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IS THERE AN EFFECT OF PARTIALLY OVERLAPPING SCRIPT ON COGNATE PROCESSING? EVIDENCE FROM GREEK HERITAGE SPEAKERS LIVING IN GERMANY

We examine the role of partially overlapping scripts on cognate processing in Greek-German heritage speakers (HSs) in a mixed lexical decision task. Based on formal and semantic similarity ratings, cognate and noncognate word pairs were allocated in four cognateness conditions. A cognate facilitation effect is expected, further influenced by formal and semantic similarity. Due to recruitment restrictions, we analyse data for the control group (CG, native Greek speakers) and discuss HSs data in terms of tendencies. Contrary to our prediction, a cognate inhibition effect is obtained. Performance for German stimuli is higher than for Greek stimuli. Data indicate an effect of low phonological similarity on reaction times and of low orthographic similarity on accuracy in both groups. We suggest that task demands and stimulus list manipulation are the factors mostly affecting cognate processing. German seems to affect processing of Greek, supporting our claim that partially overlapping scripts influence online word processing.

Keywords: heritage speakers, cognate processing, writing script, Greek, German

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1. INTRODUCTION

A commonplace feature of societies worldwide is their cultural and linguistic variability and heterogeneity (Grosjean & Li 2013). Multilingualism is now considered the rule, rather than the exception (Bhatia 2017). The resulting intermingling of native populations and immigrant-origin groups requires the use of more than one language on a daily basis. Thus, language use can vary in different contexts and environments (Aalberse, Backus & Muysken 2019). Emigration and/or immigration also usually requires that people learn a language anew, strengthen previous language knowledge, and change frequency of use in each language on a daily basis. This change in roles between the dominant and the native language may not seriously affect language competence in adult speakers, but it can greatly affect language acquisition and use in later generations (Montrul 2016). No great generalization can be made, but research has so far indicated a number of factors that can contribute to the degree of influence the societally dominant language can exert on a person's native language. Overall, both the societal and the individual aspects of variability of linguistic knowledge and use make the need for better comprehending the mechanisms that enable multilinguals to process and understand language of great importance. This also applies to *heritage speakers*, namely children or adults that are members of a community that constitutes an ethnolinguistic minority in a multilingual setting (Montrul 2016).

A basic component of multilingual language processing is word recognition. The multilingual word recognition system incorporates a vast number of words from each acquired language into the multilingual lexicon (Dijkstra 2007), a storage space for language knowledge and information relating to word representation. Words are represented in terms of being related to formal (spelling and sound), semantic and conceptual (meaning), morphological, pragmatic, and/or language membership characteristics. Overall, the multilingual lexicon is considered "a multidimensional network" (Dijkstra & van Heuven 2018: 121) in which all of a word's properties are connected.

A means into deciphering the ways in which word recognition takes place in multilingual populations is cognate processing. A *cognate* is defined as a word that shares its meaning, orthography, and/or pronunciation between/among languages, like *film* in English and *Film* in German (Lemhöfer & Dijkstra 2004). A *noncognate* is a word that shares its semantics but not its orthography and phonology between/among languages, like *tree* in English and *Baum* in German (ibid). Research on cognate processing has been conducted mainly on specific language combinations, namely English, Dutch, Spanish, French, and German (Dijkstra et al. 2010; Lemhöfer & Dijkstra 2004; Lemhöfer et al. 2004; Midgley et al. 2011; Peeters et al. 2019; Poarch & van Hell 2014; Poort & Rodd 2017), as well as Japanese (Allen 2013; Allen et al. 2020; Nakayama et al. 2014). Obviously, more languages and language combinations remain heavily under-investigated. Moreover, cognate processing in heritage speaker populations is scarce (Carrasco-Ortiz et al. 2021; van Rijswijk 2016). Last, studies conducted on writing systems in multilingual populations have mainly focused on either same- or different-script languages, with only a handful touching upon language combinations with partially-overlapping writing systems (Bowers et al. 2000; Dimitropoulou et al. 2011; Orfanidou & Sumner 2005; Voga & Grainger 2007). We define *same script languages* as those that share common phonemic and graphemic representations (English-Dutch), *different script languages* as those that share only common phonemic representations (Japanese-German), and *partially-overlapping script languages* as those sharing common phonemic and partially overlapping graphemic representations (Greek-German).

Greek and German use alphabetic writing systems (Greek and Latin alphabets, respectively). These writing systems present with a partial overlap that varies in extent depending on whether the letters are upper- or lower-case (Figure 1). It is important to note that Greek-German HSs have knowledge of at least two writing systems and may also have the ability to write in those systems, depending on the level of education received. Thus, they may interchange their writing systems daily and on various levels depending on the languages in use.

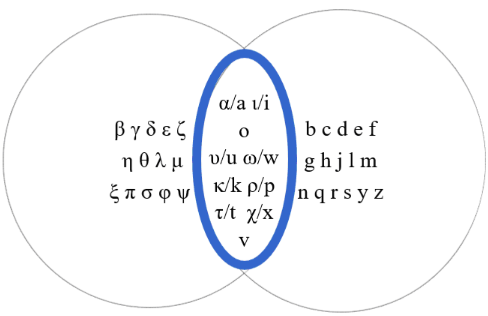

Figure 1. Venn diagram of shared graphemes between Greek and German alphabets (created by the author)

Following from the above, we are interested in providing insight on language processing in languages with partially overlapping scripts and presenting the first analysis on cognate processing in Greek as a native and a heritage language (HL). Our focus is on HL processing and the role of cross-linguistic similarity on cognate processing in languages with partially overlapping scripts. Regarding

HL processing we present the following research questions along with their respective predictions:

1. What is the effect of partially overlapping scripts (Greek and Latin) on cognate processing and how is this effect influenced by the proficiency of HSs in their two languages?

