Research Article

Inhibitory control process and lexical robustness in multi-linguals

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Abstract

When a picture is viewed by a monolingual speaker, the conceptual representation is first set into motion followed by the associated lexical and phonological representations prior verbalization. This uncomplicated mechanism becomes more complicated for multilinguals. This complication is partly resolved by inhibitory control mechanisms. The focus of the earlier studies on inhibitory control function was on bilinguals. Therefore, present study aimed at investigating the language switching performance and lexical robustness using verbal fluency task in multilinguals. Twenty multilingual speakers of Kannada (L1), English (L2) and Hindi (L3) in the age range of 18 to 23 years participated in the study. Reaction time of language switching across the languages and verbal fluency in all the three languages were calculated. The findings suggested an interaction between inhibitory control abilities and language switching capabilities when particularly switching from a more proficient language to less proficient language.

Introduction

Multilingualism is the act of using, or prompting the use of, multiple languages, either by individual speaker or by a community of speakers. A multilingual is a person who has the potential to use three or more languages, either separately or in various degrees of code-mixing. (McArthur , 1992; Edwards, 1994; Vildomec, 1963).

These Multilingual populations face a cognitive challenge during speech processing and production. That is, the words in all the languages begins to get operative to certain extent and may compete for selection (e.g., Bajo et al., 2010, Kroll, Bobb, Misra & Guo, 2008), implying that cognitive control mechanisms must be at work to control this cross-language activation. For example when a picture is viewed by a monolingual speaker, the conceptual representation is first set into motion followed by the associated lexical and phonological representations prior verbalization. This uncomplicated mechanism becomes more complicated for a multilingual, considering that for a given concept greater than one lexical representation is mapped. That is when a multilingual speaker names a picture of a 'cat' in one of the language; there is activation of the words in all the languages to some extent, by that making a person to choose the appropriate word for verbalization (Bialystok, 2009; Green 1986, 2003). In the due course the multilingual speaker produces the right word that is equivalent to the target language. This advocates that there must be a procedure which helps in selection of an appropriate word and that promote this process. Some researchers have argued that inhibitory control may serve the role of suppressing the non-target words and help in accessing the target word. (e.g., Costa, Santesteban & Ivanova, 2006; Green, 1998). Inhibitory control model (ICM) explains a prospective mechanism underlying the language selection during the multilingual speech production. When lexical items in multi-language gets activated, there exist a competition between all the languages for selection, this conflict is in part resolved by inhibitory control mechanisms applied on the non-target lexical items. That is, the non-target languages get suppressed to some extent when accessing words in one language thereby permitting the words in the target language to be selected and finally produced. Green (1986, 1998) ICM depicts the notion that active inhibition is applied on the non-target words. This model in specifically, brace the concept of language tags, which is described as a notion that there are "built-in labels" for all the words in all the languages that are already designated to the particular language that they belong to. The language tags assist inhibitory control mechanism to disseminate Inhibition accordingly (i.e., a greater extent of inhibition is exerted on the words in the non-target language because of the verity that they do not bear the suitable language tags). Further, the ICM contemplates that the extent of inhibition applied is directly propor-

tionate the extent of activation being exerted by the conceptual level. As described, the non-target words receive larger inhibition along with larger activation levels.

There are several methods to tests the Inhibitory control mechanism such as, Natural speech situations (Grosjean, 1988, 1997; Grosjean & Miller, 1994; Li, 1996, 1998), Stroop Translation Task and Brain Activity (Schwieter, 2008; Schwieter & Sunderman 2009, Abutalebi & Green, 2008; Hernandez, Dapretto, Mazziotta, & Bookheimer, 2001; Price, Green, & von Studnitz, 1999) which have been incorporated while performing empirical tests of ICM. Apart from these methods, much of the evidence in support of the ICM has come from language switching experiments that allow researchers to compare the amount of time it takes to switch into more- and less-dominant languages. Language switching tasks is one, in which the participants name either the picture (Costa & Santesteban, 2004) or numerals (Meuter & Allport, 1999) on the screen of the computer, at the same time, switching to and fro between their languages. Participants follow the colour cue (example, background colour of the screen) to name the target in that particular language which is represented through a colour code. The reaction time and the accuracy are measured during this process. This reaction time (RT) analysis of the language switching tasks provides a more sensitive measure of online language processing. Nevertheless, without any uncertainty, while conducting switching tasks, the individuals are enforced to switch to and fro between their languages, which have proved to be most detailed empirical test of the Inhibitory control mechanism. Few examples for the test employed by number of researchers in bilinguals are picture or numeral naming task with language switches (Finkbeiner, Almeida, Janssen, & Caramazza, 2006; Costa & Santesteban, 2004; Hernandez & Kohnert, 1999; Costa, La Heij, & Navarrete 2006; Abutalebi & Green, 2007; Hernandez et al., 2001; Hernandez, Martinez, &Kohnert, 2000; Jackson, Swainson, Cunnington, & Jackson, 2001; Linck, Hoshino, & Kroll, 2008; Meuter, 1994; Meuter & Allport, 1999; Schwieter & Sunderman, 2008; Schwieter, 2013; Wodniecka, Bobb, Kroll, & Green, 2005).

