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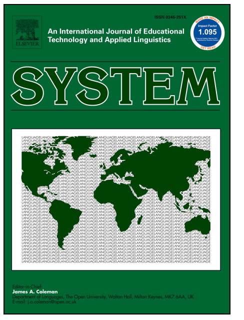

L1 – L2 semantic and syntactic processing: The influence of language proximity

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L1 – L2 semantic and syntactic processing: the influence of language proximity

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Keywords: semantics and syntax, lexical processing, language background, lexical modelling

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Abstract

This study examined the extent to which a first language (L1) influences a second language (L2). We explored this potential influence by evaluating participant responses for semantic and syntactic word strings composed from the 1K British National Corpora word list. We investigated two different first language groups, and assessed their responses to semantic and syntactic judgement tasks in their L2 (English), alongside an English control group. The participants were L1 Japanese (n = 23), L1 Italic Indo-European (n = 25), and L1 English (n = 25). Each subject was asked to judge 60 semantic word strings, and 60 syntactic word strings. We then compared each of three groups for accuracy and response time, with the L1 English group acting as the control. Results indicated significant differences which we suggest might relate to L1 background influences. The L1 Japanese participants responded less accurately to semantic judgements compared to L1 Italic Indo-European counterparts, while there was no significant difference between the two L2 learner groups for syntactic accuracy. The L1 Japanese participants were also slower than their L1 Indo-European counterparts for both semantic and syntactic word strings. We discuss our findings in relation to recent bilingual models of lexical development.

Keywords: semantics and syntax, lexical processing, language background, lexical modelling

1. Introduction

A number of studies suggest that language proximity might relate to language learning development. Such studies suggest that a learner whose L1 has more in common with the L2 might develop their L2 more easily because of L1-L2 proximity. A review of cross-linguistic issues in lexical inferencing by Wesche & Paribakht (2009) highlights how typologically similar L1 languages to the target language has a positive transfer effect on L2 lexical inferencing. More recently, Ecke (2015) and Hall et al. (2009) highlight how the form (lexeme: phonological or orthographical), syntactic frame (lemma) and the concept (semantics) influence 'parasitic' connections from L2 to L1 which is modulated by the typological relationship between the languages. In other words, these three levels (form, frame and concept) modulate how representations of new words are established in the long-term memory (Hall et al. 2009, p.161). Therefore, similarities between the L1 and L2 forms are predictably helpful when acquiring similar L2 forms. When we specifically turn to findings from vocabulary research we observe contrasting findings in this area. Studies from Jiang (2002, 2004) and Pavlenko (2009) suggest that first language background always influences second language vocabulary acquisition, yet others (Degani & Tokowicz, 2013) contend that such influences only relate to specific individual words.

While vocabulary studies have shown that L1 affects L2 processing, to the best of our knowledge few have examined L1 effects on L2 processing for both semantic and syntactic structures within the same participant groups. Motivation stems from research (e.g., Jiang, 2000, 2002; Pavlenko, 2009) which has suggested that L1 semantics and syntax play a role in the development of L2 lexical items because lexical development of L2 lexical items require both semantic and syntactical knowledge. We investigated the extent to which similarity of L1 backgrounds influence learners' perceptions of semantics and syntax in an L2 (English).

2. Research in the field

2.1 Restructuring L2 lexical items

Jiang (2000) attempted to account for the ways in which bilingual lexicons develop, adapting Levelt's (1989) monolingual language production model. Jiang's three-stage model (2000) illustrates the processes involved in L2 lexical representation, emphasising the L2 lexical entry - L1 equivalent relationship. The model implies a relationship of incremental development for each lexical item: first, L2 phonological and orthographical, second L1 semantic and syntactical, third fully L2 integrated (morphological, phonological, orthographical, semantic, and syntactical). Jiang's model suggests an L2 lexical entry depends on the L1 depending on the stage of integration by looking at, amongst other aspects of knowledge, syntax and semantics. Later, Jiang (2002) found that when asked to identify translation pairs with a single L1 translation, advanced Chinese (L1)-English (L2) bilinguals were faster and more accurate but slower for word pairs without a single translation equivalent. Jiang suggested such evidence demonstrates continued L1 access, regardless of L2 proficiency, depending on the relationship between the L1 and the L2. In a later study which used the same research method but with Korean learners of English, Jiang (2004) suggested that such L1-L2 relationships are universal, highlighting that learners remain influenced by first language background, even with a mean 10 years of formal language training.

Degani and Tokowicz (2013) contended that the extent of such relationships relates to language proficiency and is word dependent. They found that their intermediate Spanish-English bilinguals reported varying levels of 'relatedness' for specific lexical items (e.g. *flea* *market* and *housing* *market* that share an L1 Spanish 'market' translation (*mercardo*) reported as less related than *dinner* date and *expiration* date, Spanish (*date*) which has a split translation of *cita* and *fecha*. Conversely, Degani and Tokowicz (2013) found a reversal of these 'relatedness' reports from more proficient English-Spanish bilinguals. We speculated whether such differences are apparent with more distant L1 groups, a concern we return to later in the discussion.