   A cognate effect is expected in both languages. Reaction times (RTs) and error rates should vary based on the HSs' Greek proficiency. Performance should be boosted by higher Greek proficiency.

2. What is the effect of continuous measures of cross-linguistic similarity (phonological, orthographic, semantic) on cognate processing by HSs in languages with partially overlapping scripts?

   Based on previous work (Allen 2013), the higher the phonological and/or orthographic similarity the quicker the RTs should be. Low semantic similarity is also expected to boost performance in terms of RTs.

To examine cross-linguistic similarity, we created a database of formal and semantic similarity of Greek-German cognate pairs. We asked native speakers of Greek with high proficiency in German to rate word pairs for their level of phonological, orthographic, and semantic overlap. The main prediction was that the higher the formal and semantic overlap between word pairs, the more similar those words would be considered. The main purpose of this pre-test was to create four cognateness conditions that would indicate a cognateness continuum rather than a cognateness dipole. Due to restricted space, this paper will focus on the cognate processing study.

2. METHODS

The first part of this section will cover the creation of the language materials to be used in the main experimental task (mixed lexical decision task) that will be presented in the second part.

2.1. Language Material

To construct the final set of lexical items for the main experimental task, we created three similarity rating tasks (phonological, orthographic, semantic) to obtain a more objectively created pool of stimuli. The stimuli were Greek and German noun pairs that we pre-categorised as either cognate or noncognate words. They were collected from the Greek (Dimitropoulou et al. 2010) and German SUBTLEX (Brysbaert et al. 2011), as was logarithmic frequency. Regarding

Greek, orthographic density was collected by the Greek SUBTLEX, number of syllables and number of morphemes were calculated manually, number of letters was calculated by the LEN()-function in Excel (Microsoft Corportation 2018), and the number of phonemes was taken by GreekLex2 (Kyparissiadis et al. 2017). Number of letters for the German stimuli was calculated by the LEN() function in Excel (Microsoft Corportation 2018), number of syllables and number of morphemes were provided by the German WebCelex (Max Plank Institute for Psycholinguistics n.d.), while number of phonemes and orthographic density were gathered from CLEARPOND for German (Marian et al. 2012). A total of 182 cognate and 170 noncognate pairs were collected. Only two variables were controlled for the similarity rating tasks: animacy and concreteness. The similarity rating tasks included 48 animate, 64 inanimate, and 70 abstract cognate pairs, as well as 56 animate, 57 inanimate, and 57 abstract noncognate pairs.

To accommodate for the initial idea of a cognateness continuum, we opted for dividing the stimuli into four orthogonally manipulated cognateness conditions: high phonological – high orthographic similarity (HP – HO), low phonological – low orthographic similarity (LP – LO), high phonological – low orthographic similarity (HP – LO), and low phonological – high orthographic similarity (LP – HO). To that aim, we calculated the mean value for phonological and orthographic similarity rating for each word pair across participants. Following that, we calculated the median value for the total of mean values of each similarity rating. Based on these calculations, values below 3.34 for the phonological similarity ratings and below 3.51 for the orthographic similarity ratings indicated low formal similarity. For semantic similarity, word pairs rated with mean and median values below 3 were removed from the dataset.

2.2. Mixed Lexical Decision Task

Our initial aim was to examine cognate processing in Greek HSs that reside in Germany. We faced various recruitment difficulties which resulted in a very low number of HS participants, thus rendering it impossible to fully analyse data from this group. Since, however, this is our target group, we will discuss tendencies we observed in a basic analysis of RTs and error rates. We will discuss the control group first.

Control group

Mixed Lexical Decision Task

The main task was built in Gorilla (Anwyl-Irvine et al. 2020). Participants had to press the F/Φ key when the string of letters they saw was written in Greek and was a real word in Greek. They were asked to press the J/Ξ key when the string of letters was not written in Greek and/or was not a real Greek word. The experimental task started with a short practice session. The practice items were the same in every list. The main task consisted of four blocks and included three breaks. After each break, they saw the same question asked in the beginning of the task, namely whether the word they see is a real Greek word and is written in Greek. This ensured that participants remembered the aim of the task and did not mix the two keys they were asked to press. Each word remained on screen for 3 seconds or until the participants would press one of the keys, with an intertrial interval of 1 second.

Stimuli

Greek-German cognates can be easily identified by means of their formal and semantic overlap. However, employing bilingual measures of perceived similarity can provide a more precise definition of cognateness (Allen 2013; Tokowicz et al. 2002). Thus, we used the rating data collected from native speakers of Greek with a high German proficiency to create a pool of perceived similarity measures for Greek and German cognate and noncognate words. We used 182 cognate and 163 non-cognate pairs, for which logarithmic frequency, number of letters, and number of syllables were matched (Allen et al. 2020; Dijkstra et al. 2010; Lemhöfer et al. 2004; Peeters et al. 2019; Poarch & van Hell 2014; Poort & Rodd 2017; Szubko-Sitarek 2011; Voga & Grainger 2007; Zhang et al. 2019).

The matching was conducted via LexOPS (Taylor et al. 2020), a user-interface R package that performs controlled generation of word stimuli. LexOPS generated a list of 53 cognate and 53 noncognate pairs (Table 1). We also created 106 nonwords based on the Greek cognate and noncognate stimuli by replacing vowels and/or consonants in the already existing nouns.