There are few researches done on language switching in multilinguals. Schweiter and Sunderman (2012) tested whether trilingual speakers rely on inhibitory control mechanism while accessing words during speech production. The findings of their study confirmed that there was significant reliance on inhibitory control for all the three languages. And the study also found that there was an imbalance of language proficiency in all the three languages and the same reflected in their switch costs which were asymmetrical.

Lately, the researchers have shown that the inhibitory control process depends on variables such as lexical robustness (Schwieter & Sunderman, 2008, 2009, Schweiter, 2013). So the second part of the study concentrated on the Lexical robustness in multilinguals. Lexical robustness is an important aspect of global proficiency in which the greater automaticity of word retrieval is due to the familiarity with the frequency of its access (Costa et al., 2006, Schwieter & Sunderman, 2008, 2009). Verbal fluency is a measure of lexical robustness that captures the quantitative size of the lexicon. There are different forms of verbal fluency test, but in general, individual is given a particular category or a particular phoneme as a cue and is asked to name as many items as possible in that category or starting from that particular phoneme (Example, they are asked to name fruits or asked to name things starting from 'P'). Verbal fluency tasks are relatively widely used as it demands lesser task demands and it makes them suitable for both normally developing and impaired adults and children. Costa et al (2006) argued that the robustness of lexical representation may be critical to the functionality of a language specific selective mechanism.

Schweiter and Sunderman (2012) conducted verbal fluency measure in trilinguals. They measured L1, L2 and L3 separately. For each language, five semantic categories and five first letter categories were given. The stimuli were presented on the computer screen and were instructed to name as many items possible in that particular category or letter in 60 seconds. The lexical robustness was calculated by adding all the correct responses from each of the ten categories. The results of their study revealed that mean lexical robustness were better in L1 followed by L2 and L3.

In Indian context there are several studies concentrated on the lexical activation in bilinguals. Krishnan and Tiwari (2010) investigated the 'language specific' versus the 'language non specific' issue in bilinguals using 'semantic relatedness judgment' paradigm. The findings of their study supported the 'language non-specific' nature of lexical selection in bilinguals. Similarly Shivabasappa, Rajashekar and Krishnan (2011) investigated the language-specific versus language non-specific views of bilingual lexical activation using phoneme monitoring task. The results of their study also supported the language non-specific view of bilingual lexical activation. In parallel to the earlier studies, Suma (2013) studied the language activation in Kannada English Bilingual adults. The stimuli used were semantically related and semantically non related word pair conditions. The results of their study were in concurrent with the earlier findings i.e. it supported language non specific activation. In another research conducted by Sabastein and Prema (2010) studied the lexical processing in

bilingual aphasics using semantic and translation priming paradigm. The results of their study indicated that words in bilingual's two languages share a common conceptual representation.

The majority of studies till date have concentrated on inhibitory control function in bilinguals. Because of limited number of research have been conducted on trilinguals or multilinguals, the sequences of speaking more than two languages on inhibitory control and lexical robustness remain poorly understood. (Abunuwara, 1992; Kave, 2008; Lincketal., 2012; Dijikstra & Van Heuven, 2002). In Indian context, there are several studies which are concentrated on bilinguals and there is scarcity of studies concerning the inhibitory control mechanism related to multi-ligulas. Hence the present study was conducted aiming to extend research in this area by examining the inhibitory control mechanism and lexical robustness in multilingual speakers. The objectives of the study were to compare the reaction time of language switching across L1 (Kannada), L2 (English) and L3 (Hindi) languages and the performance of verbal fluency task across L1 (Kannada), L2 (English) and L3 (Hindi) languages.

