Running head: L2 SPEECH PRODUCTION

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Psycholinguistic Perspectives on Second Language Speech Production

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Cognitive research on bilingualism has shown that a bilingual's two languages are more open and interactive than previously believed. A critical observation in recent experimental studies of bilingual performance is that contrary to the intuition that a bilingual can switch off one of her languages when using the other, both languages are active regardless of the intention to use one language only (e.g., Colomé, 2001; Dijkstra, Grainger, & Van Heuven, 1999). Early accounts of cross-language interactions focused on the effects of the first language (L1) on the second language (L2). During initial stages of L2 learning, transfer from the L1 to L2 was hypothesized to guide L2 performance (e.g., Kroll & Stewart, 1994; MacWhinney, 2005). However, subsequent research has demonstrated persistent effects of the L1 on the L2 even once individuals acquire skill in the L2 and even at the earliest time course of processing (e.g., Thierry & Wu, 2007). Cross-language interactions have been documented for proficient bilinguals across all aspects of language processing from reading printed words (e.g., Dijkstra et al., 1999), to listening to spoken words (e.g., Marian & Spivey, 2003), and to planning speech in one language alone (e.g., Costa, 2005). For proficient bilinguals, there are also effects of the L2 on the L1 (e.g., Van Hell & Dijkstra, 2002).

In this chapter we focus on speech planning, the context in which it might seem most surprising to observe the effects of the language not in use. In theory, speaking should be under the speaker's control as intentions are mapped onto words to be produced. If information about both languages is activated in parallel when bilinguals plan speech in one language alone, how do they eventually manage to select the intended language? Although the evidence generally suggests that both languages are activated when only one language is required (e.g., Kroll, Bobb, & Wodnieka, 2006), it is possible that the activity of the language not in use can be modulated

by factors such as cognitive abilities and the linguistic dissimilarity across bilinguals' two languages (e.g., Hoshino & Kroll, under review; Linck, Hoshino, & Kroll, 2008).

In what follows, we discuss psycholinguistic perspectives on speech production in the L2. The first section explains the processing stages involved in speech production and the way in which bilinguals produce words and sentences. A special focus of our own research has been to identify the cognitive and linguistic constraints that might allow speech production in bilingual speakers to become more language specific. Finally, we address pedagogical implications of psycholinguistic research on L2 speech production.

Cognitive Processes of Speech Production

Components of Speech Production

Speech production requires transforming an intention into sounds representing words. This transformation includes at least three components: the conceptualizer, the formulator, and the articulator (Levelt, 1989). As illustrated in Figure 1, the conceptualizer first generates a preverbal message reflecting a speaker's intention and the preverbal message is sent to the formulator. The formulator is divided into two subcomponents: the grammatical encoder and the phonological encoder. The grammatical encoder is responsible for retrieving words corresponding to the preverbal message from the lexicon and determining syntactic relations between words. The phonological encoder generates a phonological form of the output received from the grammatical encoder. Then the articulator executes the phonological form.

Insert Figure 1 about here

For example, if a speaker tries to name a simple object such as "cat," he or she first needs

to identify the object and understand the meaning. Then the speaker selects a word corresponding to the conceived meaning and specifies the phonology of the word. When the speaker produces a sentence about the object such as “The cat is cute,” he or she retrieves all four words from the lexicon and assembles a sentence based on the syntactic information with which each word is associated. To formulate the sentence “The cat is cute,” the information on syntactic categories such as determiner, noun, verb, and adjective is used. Subject-verb agreement is computed at this stage of speech planning. Then the phonology of the formulated sentence is specified.

Speech Production in Bilinguals

If an individual speaks two languages, there is at least one more step involved in speech production—selecting the language of production. Psycholinguistic research on bilingual production suggests that bilinguals activate syntactic information (e.g., Hartsuiker, Pickering, & Veltkamp, 2003) as well as lexical and phonological information in both of their languages (e.g., Colomé, 2001). For example, when a Spanish-English bilingual intends to name a picture “cat” in their L2 English, not only English lexical representations (<CAT>) but also Spanish lexical representations (<GATO>) will be active (see Figure 2). Thus bilinguals need to select the language of production at one point during the process of speech planning. Some studies suggest that alternative candidates from both languages are active at the lexical level but that only words from the intended language are encoded into phonology (e.g., Abutalebi & Green, 2008; Green, 1998; Hermans, Bongaerts, De Bot, & Schreuder, 1998); that is, language selection occurs at the lexical level. Others suggest that alternative candidates from both languages are active all the way to the phonological level (e.g., Colomé, 2001; Costa, Caramazza, & Sebastián-Gallés, 2000; Hoshino & Kroll, 2008). In this case, the language of production is selected at the phonological level. The locus of language selection can be influenced by a number of factors such as

language-specific differences, linguistic environment, and language proficiency (see Kroll et al., 2006, for a review). Similarly, when bilinguals intend to formulate a sentence in one language, a verb as well as nouns will be activated in both of their languages (e.g., Hartsuiker et al., 2003). Syntactic information associated with the verb will be active in two languages and its activation will result in a grammatical structure to be used. The language of production will be selected when lexical items are slotted into the grammatical structure.