Matching was conducted both within and between languages. Statistical analyses were performed using R (version 4.1.0; R Core Team 2021). Regarding within-languages matching, Greek stimuli were matched for all three variables with word length approaching significance (*logarithmic frequency*: $t=-1.5$, $df=106$, $p=.15$; *word length*: $W=1760$, $p=.06$, *number of syllables*: $W=1539.5$, $p=.35$). German cognates and noncognates were matched only for logarithmic frequency and word length (*logarithmic frequency*: $t=-1.5$, $df=106$, $p=.15$; *word length*: $W=1460$, $p=.72$). Number of syllables was not matched ($W=2016$, $p<.001$), perhaps because cognates have a higher mean number of syllables since they are mostly borrowed to German, and thus are morphologically more transparent in terms of number of syllables than words not borrowed into the language.

For between-languages matching, Greek and German cognates were only matched for logarithmic frequency ($t=0.1$, $df=103.6$, $p=.93$). Number of letters

(W=1039, *p*=.03) and number of syllables (W=923, *p*<.001) were not matched. Again, this can be attributed to morphological transparency: Greek words are more morphologically transparent and thus longer than German words (Borleffs *et al.* 2017; Protopappas & Vlachou 2009). Last, Greek and German noncognates were matched for logarithmic frequency (t=0.21, df=103.44, *p*=.84) and word length (W=1321, *p*=.59), but not for number of syllables (W=571, *p*<.001) for the same reason as in previous analyses. Overall, the data can be matched for all three variables in most of the cases (Table 2). Since it would leave us with a very small number of word pairs if we attempted to match all three variables in all cases, the 53 cognate and 53 noncognate pairs generated by LexOPS were used in the mixed lexical decision task.

	Abstract	Animate	Inanimate
Cognate	16	15	22
Noncognate	18	15	20

Table 1. Total number of cognate and noncognate word pairs implemented in the mixed lexical decision task

Variable	Cognates	*P* value (t-test)	Noncognates	*P* value (t-test)
Number of letters	6.4	.02*	6.3	.60
Number of syllables	2.6	.001***	2.3	.001***
Logarithmic frequency	2.6	.93	2.6	.84

Table 2. Mean and *p* values for the matched cognate and noncognate Greek-German stimuli. The Welch Two Sample t-test was performed for logarithmic frequency and the Wilcoxon rank sum test with continuity correction was performed for number of letters and number of syllables.

Each participant saw 371 stimuli: 53 Greek cognate, 53 noncognate, 53 German cognate, 53 German noncognate, 106 Greek nonwords, and 53 Greek fillers. Participants saw a total of four blocks: 3 X 93 and 1 X 92 words. Four different lists were compiled based on the Latin Square design. The lists differed in order of blocks. Moreover, an additional number of four lists were created by reversing each block in each list, resulting in a total of eight lists. Participants were randomly assigned to each list based on Gorilla's balanced randomization mode that was set to a ratio of one participant per list.

Participants

Thirty healthy native speakers of Greek (*F*=25, *mean age-range*=21-25) with advanced knowledge of German participated in the mixed lexical decision task. Recruitment was conducted via social media. They were only required to fill in a basic demographic questionnaire where they also indicated the number of languages they speak, without being asked about language proficiency. Participants were offered the opportunity to enter a voucher draw after completing the experiment.

Procedure

The present study has received ethical approval from the University of Konstanz Research Ethics Committee. Prior to the mixed lexical decision task, participants filled in a detailed consent form. IP-address, device type, and browser restrictions limited the effects of device type and browser on the participants' RTs. The study lasted approximately 30 minutes. Participants were asked to take the task in a quiet environment using only wired equipment. They participated in the main task first, followed by the short questionnaire.

Heritage group

The heritage group participated in exactly the same tasks as the CG with the following exceptions: (1) they were asked to complete C-tests in German (Schmid & Dusseldorp 2010) and in Greek (Pata 2019); (2) they had to complete an adapted version of the *Bilingual Language Profile* questionnaire (Birdsong *et al.* 2012); and (3) they could choose whether they would see the instructions and questionnaire in Greek or German. The main task was always presented in Greek. Only the exceptions will be discussed here.

Participants

Six healthy Greek-German HSs (*F*=4, *NA*=1, *mean age-range*=26-33) participated. All participants currently live in Germany and five identify Greek as their L1 and German as their dominant language.

Questionnaire

As in the CG, basic demographic data were collected from the heritage group. Questions from the *Bilingual Language Profile* (Birdsong et al. 2012) were translated in Greek and German and implemented in the questionnaire.

The purpose of administering the specific questionnaire was to assess the HSs' dominance with respect to language history, language use, language abilities, and language identity. We followed the guidelines by Birdsong and colleagues (2012) to compute each participant's Global Language Score. Table 3 presents the results. Participants also assessed their knowledge in Greek and German (Table 4).

Participant	Dominance Score	Dominance
1	-126.418	German
2	-129.222	German
3	-85.638	German
4	-65.66	German
6	49.404	Greek

Table 3. Dominance and language score of HS group

Question	Mean values
Speaking Greek	3.29
Speaking German	5.57
Greek comprehension	4.29
German comprehension	5.57
Reading Greek	2.86
Reading German	5.14
Writing Greek	1.86
Writing German	5

Table 4. Self-assessment of Greek and German of HS group

C-tests

In order to measure the HSs' general language proficiency, we employed German (Schmid & Dusseldorp 2010) and Greek C-tests (Pata 2019). C-tests are tests in which participants are presented with a text and are required to fill in the parts of the words that are missing (Grotjahn 1987). We used a total of four C-tests, two German and two Greek. The German texts were 47 and 58 words long and contained 18 and 24 gaps, respectively. The Greek texts were 86 and 66 words long and respectively contained 20 and 21 gaps. The Greek C-tests were longer because of fewer compound words in Greek written speech and because

Greek prepositions are not combined with articles into single words (*zu + der = zur*).

