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Applying priming methods to L2 learning, teaching and research

Insights from Psycholinguistics

Edited by
Pavel Trofimovich
Kim McDonough

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Introduction

CHAPTER 1

Using priming methods to study L2 learning and teaching*

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Introduction

The field of second language (L2) acquisition is witnessing increased interest in research investigating psycholinguistic bases of language learning. A search in the *PsychInfo* abstract database for the period 2006 to 2010, for example, yields 340 citations of studies investigating psycholinguistic (processing) aspects of L2 acquisition, a nearly 30% increase from the number of studies (266) published on similar and related topics between 2001 and 2005. Despite this heightened interest in psycholinguistics, the majority of published psycholinguistic research has been purely theoretical and has not been written for researchers and teachers interested in applied and pedagogical aspects of L2 acquisition. The goal of this volume is to fill this gap.

This volume features a collection of empirical studies which use priming to explore the comprehension, production, and acquisition of L2 phonology, syntax, and lexicon. The term "priming" refers to the phenomenon in which prior exposure to specific language forms or meanings either facilitates or interferes with a speaker's subsequent language comprehension or production. Psycholinguists frequently use priming to examine how the input available to learners is related to their comprehension and production of the L2. To give a few examples, auditory priming reveals how learners perceive L2 speech while semantic priming demonstrates how learners access and use their L2 lexicon. Syntactic priming sheds light on L2 learners' knowledge of grammar and how that knowledge develops over time.

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* Some portions of this chapter appeared in an entry on priming research in the Wiley-Blackwell *Encyclopedia of Applied Linguistics* and are reprinted with permission.

To date, however, most priming research in L2 acquisition has appeared in specialized psychology journals and has been written in language which is generally inaccessible to researchers and practitioners working in language teaching and learning. At least one reason for this is that most publications which feature priming methods focus on theoretical issues and are written with cognitive psychologists in mind. Therefore, the principal contribution of this book is to bring together the various strands of priming research into a single volume that specifically addresses the interests of researchers, teachers, and university students interested in L2 teaching and learning. By way of introduction, we first provide some background information about the nature of priming methods and then discuss the historical origins of priming research along with its core issues and findings.

What are priming methods?

Priming methods are one of the predominant experimental paradigms employed to study cognitive aspects of language learning and use. These methods originated in psycholinguistics, but have become increasingly common in applied linguistics over the past two decades. The term "priming" refers to the phenomenon in which prior exposure to specific language forms or meanings either facilitates or interferes with a speaker's subsequent language comprehension or production. Priming is believed to be an implicit process that occurs with little awareness, and this implicit nature makes priming part of a larger system of human memory – implicit memory. Briefly, implicit memory involves memory for cognitive operations or procedures which are learned (often without much explicit, conscious effort) through repeated use. As an implicit cognitive phenomenon, priming suggests that language users' prior experience with language shapes their subsequent language use, which is often interpreted as a form of implicit learning (learning without much conscious effort and awareness).

Although the term "priming" describes all situations in which prior language exposure influences subsequent language processing, different types of priming have been defined in the literature (McDonough & Trofimovich 2008). For instance, language users will access the meaning of the word *cat* more quickly if they recently read the word *dog* as opposed to an unrelated word, such as *shoe*. By activating the meaning of *dog* in comprehension or production, speakers more quickly activate the meaning of *cat* due to the shared meaning between the two. This kind of priming is called **semantic priming**, and it describes the tendency for speakers to process a word more quickly and/or more accurately when they have been previously exposed to a word related in meaning. In an example of a different kind of priming, if a speaker uses a prepositional dative, such as "the

teacher gave a bad mark to the student", later in the conversation her interlocutor is likely to produce another prepositional dative ("the office worker sent her resignation letter to the manager") rather than a double-object dative ("the office worker sent the manager her resignation letter"). This type of priming is called **syntactic priming** because it refers to the tendency for speakers to produce a syntactic structure that appeared in the recent discourse, as opposed to an equally acceptable alternative. Another example of priming is called **auditory priming**. For example, if a speaker hears a particular word spoken by her interlocutor, she is likely to understand this word faster and more accurately when it is used again in the same conversation. Auditory priming thus describes the tendency for people to process a spoken word or word combination more quickly and more accurately when they have had previous exposure to that word or word combination in speech.

Historical origins of priming research

One of the first observations of priming as a phenomenon is attributed to James Cattell (1860–1944), an American psychologist who between 1883 and 1886 worked in Wilhelm Wundt's psychological laboratory in Leipzig, Germany. Cattell's time in Germany coincided with what has been called the Golden Age of the chronometric approach to the study of the human mind (Meyer, Osman, Irwin & Yantis 1988). The chronometric approach relies on the use of reaction times (response latencies) to study various mental processes, including language comprehension and production. While in Leipzig, Cattell conducted numerous experiments of this kind, examining the speed with which people reacted to letters, words, and sentences in their first language (L1) and their L2. In one experiment, Cattell (1885/1947) discovered that it takes people about twice as long to read a string of unrelated words than to read words in a sentence. This demonstration suggested that a meaningful context has a facilitatory effect on the processing of individual words.

