Can Lextale-Esp discriminate between groups of highly proficient Catalan-Spanish bilinguals with different language dominances?

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ABSTRACT

Researchers recently introduced Lextale-type word recognition tests to assess vocabulary size in a second language (L2) mastered by participants. These tests correlate well with other measures of language proficiency in unbalanced bilinguals whose second language is well below the level of their native language. In the present study we investigate whether the Lextale-type test also discriminates at the high end of the proficiency range. In several regions of Spain, people speak both the regional language (e.g., Catalan or Basque) and Spanish to a very high degree. Still, because of their living circumstances, some consider themselves as Spanish dominant or regional language dominant. We show that these two groups perform differently on the recently published Spanish Lextale-Esp: The Spanish dominant group had significantly higher scores than the Catalan dominant group. We also show that the noncognate words of the test have the highest discrimination power. This indicates that the existing Spanish Lextale-Esp can be used to estimate proficiency differences in highly proficient bilinguals with Spanish as L2, and that a more sensitive test could be built by replacing the cognates.

INTRODUCTION

Proficiency has a central role in research about bilingualism (Lemhöfer & Broersma, 2012). Indeed, second language (L2) proficiency has been demonstrated to affect performance in a variety of experimental tasks and paradigms. Davis, Sánchez-Casas, García-Albea, Guasch, Molero, and Ferré (2010), for instance, observed that highly proficient bilinguals show an interlingual cognate priming effect of the same magnitude as a within-language repetition effect (i.e., for an English-Spanish bilingual there is as much priming for the prime target pair rico-RICH as for the prime-target pair rich-RICH). The same was not true for beginning bilinguals, when the prime was in L2 and the target in L1. Rossi, Gugler, Friederici, and Hahne (2006) reported that highly-proficient late L2 learners showed the same ERP responses to syntactic violations in sentences as L1 speakers, but this was not true for low-proficiency L2 learners, who had a qualitatively different response to the violations. Other neuroscientific research indicated that the pattern of brain activation is modulated by L2 proficiency. Whereas highly proficient L2 speakers activate the same brain areas as L1 speakers during lexico-semantic processing in L2, less proficient bilinguals show the engagement of additional brain areas when performing tasks in L2 (see Abutalebi, 2008, and Costa & Sebastián, 2014, for reviews). Finally, Prior, MacWhinney, and Kroll (2007) reported that less proficient bilinguals produce lower probability translations from L1 to L2 than more proficient bilinguals.

Taking the above into account, it is clear that researchers should measure the participants' proficiency levels in all bilingual studies, not just in those directly addressing the issue of proficiency levels. Unfortunately, this is rarely done with much precision (Lemhöfer & Broersma, 2012). A common approach is to use self-ratings (i.e., the participants are asked to rate their own proficiency levels on a Likert scale).

Although self-ratings are a useful source of information, they suffer from several shortcomings. One is that they may not be comparable across studies (Brysbaert, 2013). For instance, Lemhöfer and Broersma (2012) reported that there were differences between Dutch-English bilinguals and Korean-English bilinguals in the extent to which subjective proficiency assessments correlated with performance in translation tasks as well as with a test for general proficiency. This difference might be due to cultural differences. Studies may also differ in other aspects. First instance, it might be that L2 speakers give themselves

higher ratings in a paid experiment than in an unpaid experiment, as there is more to be earned in the former.

A second shortcoming of self-ratings is that they are influenced by individual differences. MacIntyre, Noels, and Clément (1997), for instance, reported that L2 self-ratings were influenced as much by language anxiety as by language proficiency. Language anxiety was measured with a questionnaire asking how anxious participants felt using L2 in a variety of circumstances; proficiency was measured with a series of language production tasks. The authors found that participants with low anxiety overestimated their proficiency level, whereas participants with high anxiety underestimated their performance. Similarly, Izura, Cuetos, and Brysbaert (2014) observed that L2 speakers in general have lower performance levels than L1 speakers with the same self-ratings. Arguably this is because both groups use different criteria: L2 speakers compare themselves to other L2 speakers, whereas L1 compare themselves to other L1 speakers.