Another study (Fitzpatrick & Izura, 2011) supported the notion that the L1 remains active in L2 processing with evidence of L1 priming effects in an L2 word association production task. Such findings are relevant for two reasons, because: (i) participants continued to access their L1 even at upper intermediate proficiency level; and, (ii) participants were influenced by form as well as meaning (e.g., *postman→postbox*) meaning and collocation (e.g., *spider→web*) suggestive of a faster reaction time.

While such studies have suggested a dynamic interplay between bilingual lexicons, experimentation has been based on bilinguals whose L1 (e.g., Spanish) shares many properties with the L2 (English). The aim of the current study, however, was not to replicate such studies, rather to explore the extent to which bilingual lexical development depends on L1 and L2 proximity.

To inform this exploration, Pavlenko's (2009) Modified Hierarchical Model (MHM), developed from Kroll's Revised Hierarchical model (1994) shows how conceptual representations of L2 lexical items adopt one of three states. The MHM, therefore, accounts for continued access to the L1 because L2 items are fully shared with the L1, partially overlapping or fully language specific. Pavlenko (2009, pp.148–149) proposed the addition of a semantic representation level to the model to account for whether concepts are expressed by a lexical item or the extent to which mapping might occur between words and concepts. Such a level includes connections between words including collocations, word associations, synonyms, and antonyms. Thus, a sentence such as: *He bit himself in the language* (Pavlenko, 2009, p.148) in which a Finnish L1 speaker accessing the Finnish word (*kieli*) (L1 English - *language*) intends to access *tongue* (both *kieli* and *tongue* are polysemic), with *kieli* referring to two distinct concepts (a body part i.e. tongue and language for communication) which indicate this Finnish speaker maps *kieli* to the more frequent English word *language*. Such slips of the tongue might not only indicate continued access to the L1, but also the extent to which L2 items adopts one of Pavlenko's (2009) three states.

A further means to explore bilingual lexical development relates to Pavlenko's (2014) description of different L2 stages of lexical development: destabilisation, internalization, co-existence, and convergence. We wondered whether different developmental stages might clarify the processes involved in L2 access (and speed) to the extent that fully integrated items require less processing (and are therefore quicker to access). For Pavlenko (2014), L2 items enter the lexicon with *destabilization* when L1 patterns are destabilized to accommodate new L2 patterns, which might involve new pattern formation in relation to new semantic categories. Next, with *internalization*, L2 patterns account for increases or reductions in features or distinctions depending upon the extent to which two languages differ. *Co-existence* then describes the maintenance of two or more sets of language specific patterns. Finally, *convergence* describes how L2 speakers perform differently to L1 speakers with two frames of reference (while monolinguals would only have one frame of reference).

This notion of items being more readily accessible depending on L1-L2 proximity is evident in Gathercole, Stadthagen-Gonzalez, Perez-Tattam, and Yavas (2016) who explored bilinguals' performance on Spanish-English lexical categorization tasks in the two languages. Some words had a wide lexical category, e.g., Spanish *reloj* includes the English *clock* and *watch*, whereas English *wall* encompasses Spanish *pared* and *muro*. Gathercole et al. (2016) argued that when lexical items have a broad category in one language it is relatively harder to distinguish more precise categorisation in another language. Moreover, Gathercole et al. (2016) acknowledged that restructuring relates to conceptual underpinning. They showed that (L2) polysemous lexical items such as *leg* are conceptually plausible and accordingly easier to restructure in the L2 than homophones. What remains unclear is the extent to which L2 learners whose L1 does not share such conceptual underpinning are either slower or have more work to do at various stages in their language development, compared to L2 learners with a close and overlapping L1-L2.

2.2. Syntactic restructuring

Researchers such as Jarvis (2009) appear to have acknowledged that bilingual development is not only influenced by semantics but also syntax. Unsworth (2004) has argued that non-target like scrambling (i.e., variable word order based on pragmatics) relates to non-target like syntax rather than pragmatics (or semantics). Unsworth suggested it is important to consider the relationships between language systems (e.g., syntax and semantics). Studies that have explored the relationships between L1-L2 structures support the notion that learners call upon L1 structures in order to facilitate L2 syntax. Helms-Park's (2001) study found that positive transfer facilitates the learning of L2 grammatical verb properties when the L1 resembles the L2. Additionally, Rankin (2014, p.457) has suggested a 'privileged default' status for L1s that are similar to the L2, and that dissimilar L1-L2 grammatical properties do not support positive transfer. Similarly, Schwartz & Sprouse

(1996, p.65) hypothesized that 'the whole of the L1 grammar constitutes the L2 initial state' which appears to suggest a developmental stage dependent upon L1-L2 proximity.

