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The role of code-switching in bilingual creativity

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This study further explores the theme of bilingual creativity with the present focus on code-switching. Specifically, it investigates whether code-switching practice has an impact on creativity. In line with the previous research, selective attention was proposed as a potential cognitive mechanism, which on the one hand would benefit from extensive code-switching, and on the other, facilitate creative performance. One hundred and fifty-seven multilingual college students completed a code-switching attitudes and behaviors questionnaire, which served to select habitual and non-habitual code-switchers. These respective groups were compared on creativity and selective attention tests. Habitual code-switchers demonstrated greater innovative capacity than their non-habitual counterparts. However, these groups revealed no difference in selective attention. Moreover, the relationship between selective attention and innovative capacity was found only among non-habitual code-switchers. Further, code-switching induced by a particular emotional state and by a lack of specific vocabulary in a target language appeared to relate to increase in innovative capacity. The discussion of these results lays foundation for further empirical research investigating the role of bilinguals' code-switching in their creative capacity.

Keywords: creativity; bilingualism; code-switching

Introduction

The relationship between bilingualism and creativity has generated a substantial amount of research over the last four decades (see overviews in Kharkhurin 2012; Ricciardelli 1992; Simonton 2008). This research, however, seldom addresses the defining feature of bilingualism, namely, code-switching (CS) – the alternation and mixing of different languages in the same episode of speech production. Yet, CS has been argued to be a creative act (Li 2011a, 2011b, 2013; Wei and Wu 2009). For example, linguists working in the linguistic ethnography tradition replaced CS with other terms such as *translanguaging* to capture its creative and dynamic nature (see a review in Garcia and Wei 2014). They investigated the use of translanguaging in diverse contexts, from literature and drama, to pop songs, the new media, and public signs (Androutsopoulos, 2013a, 2013b; Chik 2010; Jonsson 2005; Sebba, Jonsson, and Mahootian 2012; Shohamy and Gorter 2008). These studies take CS not simply as a juxtaposition of different grammatical structural elements, but as an expressive, creative, and often multimodal performance.

Yet, not all bilinguals code-switch, and not all code-switchers switch between languages in the same way. Sociolinguists have long argued that CS is a context-sensitive

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discourse strategy (Auer 1998; Gumperz 1982), and bilinguals acquire their languages in different contexts, different manners and for different purposes; they have different language combinations, proficiency levels, and attitudes toward CS. There are bilinguals who were born into bilingual families and communities where CS is the norm. They have never had a monolingual experience. Instead, CS is their habitual discourse mode, and they would find it difficult if not entirely impossible to speak one language only. For others, CS is a learned skill; they only do so in specific contexts, for specific reasons, and with specific interlocutors. There are still others who move between bilingual and monolingual modes as part of their everyday social experience (Grosjean 2001). They code-switch in specific emotional states or for special effects (e.g. Dewaele and Wei 2014). Therefore, one might expect intergroup variations in the relationship between CS and creativity. In particular, bilinguals who code-switch frequently and regularly, i.e. habitual code-switchers (HCS), often produce highly innovative forms that incorporate elements from different languages; moreover, they do so seemingly effortlessly. They can therefore be expected to show greater creative performance than those who do not use CS in their everyday practice, i.e. non-habitual code-switchers (NHCS). The present study begins with such a hypothesis and looks at creative performance differences between HCS and NHCS.

Sociolinguists have long been interested in what they call bilingual creativity – those creative linguistic processes, which are the result of competence in two or more languages. For example, the designing of a text that uses linguistic resources from two or more related or unrelated languages; and the use of verbal strategies including CS in which subtle linguistic adjustments are made for psychological, sociological, and attitudinal reasons (see Kachru 1985, for a review of early studies). These processes are usually interpreted with reference to identity representation, or the so-called 'optimal grammar' of bilingual use (Bhatt 2008; Bhatt and Bolonyai 2011). Bhatia and Ritchie (2008) reveal various facets of bilingual creativity through CS as it manifests itself in the day-to-day verbal behaviour of a bilingual. They argue that CS is essentially an 'optimizing' strategy rendering a wide variety of new meanings which the separate linguistic systems are incapable of rendering by themselves. The creative capacity of the bilingual mind/brain depends on the bilingual's ability to maintain both language separation and language integration simultaneously.