Insert Figure 2 about here

Cognitive Constraints on Speech Production

Psycholinguistic research has shown that language comprehension and production is modulated by individual differences in the capacity of working memory (e.g., Just & Carpenter, 1992; King & Just, 1991). Language comprehension and production requires both processing and maintaining information simultaneously. When the task demands more than available resources, the speed of processing slows down or some necessary information is lost. Furthermore, bilingual research suggests that even relatively proficient bilinguals process an L2 less automatically (e.g., Segalowitz & Hulstijn, 2005) and that L2 processing requires more cognitive resources than L1 processing (e.g., Hasegawa, Carpenter, & Just, 2002; Michael & Gollan, 2005). In this section, we make an analogy between the availability of cognitive resources and the cognitive constraints posed by limited L2 proficiency by reviewing studies of subject-verb agreement with aphasic, monolingual, and bilingual speakers.

Past research on the process of subject-verb agreement has shown that the production of subject-verb agreement is influenced by available working memory resources (e.g., Hartsuiker &

Barkhuysen, 2006; Hartsuiker, Kolk, & Huinck, 1999; Hoshino, 2003). In this line of research, agreement errors were elicited by asking participants to repeat and complete sentence fragments such as “the drawing on the posters,” where there was a mismatch in number between the head noun phrase (NP) “the drawing” and the so-called local NP “posters.” Comparisons with the rate of agreement errors in a number matching control phrase such as “the drawing on the poster” revealed that speakers showed a tendency to produce a verb that agreed in number with the local NP, instead of with the head NP. Of interest is that the complex NP can refer to one thing or multiple things. Consider the following examples:

(1) The author of the novels (single-referent mismatch)

(2) The drawing on the posters (distributive-referent mismatch)

Although both NPs are grammatically singular, the conceptual number is different. The interpretation of the first example is that there is a single author who wrote multiple novels, whereas the interpretation of the second example is that each poster has a drawing and thus there are multiple drawings. If speakers are sensitive to the conceptual number in representing the subject phrase during the computation of subject–verb agreement, the rate of subject–verb agreement errors should be higher for the distributive-referent NP than for the single-referent NP because the plural notional number of the distributive-referent NP presents a conflict with the grammatical number of the phrase (i.e., singular). In contrast, if speakers are not sensitive to the conceptual number in representing the subject phrase in the production of subject–verb agreement and rely only on the grammatical number of the phrase, there should be no difference in the rate of agreement errors between the single-referent and the distributive-referent.

Specifically, Hartsuiker et al. (1999) examined the computation of subject-verb agreement in agrammatic speakers, hypothesized to have a severely reduced working memory

capacity, by using the sentence completion task described above. Hartsuiker et al. found that the agrammatic speakers were sensitive to grammatical but not conceptual number in producing subject–verb agreement (but see Vigliocco & Zilli, 1999). A control group of unimpaired speakers showed sensitivity to both grammatical and conceptual number. These results suggest that when more computational resources are available, individuals process both conceptual and grammatical information simultaneously. However, when computational capacity is limited, individuals will tend to rely on grammatical information alone because this is a more critical source of information to compute subject-verb number agreement (but see Hartsuiker & Barkhuysen, 2006).

In line with Hartsuiker et al. (1999), Hoshino (2003) and Hoshino, Dussias, and Kroll (2010) found that the sensitivity to the conceptual number is influenced by cognitive resources and language proficiency. In these studies, English monolinguals with higher and lower reading span were tested in English (Hoshino, 2003) and Spanish-English bilinguals whose L2 proficiency varied were tested in their L1 and L2 (Hoshino et al., 2010). The results showed that the English monolinguals with higher span were sensitive to the conceptual number, whereas those with lower span were not. Analogously, when more computational resources are available (i.e., computing subject-verb agreement in their more proficient language, L1 Spanish), all the Spanish-English bilinguals showed the sensitivity to the conceptual number. In contrast, when the task was in their L2 Spanish, less proficient Spanish-English bilinguals did not show such sensitivity during the production of subject-verb agreement. Only more proficient Spanish-English bilinguals produced more agreement errors for the distributive-referent items than for the single-referent items in the L2 Spanish. That is, once bilinguals become proficient in their L2, they can be sensitive to the conceptual number in both of their languages. These results suggest

that the sensitivity to the conceptual number is influenced by the availability of computational resources. A similar argument has been proposed for L2 comprehension by McDonald (2006) who has demonstrated that stressing the cognitive resources of native speakers induces performance that resembles that of bilinguals in the L2.

