

Qualitatively similar automatic semantic priming in native and non-native speakers

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Abstract

Qualitative and quantitative differences in semantic priming for native and non-native speaker groups were explored using a primed lexical decision task. In addition to response time data, coefficient of variance (CV) for response times was used to investigate quantitative differences in lexical processing between groups. Segalowitz and Segalowitz (1993) argued that differences in CV indicate processing differences. For example, lexical access via automatic routes results in lower CVs, and lexical access via attentional routes results in higher CVs. The current study replicates findings for automatic semantic priming in non-native speakers and contributes behavioural data for the argument that priming in a non-native speaker group can be qualitatively similar to that in native speakers.

Key words: priming, second language, coefficient of variance, automaticity

Introduction

Semantic priming and lexical access in non-native speakers is widely researched with one of the recent questions being whether priming and lexical access in non-native speakers is qualitatively different to that in native speakers (Frenck-Mestre & Prince, 1997; Phillips, Segalowitz, O'Brien & Yamasaki, 2004). Lexical access is often tested using response timed lexical decision tasks. However, Segalowitz and Segalowitz (1993) pointed out that response time data alone cannot indicate whether a participant is using automatic (direct access) or attentional (e.g., translation or rule checking) processes. In their influential paper, they argued that the coefficient of variance for response times (standard deviation divided by mean response time) can be used to distinguish between automatic (lower CVs) and attentional (higher CVs) processing whilst correcting for differences in response speed.

Most studies using coefficient of variance analysis have focussed on longitudinal changes in proficiency within subjects following training (for a review, see Hulstijn et al., 2009). The question of within subject change is interesting, but so far neglected in this recent wave of research is whether non-native speakers of a language can attain a native-like state. The current study investigated potential differences in semantic priming in native and non-native speakers of English using a lexical decision task. Semantic priming refers to the facilitation of responses to a stimulus as a result of a previous semantically related stimulus. Automatic semantic

priming is often attributed to spreading activation throughout representations in the semantic network (e.g., Masson, 1995).

Word frequency was also manipulated in the experiment. It has been suggested that even native speakers process high and low frequency words differently (Balota, 1994). It has also been proposed that priming effects for low frequency word targets should be stronger than for high frequency word targets (Kinoshita, 1995). This is because response times for high frequency words are already fast and less affected by the “boost” from a prime word. If different processes are indeed involved in the processing of high and low frequency words, then CVs should differ as a function of frequency in native speakers at least.

Methodology

Thirty native speakers of British English (21 females, 9 males) aged between 18–30 years (mean age = 21.2 years) were recruited from the University of Sheffield, England and 24 non-native speakers of English (18 females, 6 males) aged between 18–33 years (mean age = 22.6 years) were recruited from Saarland University, Germany. All non-native speakers had learned English in school from the age of 10 years and were studying English or used English at university.

Stimuli consisted of 90 English prime-target word pairs which appeared in related (spring-season), unrelated (tongue-season) and neutral (BLANK-season) conditions in three counterbalanced lists. Half of the targets were high frequency (rankings from 509-4231) and half were low frequency (rankings from 2-66). Frequency ratings were taken from the Thorndike-Lorge written frequency ratings (Fearnley, 1997). There was a total of 360 stimulus items including 180 prime and target words, 120 phonotactically legal nonwords and 60 word and neutral word (BLANK) filler items. Participants were presented with a single stimulus and asked to judge whether the stimulus was a word or nonword as quickly and as accurately as possible. Participants responded via mouse button press.

Results

Data from one non-native speaker participant was not recorded due to a computer error; data are reported for the twenty-three remaining participants. Correct responses were analyzed and response times of 2000 milliseconds (the time-out value) were eliminated from analysis. Response times \pm 3 SD of the subject's mean were replaced with the subject's mean response time for that condition. Response times (RT) and coefficient of variance for response times (CV) were entered into separate repeated measures ANOVAs with Condition (related, unrelated, neutral) and Frequency (high, low) as

within subjects variables and Group (native, non-native) as a between subjects variable.

For the RT data, there was a significant effect of Frequency ($F(1, 51) = 248.811, p < 0.0005$), indicating RTs for high frequency targets were significantly faster than for low frequency targets. There was a significant effect of Condition ($F(2, 102) = 16.300, p < 0.0005$). Post hoc tests showed that this was due to the significantly faster RTs for the related condition as compared to the unrelated condition ($t(52) = 3.629, p < 0.01$) and the neutral condition ($t(52) = 5.499, p < 0.0005$). There were no other significant comparisons, all $p > 0.02$; Bonferroni adjusted p value = 0.02. There was a significant interaction between Condition and Frequency ($F(2, 102) = 6.502, p < 0.01$). Post hoc tests showed that RTs for the high frequency related condition were significantly faster than for the high frequency neutral condition ($t(52) = 3.155, p < 0.008$) and RTs for the high frequency unrelated condition were faster than for the high frequency neutral condition ($t(52) = 3.185, p < 0.008$); Bonferroni adjusted p value = 0.008. There was no significant difference for the high frequency related and unrelated comparison ($t(52) = 0.418, p = 0.678$). RTs for the low frequency related condition were significantly faster than the low frequency unrelated condition ($t(52) = 4.202, p < 0.0005$) and the low frequency neutral condition ($t(52) = 4.904, p < 0.0005$), indicating a significant priming effect for low frequency targets. There was no significant difference for RTs in the low frequency unrelated and neutral comparison ($t(52) = 0.602, p = 0.550$). There was a significant main effect of Group ($F(1, 51) = 15.669, p < 0.0005$), indicating that RTs for native speakers (mean = 552.1msec) were significantly faster than for non-native speakers (mean = 640.4msec).

For the CV data, there was a significant effect of Frequency ($F(1, 51) = 24.383, p < 0.0005$), indicating that CVs for high frequency targets (mean = 0.21) were significantly lower than for low frequency targets (mean = 0.26). There was no significant effect of Condition ($F(2, 102) = 0.414, p = 0.662$), indicating that CVs across the conditions were similar. There was a significant interaction between Condition and Frequency ($F(2, 102) = 4.941, p < 0.01$), indicating different CV values for high and low frequency targets across conditions. Post hoc tests showed that CVs for the high frequency unrelated and neutral conditions were significantly different ($t(52) = 3.706, p < 0.008$). There were no other significant differences, all $p > 0.008$; Bonferroni adjusted p value = 0.008. There was no significant main effect of Group ($F(1, 51) = 0.164, p = 0.688$), indicating that native (mean = 0.23) and non-native speaker (mean = 0.24) CVs were similar.

Discussion

The results replicate previous findings of semantic priming in a second language, but in contrast to previous studies (e.g., Frenck-Mestre and Prince, 1997), the current study used coefficient of variance of response times, in addition to response time data, to explore possible qualitative semantic priming differences between native and non-native speakers.

The results yielded a number of important findings. Firstly, the current data provide empirical behavioural evidence for the difference in processing and priming of high and low frequency words in native (and non-native) speakers using the coefficient of variance for response times. CVs in both groups were lower for high frequency words indicating more automatic processing of these words. Priming for low frequency word targets was also stronger than for high frequency word targets in both groups. Secondly, the study replicates automatic semantic priming in a second language. Finally, the study shows empirical support in the form of behavioural data, notably the coefficient of variance, for the argument that semantic priming in non-native speakers can be qualitatively similar to priming in native speakers, even though non-native speaker may have longer response times than native speakers.

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