Only three participants completed all C-tests. The information on coding the C-tests and obtaining the scores was retrieved from the Language Attrition website created by Monika Schmid and the University of Essex (Schmid n.d.). We marked each correctly filled gap with the number 9, and for every incorrect answer we took into account a number of variables related to lexical stem, word class, agreement errors, spelling errors, and variants of the correct response numbered from 0 to 8. Correctly filled gaps or gaps filled in with an acceptable variant were included in the calculation. The C-test score ranges from 0 to 100. The higher the C-test score, the higher the general language proficiency is (Schmid & Dusseldorp 2010).

Overall, general language proficiency for Greek was very low in the HS group, also taking into account that Greek texts were not completed in many cases. Many mistakes were made in the German texts as well, indicating either a similarly low level of German or high difficulty of the texts in general. Irrespective of those claims, a larger sample of HSs is required to draw valid conclusions.

Procedure

Participants could choose their language of preference for the instructions and the questionnaire part. Since they were also asked to complete the C-tests, the experiment lasted approximately 45 minutes.

3. RESULTS

3.1. Mixed Lexical Decision Task

<u>Control group</u>

We inspected the data timed-out trials that comprised 1.5% of the total data. Responses shorter than 300ms and longer than 2,500ms comprised only 33 trials and they were thus not removed (Ng & Cribbie 2017). Removal of items due to error rates accounted for 9% of the data. In total, 10.5% of the data were removed.

Analyses showed that RTs for cognates (*mean*=745, *SD*=365) were significantly higher than for noncognates (*mean*=674, *SD*=269) [$p < .001$]. Noncognates were also more accurately recognized (*mean*=0.98, *SD*=0.13) than cognates (*mean*=0.94, *SD*=0.24) [$p < .001$].

We examined the effect of word status (cognate, noncognate) on RTs and accuracy via linear and generalized linear mixed-effects modelling, respectively (package *lme4*, version 1.1.27.1; Bates et al. 2015, package *lmerTest*, version 3.1.3; Kuznetsova et al. 2017). The predictors were condition (cognate Greek, cognate German, noncognate Greek, noncognate German), logarithmic frequency, number of letters, number of syllables, mean phonological similarity (MPS), mean orthographic similarity (MOS), and mean semantic similarity (MSS). We also checked for random structure, but no model converged. MPS, MOS, and MSS did not reveal any statistical significance, so we checked for correlations. MPS and MSS were moderately positively correlated ($r(5534)=.45$, $p<.001$), as were MOS and MSS ($r(5534)=.44$, $p<.001$). As a result, we created three different models for RTs and three different models for accuracy, each including one of the similarity variables. The best-fit model for RTs (AIC=1683.6) included condition, logarithmic frequency, and MPS, with no interaction effects. The best-fit model for accuracy (AIC=1518.5) included condition and MOS, again with no interaction effects.

Unlike our first prediction for a cognate facilitation effect, statistical analyses of RTs suggest a cognate inhibition effect (Figure 2). The ANOVA table for mixed-effects models (package *car*, version 3.0.11; Fox & Weisberg 2019) indicated a strong association between RTs and condition ($\chi2$ (3, N=5320)=52.16, $p<.001$). RTs also differed significantly by logarithmic frequency ($\chi2$ (1, N=5320)=5, p=.03). Responses were quicker as logarithmic frequency got higher and German stimuli being recognized faster than Greek stimuli (Figure 3). German cognates were recognized faster than Greek cognates [ß=-0.07, SE=0.02, df=Inf, z=-4.01, $p<.001$] and Greek noncognates [ß=-0.14, SE=0.05, df=Inf, z=-2.66, p=.04] (Figure 2). The same trends was observed between noncognate German and noncognate Greek words [ß=-0.10, SE=0.02, df=Inf, z=-5.90, $p<.001$].