2.3 Exploring the influence of L1 background on the L2

Sunderman (2014) suggests that processing difficulties can be inferred from longer reaction times along with decreases in accuracy. Turning to explorations of L1 background influences on the L2, much of the research has employed reaction time studies (e.g., de Groot, 1993; Dijkstra, Miwa, Brummelhuis, Sapelli, & Baayen, 2010; Fitzpatrick & Izura, 2011; Kroll & Stewart, 1994; French & Jaquet, 2004). Such research has suggested that L2 processing speed develops with increases in L2 proficiency (Fitzpatrick & Izura, 2011; Kroll & Stewart, 1994; French & Jaquet, 2004). We therefore speculated whether a threshold level might exist, to the extent that reaction times differences no longer exist after particular proficiency levels. Such studies have indicated that L1 background influences L2 development, and experimentation using reaction time appears to be an appropriate means to evaluate potential differences.

What remains unclear, however, is the extent to which influences occur both in semantic and syntactic forms and might relate to L1-L2 proximity. The current study, therefore, compared L2 learners from different L1 backgrounds. One group comprised of an Italic Indo-European first language background i.e., Italic: French, Spanish, Portuguese, Italian and Romanian, whose default word order is subject-verb-object. The other group comprised of a Japanese language background, whose default word order is subject-object-verb. A group of L1 English language background was used as a control group. We hypothesised that participants with Italic Indo-European language backgrounds, which are closer to English than Japanese, would be more accurate and faster in processing semantics and semantics in L2 English. A caveat to this definition of the L2 learners is that they have a flexible word order which we acknowledged in the discussion of the results.

3. Research questions

We based our study on three interrelated research strands: (i) reaction time research that has suggested that L2 processing speed relates to increases in proficiency (Fitzpatrick & Izura, 2011; Kroll & Stewart, 1994; French & Jaquet, 2004). We therefore explored participants from the same levels of proficiency; (ii) orthographic similarity of L1 and L2 yields superior decoding efficiency in printed words (e.g. Hamada & Coda, 2008). We therefore explored participants with close L1-L2 and distant L1-L2 (with and without orthographic similarity); (iii) expertise in L2 processing has been argued to be based on several potentially competing linguistic factors, which indicates that L2 processing can be influenced by proximity to the L1 (e.g., Jiang, 2002, 2004; Pavlenko, 2014).

Accordingly, we hypothesise that L1-L2 proximity influences L2 development and that this development relates to semantics, syntax, and vocabulary. We presented our learners with syntactic and semantic judgement tasks, using a vocabulary measure to control proficiency. We explored the extent to which two L2 (English) participant learner groups' judgements mirror L1 (English) counterpart participants. We asked two research questions:

1. Are learners with putatively close L1-L2s faster and more accurate in semantic judgements than learners with putatively distant L1-L2s?
2. Are learners with putatively close L1-L2s faster and more accurate in syntactic judgements than learners with putatively distant L1-L2s?

4. Method

Our participants were asked to judge the extent to which semantic and syntactic strings reflected the L2 (English). Word strings were therefore created for semantic categories/association and syntactic structures (see Table 1). Stimuli for the semantic and syntactic word strings were generated from the 1K (first thousand frequency band) British National Corpora (2007) word list. High frequency words were chosen based on Altarriba and Basnight-Brown's (2007) assertion that highly frequent items quickly retrieve concepts associated with words. The participants were required to judge semantic and syntactic words strings that included the same words so that the lexical frequency of the semantic and syntactic strings did not differ. We based our study on recognition rather than production reflecting Schmitt's (1998) suggestion that L2 English learners may be slow to move from receptive to productive judgements.

To minimise demands, all words strings were kept to a minimum word. Word strings were piloted with L1 English (n = 4) native speakers from a UK university student population. We wanted a clear indication of whether the effects of first language on a second language would be the same for all types of words and so of the semantic 3-word sets, 15 were noun only, 15 were mixed (verb only, pronoun only, adverb only, adjective only, verb and adjective, noun and adjective, noun and verb, verb and adverb). Minor corrections were made to guard against ambiguity regarding which sets were correct and which were incorrect. Semantic groupings were presented according to category (e.g., brother, mother, sister) and association (e.g., music, play, radio). To ensure validity, we kept a minority of cases where some of the stimulus words in the association category could be perceived as a noun or a verb.