What cognitive mechanisms may underlie the relationship between CS and creativity? In psychometric tradition, creative thinking is perceived as an ability to initiate multiple cycles of convergent and divergent thinking (Guilford 1967), which create an active, attention-demanding process that allows generation of new, alternative solutions (Mumford et al. 1991). The fundamental difference between convergent and divergent thinking is that the former is a conscious, attention-demanding process, while the latter occurs in the unconscious mind, where attention is defocused (e.g. Kasof 1997; Mendelsohn 1976) and thought is associative (e.g. Koestler 1964; Mednick and Mednick 1967; Ward, Smith, and Vaid 1997). Divergent thinking involves a broad search for information and the generation of numerous novel alternative answers or solutions to a problem (Guilford 1967). Guilford associated the properties of divergent thinking with four main characteristics: fluency (the ability to rapidly produce a large number of ideas or solutions to a problem); flexibility (the capacity to consider a variety of approaches to a problem simultaneously); elaboration (the ability to think through the details of an idea and carry it out); and originality (the tendency to produce ideas different from those of most other people). Factor analysis of these characteristics performed with several distinct sociocultural samples (Kharkhurin 2008, 2009, 2011) revealed that they can be grouped

together as two types of creative capacities: fluency, flexibility, and elaboration traits seem to represent the ability to generate and to elaborate on various, often unrelated, ideas, while the originality trait is likely to represent the ability to extract novel and unique ideas. The first type is referred to as *generative* capacity; it addresses the ability to activate a multitude of unrelated concepts and work through the concepts already activated. The second type is referred to as *innovative* capacity; it accounts for the ability to produce original and useful ideas. Recent studies demonstrated that bilinguals developed these capacities to a greater extent than their monolingual counterparts. Russian-English bilingual college students demonstrated greater generative capacity by scoring higher than their English monolingual counterparts on the Abbreviated Torrance Test for Adults (ATTA) measures of fluency, flexibility, and elaboration (Kharkhurin 2008). Farsi-English bilingual college students revealed greater innovative capacity than their Farsi monolingual counterparts (Kharkhurin 2009). Among multilingual college students, those with high proficiency in English revealed greater innovative capacity than those with moderate proficiency in this language (Kharkhurin 2011). We will use this classification in the present study and assess creativity in terms of generative and innovative capacities.

Psychometric research provides evidence favoring bilinguals' creative abilities (see an overview in Kharkhurin 2012). A series of studies conducted in different geographic, linguistic, and cultural locations identified several cognitive mechanisms potentially underlying creative thinking (Kharkhurin 2011). Of particular interest to the present study is the finding that a routine cognitive mechanism of selective attention on the one hand seems to benefit from individuals' use of several languages, and on the other plays an important role in their creative performance. Specifically, the inhibition of irrelevant information seemed to enhance the innovative capacity. Is there a relationship between selective attention and CS, which may modulate the impact of the latter on creative performance?

Empirical findings report bilinguals' advantages on the nonverbal tasks requiring control processes such as selective attention to relevant aspects of a problem, inhibition of attention to misleading information, and switching between competing alternatives (see Bialystok 2005, 2009, for an overview). Enhanced selective attention seemed to have benefited from bilinguals' extensive practice with two active language systems. In bilingual language processing, both languages become activated (e.g. Costa 2005; de Groot, Delmaar, and Lupker 2000; Jared and Kroll 2001).[1] When bilinguals use a target language, the linguistic representation of the other language is still active and may interfere with the target ones. Simultaneous activation of both languages makes bilinguals constantly focus on one language, inhibit another language or switch between languages (Bialystok et al. 2005). Selective attention ensures noninterruptive processing in the target language by attending to the representational system corresponding to this language and disregarding the system associated with a non-target language. Thus, an extensive practice with at least two active language systems may facilitate selective attention engaged in solving the conflicts in lexical retrieval as was demonstrated by empirical research (reviewed in Bialystok 2005, 2009). These findings were supported by the results of brain imaging studies revealing that experience with two languages leads to systematic changes in frontal executive functions (e.g. Bialystok et al. 2005). Due to cross-linguistic practice, bilinguals exercise crucial cognitive skills that enhance the problem-solving abilities requiring attentional control to focus on relevant and to ignore misleading cues. In a similar fashion, although unrelated to bilingualism per se, Kiesel and her colleagues (2010) presented an overview of research utilizing task-switching

paradigm to study cognitive control and task interference. These studies also converge on the notion that the ability to control the switch encouraged by well-developed selective attention seems to facilitate an individual's cognitive performance. Thus, these findings suggest that active CS may provide extensive opportunities for selective attention.