Method

Participants: Twenty Multilingual speakers participated in the study, within the age range of 18 to 23 years. Majority of the subjects were students. All were native Kannada (L1) speakers. The medium of instruction throughout their schooling was in English (L2) and they were exposed to Hindi (L3) language since the age of 10 years. So, all the participants were exposed to L1 from birth, L2 approximately at the age of 5 years and the L3 around the age of 10 years (due to obligatory Hindi in public schools). These participants first completed the informed consent form. Next, to gather information about their language use and proficiency level, the participants completed a language questionnaire (Gullberg & Indefrey, 2003).

Procedure: Two experiments were conducted in the present study.

Experiment 1 Language Switching Task: Picture naming task with language switches were administered on all the participants. These stimuli were used to investigate the extent to which inhibitory control supports lexical access when multilinguals name. A number of studies have incorporated the picture naming task with language switches in bilingual studies (e.g., Costa & Santesteban, 2004; Schwieter & Sunderman, 2008) to test the inhibitory control mechanism. So, in the present study similar procedure was adapted with slight modification. That is, along with the two language switches used in the earlier studies (e.g., Costa & Santesteban, 2004; Schwieter & Sunderman, 2008) additional third response language switch was incorporated to explore the multilingual language processing and reliance on inhibitory control within the same experiment (Schwieter & Sunderman, 2011).

Stimuli: A total of 60 concrete noun pictures with 10 pictures each belonging to six different semantic categories were presented. These nouns were taken by standardized test material developed by Aishwarya (2011). There was equal production of all three languages in the experiment that is, 20 words in each language.

Testing: The participants were individually tested. Instructions were given by the researcher verbally in addition to the instructions given on the computer screen. Each participant was seated in front of a computer screen at a distance of 2 feet and was instructed to name lists of pictures in the language according to the colour code (colour square block). Each picture presented had a language cue: green for Kannada (L1); red for English (L2); yellow for Hindi (L3). Before the experimental lists began, each participant was given practice trails as training session. This practice trial has five lists of picture similar to the experimental lists. The list of pictures were structured as follows: (i) a picture was presented at the centre of the screen on a white background for 2500 milliseconds, this was followed by blank interval of 500 milliseconds (iii) the first picture appeared with either a green, red, or yellow coloured block and the participants were instructed to name the pictures in one of their three languages as coded by the coloured block into the microphone. The entire testing of language switching task was carried out in a single sitting.

Experiment 2: Verbal fluency measure: Verbal fluency measure was carried out to check for the lexical robustness. In this task, there were two subcategories i.e., the participants were presented with (i) three "Semantic Verbal Categories" and (ii) five "Phonemic Verbal Categories". The presentation of these categories was randomized for each participant. The participants were tested individually and were given instructions verbally by the researcher. The participants were presented with a one particular category or a particular phoneme at a time as a cue and were asked to name as many items as possible in that category or starting from that particular phoneme within sixty seconds. Categories were blocked by language to avoid language switching. This task was conducted in all three languages (L1, L2, and L3) separately. The testing was carried out at three different times i.e. with a gap of one week to counteract practice effect.

A total score was calculated by adding all responses from each of the first letter and semantic

categories. The repetition of words was not added to the participant's scores. The total number of items produced by the participant has been taken as an indicator of lexical robustness.

Results

Language Switching Task: The switching task across the three languages was compared using the paired sample't' test. The RT analysis was performed on condition means for correct and validly time switching responses. The mean reaction time and error responses were extracted. The mean Reaction Time (RT) for switching task for L1, L2 and L3 were 1728.6 milliseconds, 1702.5 milliseconds and 1854 milliseconds respectively. It can be studied that the mean scores were better i.e. subjects could switch faster in L2 followed by L1 and L3. However L2 had significantly less difference (p=0.05) in RT than L1. The examination of statistical values reveals that the reaction time was faster for L2 followed by L1 and L3. The mean switching errors in L1, L2 and L3 was 6.9, 5.13 and 7.4 respectively suggesting that there were significantly more (p<0.05) error responses in L3 than in L1 and L2. The mean and standard deviation scores of this task are depicted in Table 1 and Figure 1.