Participants were told to look for related meaning and not word type. Thirty incorrect control strings, mirroring the correct strings, were used as distractors. All words were checked with an L1 speaker from the specific L1 background to check that for conceptual equivalence in the respective L1 background, and 20% of the stimulus words were cognate to the Italic Indo-European languages. We decided against removing these words as the focus of the research was to determine the extent to which learners' first language background influenced reaction time. With cognates removed, we considered the validity compromised with cognates being an intrinsic part of Italic Indo-European languages. The syntactic sets consisted of 15 subject-verb-object, 15 mixed (subject-verb-adjective, subject-verb-preposition-object, noun-preposition-noun, preposition-noun, subject-verb-adverb). Thirty incorrect control strings matched the word length of the correct strings. Most of the syntactic words strings did not have an equivalent in Japanese whereas they did in Italic European languages. Table 1 shows two examples of the semantic word strings set and two examples of the syntactic word strings. Both show the two different categories of single word type and mixed word type for semantics and two different categories of only SVO and mixed structures for syntactic word strings.

< Insert Table 1 about here>

Table 2 shows the syntactic word strings and if they have equivalent structures in Japanese or Italic European languages.

< Insert Table 2 about here>

The syntactic words strings were constructed in order to use as many words as possible from the semantic strings. The mean word length of the syntactic SVO correct was 4.07 (SD = .68) and incorrect was 4.13 (SD = .50) words, Mixed correct was 3.73 (SD = .85) and incorrect was 3.73 (SD = .85). All semantic word strings were 3 words in length.

4.1 Participants

The three participant groups were included: 23 L1 Japanese L2 learners of English, 25 L1 Italic Indo-European L2 learners of English, and a control group of 25 L1 English speakers. The L1 Japanese group were all undergraduate students aged 18 years old, studying at a university in Japan. At the time of the study, the L1 Japanese group were taking 3 hours of English instruction a week. None of the Japanese reported knowledge of a third language. Most of the L1 Italic Indo-Europeans reported being newcomers to the UK and were studying in the UK, whilst others remained in their home country; together they had a mean age of 27 years ranging from 19 to 52 years old, including both undergraduate and postgraduate students, and selected from a variety of L1 backgrounds, including (L1): French (n = 9), Spanish (n = 7), Italian (n = 6), Portuguese (n = 2), and Romanian (n = 1). The L1 backgrounds were identified because they broadly follow a subject-verb-object pattern (SVO). The L1 learner groups were matched in terms of the L2 proficiency, judged by their teachers to be at the intermediate to post intermediate levels and on a L2 vocabulary test described below. A control group of L1 English speakers took part in the study, with a mean age of 27 years which ranged from 18 to 60 years. The L1 English speakers were university educated and living in the South East of England. Ethical approval from all participants involved was obtained prior to the start of the study. All were presented with an explanatory letter, a consent form, and all were debriefed after participation.

4.2 L2 Vocabulary Knowledge

All L2 participants' vocabulary size was measured using adjusted X_Lex (v2.05) (Meara, 2006). We used a vocabulary size test because research (Meara & Milton, 2003) has shown it to be a valid indicator of language proficiency. X_Lex is a Yes/No task in which learners respond to whether words on a computer screen from frequency bands 1,000 to 5,000 are known or not. The final scores include corrections for guessing following Milton & Meara (2003). Research (Meara, 1996) has suggested that the first 5,000 vocabulary items provide detailed information regarding lexical development. To ensure that both L2 groups were comparable, participants with X_Lex scores of between 3,250 and 5,000 are reported in the study.

4.3 Procedure

DMDX (v 5.1.3.4) software was used to measure response times and accuracy (see Appendix for instructions). The semantic and syntactical sets were presented on a laptop using DMDX and participants were asked to press the *m* (coloured green) key for 'correct' or the *z* (coloured red) key for 'incorrect'. Instructions were given both verbally, and in written form in English on the PC screen. Participants were given two example word strings (correct and incorrect), for the semantic set and the syntactic set tasks. Stimuli were displayed for 5 seconds or until a response was given, before moving onto the next set. All sets were presented in random order for all participants to avoid any collusion effect. The total number of correct responses was noted for the accuracy data (maximum of 60 per set). For the reaction time data, each subject response over and below 2 standard deviations from the mean were excluded as well as any incorrect or timed out reactions.

5. Results

Four data sets were produced for each subject: (i) 60 semantic word strings reaction time (RT); (ii) 60 semantic word strings accuracy; (iii) 60 syntactic word strings RT; and, (iv) 60 syntactic word strings accuracy.

Four 3x4 repeated measures ANOVAs were run (one for RT and one for accuracy for the semantic and the syntactic sets separately) with Group (3 levels: L1 Japanese, L1 Indo-European, and L1 English) as a between factor and the four different Types of sets as a within factor (e.g. noun only, mixed, incorrect noun only, incorrect mixed for the semantic set). A power-analysis using G*power suggested that, even with a small effect size ($f = .15$) this number of participants would have enough power ($> .98$) to detect a difference between the groups. We also performed several analyses of covariance (ANCOVA), with the two language groups, L1 Italic Indo-European and L1 Japanese, Group as a between factor, adjusted X_Lex scores as the covariant and Type as a within factor for both the semantic and syntactic sets.