Brain imaging studies also hinted at the potential relation between CS and selective attention. Jackson et al. (2001) used event-related dense-sensor electroencephalography recording techniques to examine the time course of language switching during a visually cued naming task in which bilingual participants named digits in either their first or second language. They found modulation of event-related electrical potential components in frontal cortex, when engaged in language switching and in suppressing manual response in a Go/No-Go reaction time task. These findings suggest that similar inhibitory mechanisms are involved in both response suppression and language switching. A more recent study (Abutalebi et al. 2007) used event-related functional magnetic resonance imaging on highly proficient bilinguals while they listened to narratives containing 'switched passages' that could either respect or violate the constituents of sentence structure. One of the findings demonstrated that a switch into a less-exposed language triggered activity in subcortical structures and the anterior cingulate cortex, which are presumably involved in selective attention.

Thus, if there is a relationship between CS and selective attention, it is prudent to suppose that extensive CS practice may result in enhanced selective attention capacity, which may potentially entail increase in creative performance. This consideration entails two hypotheses: (1) extensive CS practice enhances creative performance; and (2) extensive CS practice strengthens selective attention. To test these hypotheses, a group of HCS was compared to a group of NHCS on a creativity test and a test of selective attention. We expected to find CS group performance differences on both tests. In addition, considering the exploratory nature of the present study, which represents the first attempt at investigating the relationship between CS and creativity in bilinguals, we tried to identify possible CS factors enhancing creativity.

Method

Participants

The participants were 157 American University of Sharjah (United Arab Emirates) multilingual students (56 male and 101 female) aged between 16 and 24 (M = 20.07, SD = 1.55) who were recruited from the General Psychology subject pool. The major languages – both first (L1) and second (L2) – were English, Arabic, and Urdu: 93 participants were Arabic-English; 19 participants were English-Arabic; 14 participants were Urdu-English; and five participants were English-Urdu; 26 others reported a different language combination. Forty-two participants indicated that they speak three languages and eight of them revealed knowledge of a fourth language, French being the most common third and fourth languages.

Procedure

Participants had to complete two online questionnaires prior to the offline testing in the laboratory setting: biographical questionnaire and the one reporting their CS behavior and attitudes. In the laboratory, participants received a creativity test and a test of selective attention presented in counter-balanced order. All assessments were presented in English. Using English as language of testing was justified by the fact that participants were

fluent in English as shown by their high self-assessment of linguistic abilities ($M = 24.27$, $SD = 3.66$, out of 28.00, see below). The self-assessment seemed to provide a reliable measure given that English is the language of instruction at this university and a language of communication in this country. That is, although United Arab Emirates is located on the Arabian Peninsula, the primary language of official as well as informal everyday communication is English. The majority of the population are expatriates from different countries whose primary language of communication is English.

Instruments

Biographical questionnaire

An Internet-based multilingual and multicultural experience questionnaire (http://surveys.aus.edu/index.php?sid=87644) was administered to determine participants' linguistic and cultural backgrounds. They received a questionnaire that, among other issues, obtained data on participants' place of origin, languages they speak, their assessment of linguistic skills in each of these languages, and age of acquisition of these languages. The questionnaire also included Likert-type 7-point scales on which participants rated their abilities in reading, writing, speaking, and listening in their respective languages. The total self-rating score ranged from 0 to 28 for each language.

Self-report of code-switching attitudes and behaviors

An Internet-based Code-Switching Attitudes and Behaviors questionnaire (http://surveys.aus.edu/index.php?sid=39486) was administered to determine participants' CS attitudes and behaviors (see paper version in Appendix 1). The questionnaire enabled us to obtain data on, among other issues, the participants' rate of CS, possible reasons why they code-switch, and the emotional states and various circumstances in which they are likely to code-switch. The first question asked the participants to select one out of five answers concerning whether they code-switch when speaking with other bilinguals; the answers were presented in the order of descending frequency of CS. Participants' answers to this question were used to assign them to HCS and NHCS. Four Likert-type 7-point scales (see Appendix 1, items 4–7) assessed their CS frequency in a sentence, in a conversation, unintentional, and intentional, respectively. Participants also had to indicate on eight Likert-type 7-point scales (see Appendix 1, item 10) the likelihood of CS in various circumstances. Participants' answers to these questions were used to confirm the group assignment. Additionally, participants were asked to select up to four reasons why they switch languages (item 8: in a particular emotional state, to better convey a message, to achieve special communicative effects, due to lack of a word in target language). They also had to indicate on eight Likert-type 7-point scales (see Appendix 1, item 9) which emotional states influence their likelihood to switch languages. The Likert-type scales ranged from −3 to 3 for 7-point, and from −2 to 2 for 5-point, respectively. Other questions addressed participants' CS attitude and were not used in the present analysis.

Assessment of creativity

Participants' creative abilities were assessed using the ATTA (Goff and Torrance 2002). The ATTA was developed on the basis of the Torrance Tests of Creative Thinking (Torrance 1966). It consists of activities utilizing the same rationale as activities in the

original test, but in abbreviated form and requires considerably less testing time, which is particularly beneficial when administering it to adults.