Verbal Fluency Task

Phonemic Verbal Fluency Task: The mean scores for phonemic and semantic fluency for L1 was 14.8, for L2 was 17.2 and 12.3 for L3. This indicates that the participants had lesser lexical robustness in L3 than in L1 and L2. The mean and standard deviation scores for this task are shown in Table 2 and Figure 2.

Table 1: Showing the mean reaction time and standard deviation for switching task across languages

Languages	Mean (ms)	S.D
Kannada (L1)	1728.6	177.0
English (L2)	1702.5	152.9
Hindi (L3)	1854	252.1

Table 2: Showing the mean reaction time and standard deviation for switching task across languages

Languages	**Mean**	**S.D**
Kannada (L1)	14.8	3.3
English (L2)	17.2	3.6
Hindi (L3)	12.3	2.6

Table 3: Mean scores and Standard Deviation for Semantic Fluency across languages

Languages	Mean	S.D
Kannada (L1)	13.2	2.3
English (L2)	16	2.6
Hindi (L3)	10	2.2

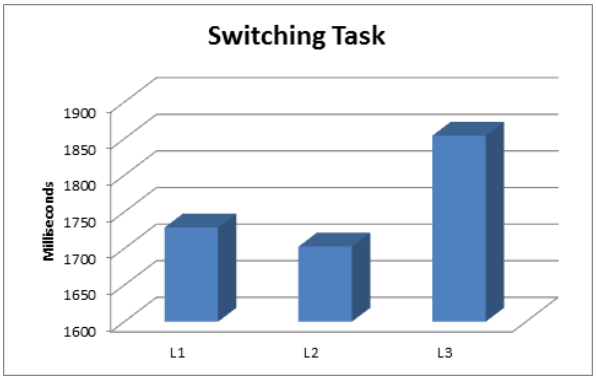

Figure 1: Mean Reaction time for switching task across languages.

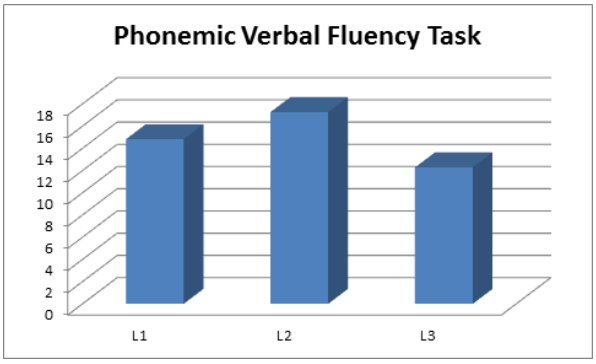

Figure 2: Depicting mean scores for Phonemic Fluency across languages.

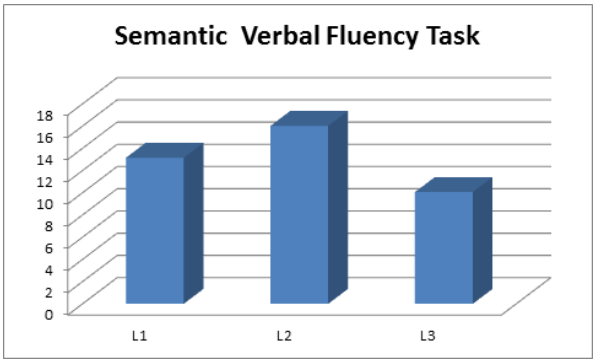

Figure 3: Depicting mean scores for Semantic Fluency across languages.

Semantic Verbal Fluency Task: The mean scores of semantic fluency task were 13.2, 16, and 10 for L1, L2 and L3 respectively. Paired sample't' test was carried out to examine the significant difference in semantic verbal fluency across languages.

This indicates that the participants had higher lexical robustness in L2 followed by L1 and L3. Total of three categories were presented. The mean and standard deviation scores for this task are given in Table 3 and Figure 3.

Discussion

In this study, we conducted switching task and verbal fluency task to study the inhibitory control mechanism and lexical robustness in multilinguals. Language switching task was incorporated in the present study as it specifically argued that it rely more heavily on the inhibitory control mechanism. Verbal Fluency measurement was used and the total number of unique category exemplars produced by the participants was taken as the indicator of lexical robustness.