It appears that the term "priming" was first used by Feldman and Weld (1939), who defined it as a state of attentional preparedness for perception (e.g., a decision to wake up early increases the likelihood that the alarm will be heard), and later by Lashley (1951) who used it to describe internal activation or readiness of linguistic elements in speech production (i.e., preparing a structural configuration of an utterance before producing it). However, in the sense we use it now, the term "priming" did not become mainstream until the early 1960s when Segal and Cofer (1960) published a study which replicated and extended an earlier experiment by Storms (1958). Segal and Cofer demonstrated that when language

users are exposed to a list of words, they are more likely to reuse these words to perform a subsequent task. They referred to this phenomenon as priming. Since then, priming has been used as an experimental technique to address many interesting questions about how languages are organized in the human mind and how people learn them. Examples of such questions can be found in seminal early investigations by Meyer and Schvaneveldt (1971) on semantic priming and by Bock (1986) on syntactic priming, and in recent reviews of priming literature by McNamara (2005), McDonough and Trofimovich (2008), and Pickering and Ferreira (2008). Beyond the study of language, examples of priming research in the wider context of cognitive psychology can be found in edited volumes by Bowers and Marsolek (2003) and Kinoshita and Lupker (2003).

The history of priming research is closely tied to the development of instruments that have allowed researchers to present different kinds of language materials to participants and to measure their responses to these materials. For example, Cattell used a gravity chronometer to present language materials (e.g., letters or words) to participants. The gravity chronometer was an early version of a tachistoscope, an instrument which was used for over 100 years in psycholinguistic research to present visual stimuli to participants rapidly, for a given amount of time (Benschop 1998). The Cattell version of the gravity chronometer featured an electromagnet controlling a screen; when the electric current flowing through the spiral of the electromagnet was broken, the screen would fall and would reveal an object to be seen by the participant (for example, a card with a word written on it). To record participants' reaction times, Cattell used another sophisticated device of the day – a Hipp chronoscope (depicted in Cattell 1886a). The chronoscope was an electromechanically controlled timer which allowed researchers to record reaction times with millisecond accuracy when participants pressed a telegraphic key or even when they simply spoke in response to a stimulus (Benschop & Draaisma 2000; Schmidgen 2005).

Yet another early technological invention used in psycholinguistic research was a memory drum. This device consisted of a rotating kymograph drum which showed lists of words or sentences, or series of pictures for fixed intervals of time so that participants could view them and respond to them individually (Haupt 2001). According to Haupt, the memory drum was the standard way of presenting language materials in research on memory and language for almost 100 years, from about the 1890s to approximately the mid 1970s, when affordable computers and monitors became available (Bailey & Polson 1975). Over the past several decades, nearly all psycholinguistic research, including priming research, has been carried out by using powerful personal computers running multifunctional psychological software which allows researchers to present various kinds of stimuli to participants (e.g., images, texts, audio, video) and

to measure participants' reactions to these stimuli (e.g., in terms of accuracy, speed, duration). Examples of common psychological presentation software are E-Prime (Schneider, Eschman & Zuccolotto 2002), DMDX (Forster & Forster 2003), PsyScope (Cohen, MacWhinney, Flatt & Provost 1993), and SuperLab (Cedrus Corporation 2008).

Core issues and findings

Although a comprehensive review of the priming literature is not possible due to space limitations, this section includes a brief outline of the main strands of semantic, syntactic, and auditory priming research, with a particular emphasis on L2 processing and learning.

Semantic priming

As was discussed earlier, semantic priming is defined as the tendency for language users to process a word more quickly and/or more accurately when they have been previously exposed to a word related in meaning. For example, the word *table* will be responded to faster if the word *chair* has been heard or seen recently. This suggests that semantically related words (like *table* and *chair*) are "stored" together or are somehow linked in the mind of a language user and that both get activated by virtue of having such links.

In the last three decades, researchers have relied on semantic priming to explore the nature of semantic networks in the mental lexicons of L1 and L2 speakers. Some researchers have used semantic priming to understand how bilinguals organize words in their two languages (e.g., Basnight-Brown & Altarriba 2007; for reviews, see Altarriba & Basnight-Brown 2007 and Williams & Cheung, this volume). For instance, if English-French bilinguals show semantic priming for word translations (e.g., *chien-dog* in French and English), then this would indicate that they organize the meanings of words in their two languages in a shared, interdependent manner. Results from this line of research are complex; they suggest that the manner in which bilinguals organize and access the meanings of words in their two languages depends on many factors, including the specific nature of words being examined (de Groot & Nas 1991), bilinguals' proficiency in the two languages (Grainger & Beauvillain 1988), and the age at which they start learning their L2 (Silverberg & Samuel 2004). To illustrate, Silverberg and Samuel showed that only early, but not late, Spanish learners of English showed semantic priming for English-Spanish word pairs such as *nail* and *tornillo* ("screw" in Spanish).

