.academia.edu/60326727/The_Mental_Lexicon.

Schiller, N. O., & Verdonschot, R. (2015). Accessing words from the mental lexicon. In J. R. Taylor (Ed.), *The Oxford Handbook of the Word* (pp. 481–492). Oxford: Oxford University Press.

Tytus, A. E., & Rundblad, G. (2016). Cross-language priming as a means of investigating bilingual conceptual representations: A comparison of visual and auditory modality. *Linguistic Approaches to Bilingualism*, 6(4), 440–466.

Zeelenberg, R., & Pecher, D. (2003). Evidence for long-term cross-language repetition priming in conceptual implicit memory tasks. *Journal of Memory and Language*, 49(1), 80–94.

(Editors: ZOU Ling & JIANG Qing)