The results of the present study revealed that, in both switching and verbal fluency tasks, the performance was better in L2 compared to L1 and L3. This could be attributed to the usage and exposure of L2 being more. Heredia and Altarriba (2001) explained that the active use of L2 for a longer time could result in concepts becoming more accessible in that language. Research also indicates that the degree of language dominance or the language which is readily accessible depends on the usage and exposure which may be a factor in language processing or language switching (Heredia, 1997, Heredia and Altarriba, 2001; Altarriba & Basnight-Brown 2007). So the present experiment suggested that English stimuli were easier to switch as a function of participants accessibility in that language. Also as the student population was taken for the study, the exposure to L2 language was higher. However during conversations with friends and family, subjects preferred combination of L1 and L2 languages. This was supported by the information obtained by the questionnaire where subjects reported the usage of L1 and L2 on a regular basis for communication. So, these results showed that better inhibitory control mechanism in L2 compared to L1 and L3. Hence this indicates good inhibition skills for L2 which is needed to alternate between the languages, inhibiting the other unselected one (s) (Green, 1998: Meuter&Allport, 1999; Kroll, Bobb, & Wodniecka, 2006). Therefore, even though the subjects were almost equal proficient in both L1 and L2 there accessibility was better in L2 compared to L1 followed by L3.Thus for these participants; L2 was effortless processing relative to the automatized L1.

The study also discloses that in this sample of unbalanced multilinguals, the differences in inhibitory control mechanism are most salient in conflict condition, specifically, when naming in less dominant. This finding is coherent with the with competition-for-selection models of speech production (Kroll, Bobb & Wodniecka, 2006). As stated in these models, the larger amount of competition occurs in a less dominant language. In the present population L3 was less dominant than both L1 and L2 so, the enormous competition would have been naming in L3.

In verbal fluency task, the participants of the study performed better in L2 compared to L1 and L3 similar to switching task. The research argued that verbal fluency measured both strength of the lexical representation and ability to access them. So in the present group the lexical representation and ability to access was better in L2 followed by L1 and then followed by L3. So this also suggests that they were L2 proficient multilinguals with dominant L1 and comparatively less proficiency in L3. This verbal fluency measure, taps into the lexical robustness and has consistently correlated with the participants language questionnaire which showed subjects reported the usage of L1 and L2 on a regular basis for communication. Even though the test questionnaire stated almost equal proficiency between the L1 and L2 languages, the performance in L2 was better than the performance in L1 and L3 which stated that language usage also had an influence on the switching and lexical robustness. That is., the usage and exposure of L2 being more than that of L1 and L3 in the present population who were students.

Conclusions

This study examined the inhibitory control mechanism during language switching task and lexical robustness in multilinguals. Results suggested an interaction between inhibitory control abilities and language switching capabilities when particularly switching from a more proficient into a less proficient. The results also indicated that in the context of multilingual language processing, asymmetrical switching arose for all languages. This can be taken as evidence that Inhibitory control is utilized in multilingual speech production. The greater proficiency in switching and lexical robustness in L2 may account for the fact that L2 is being used as a widespread language for communication purpose.

References

Abunuwara, E. (1992). The structure of the trilingual lexicon. *European Journal of Cognitive Psychology*, *4*, 311-322.

Abutalebi, J., & Green D. (2007). Bilingual language production: The neurocognition of language representation and control. *Journal of Neurolinguistics, 20*, 242-275.

Abutalebi, J., & Green D. (2008). Control mechanisms in bilingual language production: Neural evidence from language switching studies. *Language and Cognitive Processes, 23*, 557-582.

Aishwarya, N. D. (2011). Lexical access in Kannada speaking children- Urban and Rural. Master's dissertation submitted to University of Mysore, Mysore, India.

Almeida, J., Janssen, N., & Caramazza, A. (2006). Lexical selection in bilingual speech production does not involve language suppression. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 32*(5), 1075 - 1089.

Altarriba, J., & Basnight-Brown, D. M. (2007). Methodological considerations in performing semantic- and translation-priming experiments across languages. *Behavior Research Methods , 39*(1), 1-18.

Bajo, R., Maestş, F., Nevado, A., Sancho, M., Gutirrez, R., Campo, P., Castellanos, N. P., Gil, P., Moratti, S., Pereda, E., & Del-Pozo, F. (2010) Functional connectivity in mild cognitive impairment during a memory task: implications for the disconnection hypothesis. *Journal of Alzheimer's Disease, 22*(1), 183-193.

