

Processing of cognates in Croatian as L1 and German as L2

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1 Introduction

Cognates are defined as words similar in form and meaning across two languages. Similarity in form may range from full orthographic overlap, as in English film – German Film, to partial overlap, as in English chapel – German Kapelle. Some pairs of cognate words developed historically from a common ancestor word, whereas others emerge when languages come into contact and loan each other words. Language users are typically unaware of such diachronic pressures. When acquiring a second language (L2) they can only perceive shared elements between L1 and L2.

Cognates help explain the nature of lexical processing and the manner in which elements from the two languages interact. Different measures have been used to explore cognate processing and representation, including ERP (Midgley et al., 2011; Peeters et al., 2013; Strijkers et al., 2009), latencies in single word (Dijkstra et al., 2010; Lemhöfer and Dijkstra, 2004), and primed lexical decision (De Groot and Nas, 1991), eye-movements (Mulder et al., 2011; Rosselli et al., 2012), and scores on standardized tests (Kelley and Kohnert, 2012; Pérez et al., 2010). Taken together, empirical findings support the claim that cognates are processed differently from noncognate words. Despite the fact that the aforementioned experimental measures and techniques diverge, the conclusion is similar both in language production and in language comprehension (Dijkstra et al., 2010, for an overview). Nevertheless, results do differ with respect to a range of details, including the direction as well as the magnitude of

the cognate effect. Specifically, most studies find facilitation in the processing of cognates in L2 (Dijkstra et al., 1999; Lemhöfer and Dijkstra, 2004; Van Hell and De Groot, 2008), but results are less clear when it comes to the effect of cognates in L1. For example, Van Hell and Dijkstra (2002) and Duyck (2005) reported cognates facilitation in the dominant language, while Kroll et al. (2002) reported small cognate inhibition in an L1 naming task, and Caramazza and Brones (1979) failed to find such an effect at all.

In the present study we sought to examine the influence of cognates on lexical processing in a visual lexical decision task, using L1/L2 language pairs that belong to different subgroups of Indo-European languages: Slavic L1 and Germanic L2. The aim was to carefully replicate recent findings from a study by Radanović, Feldman, and Milin (2014). Crucially, their study showed quite a complex pattern of effects that included a three-way interaction of language (Serbian L1 vs. English L2) by cognate status (cognate vs. noncognate) by word frequency (as a numerical predictor – covariate). Cognates were processed faster than noncognates in L2, but, surprisingly, significantly slower than noncognates in L1. Furthermore, the size of the effect was greater when word frequency was low.

Because this pattern of effects differs from what is typically reported in the literature, we designed a replication of the Radanović et al. study and followed their method and design, this time using another contrasting pair of languages: Croatian (L1) and German (L2).

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2 Experiment

Late bilinguals of German ($N = 69$) – students of German with Croatian as their L1, participated in a visual lexical decision experiment. There were two forms of the experiment (in Croatian and in German), and students were randomly assigned to one version. The entire experiment (materials and instruction) was in one language and presentation sequence was randomized for each participant.

In preparation for their study, Radanović et al. (2014) also conducted a normative survey with 1000 Serbian – English translation equivalents ranging from pairs consisting of completely different words (e.g., priča – story) to the identical cognates (e.g., drama – drama). They then selected 400 noun pairs covering a wider range of ortho-phonological similarity between L1/L2 words, using both subjective similarity ratings as well as Levenshtein distance. In the present study we made use of 344 of the previously rated word pairs, and constructed the same number of pseudowords. All of the selected 344 pairs fitted nicely for the present purposes of studying Croatian – German cognates, consistently ranging from perfect cognates to orthographically different words. We reused the same noun pairs to allow for strict comparisons of the experimental data.

2.1 Results

We calculated normalized Levenshtein distance measure for pairs of nouns used in two forms of the present experiment. Similarly to the study of Radanović et al., the distribution of the Levenshtein distance measure was strictly bimodal, and, as before, the modes matched cognate vs. noncognate distinction. That allowed us to further use a dummy-coded variable *cognate* (TRUE/FALSE), same as in the original study (Radanović et al., 2014).

Furthermore, we transformed the measures to ensure a better approximation to a Gaussian distribution. Word frequencies and word length were log-transformed, while an inverse transformation was applied to response latencies, following Baayen and Milin (2010).

As a last step, we excluded a small number of the extreme outliers (0.07%) from further analysis based on the visual inspection of the reaction time distribution.

The data were analyzed with Linear Mixed Ef-

fect Modeling (LMM), in the R software environment for statistical computing (R Core Team, 2014), with the `lme4` and the `lmerTest` packages (Bates et al., 2014; Kuznetsova et al., 2014). The refitted model (after removing residual values greater than 2.5 of absolute standardized units), revealed a significant effects of the control predictors, in the expected direction: facilitation from order of a presentation ($\beta = -.044$; $SE_{\beta} = .007$; $t = -6.42$; $Pr(> |t|) < .0001$), and inhibition from the word length ($\beta = .211$; $SE_{\beta} = .023$; $t = 9.33$; $Pr(> |t|) < .0001$). Also, there was a significant effect of the lexicality of the previous word, where stimuli preceded by a word were recognized faster than those preceded by a pseudoword ($\beta = -.077$; $SE_{\beta} = .005$; $t = -14.36$; $Pr(> |t|) < .0001$).

Most interestingly, the model revealed a significant three-way interaction between word frequency, language and cognate status ($\beta = .053$; $SE_{\beta} = .012$; $t = 4.44$; $Pr(> |t|) < .0001$). The observed interaction is an almost exact replication of the three-way interaction reported by Radanović et al. (2014): cognates are processed faster than noncognates in German (L2), but slower than noncognates in Croatian (L1), and the size of the effect is attenuated for high frequency words. This pattern of results is depicted in Figure 1.