Because L2 words (like *nail*) facilitated the processing of L1 words (like *tornillo*) for the early learners, these learners appear to store the meanings of semantically related words across the two languages in a shared manner. In contrast, late learners appear to store such meanings separately.

Other researchers have investigated whether L1 and L2 speakers differ in their patterns of semantic priming in a language (e.g., Devitto & Burgess 2004; Frenck-Mestre & Prince 1997; for a review, see McDonough & Trofimovich 2008). For example, if L2 speakers do not show priming for word pairs like *table* and *chair*, while L1 speakers do, then this would indicate that L2 speakers store and access these words differently from L1 speakers. The findings from this strand of research indicate that L2 speakers who have reached a high level of proficiency can access and use the semantic information in the same way as L1 speakers do. Frenck-Mestre and Prince, for example, found that the native English speakers and the more proficient French learners of English in their study showed semantic priming for semantically related words in English (e.g., *wet-dry*). In contrast, the less proficient learners did not.

Syntactic priming

As its name suggests, syntactic priming refers to the tendency for speakers to produce a syntactic structure that appeared in the recent discourse, as opposed to an equally acceptable alternative. For instance, speakers are more likely to produce a passive sentence if they recently heard a passive sentence or if they themselves produced one earlier in the discourse. In fact, speakers tend to produce the recently encountered syntactic structure even if the initial and subsequent utterances do not have any of the same lexical items, phonological or prosodic properties, or shared semantic information. For example, the initial utterance "the teacher gave a bad mark to the student" and a subsequently produced sentence "the office worker sent her resignation letter to the manager" are unrelated in terms of their lexis, phonology, or semantics, but share a common syntactic structure (subject–verb–direct object–prepositional object), which is responsible for a priming effect. This implies that it is easier for speakers to access a syntactic structure that has been recently activated than to access a completely new structure, and that speakers tend to implicitly "fine-tune" their use of syntactic structures in response to recent experience with language.

Similar to the semantic priming studies that explore how bilinguals organize their L1 and L2 lexicons, bilingual syntactic priming research has investigated how syntactic information is represented. One possibility is that bilinguals store L1 and L2 syntactic information separately, while another possibility is that at least

some syntactic information used in both languages is shared. The separate-syntax account predicts that cross-language priming would not occur since activation of linguistic information in one language would not affect the linguistic information of the other language. However, the shared-syntax account predicts that cross-language priming would occur as activation of the syntactic structure in one language would facilitate production of the related structure in the other language. Cross-language syntactic priming research has demonstrated that syntactic priming occurs cross-linguistically, which supports the shared-syntax account (e.g., Bernolet, Hartsuiker & Pickering 2007; Hartsuiker, Pickering & Veltkamp 2004; Salamoura & Williams 2007; Schoonbaert, Hartsuiker & Pickering 2007). Current research is exploring how L2 proficiency impacts the development and strength of shared syntactic representations.

Other researchers have explored the occurrence of syntactic priming in L2 speech production, which is within-language priming. The initial question asked in within-language L2 syntactic priming research was simply whether it occurred, as the previous research had been carried out with L1 speakers. Researchers initially focused on demonstrating that priming occurred in L2 speech production for a variety of equally acceptable (i.e., grammatically correct) structures, such as dative constructions (Gries 2005; McDonough 2006; Schoonbaert et al. 2007), actives and passives (Kim & McDonough 2008), and alternation between adjective + noun phrases and relative clauses (Bernolet et al. 2007). Subsequent studies have explored whether syntactic priming occurs for alternation between two structures in an L2 learner's interlanguage (McDonough & Kim 2009; McDonough & Mackey 2008). In this line of research, syntactic priming is being used to encourage L2 learners to produce the developmentally-advanced structures as opposed to the less advanced or non-targetlike forms.

Auditory priming

As was mentioned earlier, auditory priming refers to implicit, unintentional facilitation in auditory processing of language. This facilitation is most often observable as a time and/or accuracy benefit for repeated versus non-repeated spoken words and word combinations. For example, in a typical auditory priming experiment, participants are first exposed to a set of spoken words and then are tested on another set containing both words that were previously heard and words that are new to the task. A common finding here is that participants show a repetition effect, responding faster and/or more accurately to previously-heard words compared to new words.