5.1 Vocabulary Size

The L1 Japanese participants scored higher on X_Lex (mean = 4166, SD = 297.46) than the L1 Italic Indo-European (mean = 3331.250, SD = 1062.18). An independent t-test showed the difference was significant: $t(47) = -.3.780$, $p = .000$, Cohen's $d = 1.070$. We are aware that the X_Lex might be problematic for the L1 French group, as some of the pseudo words appear like cognate words. We therefore opted to include any French participants with IELTS scores ranging 5-7 when their adjusted X_Lex score was below the benchmark.

5.2 Semantic sets

5.2.1 Accuracy in semantic judgements

Figure 1 shows semantic judgement accuracy. A 3x4 repeated measures analysis showed that there was an effect for Type; $F(2.411, 166.383) = 13.204$, $p < .001$, *partial* $\eta^2 = .16$, and an effect for group; $F(2,69) = 10.327$, $p < .001$, partial $\eta^2 = .23$, but no interaction for Type x Group; $F(4.823, 166.383) = 1.141$, $p = .341$, partial $\eta^2 = .032$. Pairwise comparisons showed that the L1 Japanese group were less accurate compared to the L1 Italic Indo-European group ($p = .021$) as well as the L1 English group ($p < .001$), but the English and the Italic Indo-European group did not differ ($p = .231$). All groups found it easier to reject the unrelated semantic noun strings compared to the other Types.

<Insert Figure 1 about here>

5.2.2 Reaction time in semantic judgements

Figure 2 shows semantic judgement RT. A 3x4 repeated measures analysis revealed an effect for Type; $F(3,207) = 60.324$, $p < .001$, partial $\eta^2 = .46$, for Group; $F(2,69) = 27.225$, $p < .001$, partial $\eta^2 = .44$, as well as an interaction for Group x Type; $F(6,207) = 2.499$, $p = .024$, partial $\eta^2 = .07$. Overall, RTs for the different types showed that participants responded faster to related nouns than unrelated nouns and related mixed, both groups responded faster to than incorrect mixed strings. As Table 3 shows, the L1 Japanese group was slower to respond compared to both the L1 English ($p < .001$) and the L1 Italic Indo-European group ($p = .004$) for the semantic judgements. The L1 Italic Indo-European group was similar to the L1 English group for all types, except for the incorrect mixed semantic groups, where their performance was similar to the L1 Japanese group ($p = .292$).

An ANCOVA found the interaction of Group was significantly related to RT; $F(1,44) = 6.710$, $p = .013$, partial $\eta^2 = .132$. The covariant X_Lex score was not related to RT; $F(1,44) = .547$, $p = .463$, partial $\eta^2 = .012$. The Type of set did not affect RT; $F(3, 132) = .066$, $p = .978$, partial $\eta^2 = .001$. There was a significant effect for interaction between Type and Group; $F(3, 132) = 4.148$, $p = .008$, partial $\eta^2 = .086$. The L1 Japanese RT for semantic sets are longer than the L1 Italic Indo-European, especially for the correct semantic sets. The interaction between Type and X_Lex was not significant; $F(3,132) = 1.150$, $p = .332$, partial $\eta^2 = .025$. Table 3 shows the corresponding means and standard deviations.

<Insert Figure 2 about here>

<Insert Table 3 about here (accuracy and reaction time semantic sets)>

5.3 Syntactic sets

5.3.1 Accuracy in syntactic judgements

Figure 3 shows syntactic judgement accuracy. A 3x4 repeated measures analysis showed that there was an effect for Type; $F(2.467, 172.709) = 6.239$, $p = .001$, partial $\eta^2 = .082$, for Group; $F(2,70) = 4.570$, $p = .014$, partial $\eta^2 = .12$, as well as for Group x Type; $F(4.935, 172.709) = 3.961$, $p = .002$, partial $\eta^2 = .10$. The L1 English and the L1 Italic Indo-European group were less accurate when rejecting the incorrect mixed syntactic strings compared to the three other types, the L1 Japanese were the least accurate for the correct mixed strings. Pairwise comparisons show that overall the L1 English were more accurate than the L1 Japanese participants ($p = .004$) but the difference between the L1 Italic Indo-Europeans and L1 English failed to reach significance ($p = .080$) and there was no significant difference between the Indo-European and Japanese counterparts ($p = .209$).

An additional analysis of group differences per sub-type, using the parameter estimates, shows that the three groups performed similarly for the incorrect mixed and the incorrect SOV syntactic strings. The L1 Italic Indo-European group did not differ from the L1 Japanese group for the correct SVO strings. Accuracy scores for the correct mixed syntactic strings differed significantly between all three different groups, with L1 English more accurate than L1 Italic Indo-European who were more accurate than the L1 Japanese.