The standard ATTA has three paper-and-pencil activities preceded by written instruction that explains general guidelines and encourages participants to use their imagination and thinking abilities. In Activity 1, participants were asked to suppose that they could walk on air or fly, and then to identify the troubles that they might encounter. This activity provided verbal fluency and originality scores. In Activity 2, participants were presented with two incomplete figures (see Appendix 2.1) and were asked to draw pictures with these figures and to attempt to make these pictures as unusual as possible. This activity provided figural fluency, originality, and elaboration scores. In Activity 3, the participants were presented with a group of nine triangles arranged in a 3 × 3 matrix (see Appendix 2.2) and were asked to draw as many pictures or objects as they could using those triangles. This activity provided figural fluency, originality, elaboration, and flexibility scores.

The standard ATTA assessment consists of four divergent thinking traits: fluency, originality, elaboration, and flexibility. Fluency measures the ability to produce quantities of ideas, which are relevant to the task instructions. The sum of fluency scores in all three activities provided a fluency raw score. Originality measures the ability to produce uncommon ideas, or ideas that are totally new or unique. The sum of originality scores in all three activities provided an originality raw score. Elaboration measures the ability to embellish ideas with details. The sum of elaboration scores in Activities 2 and 3 provided an elaboration raw score. Finally, flexibility measures the ability to process information or objects in different ways, given the same stimulus. A flexibility raw score was obtained from Activity 3. The raw scores for fluency, originality, elaboration, and flexibility obtained in the test were subsequently transformed into scaled norm-referenced scores by the recommended procedure (Goff and Torrance 2002), which took age-related norms into account. The ATTA manual reports the Kuder-Richardson (KR21) reliability coefficient for the total raw score for the four traits measured by the ATTA as .84.

Two independent raters assessed participants' creative thinking abilities using the standard ATTA assessment procedure (Goff and Torrance 2002). The significantly high inter-rater correlation between the four norm-referenced scores produced by both raters (r = .93 for fluency; r = .99 for originality; r = .97 for elaboration; and r = .93 for flexibility, all ps < .001) indicated that the raters used the same rationale, and their ratings were comparable. Subsequently, the respective scores produced by both raters were averaged.

Table 1. Pearson correlations and factor loadings for the norm-referenced ATTA scores (N = 157).

	Divergent thinking measures			Factor loadings	
	2	3	4	I	II
1. Fluency	.60*	.42*	−.05	*.85*	−.17
2. Flexibility		.51*	.09	*.87*	.06
3. Elaboration			.22**	*.73*	.36
4. Originality				.02	*.96*

Note: The highest loadings of the measures are italicized. *p < .001; **p < .01.

Generative and innovative capacities. Similar to the previous studies (e.g. Kharkhurin 2008, 2009, 2011), four ATTA norm-referenced scores were entered into a principle component factor analysis with varimax rotation. The first three columns of Table 1 present the inter-correlations among the norm-referenced ATTA scores. The analysis extracted two factors (whose eigenvalues exceeded 1), which accounted for 77.54% of the variance. Loadings of the measures on these factors appear in the last two columns of Table 1. The first factor was determined by the ATTA measures of fluency, flexibility, and elaboration and represented the generative capacity. The second factor represented the innovative capacity with the highest loading on originality. Subsequently, each factor score was transformed into a new variable, thereby creating generative capacity and innovative capacity scores, respectively. The Anderson and Rubin's (1949) method of estimating factor score coefficients was used to ensure orthogonality of the estimated factors. The scores ranged from −1.46 to 2.76 for generative capacity and −1.65 to 1.85 for innovative capacity (both *M*s = 0.00, *SD*s = 1.00), with higher scores representing greater creative capacities. These scores were used in further analyses.

Assessment of selective attention

Selective attention was assessed by a version of the standard Eriksen flanker task (Eriksen and Eriksen 1974). In this test, participants were first presented with a fixation cross for 500 ms, which was immediately followed by a horizontal array of five equally sized and spaced arrows for 1700 ms. The array was 14.87 cm wide and 1.16 cm high. The stimuli were presented in black-on-white background using 19? flat monitor. Participants were instructed to attend to the central arrow and ignore the four flankers. They were to press the left key for a left-facing central arrow and the right key for a right-facing central arrow. The flanking arrows either all pointed in the same direction as the target arrow, or they all pointed in the opposite direction. The trials on which the flanking arrows pointed in the same direction as the target arrow were the *congruent* trials; the trials in which they pointed in the opposite direction were the *incongruent* trials. Subjects received a total of 80 trials (40 congruent and 40 incongruent ones) in a random order, requiring an equal number of left or right responses. The experiment was preceded by 12 practice trials; participants had to obtain 85% of correct responses before continuing with the experiment. The Eriksen flanker task lasted approximately 10 min. The Flanker score reflected a proportional reaction time increase in the condition that required suppression of the irrelevant information. That is, it was calculated as a reaction time difference between incongruent and congruent conditions divided by their sum. The greater Flanker score value indicates lower suppression capacity and therefore weaker selective attention.