Linguistic Constraints on Speech Production

The research reviewed above suggests that the production of subject-verb agreement can be influenced by cognitive factors. In the next section, we review the extent to which structural linguistic properties constrain the production of subject-verb agreement and the degree of cross-language activation.

Grammatical Encoding

To address the question of how structural dissimilarities in a bilingual's first and second language affect grammatical encoding during speech production in an L2, we examined the production of subject-verb agreement in Japanese-English bilinguals (Hoshino, 2003). In this experiment, we exploited two linguistic properties of Japanese. In Japanese, count nouns are not always overtly marked with a plural feature even when they refer to multiple entities, and subjects do not need to agree with their verbs in number. If the absence of rules for subject-verb agreement and for number marking in the L1 affects performance in the L2, then Japanese-English bilinguals may fail to demonstrate sensitivity to conceptual number. They may also fail to show sensitivity to grammatical number under the processing constraints of the online sentence completion task (see Jiang, 2004, for evidence that Chinese-English bilinguals are sensitive to agreement in offline but not online comprehension measures; Jiang, Novokshanova, Masuda, & Wang, 2011, for evidence that Japanese-English bilinguals are not sensitive to errors in plural markings in an online comprehension task). As described in the previous section,

however, if the availability of computational resources plays a major role in the production of subject-verb agreement, then highly proficient Japanese-English bilinguals should be sensitive to the conceptual number as well as the grammatical number during the process of subject-verb agreement as highly proficient Spanish-English bilinguals were in past research (Hoshino et al., 2011; Nicol, Teller, & Greth, 2001). In this case, Japanese-English bilinguals should produce more agreement errors for the distributive-referent mismatch such as "the drawing on the posters" than for the single-referent mismatch such as "the author of the novels" and should not show a difference in the rate of agreement errors between the distributive-referent match control and the single-referent match control ("the drawing on the poster" and "the author of the novel" respectively). Results showed (see Figure 3) that Japanese-English bilinguals made more agreement errors for the mismatched items than for the matched control items but did not produce significantly more agreement errors for the distributive-referent mismatched condition than for the single-referent mismatched condition. This finding suggests that unlike highly proficient Spanish-English bilinguals in the other study (Hoshino et al., 2010), Japanese-English bilinguals are sensitive to the grammatical number but do not appear to be as sensitive to the conceptual number.

Insert Figure 3 about here

Although the result of Japanese-English bilinguals' insensitivity to the conceptually distributive number can be interpreted to be a linguistic constraint on the process of subject-verb agreement, another possibility is that Japanese-English bilinguals in our study were simply not

proficient enough to show the sensitivity to the conceptual number. To rule out this possibility, we sampled 20 Spanish-English bilinguals whose L2 English proficiency was matched with the Japanese-English bilinguals from Hoshino et al. (2010). The two groups of bilinguals were matched on age, L1 self-assessed ratings, L2 AoA, length of living in English speaking countries, nonword and word accuracy on the lexical decision task. The comparison of the two bilingual groups showed that the Spanish-English bilinguals produced more agreement errors for the distributive-referent mismatch condition than for the single-referent mismatch condition, whereas the Japanese-English bilinguals did not show such a difference (see Figure 3). These results confirm that the syntactic and morphosyntactic properties of L1 do not appear to constrain the sensitivity to the grammatical number but seem to modulate the ease of access to the conceptual number.

Another possibility is that the Japanese-English bilinguals in our study might not have understood the reading of conceptually distributive number in phrases such as “the drawing on the posters.” If this was the case, the observed insensitivity to the conceptual number by Japanese-English bilinguals would reflect that Japanese-English bilinguals did not appreciate the distributive-referent readings in the L2 English. We investigated the possibility of the incomplete representation of the conceptually distributive number in Japanese-English bilinguals whose L1 does not require subject-verb agreement in number and mark plural morphology on nouns by asking them to complete an off-line questionnaire. In the off-line questionnaire, the Japanese-English bilinguals were asked to rate the preambles such as “the author of the novels” and “the drawing on the posters” used in the online sentence completion task according to whether they refer to one thing or more than one thing. The results showed that the Japanese-English bilinguals can understand that single-referent preambles refer to one thing, whereas distributive-

referent preambles refer to more than one thing. That is, the Japanese-English bilinguals can make a distinction between single-referent and distributive-referent readings during the off-line task, not during the on-line sentence completion task.