A final limitation of self-ratings is that they tend to give rather crude information. For instance, Izura et al. (2014) found that low and high ratings were a good indication of respectively poor and strong performance, but that medium ratings (4-8 on a 10-point scale) were associated with a large variety of performance levels. Along the same lines, participants may be perfectly able to indicate they are more dominant in one language than in the other, but this is rather limited information if one wants to use language proficiency as a predictor variable or if one wants to estimate the difference in proficiency levels between the languages.

In light of the above limitations, there is a high need for performance-based measures of language proficiency with a good sensitivity and specificity. Several measures have been proposed. For instance, some researchers have relied on fluency tasks (e.g., Ferré, García, Fraga, Sánchez-Casas, & Molero, 2010), others on vocabulary tests (e.g., Conrad, Recio, & Jacobs, 2011), and still others on commercially available proficiency tests (e.g., Zhou, Chen, Yang, & Dunlap, 2010). Common problems with these tests are that they are too demanding (in time or technical facilities) and/or too expensive.

Lemhöfer and Broersma (2012) proposed a quick and easy way to measure L2 proficiency, which can be used with different groups of bilinguals. It relies on word knowledge as a proxy for language proficiency and is called the Lexical Test for Advanced

Learners of English (LexTALE). The test consists of an un-speeded lexical decision task in which participants have to make word/non-word decisions to 60 items (40 words and 20 non-words). The list includes words ranging from moderately well known to native speakers to very well-known by native speakers. In this way, various proficiency levels can be discerned in L2 speakers. Non-words are included to correct the test for false positives (i.e., the tendency some participants have to indicate they 'know' words they have never encountered before). The number of non-words is smaller than the number of words to make the subjective proportions of words and non-words more equal, given that most participants do not know all the words. The final score is computed by taking into account both the number of correct words identified and the yes-responses to non-words.

Lemhöfer and Broersma (2012) validated the LexTALE by examining its relationship with other measures of L2 proficiency in a group of Korean-English bilinguals and a group of Dutch-English bilinguals. The participants not only took the LexTALE, but also completed a translation task, which was performed in both translation directions (from L1 to L2 and the other way around) and a test for general English proficiency (the Quick Placement Test, QPT). Finally, they also rated their English proficiency in reading, writing, speaking and listening. Lemhöfer and Broersma examined which measure (i.e., LexTALE scores or subjective proficiency ratings) was more correlated with the objective measures (i.e., the QPT scores and the translation performance). The results revealed that LexTALE scores correlated substantially higher than self-ratings with QPT and translation performance. To obtain further evidence of the predictive value of LexTALE, Lemhöfer & Broersma (2012) reanalyzed the data of two previous studies (Lemhöfer & Dijkstra, 2004; Lemhöfer, Dijkstra, Schriefers, Baayen, Grainger, & Zwitserlood, 2008), in which bilinguals had participated in two different experimental paradigms commonly used in word recognition studies: lexical decision and progressive demasking. Participants also had completed self-ratings of proficiency together with LexTALE. The results showed that the LexTALE scores were more correlated to the experimental measures (i.e., reaction times and error rates) than self-ratings. In light of these findings, Lemhöfer and Broersma (2012) concluded that LexTALE provides a valid and useful measure of English vocabulary knowledge of bilinguals with different proficiency levels, who have English as a second language.

Since the publication of Lemhöfer and Broersma's paper (2012), other researchers have reported evidence about the usefulness of LexTALE as well. For instance, Diependaele, Lemhöfer, and Brysbaert (2013) demonstrated that participants with low LexTALE scores had a steeper word frequency effect in visual word recognition than participants with high scores. Interestingly, the results of this study also revealed that the larger word frequency effect in L2 than usually found in L1 could be accounted for by differences in vocabulary size. In other work, Khare, Verma, Kar, Srinivasan, and Brysbaert (2013) focused on the attentional blink effect (i.e., the difficulty to report a second visually presented target when it appears in close proximity to a first visual target; Raymond, Shapiro, & Arnell, 1992). These researchers obtained a significant positive correlation between the attentional blink effect and bilinguals' proficiency in L2. That is, bilinguals showed a stronger attentional blink effect than monolinguals. Importantly, the correlation was only reliable when LexTALE scores were used, not when participants' self-ratings were considered, again suggesting that performance-based assessment of L2 proficiency is more informative than subjective ratings.