Results

Habitual vs. non-habitual code-switchers

As explained above, to test our hypotheses we identified two CS groups: HCS and NHCS. Participants who responded with option 1 or 2 to the question on CS frequency (see Appendix 1, item 1) were assigned as the HCS. Participants who responded with options 4 or 5 to this question were considered as not CS and were grouped as the NHCS. Participants who selected option 3 were considered as infrequently CS and were excluded from the analysis. Table 2 presents mean responses of participants in each group to the questions assessing their CS behaviour. All three groups showed highly significantly different results on all questions (all *p*s < .001) with the HCS obtaining the highest, the

Table 2. Group size, mean age (with standard deviations), and mean scores (with standard deviations) on selected Code-Switching Attitudes and Behaviors questionnaire items assessing CS behavior of HCS, NHCS, and those excluded from the analysis.

	HCS	NHCS	Excluded	$F(2, 154)$
N	89	22	46	
Age	20.17 (1.49)	19.91 (1.74)	19.96 (1.61)	0.42
CS within sentence (item 4)	0.55 (1.42)	−2.05 (1.05)	−0.80 (1.05)	43.65*
CS within conversation (item 5)	1.06 (1.33)	−1.68 (0.72)	−0.24 (1.10)	52.77*
CS unintentionally (item 6)	0.98 (1.47)	−1.73 (1.32)	−0.46 (1.33)	39.11*
CS intentionally (item 7)	0.65 (1.35)	−1.18 (1.30)	−0.54 (1.36)	22.59*
CS in various circumstances (averaged over eight questions of item 10)	0.66 (0.64)	0.00 (0.89)	0.48 (0.58)	8.76*

Note: The last column presents ANOVA's *F*-values. *$p < .001$.

NHCS the lowest, and excluded group the middle scores. These results confirmed the propriety of our group selection, and these groups were used in further analysis.

Selective attention and creativity in CS groups

To test our hypotheses, we looked at selective attention and creative performance differences between two selected CS groups. Table 3 presents mean Flanker, generative, and innovative capacity scores of the HCS and NHCS groups. The HCS significantly outperformed the NHCS on the measure of innovative capacity ($F(1, 109) = 6.14$, $p < .05$, $\eta^2 = .05$). No group differences were observed either for generative capacity or for selective attention. In addition, as Table 3 demonstrates, there were no differences between L1 and L2 groups' self-ratings as well as their age of acquisition of both languages, which eliminated a potential effect of covariance.

Although the first hypothesis was confirmed, we did not find support for the second one. The HCS group demonstrated no differences in selective attention with the NHCS group. In an attempt to find an explanation for this finding, we performed some additional testing. A repeated-measure analysis of variance (ANOVA) revealed an interaction effect of CS group and the frequency with which participants switch between languages (intentionally, unintentionally). The NHCS indicated a higher intentional CS rate than unintentional one, whereas the HCS indicated a reverse tendency ($F(1, 109) = 4.95$, $p <$

Table 3. HCS and NHCS code-switchers' mean scores (with standard deviations) on Flanker, generative, and innovative capacities (transformed scores), L1 and L2 self-ratings, and age of L1 and L2 acquisition.

	HCS	NHCS
Flanker	0.06 (0.04)	0.06 (0.03)
Generative capacity	−0.10 (0.90)	−0.17 (1.09)
Innovative capacity	0.10 (1.04)*	−0.51 (0.93)
L1 self-rating	24.60 (4.35)	24.32 (5.40)
L2 self-rating	23.94 (3.89)	22.32 (5.77)
Age of L1 acquisition	4.44 (2.76)	4.44 (2.58)
Age of L2 acquisition	5.55 (2.94)	5.11 (3.05)

Note: *$p < .05$.

.05, $\eta^2 = .04$). This finding suggests that the NHCS group is more prone to controlled CS and therefore may reveal a more pronounced language switch costs effect than the HCS group.

Therefore, we analyzed the relationship between selective attention and creativity in each group separately. The NHCS revealed a highly significant correlation between the Flanker score and the innovative capacity ($r = -.47$, $p < .05$), whereas the HCS showed no significant correlation between these measures. The negative correlation suggests that the enhanced innovative capacity in the NHCS is related to greater suppression capacity.

