Bilingual Language Production: Shared or Separate Processing?

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Abstract
Language production processes have recently been of interest to many psycholinguistic researchers. While human beings are able to acquire multiple languages at the same time, this has pointed to the fact that different mental cognitive processes may be involved in multilingual language production. An existing debate in bilingual research is the question whether the mental linguistic representations in bilinguals are governed by a separate or shared processing mechanism (Kecskes, 2006; Poulisse & Bongaerts, 1994; Riehl, 2005). While this controversy may involve a broad scope of discussion, it has indeed provided a solid basis for the subsequent empirical research to further document bilingual speakers' speech processing, such as code-switching (Azuma & Meier, 1997; Kecskes, 2006; Kootstra, Hell, & Dijkstra, 2012; Meuter & Allport, 1999; Poulisse & Bongaerts, 1994; Riehl, 2005), neural laterality (Hull & Vaid, 2007), or executive function (Bialystok & DePape, 2009). While previous research has mostly been interested in the bilingual code-switching phenomenon (e.g. Hartsuiker et al., 2004), it has been unclear whether there is a difference in the mental representations of bilinguals, who differed in the age of acquisition (AOA) of the second language, given the fact that language proficiency is positively associated with the degree of code-switching and structural priming (Chen & Ng, 1989; Kecskes, 2006; Kootstra et al., 2012). Thus, the purpose of this paper is not only to review the current state of bilingual speech production research but also to examine whether AOA influences early/late bilinguals' speech production representations and its processing structure.

Keywords: Bilingualism, Code-switching, Language Production, Age of Acquisition

Introduction

In recent years, language production processes have been of interest to many psycholinguistic researchers. While human beings are able to acquire multiple languages at the same time, this has pointed to the fact that different mental cognitive processes may be involved in multilingual language production in comparison to monolingual speech production (Banich & Mack, 2003). An existing debate in bilingual research is the question whether the mental linguistic representations in bilinguals are governed by a separate or shared processing mechanism (Kecskes, 2006; Poulisse & Bongaerts, 1994; Riehl, 2005). While this controversy may involve a broad scope of discussion, it has indeed provided a solid basis for the subsequent empirical research to further document bilingual speakers' speech processing, such as code-switching (Azuma & Meier, 1997; Kecskes, 2006; Kootstra, Hell, & Dijkstra, 2012; Meuter & Allport, 1999; Poulisse & Bongaerts, 1994; Riehl, 2005), neural laterality (Hull & Vaid, 2007), or executive function (Bialystok & DePape, 2009). While previous research has mostly been interested in the bilingual code-switching phenomenon (e.g. Hartsuiker et al., 2004), it has been unclear whether there is a difference in the mental representations of bilinguals, who differed in the age of acquisition (AOA) of the second language, given the fact that language proficiency is positively associated with the degree of code-switching and structural priming (Chen & Ng, 1989; Kecskes, 2006; Kootstra et al., 2012). Thus, the purpose of this paper is not only to review the current state of bilingual speech production research but also to examine whether AOA influences early/late bilinguals' speech production representations and its processing architecture.

Bilingual Production Models – Spreading Activation

It has been generally agreed that the underlying processing mechanism for speech production involves several levels of representations. Dell (1986)'s spreading activation theory, for example, proposes a series of interconnected levels, where the activation of a unit also activates other relevant units in a network. This simply accounts for why people commit speech errors, such as slips of the tongue (Dell, 1986; Garrett, 1980). While it can be seen that the spreading activation theory mostly focuses on monolingual speakers' speech representation, similarly, it can still explain bilingual speakers' speech production, particularly code-switching. The ability to code-switch between two languages has been classified into two types: (1) Unintentional Switch and (2) Intentional Switch. Unintentional code-switching, namely conditioned code-switching, is the phenomenon that bilingual speakers happen to switch from one language to another incidentally (Riehl, 2005). Intentional switches bear more psychological reasons, such as lack of a word in one language or social identity (Riehl, 2005; Poulisse and Bongaerts, 1994). In the following sub-sections, an attempt is made to situate the code-switching phenomenon in the context of the interactive network and spreading activation in order to examine whether code-switching bilingual production is governed by a shared or a separate mechanism.

A Separate or Shared Language Network?