A question arises, then, in asking why the L1 syntactic and morphological properties constrain the sensitivity to the conceptual number during the on-line task, but not during the off-line task. When the two languages are dissimilar, the distinctive characteristics may impose higher demands on working memory on the bilingual than when the two languages are similar. In other words, the cognitive and linguistic constraints may not be mutually exclusive alternatives. It may be harder for a native Japanese speaker to compute subject-verb agreement in English than a native Spanish speaker for whom the syntactic and morphosyntactic structures already exist because of the higher demands on cognitive resources. This hypothesis finds support in other second language acquisition research (e.g., Van Patten, 1996; Juffs, 1998). For example, Juffs (1998) investigated whether cross-linguistic differences in the way in which Japanese, Chinese, Korean and Romance languages encode causative/inchoative alternations would pose difficulties for L1 speakers of these languages when parsing structures in English, their L2. English does not mark the difference in syntactic position between a causative construction (e.g., *'Sally broke the window'*) and an inchoative construction (e.g., *The window broke*); however, in many languages, these alternations are typically associated with morphological changes on the verb or are indicated in the sentence morphosyntactically. This is the case for Japanese, Korean, Chinese and many Romance languages. Juffs reasoned that causative-inchoative constructions would be difficult to process for these speakers because their L1 requires additional morphology for the causative construction or extra morphology for inchocative sentences. In addition, because Chinese marks causation morphosyntactically (e.g., Sally *made* the window break) and

English allows such a construction, Chinese-English bilinguals were predicted to prefer the 'make' construction over the English causative construction. The results from a reading moving window experiment revealed that, despite the advanced level of proficiency in their second language, all L2 speakers differed significantly from the monolingual English group. In addition, the Chinese-English speakers showed a preference for the 'make' construction (although this preference did not reach statistical significance). These findings suggest that L2 learners may have advanced competence in the area of grammar, but their ability to deploy it online may be affected by the computational resources and the L1 structures. (See Sabourin, Stowe, and De Haan (2006) for a related discussion of how the processing of grammatical gender in the L2 is affected by the presence of gender marking in the L1.)

Lexical Access

Cross-linguistic differences in writing systems as well as in grammatical structures also influence the process of speech planning in bilingual speakers. Hoshino and Kroll (2008, under review) examined the way in which different-script bilinguals select the language of production by comparing the performance of Japanese-English bilinguals whose two languages differ in script with that of Spanish-English bilinguals whose two languages share the same Roman alphabets on two different word production tasks. In one study, both groups of bilinguals were asked to name pictures in their L2 English (Hoshino & Kroll, 2008). Some of the pictures had names that were cognates in the bilingual's two languages and others were noncognates. Cognates are words whose meanings and phonology are shared across languages (e.g., guitar-guitarra, guitar-ｷﾞﾀｰ). If both languages are active even when the bilingual's two languages do not share script, then not only Spanish-English bilinguals but also Japanese-English bilinguals should be faster to name cognate pictures than noncognate pictures in their L2 English. However,

if different scripts constrain the degree of cross-language activation, then only Spanish-English bilinguals, but not Japanese-English bilinguals, should be faster name to cognate pictures than noncognate pictures. Results showed that both groups of bilinguals performed similarly on the simple picture naming task with faster naming for cognate pictures than for noncognate pictures. This finding suggest that that even when the bilingual's two languages do not share script, there is activation of the phonology of the nontarget language (L1).

Why do Japanese-English bilinguals show cognate facilitation? One possibility is that different scripts are not sufficient to reduce cross-language activation. Another possibility is that scripts are not activated in planning speech (e.g., Alario, Perre, Castel, & Ziegler, 2007; Roelofs, 2006). To investigate this issue, we performed a second study in which the script was present in the task. We used a picture-word interference paradigm in which bilinguals named noncognate pictures in their L2 English while ignoring L1 distractor words that were visually presented with the pictures (Hoshino & Kroll, under review). The logic of this task was to force the activation of L1 orthography/script by presenting L1 distractor words during L2 picture naming. The hypothesis was that the presence of distractor words in a language whose script was different from the target language might provide a language cue in speech planning that would enable inhibition of cross-language competitors. In other words, if script differences modulate cross-language activation, then Spanish-English and Japanese-English bilinguals would show a different pattern of the results in the picture-word interference task. We included both phonologically and semantically related and unrelated distractors. Spanish-English bilinguals named pictures with phonologically related distractors (e.g., the picture "envelope" with the distractor "enchufe" meaning a plug) faster than those with phonologically unrelated distractors (e.g., the picture "envelope" with the distractor "rodilla" meaning a knee) and pictures with

semantically related distractors (e.g., the picture “envelope” with the distractor “tarjeta” meaning a postcard) slower than those with semantically unrelated distracters (e.g., the picture “envelope” with the distractor “alicates” meaning pliers), replicating previous findings with bilinguals whose two languages share the same script (e.g., Costa, Miozzo, & Caramazza, 1999; Hermans et al., 1998). In contrast, Japanese-English bilinguals showed phonological facilitation but not semantic interference. The pattern of results suggests that Japanese-English bilinguals select the language of production prior to the semantic activation of the L1 distractor word, whereas Spanish-English bilinguals do not. The availability of perceptual cues such as script appears to modulate cross-language activation during word production, but only when the script itself is actually present.