<Insert Figure 3 about here>

5.3.2 Reaction time in syntactic judgements

Figure 4 shows the syntactic judgement RTs. The repeated measures analysis showed that there is an effect for Type; $F(3, 210) = 27.394$, $p < .001$, *partial* $\eta^2 = .28$, and for Group; $F(2,70) = 27.947$, $p < .001$, partial $\eta^2 = .44$, but no significant interaction for Group x Type; $F(6, 210) = 1.594$, $p = .150$, partial $\eta^2 = .04$. As Table 4 shows, RTs for correct mixed syntactic sets were faster compared to correct SVO sets, RTs for SVO sets were similar to incorrect mixed sets, and slowest for the incorrect SVO sets. Pairwise comparison tests showed that the L1 English were faster than the L1 Italic Indo-Europeans ($p < .001$) and the L1 Japanese ($p < .001$) and that the L1 Italic Indo-Europeans were faster than the L1 Japanese ($p < .007$).

An ANCOVA showed an effect for Group (L1 Italic Indo-European and L1 Japanese) on RT; $F(1, 44) = 5.011$, $p = .030$, partial $\eta^2 = .102$. The L1 Italic-Indo Europeans responded overall faster than L1 Japanese. There was no significant effect for adjusted X_Lex scores on RT; $F(1, 44) = .002$, $p = .963$, partial η^2 .000. The RTs did not differ depending on the Type of set; $F(2.60, 114) = .099$, $p = .944$, partial $\eta^2 = .002$. Type was not significantly related to X_Lex scores; $F(2.60, 114) = 1.104$, $p = .350$, partial $\eta^2 = .024$. There was also no interaction between Type and Group; $F(2.60, 114) = .307$, $p = .821$, partial $\eta^2 = .007$. Table 4 shows the corresponding means and standard deviations.

<Insert Figure 4 about here>

<Insert Table 4 about here (accuracy and reaction time syntactic sets)>

6. Discussion

The current study examined whether L1-L2 proximity influences word string judgements. We compared data from three groups of L1 participants: English, Italic Indo-European, and Japanese. Data for both accuracy and reaction time indicated first language background influences L2 learning. It is important to note that although participants with Italic Indo-European languages were compared to the single L1 Japanese group, the former group showed similar standard deviations for accuracy and RT scores on both the semantic and syntactic tasks compared to the Japanese L1 group.

6.1 Summary of findings

In response to our first research question, even though the L1 Japanese group had higher adjusted X_Lex scores compared to the L1 Italic Indo-European group, the latter group was both more accurate and faster in RTs than their L1 Japanese counterparts for semantic judgements. Unrelated noun sets were most accurately detected by all L1 groups and related noun sets were fastest by all groups. The L1 Italic Indo-Europeans performed in a similar way to the L1 English control group in their semantic RTs.

In response to our second research question, the L1 Italic Indo-Europeans were similar to the L1 Japanese in terms of accuracy for syntactic judgments. The L1 Italic Indo-Europeans and L1 English did not significantly differ. The L1 Italic Indo-Europeans and the L1 English groups were least accurate for the mixed syntactic strings whereas the L1 Japanese group was the least accurate for the correct mixed strings. RT data showed that all three groups differed significantly with the L1 English responding the fastest and the L1

Japanese the slowest. All groups responded the slowest to the incorrect SVO sets but the groups differed in terms of judgements for the correct and incorrect sets.

When L2 proficiency (X_Lex) is covaried with both semantic and syntactic types RT we see no differences in terms proficiency. However, this covariance of proficiency and semantic and syntactic types needs to be interpreted with caution as the L1 Italic Indo-European group had high X_Lex error scores in measuring their vocabulary knowledge. Additional longitudinal studies are required to assess whether semantic and syntactic processing RTs converge as proficiency improves for such L1 Japanese learners of an L2.

6.2 Complexity and modelling

The results from our study clearly show that any modelling of L2 lexical items need to take into account the typological distance of the learners first language background when learning a second language. Moreover, the semantics and syntax may not develop in parallel and so any modelling of L2 lexical representation and development needs to highlight how they may develop differently.

6.2.1 Jiang's model

Returning to Jiang's (2000) lexical representation and development model, L2 lexical items are mediated by their L1 counterparts for both semantics and syntax. It is only by the final stage of development that the model predicts that L2-specific information dominates L2 entries. We suggest that this process of *semantic* transference might be delayed for distant L1-L2s. Learners with close L1-L2s might, therefore, be at a distinct advantage when learning another L2. What remains unknown is whether these patterns exist for those different L1s. Komori, Ahn, Granena and Jiang (2012) indicate that L1/L2 word association behaviour relates to L1 syntax and that word association patterns mirror participants L1s syntax. We suggest that L1 syntax influences L2 lexical items, to the extent that distant L1-L2s might demand extra processing for the L2 learner.