Other researchers have used the LexTALE to assess bilinguals' proficiency in their first as well as in their second language (e.g., Bultena, Dijkstra, & van Hell, 2014; Cop, Keuleers, Drieghe, & Duyck, 2015; Correia, Formisano, Valente, Hausfeld, Jansma, & Bonte, 2014; De Bruin, Roelofs, Dijkstra, & FitzPatrick, 2014; Weber, Broersma, & Aoyagi, 2011), or to assess L2 proficiency levels of different groups of bilinguals included in the same study (Christoffels, de Haan, Steenbergen, van den Wildenberg, & Colzato, 2014). The results of these studies confirmed that participants differing in LexTALE score also show differences in performance in linguistic tasks. For instance, Cop et al. (2015) observed that the frequency effect in natural reading decreased with increasing L1 proficiency as measured by LexTALE. Christoffels et al. (2014) reported that LexTALE scores are also useful in research on nonlinguistic tasks. They found differences in cognitive flexibility between bilinguals who followed regular classes in L2 and those who did not. Of note, the former had higher LexTALE scores than the latter.

Based on the work of Lemhöfer and Broersma (2012), Lextale-type tests have also been developed for other languages. First, Lemhöfer and Broersma (2012) developed LexTALE versions for Dutch and German, which were matched to the English test to make

cross-language comparisons possible (see www.lextale.com). Second, Brysbaert (2013) and Izura et al. (2014) published Lextale-inspired tests for French and Spanish (respectively named Lextale-Fr and Lextale-Esp). These tests differed in a number of respects from the original LexTALE tests, the most important of which is that no attempt was made to equate the difficulty levels of the words cross-linguistically, so that the scores can no longer be compared across languages.[1] Brysbaert (2013) and Izura et al. (2014) were more interested in developing a test that could be used across a wide range of proficiency levels, including native speakers. Therefore, their tests included more difficult items. The authors were also more lenient in the administration of the test. Whereas the original LexTALE tests must be taken online with a yes/no response given to each individual word, the new tests were also administered on paper. Participants got a sheet of words and nonwords and were asked to mark the words they knew. Because of these differences, it is better not to denote the new tests with the original name LexTALE, but with the acronym Lextale-*, in which Lextale stands for *Lex*ical *t*est for *a*dvanced *le*arners, and the suffix indicates which language is tested. Lextale-Fr was recently used successfully as a measure of spelling ability and vocabulary of native French speakers (Beyersmann, Casalis, Ziegler, & Grainger, 2015), indicating that it can be used to assess L1 abilities.

The construction of the Spanish Lextale-Esp test was inspired by Brysbaert (2013). Izura et al. (2014) selected an original pool of 90 words, ranging in frequency from very high to very low, and a set of 90 non-words. The authors presented these items to a group of highly proficient Spanish L1 speakers and to a group of Spanish L2 speakers with different L1 backgrounds. Based on point-biserial correlations between the responses to the items and the participants' total scores, and on an item response theory (IRT) analysis, they selected the 60 best words and 30 best non-words to assess the Spanish proficiency from very low to very high, and included them in the final version of Lextale-Esp. Concerning the differences between groups, the results obtained with Lextale-Esp were similar to those obtained with Lextale-Fr (Brysbaert, 2013). Indeed, the difference in performance between the Spanish L1 speakers and the low-proficiency Spanish L2 speakers in the study of Izura et al. (2014) was huge (the average score for the L1 group and the L2 group were 53.9 and

[1] Another, better way to compare scores across languages is to present the various tests to comparable groups of native speakers (e.g., ungraduated students), so that standardized scores can be calculated on the basis of the norms.

11.9 on a total of 60, respectively, corresponding to a standardized effect size of d = 3.1), demonstrating the discrimination power of the test.