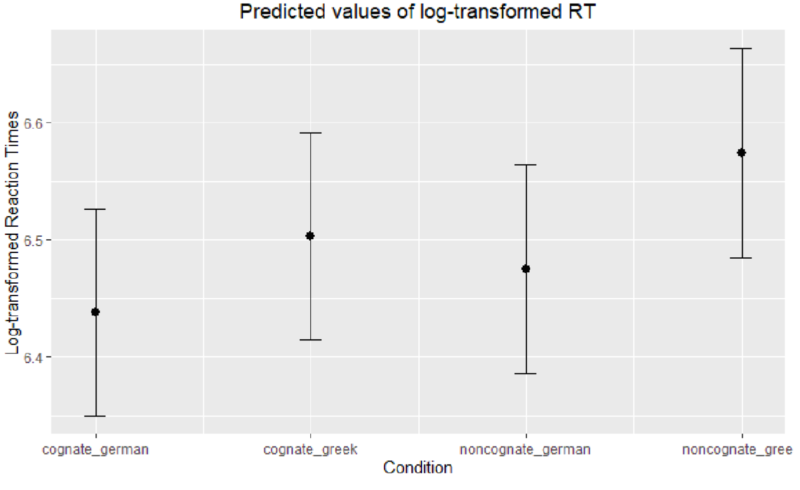

Figure 2. Predicted values of log-transformed RTs across conditions

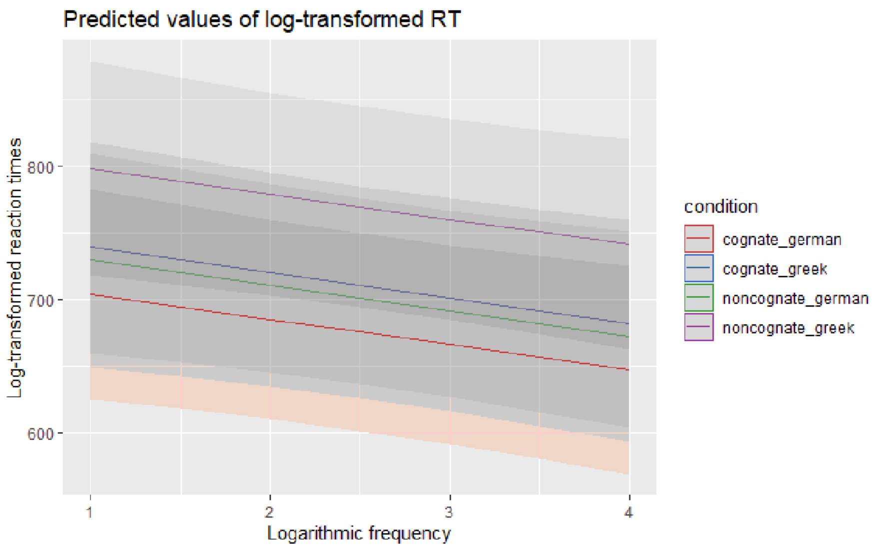

Figure 3. Predicted values of log-transformed RTs across conditions and logarithmic frequency

Regarding accuracy, the ANOVA table for mixed-effects models (package *car*, version 3.0.11; Fox & Weisberg 2019) showed that condition ($\chi2$ (3, *N*=5534)=24.92, *p*<.001) highly affects error rates. More specifically, there is a significant difference within conditions and between languages: between German and Greek cognates (ß=-1.04, SE=0.28, df=Inf, *z*=-3.73, *p*=.001) and German and Greek noncognates (ß=1.45, SE=0.46, df=Inf, *z*=3.13, *p*=.009). Compared to the baseline German cognates, the chances for such an item to be correct are higher compared to a Greek cognate and to a German noncognate word (Figure 4). Figure 5 shows the predicted values of accuracy across the four conditions with cognate accuracy rates being higher than those of noncognate items. Greek cognates present with the lowest error rate, as do German noncognates and cognates. Greek noncognates show the highest degree of variability with accuracy extending from approximately 88% to 99%. Accuracy rates for cognates is not significantly different from noncognates.