How do these findings fit into the emerging literature on lexical production in bilinguals? The debate about bilingual speech planning is focused on the issue of whether bilinguals can attend to critical features that might enable them to separate the two languages and to minimize the influence of the language not in use. Language-specific models (e.g., Costa et al., 1999) propose that there is parallel activation of words in the language not in use but that those words do not become candidates for lexical selection. In contrast, language non-specific models (e.g., Green, 1998; Kroll, Bobb, Misra, & Guo, 2008) assume that there is competition for selection among all activated alternatives. Another mechanism, possibility inhibition, serves to reduce the activation of the unintended language.

It is beyond the scope of the present chapter to fully discuss all of the evidence that has been taken to support each of these models. However, we might consider the implications of the data we have presented for this debate. The fact that different-script bilinguals appear to activate the phonology of the language not in use when naming pictures, suggests that a life experience of using different-script languages does not function to create a reliable cue to the target language

that can be exploited during speech planning. A language-specific model of bilingual speech would require that such cues be available to be exploited or there would be no means to identify the language not in use. Likewise, the result in Hoshino and Kroll (under review) that Japanese-English bilinguals fail to demonstrate semantic interference in the picture-word Stroop task at the same time that they do reveal translation facilitation and phonological facilitation, suggests that the presence of the different script modulates, but does not eliminate, the activation of the unintended language. If it were possible to eliminate the activation of the nontarget language, then none of the Japanese distractor words would have had any effect when these bilinguals were speaking the name of a picture in English. The overall pattern of results is more compatible with a version of the competition for selection model that assumes that there may be a modulation of the locus of lexical selection but that it is virtually impossible to switch off the unintended language in advance (e.g., Kroll et al., 2006). In an interesting parallel to these results, recent studies of language production in bimodal bilinguals who are hearing users of American Sign Language (ASL) and spoken English, two languages that differ in structure even more dramatically than Japanese and English, have reported similar findings. Bimodal bilinguals reveal the activity of ASL even when they are speaking English with other English speakers who know no ASL (e.g. Emmorey, Borinstein, Thompson, & Gollan, 2008; Pyers & Emmorey, 2008). Taken together, these studies demonstrate the way in which a comparative approach to bilingualism may be useful in adjudicating between alternative theoretical claims.

Implications for Second Language Teaching

Speech planning is a cognitively demanding task particularly in the L2. Even highly proficient bilinguals have to resolve the activation of the L1 to speak in the L2 (e.g., Colomé, 2001; Costa et al., 2000). It is harder to assemble a sentence without making mistakes in the L2

than in the L1 (e.g., Hoshino et al., 2010). As reviewed above, psycholinguistic research on speech production suggests that the cognitive demand imposed by L2 speech production can be modulated by the availability of processing resources and linguistic cues. There are at least two implications for L2 classrooms based on the psycholinguistic studies reviewed in this chapter. A first implication is that teachers should use the L2 in classrooms not because the nonuse of L1 allows learners to switch off their L1, but because it allows learners to receive more input in the target language. One strategy to reduce the activation of the L1 is to provide cues that help learners to ignore their L1. These cues include a variety of visual materials such as pictures and actions, as well as exposure to the target language in target language environments. With the advent of the Internet, creating "virtual" target language environments is clearly within reach. One candidate is the integration of computer-mediated communication to the foreign language curriculum. It has been suggested (e.g., Kern, Ware, & Warschauer, 2004) that computer-mediated communication provides an ideal forum for foreign language learners to benefit from interaction with native speakers to enhance foreign language (L2) development. This is so because the written nature of the discourse may provide a private, stress-free environment with access to input, self-paced practice, feedback, and opportunities for negotiation of meaning (e.g., Blake, 2000; Nagata,1993; Nagata & Swisher 1995; Neri, Cucchiarini, Strik, & Boves 2002; Pellettieri, 2000; Rosa & Leow 2004; Smith 2003). At the same time, computer-mediated communication affords learners with greater opportunities to notice and to reflect on the form and content of the input.