Bialystok, E. (2009). Claiming Evidence from Non-evidence: A Reply to Morton and Harper. *Journal of Developmental Science, 12*(4),499-503.

Bialystok, E. (2009). Bilingualism: The good, the bad, and the indifferent. *Bilingualism: Language and Cognition, 12*, 3-11.

Bialystok, E. (2014). Double threshold in bi- and multilingual contexts: preconditions for higher academic attainment in English as an additional language. *Frontiers in Psychology, 5,* 556.

Costa, A., & Santesteban, M. (2004). Lexical access in bilingual speech production: Evidence from language switching in highly proficient bilinguals and L2 learners. *Journal of Memory and Language, 50*, 491-511.

Costa, A., Santesteban, M., & Ivanova, I., (2006). How do highly proficient bilinguals control their lexicalization process? Inhibitory and language-specific selection mechanisms are both functional. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 32,* 1057-1074.

Costa, A., La Heij, W. & Navarrete, E. (2006). The dynamics of bilingual lexical access.*Bilingualism: Language and Cognition, 9,*(2), 137-151.

Dijkstra, T., & van Heuven, W. J. B. (2002). The architecture of the bilingual word recognition system: from identification to decision. *Bilingual Language Cognition, 5,* 175-197.

Edwards, J., (1994). *Multilingualism.* UK: Penguin Books.

Finkbeiner, M., Almeida J., Janssen N., & Caramazza A., (2006). Lexical selection in bilingual speech production does not involve language suppression. *Journal of Experimental Psychology: Learning, Memory and Cognition, 32,* 1075-1089.

Green, D.W. (1986). Control, activation and resource: a framework and a model for the control of speech in bilinguals. *Brain and Language, 27*, 210-223.

Green, D. W. (1998). Mental control of the bilingual lexico-semantic system. *Bilingualism : Language and cognition, 1,* 67-81.

Green, D.W. (2003). The neural basis of the lexicon and the grammar in L2 acquisition: the convergence hypothesis. In R. van Hout, A. Hulk, F. Kuiken and R. Towell (Eds.), *The interface between syntax and the lexicon in second language acquisition.* (pp. 197-218). Amsterdam: John Benjamins.

Grosjean, F., (1988). Exploring the recognition of guest words in bilingual speech. *Language and Cognitive Processes, 3*, 233-274.

Grosjean, F. (1997). Processing mixed languages: Issues, findings and models. In Annettee de Groot and Judith Kroll (Eds.). *Tutorials in bilingualism: Psycholinguistic perspectives,* pp. 225-254, Mahwah, NJ: Erlbaum.

Grosjean, F. & Miller J., (1994). Going in and out of languages: An example of bilingual flexibility. *Psychological Science, 5*, 201-206.

Gullberg, M. & Indefrey, P. (2003). Language background questionnaire. Nijmegen: Max Planck Institute for Psycholinguistics. http://www.mpi.nl/research/ researchprojects/the-dynamics-of-multilingual-processing).

Heredia, R. (1997). Bilingual memory and hierarchical models: A case for language dominance. *Current Directions in Psychological Science, 6*, 34-39.

Heredia, R. R., & Altarriba, J. (2001). Bilingual language mixing: Why do bilinguals code-switch? *Current directions in Psychological Sciences, 10*, 164-168.

Hernandez, A. E., & Kohnert, K. (1999). Aging and language switching in bilinguals. *Aging Neuropsychology and Cognition, 6,* 69-83

Hernandez, A., Martinez A., & Kohnert K., (2000). In search of the language switch: An fMRI study of picture naming in Spanish-English bilinguals. *Brain and Language, 73*, 421-431.

Hernandez, A., Daprettob, M., Mazziottab, J., & Bookheimer, S., (2001). Language switching and language representation in Spanish-English bilinguals: An fMRI study. *NeuroImage, 14*, 510-520.

Jackson, G., Swainson R., Cunnington R., & Jackson S., (2001). ERP correlates of executive control during repeated language switching. Bilingualism: *Language and Cognition, 4*, 169-178.

Kave, G., (2008). Multilingualism and cognitive state in the oldest old. *Psychology and Aging, 23*(1), 70-78.