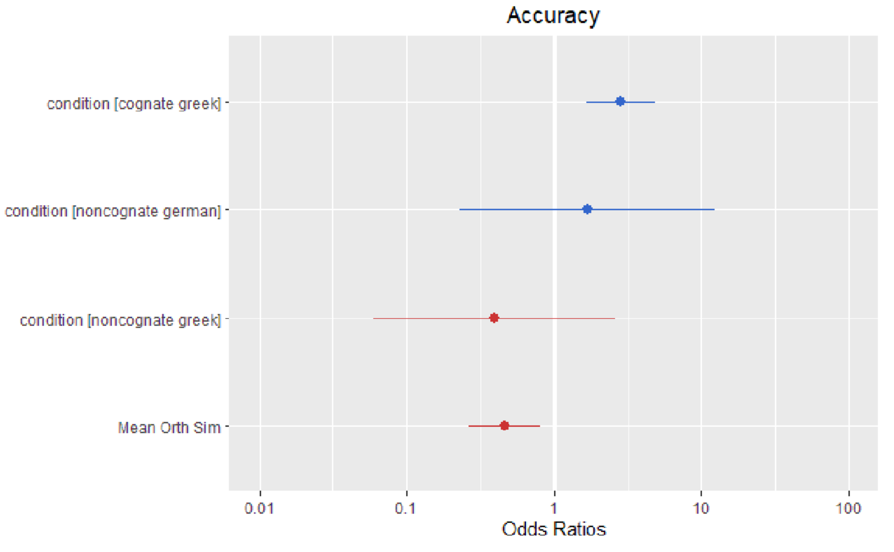

Figure 4. Probability plot for error rates across conditions and MOS

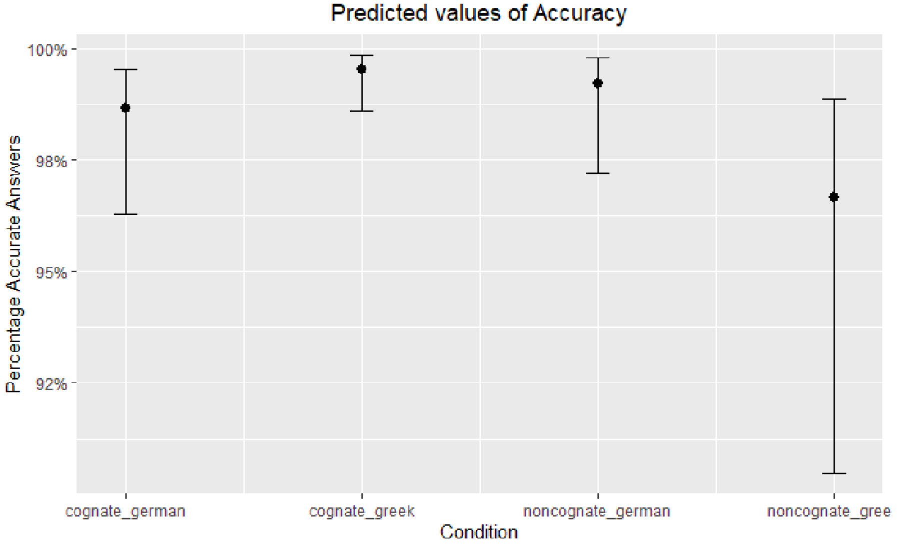

Figure 5. Predicted values of accuracy across conditions

Our second hypothesis focused on effects of cross-linguistic formal and semantic similarity on Greek-German cognate processing. We expected that increased phonological similarity in cognate pairs would cause shorter response latencies and greater accuracy rates. The same tendency was expected for increased orthographic similarity, but higher semantic similarity should slow down RTs. The best-fit models for RTs and accuracy do not include semantic similarity as a predictor. Thus, it seems that this variable does not have a significant effect in the processing of Greek-German cognate and noncognate words in terms of RTs and error rates.

The model that better explains the greatest amount of variation in our RT data includes MPS as one of its predictors. MOS does not affect RT performance. Refuting our hypothesis, the significant association between RTs and MPS ($\chi 2$ (1, N=5320)=52.2, p=.008) suggests that stimuli are recognized faster when phonological similarity is lower (Figure 6).

Effects on accuracy discussed above with regard to condition are also observed for MOS ($\chi 2$ (1, N=5534)=52.16, p<.001). Predicted values reached ceiling performance with lower MOS (Figure 7), mostly for German cognates and Greek noncognates. MPS did not have any effect of accuracy rates.

Correlation tests were conducted between MPS, MOS, MSS and word status (cognate, noncognate) to test whether these variables can predict the same characteristic. Both MPS (r(5534)=-.97, p<.001) and MOS (r(5534)=-.97, p<.001) almost perfectly correlate with word status, suggesting that they can both be successful predictors of word status. MSS is only moderately negatively correlated with word status (r(5534)=-.40, p<.001).

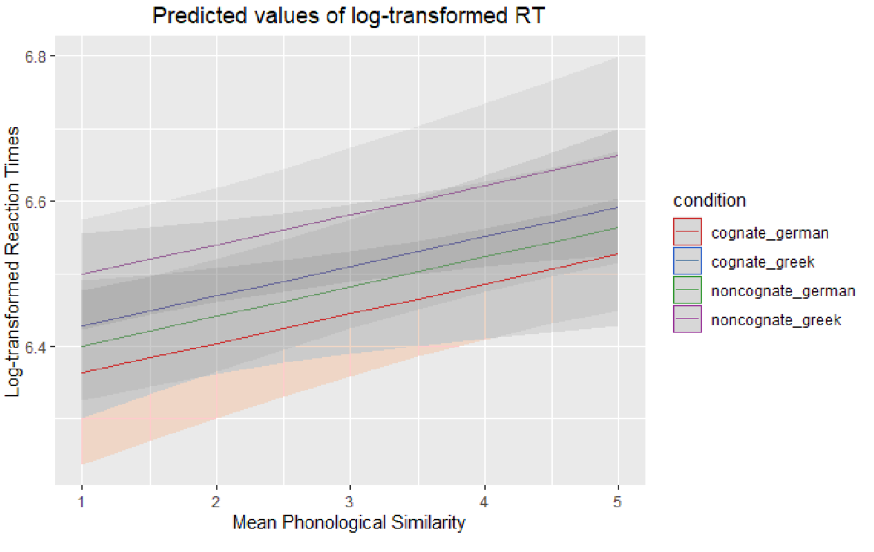

Figure 6. Predicted values of log-transformed RTs across conditions and MPS

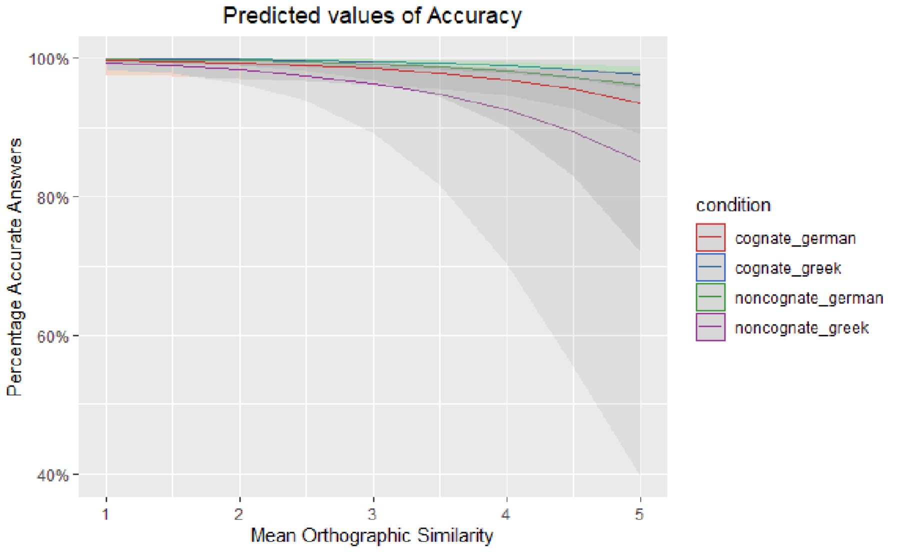

Figure 7. Predicted values of accuracy across conditions and MOS

<u>Heritage group</u>

Regarding RTs, HSs seem to perform slower than the CG (*mean*=859ms). When discussing the different response latencies in the four different conditions, the results suggest slower RTs for the Greek cognates and noncognates than for the German cognates and noncognates. They also suggest a cognate inhibition effect for the Greek stimuli and a cognate facilitation effect for the German stimuli. Regarding accuracy, participants are more accurate for German than for Greek stimuli. Half of the participants performed equally accurately for German cognates and noncognates. Greek cognates were less correctly recognized than Greek noncognates for most participants. These results could be explained by their low proficiency in Greek and higher proficiency in German.