CS factors enhancing creativity

Further, we explored what factors in CS behavior may facilitate innovative capacity of the HCS. With this group, we performed an ANOVA with four reasons for CS (see Appendix 1, item 8) as independent factors and innovative capacity as the dependent variable. We found a significant interaction between CS due to lack of a word in target language and CS in a particular emotional state ($F(1, 88) = 4.61$, $p < .05$, $\eta^2 = .06$). As Figure 1 demonstrates, only HCS participants who indicated that they code-switch when in a particular emotional state and when lacking a word in the target language obtained greater innovative capacity compared to others, although the effect did not reach significance (*p*s ranging from .11 to .38). Unfortunately, this analysis cannot be performed on the NHCS due to its small size (e.g. there was only one participant who reported CS in a particular emotional state and when lacking a word in the target language).

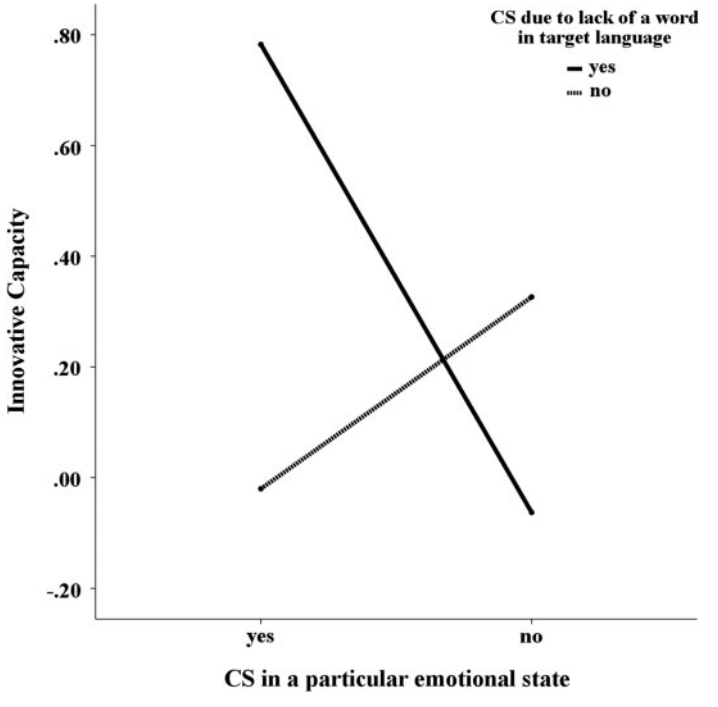

Figure 1. The effect of interaction between the CS in particular emotional state and the CS due to lack of a word in target language on the innovative capacity of the HCS, $N = 89$.

Finally, a logistic regression analysis was conducted with the HCS group to predict CS in a particular emotional state using the frequency with which various emotional states influence likelihood to switch languages (see Appendix 1, item 9) as predictors. A test of the full model against a constant-only model was statistically significant, indicating that the predictors as a set reliably distinguished between participants who switch in particular emotional state and those who do not ($\chi^2 = 17.33$, $p < .05$ with $df = 8$). The Wald criterion demonstrated that only alertness made a significant contribution to prediction ($p = .04$). This finding indicates that participants are likely to switch languages in the state of alertness.

Discussion

This study continues a line of research investigating various aspects of bilingual creativity (Kharkhurin 2012). The present article focuses on the role of bilinguals' CS in their creative performance. The results confirmed the major hypothesis of the study by showing greater innovative capacity in bilinguals who code-switch frequently and regularly as compared to their counterparts who do not code-switch in their everyday practice. This finding can be explained by a two-fold argument. First, the studies reviewed in the introduction demonstrate a relationship between CS and selective attention. Second, Kharkhurin (2011) found that the inhibition of irrelevant information, which appears to be an important selective attention mechanism, was related to enhancement in bilinguals' innovative capacity. Therefore, extensively CS bilinguals should outperform their counterparts who do not code-switch on the measure of innovative capacity; this is what the results of the present study show. However, if this line of reasoning holds, we would expect greater selective attention in the HCS group. Our findings though revealed this not to be the case; rather, we found no difference in selective attention between HCS and NHCS. Moreover, the relationship between selective attention and innovative capacity found in the previous study appeared only among NHCS. One possible explanation is that HCS and NHCS differ in their language switch cost. Behavioral studies of language switching in bilinguals provided evidence that there is a significant and measurable response time cost associated with switching from one language to another, and that this cost is observed even when switching is entirely predictable (Meuter and Allport 1999). Research also shows that language switch cost is observed with controlled, involuntary switching (e.g. Costa and Santesteban 2004; Gollan and Ferreira 2009; Macizo, Bajo, and Paolieri 2012). It then follows that the NHCS is more likely to reveal the language switch cost effect. This means that participants in this group need to make an additional use of selective attention to compensate for language switch cost. Those with relatively more elaborate selective attention capacity demonstrated greater innovative capacity. These findings, therefore, can contribute to the development of a more general model of cognitive control of CS (e.g. Green and Wei, 2014).