Strong Separate Account

Based on Dell's theory of spreading activation (Aitchison, 1994; Dell, 1986), Riehl (2005) has proposed an interactive activation model that accounts for bilingual production and code-switching. In the interactive bilingual network, it is assumed that bilinguals have two distinct, yet inter-related language networks, as the bilinguals use only one language at the same time, yet they are able to switch to another language due to a trigger word. Empirical evidence comes from observations of unintentional switches, which Riehl (2005) argued that such unintentional switches are triggered by phonologically-similar proper nouns, non-existent L1 word, bilingual homophones, and discourse markers. This offers support to a separate bilingual production network that there should be two separate nodes in either language; unintentional switches occur when the nodes in other language are incidentally selected.

When an English-German bilingual activates the image of "beaver", for example, not only will the lemma "BEAVER" in English be activated, but its phonologically-similar counterpart "BIBER" in German will also be activated. When the phonetic pattern for L2 "BIBER" is activated, it also sends a feedback to the lemma "beaver", thus the lemma in both languages become available. If the bilingual is currently in the context where the use of the German L2 is possible, then very likely the "BIBER" in German will be selected and activated, and eventually the activation causes the L2 word to be spoken.

Mixture of Shared and Separate Account – Evidence from Code-switching

While a recent proposal by Riehl (2005) has claimed that bilinguals have two separate interactive language networks, another account, which is also based on spreading activation, had already been proposed earlier by Poulisse and Bongaerts (1994). The difference between Riehl (2005) and Poulisse and Bongaerts (1994) is that the former made no clear assumption about language membership of a lemma, but the latter proposes that the strength of a lemma's language membership is highly correlated with a bilingual speaker's proficiency, suggesting that the highly proficient bilinguals may possess a shared bilingual speech network.

Poulisse and Bongaerts (1994) have found three groups of participants: (1) University Dutch-English speakers (2) Grade 11 native Dutch English as a second language (ESL) speakers and (3) Grade 9 native Dutch ESL speakers. These three groups were asked to (1) name an object in English (2) describe a novel in English (3) recall a Dutch story and retell it in English and (4) talk about a topic with a native English speaker. Results indicate a gradational pattern that the grade 9 participants code-switch more than the rest of two groups, whereas the university participants did the least code-switching. This has pointed to the fact that less-proficient bilingual participants' lexical selection, word-form encoding, and articulation are less automatic, implying that their L1 lexical items will be selected faster than the L2 items. This is because the language membership L2 English has not yet attached strongly to the English lemmas, causing the lexical selection of English L2 to be slower; thereby less-proficient speakers exhibit more code-switching back to L1. However, once a bilingual speaker becomes more proficient in the L2, the resting

level of the L1 will increase, as the speaker gains a more automatic control for both languages. Such automatic control therefore suggests that proficient bilinguals have the greater control of managing two languages at the same time, and therefore code-switching will be more context-dependent.

Strong Shared Account

Shared Conceptualization – Evidence from Translation Effect

Researchers in the school of a strong shared bilingual network advocate that the lexical access to either language is based on a shared network of conceptualization (Chen & Ng, 1989; Kecskes, 2006). The empirical evidence comes from the translation effect and the structural priming effect. From an earlier study by Chen & Ng (1989), they have hypothesized that the language processing network for bilinguals is shared because bilinguals are able to find a translation-equivalent L2 word from their L1. In their experiment, a group of Chinese L1 English L2 bilinguals were recruited. The experiment has three conditions: (1) translation-equivalent prime-target pair (L1: CAT; L2: CAT) (2) related prime-target pair (L1: CAT; L2: DOG) and (3) unrelated prime-target pair (L1: CAT; L2: WATCH). The participants had to decide whether the presented target (English or Chinese) is a word or non-word. Results indicated that the decision latencies in the translation condition are the shortest, regardless whether the presented target is L1 or L2. This lends strong support to the fact that bilingual lexical access is shared and concept-driven, as translation equivalents will activate only a single conceptual item.