Our RT findings indicate that the L1 Japanese group are slower in processing both semantic and syntactic sets than their L1 Indo-European counterparts. These findings support Fitzpatrick and Izura's (2011), which also showed that L2 words that have equivalent meaning in their L1 are produced faster. We suggest semantic transfer might need careful reconsidering for close L1-L2s because there might be less discrepancy between L1 and L2 semantic and syntactic information. Findings from the current study underline the need to incorporate greater complexity when considering L1 influences on L2 lemmas.

6.2.2 Pavlenko's MHM

Pavlenko's (2009) MHM appears to account for conceptual partial non-equivalence and conceptual non-equivalence, but our study suggests a difference for structural differences. The L1 Japanese group were slower to respond to the semantic sets than the Italic Indo-Europeans, possibly because of the cognates that exist between English and Italic Indo-European languages and, potentially, script differences. The potential advantage of similar or same script might account for the faster Italic Indo-European participant RTs, despite semantic and conceptual equivalences for both groups of L2 participants. We might have observed script differences manifested by a faster processing speed that the MHM does not currently account for.

In teasing apart the semantic and syntactic judgments we find subtle differences between the two learner groups. At a semantic processing level, accuracy and RT, the L1 Japanese participants appear to be at a disadvantage. At a syntactic processing level, the L1 Japanese and Italic Indo-Europeans also differ in RT. These findings appear to support Helms-Park (2001) where L1 and L2 resemble each other in terms of grammatical properties, in this case the syntactic sets, then positive transfer facilitates L2 processing. While the L1 Italic Indo-European participants were faster overall than the L1 Japanese counterparts, there were no differences between the two L2 groups for overall syntax accuracy judgements. Such results suggest that close L1-L2s may benefit syntactic processing speed in the L2 but that perception of accuracy of L2 syntactic strings might not be influenced by language distance. It appears possible that exposure negates potential distance effects for semantic and syntactic knowledge.

7. Conclusion

The current study compared two different L1 subject groups, according to L1-L2 proximity, with an L1 (English) control group. The results highlight the importance of distance for L2 lexical development models as well as the need to consider the complexities of first language differences in relation to the target language.

Jiang's model of three-stage development, therefore, needs to be reconsidered. The strength of L1 semantics and syntax properties of an L2 lexical item appear to depend on L1-L2 proximity. L2 lexical items with L1 properties embedded appear to require more processing when the L1 is distant. Moreover, semantics and syntax may not develop in parallel. The two L2 groups were similar in terms of their L2 syntactic accuracy judgements, but different in terms of their semantic judgements. Differences might relate to the flexible word order in some of the Italic Indo-European languages, the variability of which poses problems for L1-L2 close languages.

Our study indicated that the speed of processing L2 conceptual representations, i.e. semantics, seems to be mediated by the L1 proximity. Pavlenko's (2009) model does not take script differences into account which may also affect processing speed. Consequently, L2 semantic property internalization may not solely rely on learner restructuring.

In sum, we observed that L2 reaction time not only relates to language proficiency but also to language proximity. We have also seen that accuracy in the L2 may not develop in parallel with speed of processing. Both concerns might, to some extent, relate to second language proficiency to the extent that a threshold exists. The pedagogical implications for our findings question whether a multi-lingual class favours learners from close language backgrounds to the target language.

A limitation of this type of study is that much of the research on L1 background influences is based on RTs. Dijkstra et al (2010) found that RTs decrease with formal similarity. Similarly, De Groot (1993) demonstrated that cognates are translated faster than non-cognates. A further potential influence, specific to vocabulary items, might relate to semantic concreteness, as processing is faster for concrete nouns as opposed to abstract nouns (de Groot, 1993). All such factors might have influenced our findings in that linguistic differences influence processing differences in L2 learners of English.

Additional studies in which the same script but typologically distant (e.g., L1 Finnish-L2 English) and close first language backgrounds (e.g., L1 French-L2 English) might illuminate the extent to which reaction times improve or lag, but not script differences at different proficiency levels (e.g., Sjöholm, 1998). We predict that script similarity but L1-L2 distance would result in longer reaction times.

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Appendix

Instructions to participants

“Hello! Press ENTER to continue the instructions";

"You will be see 3 words on the screen.”;

“you need to say if the three words relate to each other”;

"Please answer as quickly as possible";

“if they relate press M”;

“if they do not relate press Z”;

“If you do not know the answer, just wait for the next one”;

“Ask ____ if you need any help or would like to stop”;

“Here are some practice sets”;

+998 "lion dog horse"

-999 "cat house beach"

"Now press ENTER to start the test";

Similar instructions were given for the syntactic sets.