Computer-mediated communication can take many forms but perhaps one of the most popular is *telecollaboration*, defined as the use of Internet-based communication for intercultural interactions. Numerous studies (e.g., Belz, 2004; Dussias, 2005; Kitade, 2000; Salaberry, 2000)

have shown the benefits of telecollaboration in creating environments that allow L2 learners to be maximally exposed to native speaker input in a virtual environment. For example, Dussias (2005) found that e-mail and chat-room interactions involving native and non-native speakers of Spanish, which took place over a period of three months, resulted in significant linguistic gains. The participants were part of a larger group of L2 language learners who were enrolled in fourth-semester college-level foreign language courses. Participants were assigned to either an experimental group (i.e., telecollaboration group) or a control group (i.e., non-telecollaboration group). Learners in the experimental group participated in e-mail and chat room interactions with native speakers of Spanish (i.e., intercultural CMC), whereas learners in the control group interacted electronically with other learners of Spanish of similar proficiency (i.e., intracultural CMC). Linguistic gains were assessed by examining the language samples obtained from transcriptions of Oral Proficiency Interviews. These interviews were conducted immediately before the learners began computer-mediated communication sessions and immediately after the last session ended three months later. The findings revealed that learners in the experimental group showed increased linguistic control as well as greater communicative fluency, relative to learners in the control group. Because increased fluency is likely to help offset the cognitive demands imposed by L2 speech production, the use of telecollaboration in the foreign language classroom can prove to be a valuable tool.

A second implication of the findings presented here is that teachers should focus on one grammatical point at a time, particularly when novice learners speak the L2. Speech planning in a less proficient language imposes an increasing processing load and there is not much capacity left to pay attention to multiple grammatical features that learners cannot produce automatically without making any errors. It is important to reduce the amount of processing load so that L2

learners can allocate their attention to the most important aspect of the utterance at a given stage of learning. One classroom method ideally suited for this is *processing instruction*, an input-oriented approach to grammar instruction which promotes the acquisition of grammatical knowledge (VanPatten & Cadierno, 1993; VanPatten & Oikkenon, 1996). The basic premise underlying processing instruction is that L2 learning is cognitively effortful—because L2 learners are "limited processors," only a small portion of the input that L2 learners are exposed to actually gets processed, with the result that the acquisition of linguistic aspects of the L2 is compromised (Van Patten, 1996). According to VanPatten (2004), one way to overcome this is to alter the way in which L2 learners process grammatical input by creating so-called *structured input* activities (reading and listening activities that foster the link between particular linguistic forms and their corresponding linguistic functions). Although space limitations preclude us from discussing the set of guidelines for developing these activities, one critical feature of structured-input exercises is to focus on only one thing at a time; in other words, to focus on one single form at any given point during instruction. The reason behind this is straightforward: because learners have a limited capacity to process information, it is important not to overload learners' processing resources. In other words, when there is less information to pay attention to, learners are in a better position to pay attention.

There is now considerable empirical evidence suggesting that presenting one grammatical point at a time not only maximizes intake efficiency, but the benefits extend from comprehension processes into production (e.g., Cadierno, 1995; Sanz & VanPatten, 1998; VanPatten, 1993, 1996, 2002; Van Patten & Cadierno, 1993). For example, VanPatten & Cadierno (1993) showed that the structured-input activities derived from processing instruction were more beneficial than activities framed within traditional instruction approaches (e.g., instruction that consists of

grammatical explanations followed by production exercises) in increasing learners' abilities to interpret syntactic dependencies between words by Spanish learners, but also in facilitating learners' access to the newly gained knowledge during production. This suggests that pedagogical interventions that take into account both the strategies and mechanisms that learners use to link linguistic form to function as well as the learners' processing limitations have the potential to produce benefits that extend beyond comprehension in the L2, affecting simultaneously both the comprehension and production mechanisms.

Conclusions

In sum, psycholinguistic research on L2 speech production have shown that the process of grammatical encoding in L2 speech production is constrained by proficiency and linguistic similarity and that the degree of cross-language activation during production can be reduced by salient cues. The studies reviewed in this chapter suggest that learners will benefit from receiving visual cues which do not include L1 input and focusing on one source of information at a time in classrooms. In future research, it will be important to examine the extent to which the strategies of including visual cues and of focusing on one aspect at a time improve speech production in the L2.