4. DISCUSSION AND CONCLUSION

Evidence for a cognate facilitation effect has been provided for both same- and different-script languages (Allen 2013; Lemhöfer & Dijkstra 2004; Nakayama et al. 2014; Peeters et al. 2013; Poarch & van Hell 2014). These studies mostly compared RTs and error rates for binary-categorised cognates and noncognates. Only a few studies focused on the effect of continuous measures of formal and semantic cross linguistic similarity between languages (Allen 2013; Tokowicz et al. 2002). These studies employed ratings to obtain a more objective pool of stimuli that encompass a continuum of cognateness based on formal and semantic similarity. A further gap in the cognate processing literature concerns languages with partially overlapping scripts that extends to the field of HL processing. For those reasons, we aimed at providing an insight into cognate processing: (a) in languages with partially overlapping scripts (Greek, German); and (b) in adult HSs of Greek that permanently live in Germany. We designed three similarity rating tasks to acquire a continuum of cognateness based on the perceived similarity ratings of Greek and German cognates and noncognates. These stimuli would then be used in the mixed lexical decision task that would examine cognate processing in the HSs. Owing to recruitment difficulties, we presented data from the CG (native speakers of Greek).

Our first hypothesis predicted a cognate facilitation effect (Peeters et al. 2019). However, CG data indicate a cognate inhibition effect. Cognates induced longer response latencies and higher error rates than noncognates. This outcome is unexpected for various reasons. First, in terms of task demands, cognate inhibition effects are mostly caused in general language decision tasks that require participants to correctly identify in which of the languages tested each stimulus belongs (Biloushchenko 2017; Dijkstra & van Heuven 2018; Poort & Rodd 2017). The opposite has been suggested for mixed lexical decision tasks where only one of the presented languages needs to be identified. This is claimed to cause facilitation rather than inhibition effects (Lemhöfer & Dijkstra 2004). Our results refute this claim and pose a question regarding the role of language membership for word recognition at the lexical level. There is also evidence for stronger facilitation effects for identical and non-identical cognates with high formal overlap (Comesana et al. 2014; Dijkstra et al. 2010). If that applied to our stimuli, at least HP-HO cognates should induce faster RTs and balance out the statistically significant effect we found for RTs in noncognates.

Nevertheless, the cognate inhibition effect in our study replicates the findings by Poort and Rood (2017) that included Dutch words in an English lexical decision task. They compared this mixed version of the task to the standard one (only English stimuli) in terms of real words and found that the Dutch items significantly influenced the cognate facilitation effect that was observed in the standard lexical decision task. Vanlangendonck and colleagues (2019) also acquired a cognate inhibition effect after replacing pseudowords from an English lexical decision task with Dutch words which can indicate that both languages in the bilingual lexicon are considered for selection at the response level. Those findings suggest that the cognate inhibition effect in our analyses could be an outcome of stimulus list composition.

A further reason for the inhibition effect is that, although all participants were native in Greek with knowledge of various foreign languages, in all likelihood some of them may be late sequential bilinguals in Greek and one other language. Although far-fetched, this claim suggests that, apart from the effect of stimulus list composition, there is influence of the task relevant L2/Ln (German) to the also task relevant L1 (Greek). This could be further accounted by the quicker RTs observed for German stimuli. This could also be proof that the partially overlapping scripts of Greek and German highly affected the participants' lexical access and representation and indeed acted as visual cues that facilitated lexical access in the case of German. Gollan and colleagues (1997) obtained similar results in their translation priming task with Hebrew as the L1 and English as the L2 where priming was obtained for noncognate items and for cognates only with Hebrew primes.

Further proof that partially overlapping scripts can function as visual cues for word recognition comes from Van Rijswik (2016) who tested auditory word recognition in Turkish-Dutch HSs. They found a cognate inhibition effect for the L1 Turkish which they explained as an outcome of double language check for language membership in Turkish, as well as an effect of the participants' insecurity regarding word language origin. Although our CG participants are native in Greek, the cognate inhibition effect we obtained could be explained by cognate borrowing into Greek from other Indo-European languages.

Our second hypothesis focused on the effect of formal and semantic cross-linguistic similarity on cognate processing. We expected quicker RTs with high(er) phonological and orthographic similarity, whereas increased semantic similarity should have an inhibitory effect in RTs (Allen 2013). Interestingly, our data refuted all three expectations. Low phonological similarity facilitated RTs, especially for German stimuli that were recognized faster than Greek words. Accuracy was higher when orthographic similarity was low, with German cognates and Greek noncognates showing higher error rates when orthographic similarity increased. There was no significant effect of semantic similarity for RTs and error rates. We suggest that partially overlapping script has a different effect on cognate processing than different script, as in the case of Japanese and English (Allen 2013). Further research is needed in languages with partially overlapping scripts in order for more solid results to be obtained.