Note that the present study presents an attempt to initiate a line of research investigating the relationship between CS and creativity. Considering the exploratory nature of the study, we looked at potential CS factors, which may contribute to enhancement in bilinguals' creativity. Two CS conditions were found to be facilitatory for creative functioning. Specifically, CS induced by a particular emotional state and by insufficient vocabulary in the target language appeared to relate to increase in innovative capacity. The relatedness of these two CS conditions can be speculatively addressed by our finding that alertness was the only significant predictor for emotion-triggered CS.

Alertness, for example, may be heightened during temporary loss for words in a particular language, which in turn triggers CS. Alertness may also require more selective attention, which is connected to innovative capacity. This finding provides an interesting account, in which emotion-triggered CS results in activation of creative capacities. Recent research on the relationship between bilingualism and emotions provided evidence that CS is often triggered by the speaker's emotions and other affective factors (e.g. Dewaele 2010b; Pavlenko 2005). Dewaele (2008, 2010a), in particular, showed that bilinguals code-switch to specific language to express love, anger, and frustration. Our finding suggests that this kind of emotion-triggered CS could be connected to creativity. This may be because CS breaks the conventional conversational routine by introducing different, emotionally laden elements of language. Needless to say though that these conclusions are far too preliminary and any account of these findings should be considered as highly speculative.

Conclusion

As stated in the Introduction, a major objective of the present study is to introduce a new theme to the scientific investigation of bilingual creativity. We have fulfilled this purpose as our findings provide the empirical basis for further research on the relationship between CS, the defining characteristic behavior of bilingual speakers, and their creative capacities.

As an exploratory study, this one has some limitations. It is evident that assessment of language-related practices using self-report questionnaires may mask certain effects. This method can be safely utilized in assessment of linguistic aptitude due to the fact that self-reports have been demonstrated to adequately reflect language abilities (e.g. Albert and Obler 1978; Macnamara 1967, 1969). Unfortunately, this may not be true for CS. This practice involves both conscious and unconscious processes, which participants may not be aware of. We recognize that the information we use to assign the participants into the two groups is self-report rather than actual behaviour. Sociolinguists who have studied bilinguals' attitudes toward CS have revealed certain level of under-reporting by those who view CS as a sign of linguistic deficiency. But over-reporting of CS has not been reported by any researcher. While there may be participants in our NHCS group who code-switch more often than they self-reported, there is no reason for us to believe that the HCS group with its substantial size is not reliable. Nevertheless, introducing more objective measures of CS seems to be prudent in future research, especially when it comes to differentiation of HCS and NHCS. For example, participants can be engaged in a specifically constructed dialog, which prompts CS in different conversational contexts (e.g. to express emotions, to achieve special communicative effects, when lacking a word in the target language).

Further, some people may see the size of the NHCS group not large enough to draw reliable conclusions. Although $N = 22$ is not a large number indeed, it appears to provide sufficient statistical power. A comparison between HCS and NHCS gained significant results, and the correlational analysis of the NHCS group produced such a high r that even with a relatively small number, it obtained significance.

Thus, once the empirical foundation for the relationship between CS and creativity is established, further research is required to build an elaborate framework. What is the role of CS in bilingual creativity? What cognitive mechanisms and psychological states may have an impact on this relationship? These are just a few fundamental questions that researchers will need to answer. Another question that needs to be further explored is

pertinent to the relationship between CS and selective attention. Does CS require more or less selective attention? Although the answer to this question seems to be straightforward, it may present a key to any model building for bilingual cognition.

Further, one may be interested in looking at how various emotional states are related to CS. Earlier we have speculated that the state of alertness may be triggered by temporary loss for words in a particular language, which in turn facilitates CS. There is emerging evidence to suggest that some multilinguals code-switch more frequently in certain emotional states (Dewaele and Wei 2014). Research by Pavlenko (2005) and Dewaele (2010b) indicates that the relationships between emotion and particular languages in the multilingual's linguistic repertoire are complex and multidimensional. Some emotions may trigger more CS in some multilinguals, while in others they may trigger inhibition of particular languages. In other words, different emotional states may facilitate or inhibit CS, which in turn may have ramifications for creative capacities. A new line of research on the role of emotions in bilingual creativity (Kharkhurin and Altarriba, 2011) provides evidence of the interactive effect of the mood (positive vs. negative) and linguistic context (use of dominant vs. subordinate language) on an individual's creative performance. Thus, future studies may explore potential effects of emotions, specific languages, and CS on creativity.