A considerable line of bilingualism research in Spain, however, is not directed at differences between native speakers and unbalanced bilinguals with rather low levels of Spanish knowledge. An interesting feature of the Spanish society is that in various regions local languages are spoken in addition to Spanish. One of these regions is Catalonia, where both Catalan and Spanish are official languages. In Catalonia, people usually are highly proficient in Catalan and Spanish. Some people are raised bilingually (i.e., with mixed-language parents) and everybody learns both languages in an immersion context from early childhood. This type of population is rather uncommon in bilingualism research, where participants often are substantially more proficient in L1 than in L2. It provides us with a unique population coming closest to the ideal of balanced bilinguals. This is interesting for various research questions (see, for instance, Costa & Santesteban, 2004; Duñabeitia, Perea, & Carreiras, 2010). Even in this population, however, most individuals differ in the degree to which they use Spanish and Catalan in daily life and, therefore, have a dominant language. This can be assessed through questionnaires including questions about language use and preference (Moldovan, Sánchez-Casas, Demestre, & Ferré, 2012; also below). Given the limitations of subjective assessments described above, it would be interesting to know whether Lextale-Esp scores can be used in this population as a performance-based measure of proficiency in Spanish.

In the present study, we compared Catalan students, who were all highly proficient in Spanish, but who considered themselves as either Spanish dominant or Catalan dominant in a Language History Questionnaire. In addition, we compared the performance on cognate and non-cognate words. Because Catalan and Spanish are closely related languages, many words have the same origin and, therefore, are cognates (words with the same meaning and a similar form). Izura et al. (2014) were aware of this problem, but decided not to take cognate status into account, as this would have made the test rather artificial, because Spanish has cognates with many languages (Basque, Catalan, English, French, Italian, Portuguese, …).

METHOD

Participants

An initial pool of 184 students of Education from the University Rovira i Virgili (Tarragona, Spain) participated as volunteers in the study. All of them were highly proficient bilinguals of Catalan and Spanish. Participants were classified as Catalan dominant or Spanish dominant on the basis of their answers to a Language History Questionnaire in which they had to assess their competence in listening, reading, speaking and writing in Catalan and Spanish on a 7-point scale (1=a very poor level of competence; 7=a very good level). They also rated their frequency of language use for each of the four abilities on a 7-point scale (1=only in Catalan; 7=only in Spanish) and their preference of use also for the four abilities (1=only in Catalan; 7=only in Spanish). We obtained a global score of proficiency, frequency and preference by averaging the data of the four abilities. Participants were considered as Spanish dominants when their average proficiency level was higher in Spanish than in Catalan and when their average frequency and preference of use were higher than 4 in the 1 to 7 scale. Conversely, they were classified as Catalan dominants if their average proficiency level was higher in Catalan than in Spanish and their average frequency and preference of use were equal or lower than 4. We discarded 26 bilinguals who could not be clearly classified as dominant in one of the two languages. This classification led a final group of 156 participants (134 women, ages ranging from 17 to 36, M_{age} = 20.8, *SD* = 3.3), composed of 86 Catalan dominants and 70 Spanish dominants (see Table 1).

Materials

Lextale-Esp consists of 60 Spanish words and 30 nonwords. In order to explore the effects of cognate status, we classified the 60 Spanish words as cognates or noncognates. To that end, we used the NIM engine (Guasch, Boada, Ferré, & Sánchez-Casas, 2012) to compute the degree of orthographic similarity (OS, Van Orden, 1987) as well as the Normalized Levensthein Distance (NLD, Levensthein, 1966) between the Spanish words and their Catalan translation equivalents. Both parameters range from 0 to 1, where 1 means a total overlap in orthography between the two words and 0 means no overlap at all. We considered a given word as a cognate if any of the two parameters was higher than 0.5.

According to this criterion, Lextale-Esp includes 39 cognate words and 21 noncognate words between Catalan and Spanish.

In addition to the Lextale-Esp, participants filled in the Language History Questionnaire described above, developed by our research group. It contains questions about proficiency, frequency of use and preference of use for the two.

Procedure

Participants completed the paper-and-pencil version of Lextale-Esp (Izura et al., 2014) during a classroom session. This version includes 90 strings of letters. The instructions were taken from Izura et al. (2014). Participants were asked to indicate the Spanish words they knew by ticking the box next to them. They were also warned against guessing, as errors were penalized. There was no time limit. When they were finished, participants filled in a paper-and-pencil version of the Language History Questionnaire.