Overall, it was shown that MPS greatly influenced RTs (Nakayama et al. 2014; Dimitropoulou et al. 2011; Voga & Grainger 2007), whereas MOS affected accuracy (Dimitropoulou et al. 2011). Both variables were highly correlated with one another and with word status and can thus be considered significant predictors of cognateness. Regarding semantic similarity, research on word processing has shown that language information comes before semantic information (Casaponsa et al. 2015). These findings, together with the fact that our stimuli were highly controlled for semantic similarity could account for the insignificant role of this variable in the RTs and accuracy rates in our study. In order for a better insight on the role of semantic similarity in languages with partially overlapping scripts to be obtained, the same pool of stimuli could be re-examined in a design that includes bidirectional translation of the Greek and German stimuli from participants with high proficiency in both languages. Correlation analyses could then indicate whether an association exists between number of senses and MSS (Allen 2013).

We faced difficulties in recruiting HSs and as a result, we were not able to analyse and further discuss the data we collected from Greek HSs that live in Germany. We will present tendencies from those data. More specifically, HSs were overall slower and less accurate than the CG. However, they presented with the same pattern in terms of their RTs and accuracy. Namely, no cognate facilitation effect was found and they were overall slower and less accurate with Greek stimuli. This finding corroborates Carrasco-Ortiz and colleagues (2019) regarding cognate processing in Spanish HSs dominant in English who were overall faster in recognizing English than Spanish words. The fact that HSs in our study show a pattern of slower RTs and lower accuracy in Greek than in German words could be supported by van Rijswijk's (2016) findings with Turkish-Dutch HSs that presented with a cognate inhibition effect in their L1 as a possible outcome of insecurity regarding language origin and consequently language membership. It is of course impossible to draw solid conclusions without a bigger sample of HSs and more complex statistical analyses that could indicate whether the tendencies we observed in our study could be considered firm patterns for cognate processing in HSs.

All in all, our study provides further evidence on the importance of cognate processing for bilingual populations, and more specifically for HSs. It also suggests that partially overlapping scripts, such as Greek and German, can have a great effect on lexical processing. Further research is needed to acquire a better understanding of how this process takes place in HSs. Future research could employ more methodologies, such as eye-tracking and electroencephalography, to examine the effect of partially overlapping scripts on the comprehension and production of auditory and visual stimuli by HSs.

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ΕΠΗΡΕΑΖΕΤΑΙ Η ΕΠΕΞΕΡΓΑΣΙΑ ΟΜΟΡΡΙΖΩΝ ΛΕΞΕΩΝ ΑΠΟ ΤΗ ΓΝΩΣΗ ΜΕΡΙΚΩΣ ΚΟΙΝΩΝ ΑΛΦΑΒΗΤΩΝ; ΔΕΔΟΜΕΝΑ ΑΠΟ ΕΛΛΗΝΕΣ ΟΜΙΛΗΤΕΣ ΠΟΛΙΤΙΣΜΙΚΗΣ ΚΛΗΡΟΝΟΜΙΑΣ ΣΤΗ ΓΕΡΜΑΝΙΑ

Περίληψη

Εξετάζουμε τον ρόλο των μερικώς επικαλυπτόμενων αλφαβήτων στη επεξεργασία ομόρριζων/συγγενών λέξεων (cognates) σε Έλληνες ομιλητές πολιτισμικής κληρονομιάς σε ένα έργο μεικτής λεξικής απόφασης. Με βάση αξιολογήσεις φωνολογικής, ορθογραφικής, και σημασιολογικής ομοιότητας/εγγύτητας, τα ζεύγη συγγενών και μη συγγενών λέξεων κατανεμήθηκαν σε τέσσερις συνθήκες συγγένειας. Αναμένεται ο βαθμός ομοιότητας να διευκολύνει την επίδοση των συμμετεχόντων στην λεξική απόφαση. Λόγω περιορισμένου αριθμού συμμετεχόντων με το επιθυμητό προφίλ, αναλύουμε δεδομένα για την ομάδα ελέγχου (φυσικοί ομιλητές Ελληνικών) και συζητάμε τα δεδομένα των Ελλήνων ομιλητών πολιτισμικής κληρονομιάς ως προτς τις παρατηρούμενες τάσεις. Αντικρούοντας την πρόβλεψή μας, ο υψηλός βαθμός συγγένειας (cognate status) μειώνει την απόδοση αναφορικά με τον χρόνο αντίδρασης στην λεξική απόφαση . Η επίδοση για τις γερμανικές λέξεις είναι υψηλότερη από αυτή για τις ελληνικές λέξεις. Τα δεδομένα υποδεικνύουν επίδραση χαμηλής φωνολογικής ομοιότητας στους χρόνους αντίδρασης και χαμηλής ορθογραφικής ομοιότητας στην ακρίβεια και στις δύο ομάδες. Προτείνουμε ότι η δυσκολία διεκπεραίωσης του πειράματος λεξικής απόφασης και ο στοχευμένος σχεδιασμός του έργου είναι οι παράγοντες που επηρεάζουν περισσότερο τη επεξεργασία των ζευγών. Η γερμανική φαίνεται να επηρεάζει την επεξεργασία της ελληνικής, υποστηρίζοντας τον ισχυρισμό μας ότι τα μερικώς επικαλυπτόμενα αλφάβητα επηρεάζουν τη γλωσσική επεξεργασία.

Λέξεις-κλειδιά: ομιλητές πολιτισμικής κληρονομιάς, cognate processing, αλφάβητο, Ελληνικά, Γερμανικά