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Author Notes

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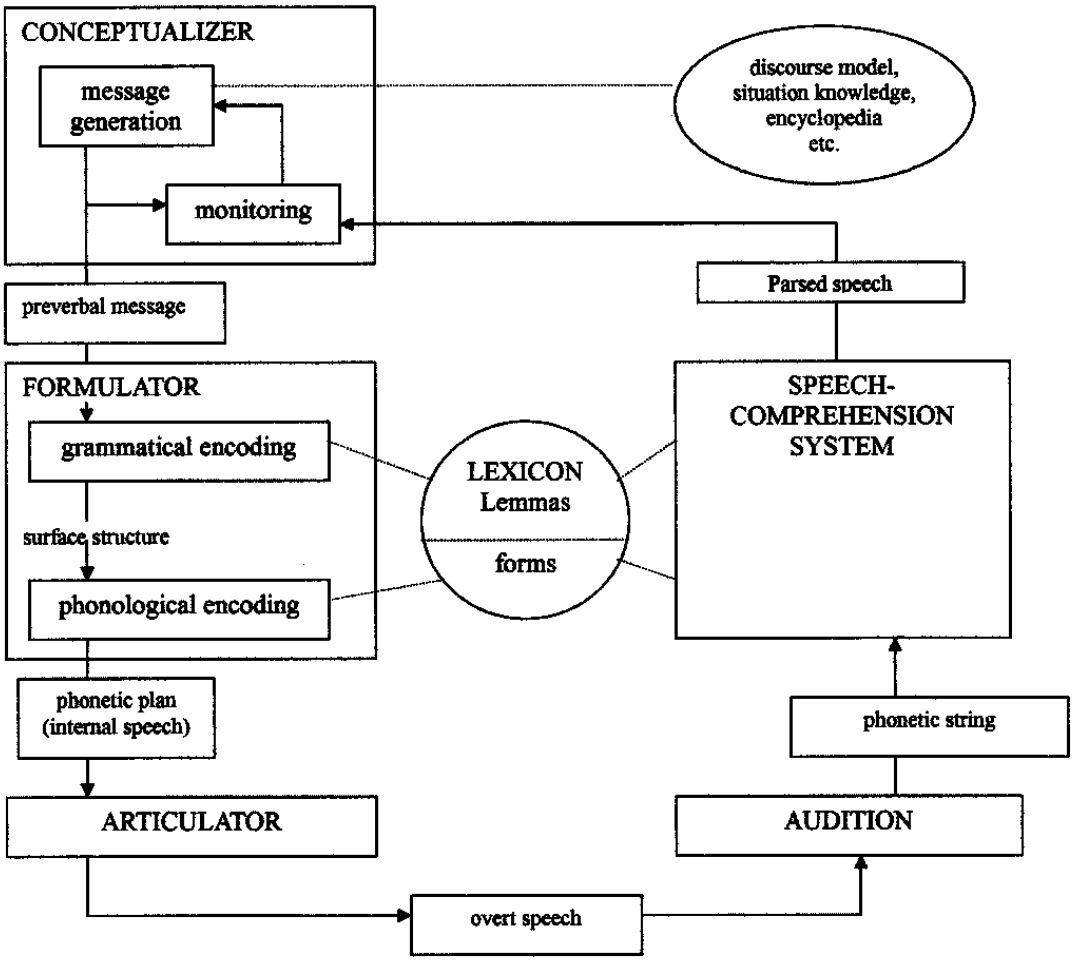
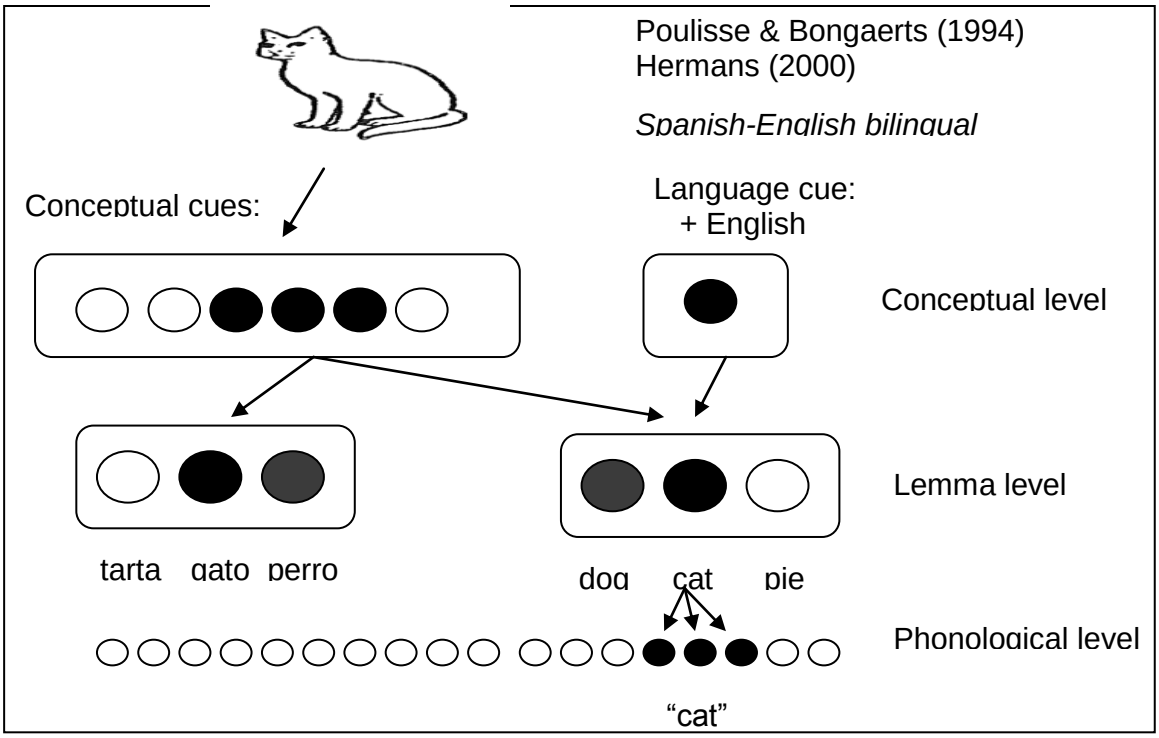
Figure Captions