With regards to the random-effects structure, by-participant and by-item adjustments to the intercept significantly contributed to the model's goodness-of-fit. Word frequency and trial order needed additional by-participant adjustments for the slopes. Similar by-participant adjustments for the slope were held by the word length, which also revealed significant correlation between adjustments for the intercept and the slope ($r = -.72$), indicating that slower and more careful participants were slowed less as item length increased.

3 Discussion

Radanović, Feldman, and Milin (2014) suggested that cognate facilitation in L2 and inhibition in L1 might be specific to the particular pairing of first and second language and/or to the level of proficiency in the L2. Results of the present study show that the particular L1/L2 combination is not critical in the sense that the same pattern generalized

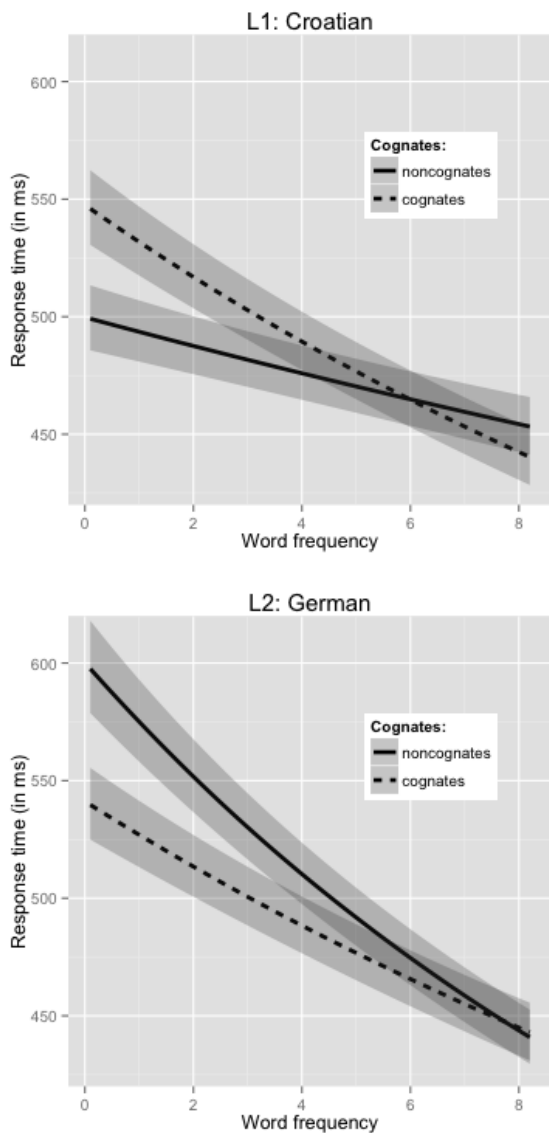


Figure 1: Three-way interaction language by cognates by frequency to reaction time latencies in visual lexical decision task.

to another sample of participants (studying L2 as their major) and another L1/L2 combination. The fact that target frequency played an important role seems more compatible with an account based on proficiency.

However, to find a general explanation and testable hypotheses we turn to learning theory. Arnon and Ramscar (2012), who investigated how adult learners acquire an artificial L2, convincingly demonstrated that “the way in which learning is structured has a considerable impact on what gets learned” (p. 302). In general, knowledge acquisition is codetermined by discrepancies between expectations based on our previous experi-

ence and the constellation of cues available in the learning environment. In particular, knowledge in L1 as well as learning history will determine the degree and style of interference that we encounter when learning an L2. This kind of **blocking effect** is well documented in learning theory (Kamin, 1969).

A blocking effect describes failures of learning that arise when a target cue is presented with another cue whose informativity with respect to an outcome has already been established. Arnon and Ramscar (2012) demonstrated in great detail how blocking may influence L2 acquisition when cues from the two languages are competing for the same outcome (a symbolic lexical representation).

Cue blocking does not apply directly to cognates, however, because typically, cues are identical and, thus, cannot compete and/or block each other. Nonetheless, Arnon and Ramscar’s general observation regarding the way in which learning is structured helps to make sense of the present findings. All that is needed is to extend it to the distinctive properties of cognates whereby learning entails mapping the very same cues (cognate word forms) onto the same outcome.

Further insights derive from the **highlighting effect** (Kruschke, 2009) on the target cues. First, the theory predicts that contextual (ambient) cues are informative about the learning cues, but not about outcomes (Kruschke and Hullinger, 2010). Therefore, temporal and/or contingency aspects of the situation are useful for discriminating between specific contexts of learning. Second, learning cues can be unambiguous or ambiguous for a particular outcome, and the highlighting effect predicts that early ambiguous and late unambiguous cues are more informative (Kruschke, 2009). Thus, the availability of either L1 or L2 (but not both) provides a context for a given cognate cue (actively present in the sensory input). Given highlighting mechanism, with cognate forms are unambiguous cues we expect facilitation for a later learned outcome. Conversely, ambiguous cues should facilitate an earlier learned outcome as in an L1 context and, hence, noncognates ought to be faster in L1 but slower in L2.

In summary, in the case of ambiguous cues highlighting is in essence a blocking effect: firstly learned relationships will be favored. This outcome is fully consistent with the account by Arnon and Ramscar (2012). In the case of unam-

biguous cues, such as cognate words, competition between cues does not emerge and the latter learned relationships will show some preference. Previous research on highlighting indicates that this pattern might be even more pronounced when the cues are verbally (i.e., linguistically) encoded (Kruschke et al., 2005; Kruschke, 2009). This is what present results confirm as well.

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