RESULTS

The global test score of Lextale-Esp in the present study was the same as used by Izura et al. (2014). It was defined as:

$$Score = N_{\text{yes to words}} - 2 * N_{\text{yes to nonwords}}$$

We also computed the percentage of cognate and noncognate words identified by the participants as well as an index of cognate advantage (i.e., the percentage of correctly identified cognates minus the percentage of correctly identified noncognates).

The results are represented in Table 1. We would first like to note that the score of our Spanish dominant group was very close to that obtained by Izura et al. (2014) with native speakers of Spanish (M = 53.2, SD = 5.6; compared to M = 53.9, SD = 6.6). Thus, our Spanish dominant bilinguals are very similar to the population on which the test was developed.

We next analyzed the correlations between the total Lextale-Esp scores and the self-assessment ratings included in the Language History Questionnaire (see Table 2). Because we have many comparisons, the critical p-value was divided by the number of comparisons (Bonferroni correction). Hence, a correlation was significant only if $p < .003$. When we included all the participants in the analysis, there was a significant correlation between the Lextale-Esp score and the Spanish proficiency rating, as well as with the self-ratings of preference and use. The same pattern of correlations was observed for the number of correctly identified words, but not for the number of nonwords wrongly selected. Finally, the cognate advantage was inversely correlated with language preference. These correlations mean that participants with higher Lextale-Esp scores (and with better performance on the words) rated themselves as more proficient in Spanish. They also used more Spanish than Catalan and preferred Spanish over Catalan. Finally, the participants preferring Spanish over Catalan benefited less from the cognate status of words.

We further analyzed the pattern of correlations for Catalan dominants and Spanish dominants separately. Concerning Catalan dominants, the correlations of Lextale-Esp scores with Spanish proficiency remained significant. In contrast, the group of Spanish dominants failed to show significant correlations between Lextale-Esp scores and self-assessment ratings. This result is in line with that reported by Izura et al. (2014), who obtained a significant correlation between those two measures only in participants who had Spanish as L2 but not in participants who had it as their L1. According to these authors, the reason is that the Spanish L1 speakers are a very homogeneous group, all having quite high scores. As it is difficult to find significant correlations in homogeneous datasets, this factor in all likelihood also contributed to the lack of relationship between the objective scores and the subjective ones in our sample of Spanish dominant bilinguals. Importantly, neither the whole group of participants nor the Catalan or Spanish dominant participants showed any correlation between Lextale-Esp scores and self-assessment ratings of proficiency in Catalan.

In addition to studying the correlation between Lextale-Esp scores and subjective ratings, we examined the differences in performance between the two groups. As can be seen in Table 1, Spanish dominant bilinguals performed better on Lextale-Esp than Catalan dominant bilinguals. The statistical analyses revealed that this difference was significant,

t(154) = 4.19, p<.001, d = .7. In order to know if the difference was produced by the performance on words or on non-words, we separately analyzed the scores for these two types of items. There was a significant difference between the two groups of participants in the number of words known, t(154) = 4.41, p < .001. In contrast, the number of non-words that were incorrectly considered as words was not different between the two groups, t(154) = 0.90, p = .36.

To examine the effect of cognate status, we ran a mixed ANOVA on the words only. We included cognate status (cognate vs. noncognate) as a within-subjects factor and group (Catalan dominants vs Spanish dominants) as a between-subjects factor. Dependent variable was the percentage of words recognized. The results of this analysis revealed a main effect of cognate status, F (1, 152) = 107.69, *MSE* = 6371.45, $p < .001$, $\eta^2_p = .42$, as the percentage of recognized words was higher for cognates (M = 94 %) than for noncognates (M = 86%). There was also a main effect of group, showing that Spanish dominants recognized more words than Catalan dominants, F (1, 152) = 19.01, *MSE* = 3451.46, $p < .001$, $\eta^2_p = .11$. Finally, the interaction between cognate status and group also reached statistical significance, F (1, 152) = 11.66, *MSE* = 6371.45, $p < .005$, $\eta^2_p = .07$. This interaction revealed that, although both Catalan dominants and Spanish dominants showed a better performance with cognates than with noncognates, the advantage for cognates with respect to noncognates was larger for Catalan dominants (M = 10.2) than for Spanish dominants (M = 5.2).