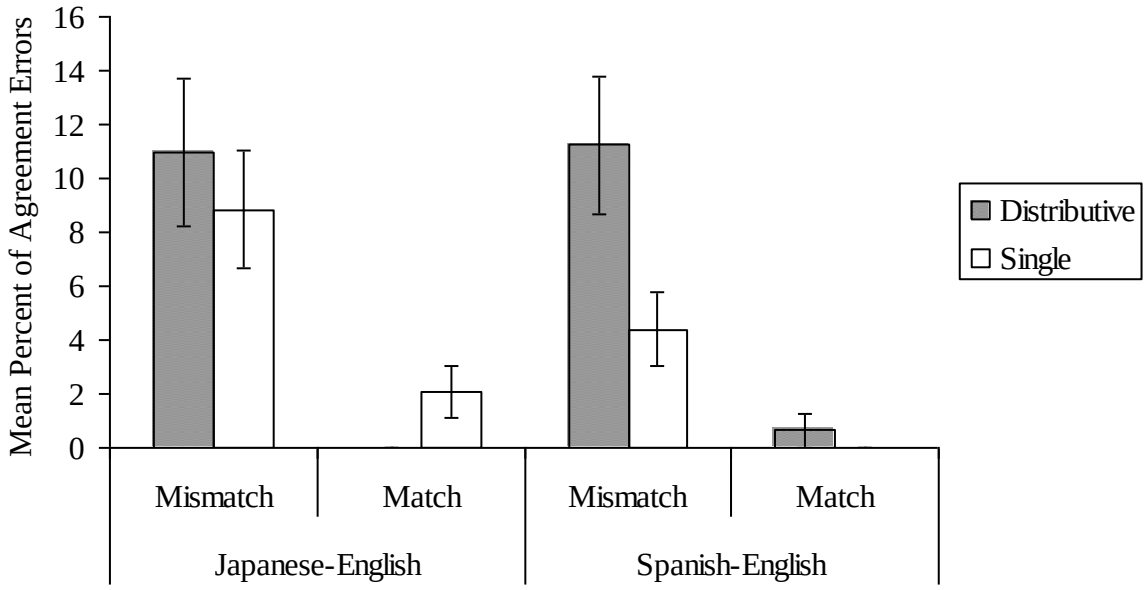
Figure 1. A blueprint of the speaker (adapted from Levelt, 1989).

Figure 2. A model of nonselective lexical activation (adapted from Poulisse & Bongaerts, 1994 and Hermans, 2000).

Figure 3. Mean percent of agreement errors as a function of number mismatch, distributivity, and language group.


CONCEPTUALIZER
message generation
monitoring
discourse model, situation knowledge, encyclopedia etc.
preverbal message
Parsed speech
FORMULATOR
grammatical encoding
surface structure
phonological encoding
LEXICON
Lemmas
forms
SPEECH-COMPREHENSION SYSTEM
phonetic plan (internal speech)
phonetic string
ARTICULATOR
AUDITION
overt speech


Poulisse & Bongaerts (1994)
Hermans (2000)
Spanish-English bilingual
Conceptual cues:
Language cue:
+ English
Conceptual level
Lemma level
tarta gato perro
dog cat pie
Phonological level
"cat"


Mean Percent of Agreement Errors
16
14
12
10
8
6
4
2
0
Distributive
Single
Mismatch
Match
Mismatch
Match
Japanese-English
Spanish-English