Last but not least, the ideas presented in this study have important implications for pedagogy. The role of CS in multilingual education has already received a substantial consideration in linguistic ethnography tradition in the context of above-mentioned translanguaging in teaching and learning (see Garcia and Wei 2014, for a detailed discussion). Our results contribute with a cognitive perspective. Kharkhurin (2012) argued that CS can be detrimental for interference suppression (a manifestation of selective attention capacity), which in turn may harm creative thinking. A logical conclusion from this argument called for discouraging students from CS. In fact, this statement initiated a discussion between the authors of the present work, which gave rise to this empirical study. The findings clearly demonstrate that CS has no impact on selective attention; moreover, HCS revealed advantages in creative thinking compared to NHCS. Thus, instead of discouraging CS in a multilingual classroom (or in a multilingual household), researchers and educators should develop strategies encouraging this practice. This initiative can be supported by a systematic study of cognitive mechanisms underlying creative thinking, which could be strengthened by CS, and those conditions that may facilitate it.

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Note

1. This integrated lexicon approach to the bilingual memory is contrasted with an alternative view that advocates a language-specific access system in which both languages are stored separately and activation of one language does not entail the activation of the other (Gerard and Scarborough 1989; Soares and Grosjean 1984).

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Appendix 1: Code-switching attitudes and behaviors

1. Do you switch between languages when speaking with other bilinguals (those who speak the same languages as you)? *Check one*

(1) Every time I speak with another bilingual.
(2) Almost every time I speak with another bilingual.
(3) Occasionally when I speak with other bilinguals.
(4) I hardly do this when I speak with other bilinguals.
(5) I never code-switch. I always maintain ONE language consistently in my conversations with other bilinguals.

2. How many languages do you speak?

3. Please indicate below each of your languages and rate from **1** (**lowest**) to **10** (**highest**) how well you can maintain a conversation in this language without using your other languages.

4. How often do you switch between different languages within one sentence?

Never Rare Not often Sometimes Often Very often Always

5. How often do you switch between different languages within one conversation?

Never Rare Not often Sometimes Often Very often Always

6. How often do you switch between languages unintentionally?

Never Rare Not often Sometimes Often Very often Always

7. How often do you switch between languages intentionally?

Never Rare Not often Sometimes Often Very often Always

8. If you do switch, why do you think you do this? *Mark all that applies*

(1) I switch to another language when I am in a particular emotional state.
(2) Although I know words in both languages, I still switch to another language to convey my message better (with more precision).
(3) Although I know words in both languages, I still switch to another language to say something unusual, to achieve special communicative effects.
(4) I switch to another language when I don't know a word in a language I currently speak.

9. How often do the following emotional states influence your likelihood to switch languages (i.e. do any of the options make you more or less likely to switch)?

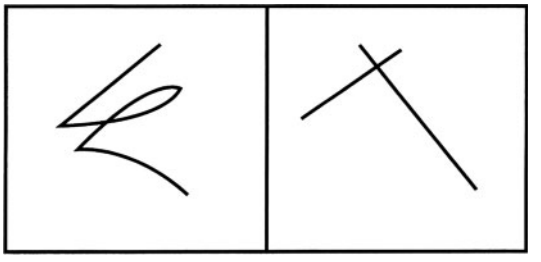
	Never	Rare	Not often	Sometimes	Often	Very often	Always
(1) Happiness							
(2) Excitement							
(3) Affection							
(4) Alertness							
(5) Tiredness/ Fatigue							
(6) Anger							
(7) Anxiety							
(8) Stress							

10. How likely would you switch languages in various circumstances?

	Very unlikely	Quite unlikely	Neutral	Quite likely	Very likely
(1) When a monolingual (someone who does not speak one of your languages) joins the conversation.					
(2) When I am re-telling a story/joke that occurred in a particular language.					
(3) When the person with whom I am speaking, switches between languages.					
(4) When I do not have the vocabulary to express in a particular language.					
(5) When the concept I am discussing doesn't exist in a particular language.					
(6) If I do not want other people in the vicinity to understand what I am saying.					
(7) If I feel the person with whom I am speaking, will have trouble understanding what I am saying.					
(8) When I am trying to represent myself in a certain way, as belonging to a certain group.					

Appendix 2: Abbreviated Torrance Test for Adults

(1) Stimuli for Activity 2



(2) Stimuli for Activity 3