DISCUSSION

In this study we examined whether Lextale-Esp scores can be used with Catalan-Spanish bilinguals. There are two reasons why this may not be the case. First, all bilinguals are highly proficient in Spanish, having been raised in a fully bilingual community. Their command of Spanish is much better than most of the Spanish L2 speakers tested in other studies. Second, Catalan and Spanish share a considerable number of cognates (nearly two thirds of the words used in Lextale-Esp).

As a validation criterion, we use the results of a self-rating questionnaire, asking for the proficiency in Spanish and Catalan, the relative use of the both languages, and the preference for one language over the other. On the basis of the answers to the questionnaire we distinguished a group of Spanish dominant participants and a group of Catalan dominant participants. As can be seen in Table 1, there was a significant difference between both groups in the number of Spanish words known. They did not differ in the erroneous selection of nonwords (in both groups, the percentage of false alarms was below 10%, which is good). As a matter of fact, the effect size of the difference between the two groups was d = .7 when based on the total Lextale-Esp scores. This is considerable, given the variability in vocabulary sizes present in both groups.

Further analysis indicated that the test could be made stronger by replacing the Catalan-Spanish cognates (Table 1). Izura et al. (2014) did not do so, because they would have had to exclude even more words, which are cognates in other languages. However, the data of our study shown that if Catalan researchers want to make a Lextale-type test specific for Catalan research, they can do so by replacing the Spanish-Catalan cognates. On the other hand, one of the reasons why Catalan people have a high proficiency in Spanish is the large overlap of both languages. Trying to exclude this overlap may give a wrong picture of the participant's proficiency level in Spanish.

Another interesting line of research is to examine how Lextale-Esp scores relate to other measures of language proficiency. Correlations with self-ratings are important, but as indicated in the Introduction, limited in a number of respects. The Lextale yes/no format is interesting because it only takes 5 mins and, therefore, can easily be integrated in experiments. Research in English has shown that the Lextale yes/no format correlates well with other tests of L2 proficiency (Harrington & Carry, 2009; Harsch & Hartig, 2016; Lemhöfer & Broersma, 2012; Mochida & Harrington, 2006). However, it would be good to run similar validation studies for Lextale-Esp.

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TABLE 1-STUDY 1: DATA FROM THE LANGUAGE HISTORY QUESTIONNAIRE AND LEXTALE_ESP SCORES OF CATALAN DOMINANT BILINGUALS AND SPANISH DOMINANT BILINGUALS (standard deviation in parentheses)

	Spanish dominant bilinguals	Catalan dominant bilinguals
Spanish proficiency	6.6 (0.4)	6.3 (0.7) *
Catalan proficiency	6.0 (0.9)	6.7 (0.4) *
Preference of use	5.5 (0.9)	2.5 (1.0) *
Frequency of use	5.4 (0.8)	2.5 (0.8) *
Lextale-Esp words	56.6 (4.3)	52.9 (5.7) *
Lextale-Esp nonwords	1.7 (2.1)	2.0 (2.6)
Lextale-Esp total score	53.2 (5.6)	48.9 (7.1) *
Percentage of cognates recognized	96.0 (5.2)	91.8 (7.9) *
Percentage of noncognates recognized	90.8 (11.7)	81.6 (14.5) *
Cognate advantage	5.2 (7.9)	10.2 (10.1) *

* $p < .001$

TABLE 2-STUDY 1: CORRELATIONS BETWEEN LEXTALE_ESP SCORES AND DATA FROM THE LANGUAGE HISTORY QUESTIONNAIRE (all the participants)

	Spanish proficiency	Catalan proficiency	Preference of use	Frequency of use
LexTALE_Esp total score	.35*	-.06	.32*	.31*
Words	.33*	-.06	.30*	.29*
Nonwords	-.14	.02	-.07	-.11
Cognate advantage	-.11	.09	-.27*	-.23

* $p < .003$