Krishnan, G., & Tiwari, S. (2010). Evidence for the Inhibitory Control-based Language Non-specific Lexical Selection in Bilinguals. *Journal of the All India Institute of Speech and Hearing, 29*(1), 147-54.

Kroll, J. F., Bobb, S., & Wodniecka, Z. (2006). Language selectivity is the exception, not the rule: Arguments against a fixed locus of language selection in bilingual speech. *Bilingualism: Language and Cognition, 9*, 119-135.

Kroll, J. F., Bobb, S. C., Misra, M., & Guo T. (2008). Language selection in bilingual speech: Evidence for inhibitory processes. *Acta Psychologica, 128*, 416-430.

Li, P. (1996). Spoken word recognition of code-switched words by Chinese-English bilinguals. *Journal of Memory and Language, 35,* 757-774.

Li, P. (1998). Mental control, language tags, and language nodes in bilingual lexical processing. *Bilingualism: Language and Cognition, 1,* 92-93.

Linck, J. A., Hoshino, N., & Kroll, J. F. (2008). Cross-language lexical processes and inhibitory control. *The Mental Lexicon, 3*, 349-374.

Linck J. A., Schwieter, J. M., & Sunderman, G. (2012). Inhibitory control predicts language switching performance in trilingual speech production. *Bilingualism: Language and Cognition, 15,* 651-662.

McArthur T., (1992). *The Oxford companion to the English language.* Oxford:University Press.

Meuter, R., (1994). *Language switching in naming tasks.* Oxford: Oxford University dissertation.

Meuter, R., & Allport A., (1999). Bilingual language switching in naming: Asymmetrical costs of language selection. *Journal of Memory and Language , 40*, 25-40.

Price, C., Green D., & Studnitz R., (1999). A functional imaging study of translation and language switching. *Brain, 122,* 2221-2235.

Sebastian, R., & Prema, K. S. (2005). Cross language priming in bilingual aphasics. *Student Research at AIISH part-B, III,* 112-126, A Publication of AIISH, Mysore.

Schwieter, J. W., (2008). The effects of bilingual type on language Selectivity. In Miguel Montero, Paul Chamness Miller, and John Watze (Eds.). *Readings in language studies: Language across disciplinary boundaries* (pp. 417-431), New York: Information Age Publishing.

Schwieter, J. W., (2010). *Cognition and bilingual speech: Psycholinguistic aspects of language production, pro-*

cessing, and inhibitory control. Saarbrucken, Germany: Lambert Academic Publishing.

Schwieter, J. W.,(2013). Lexical inhibition in trilingual speakers. In Tirkkonen, J., Anttikoski, E. (Eds.). *Proceedings of The 24th Conference of Scandinavian Linguistics. Publications of the University of Eastern Finland: Reports and Studies in Education, Humanities, and Theology.* University of Eastern Finland Press, Joensuu, Finland, pp. 249-260.

Schwieter, J. W., & Sunderman, G. (2008). Language switching in bilingual speech production: In search of the language-specific selection mechanism. *Mental Lexicon, 3,* 214238.

Schwieter, J., & Sunderman, G. (2009). Concept selection and developmental effects in bilingual speech production. *Language Learning, 59,* 897-927.

Schwieter, J., & Sunderman, G. (2011). "Inhibitory control processes and lexical access in trilingual speech production." *Linguistic approaches to bilingualism, 1*(4), 391-412.

Schwieter, J., & Sunderman G., (2012). Inhibitory control predicts language switching performance in trilingual speech production. *Bilingualism: Language and Cognition, 15*(3), 651-662.

Shivabasappa, P., Rajashekar, B. & Krishnan, G. (2011). Language Non-Specific Lexical Activation in Bilinguals: Evidence from the Phoneme Monitoring Task, *Journal of All India Institute of Speech and Hearing, 30,* 160-168.

Suma, D. R. (2013). *Language Non-Specific Lexical Selection in Bilingual Adults. Unpublished dissertation.* University of Mysore, Mysore.

Vildomec, V. (1963). *Multilingualism.* Leyden: A.W. Sythoff.

Wodniecka, Z., Bobb S., Kroll S., & Green D., (2005). Is the first language inhibited when speaking the second language? Evidence from a competitor priming paradigm. *Paper presented at the 14th conference of the European Society for Cognitive Psychology,* Leiden, and The Netherlands.