Shared Syntax – Evidence from Structural Priming Effect

While the translation effect has been found to support the shared bilingual processing account at the level of conceptualization, the structural priming effect also explains a shared language network for bilinguals at the syntactic level. In a recent study by Kootstra, Hell & Dijkstra (2012), they have used an auditory priming paradigm to examine whether bilinguals' code-switching production is influenced by the auditory structural input. The auditory prime is a code-switched sentence (Dutch-English) with a syntactic structure NP+VP+PP, where the code-switching position is fixed at PP. Results have shown that fluent Dutch-L1-English-L2 bilinguals' description of the picture is strongly affected by the auditory prime and the code-switching position in the prime. That is, their production is more likely to be code-switched and the code-switching position actually fully aligns the auditory prime, particularly in the condition where the auditory prime and the picture contains the same word. However, contradictory results were obtained from the 9th grade Dutch ESL speakers. That is, an effect of structural priming is not significant. Taken together, these findings have offered support to the shared account for syntactic representation, as the fluent bilinguals are able to describe a sentence in their both languages with the influence from the previously-heard syntactic knowledge.

Implications for Future Research

Upon careful examinations of past literature in bilingual production theories, it can be seen that the debate between a shared or separate bilingual language processing has had different empirical basis. Advocates for separate processing regard code-switching as unintentional and consider it to be similar to the slip-of-the-tongue phenomenon, as in monolingual production research, whereas advocates for a shared processing have argued that code-switching can be experimentally documented by the factor of translation and the effect of structural priming.

It can be seen that only two studies from the above (e.g. Poulisse & Bongaerts, 1994; Kootstra et al., 2012) have taken bilingual speakers' language proficiency into account. Commonalities from these two studies show that more proficient bilingual speakers are more likely to manage two languages simultaneously during a code-switching elicitation task (Poulisse & Bongaerts, 1994) and also they are more likely to produce a code-switched sentence if they are auditorily-primed with the same structure (Kootstra et al., 2012).

While language proficiency plays a role in the bilingual production processes, it has been unclear, however, whether the factor of age of acquisition (AoA) – which has already been examined extensively in second language perceptual research – affects the bilingual production processes. Based on Flege, Munro, & MacKay (1995)'s finding that early-arrived bilinguals (L1: Italian; L2: English) have close-to-native-like pronunciation of English consonants, it can be hypothesized that the age, in which a person acquires the L2, has an influence on the connection strength of language feature (or language membership) at the level of lemma access, lexical selection, and syntactic assembly (or namely sentence production). That is, for people who acquired an L2 earlier and are very proficient in their L1 & L2, both of their L2 & L1 lemmas have a higher likelihood to be shared and well-formed, triggering a more automatic control of both languages and thereby least code-switching at the process of lexical selection and syntactic production.

To test the above hypothesis, future research should recruit four groups of participants with two independent variables (AOA and Language Proficiency): (1) Early L1&L2 proficient bilinguals (2) Early only-L2-proficient bilinguals (3) Late L1&L2 proficient bilinguals (4) Late only-L1-proficeint bilinguals. A code-switching elicitation priming task can be used, similarly to what Kootstra et al. (2012) have conducted. It will be expected that the early bilinguals will exhibit a more shared L1-L2 network at the processes of lemma access, lexical selection, and syntactic production, based on the assumption that early bilinguals have higher likelihood of developing two languages simultaneously and proficiently (Genesee & others, 1989). Late bilinguals, on the other hand, will exhibit a more separate L1-L2 network at the level of lemma, lexical selection, and sentence production, based on the fact that the development of their second language is subject to the interference from their L1 (Kroll & Stewart, 1994), thereby suggesting that the L2 nodes at each level in the network are more likely to be weakly-formed.

Conclusion

The present paper has re-visited previous bilingual production research based on the question of a shared bilingual network or that of a separate bilingual network. Based on what have been reviewed, research in general has agreed that bilingual code-switching can be the empirical phenomenon, motivating investigations whether their production network is governed by a shared or a separate mechanism. Researchers in the school of separation consider code-switching to be more unintentional and error-prone, whereas researchers in the school of shared network regard code-switching as more intentional, and it may be subject to an influence from the effect translation-equivalent and structural priming.

Based on these empirical facts, it has been unclear so far whether age distinction, documented extensively in L2 acquisition research, affects a bilingual speaker's mental speech representations with respect to code-switched productions. It has been suggested that early bilinguals may possess a more shared network in production due to their stable ability of managing two languages simultaneously. Thus, the present paper has offered implications for future research to focus on two factors, such as age of acquisition and language proficiency in hopes to further unify the existing bilingual code-switching research and solve the debate between a shared bilingual processing and a separate bilingual processing.

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