Table 1. *Examples of 3-word strings*

	Categories	
	Single	**Mixed**
Semantic word strings		
Correct set	brother, mother, sister	dead, kill, shoot
Incorrect set	brother, village, room	accept, talk, school
syntactic word strings		
Correct set	my sister married a doctor	one plus two
Incorrect set	she a doctor shot	seven six plus

Table 2. *Syntactic word strings and translation equivalents*

Word string	**Structure**	**Equivalent in Japanese**	**Italic European**
He telephones his mother	SVO	No	Yes
He is dead	SVAdj	No	Yes
the radio is for listening	SVPrepO	No	Yes
one plus two	NPrepN	Yes	Yes
they talk each day	SVAdv	No	Yes

Table 3. *Semantic sets: accuracy and reaction times*

		Category							
	L1 Group	Noun correct		Mixed correct		Noun incorrect		Mixed incorrect	
		M	SD	M	SD	M	SD	M	SD
Accuracy	English	14.38	1.06	13.42	1.50	14.21	1.10	13.83	1.37
	Italic European	14.04	0.84	13.00	1.38	13.96	1.40	13.12	1.36
	Japanese	13.13	1.71	12.26	1.71	13.87	1.42	12.17	1.83
	Total	13.86	1.34	12.90	1.58	14.01	1.31	13.06	1.65
Reaction time	English	1316.51	313.24	1410.34	382.07	1538.76	350.68	1842.94	452.58
	Italic European	1643.26	347.58	1751.28	403.80	1967.81	383.27	2265.64	445.39
	Japanese	2016.16	281.57	2219.07	388.59	2214.80	373.15	2397.36	384.49
	Total	1653.46	422.16	1787.07	508.01	1903.69	458.76	2166.82	485.11

Table 4. *Syntactic sets: accuracy and reaction time*

	L1 Group	SVO correct		Mixed Correct		SVO incorrect		Mixed incorrect	
		M	SD	M	SD	M	SD	M	SD
Accuracy	English	13.76	1.16	13.96	1.10	14.36	1.11	12.64	1.52
	Italic European	13.12	1.88	13.12	1.13	13.68	1.11	12.80	1.71
	Japanese	12.87	1.96	11.87	1.71	13.30	1.99	13.22	1.86
	Total	13.26	1.72	13.01	1.57	13.79	1.49	12.88	1.69
Reaction time	English	1424.96	333.27	1323.01	271.76	1746.84	393.93	1478.25	270.91
	Italic European	1901.01	444.94	1738.12	305.01	2026.75	387.83	1919.58	468.78
	Japanese	2224.37	368.74	1892.72	315.29	2338.54	525.30	2096.35	340.47
	Total	1839.86	502.85	1644.67	380.28	2029.12	494.40	1824.13	448.90

Category spans all SVO correct, Mixed Correct, SVO incorrect and Mixed incorrect columns.

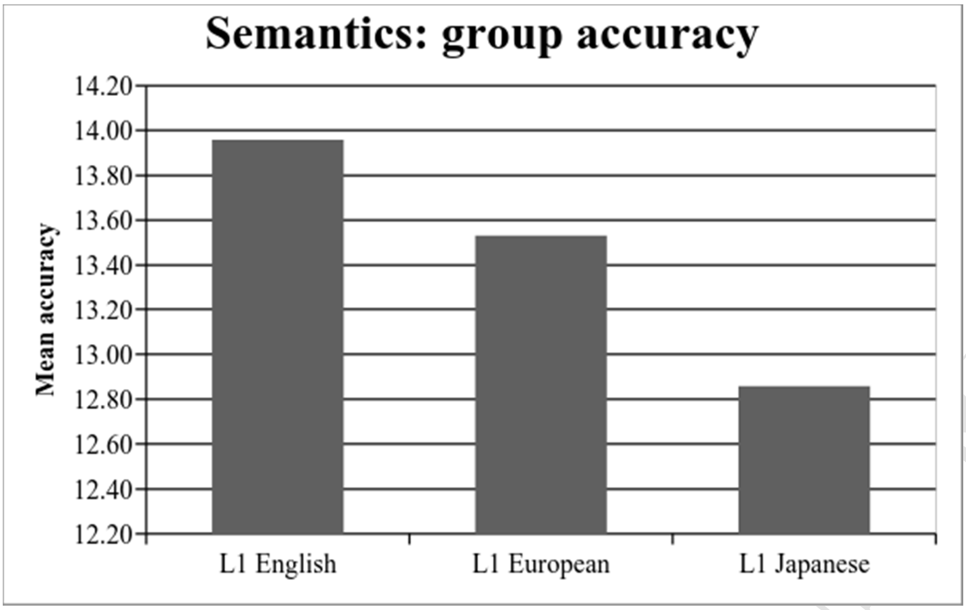

Figure 1: Accuracy scores for semantic judgements (y-axis) and L1 group (x-axis)

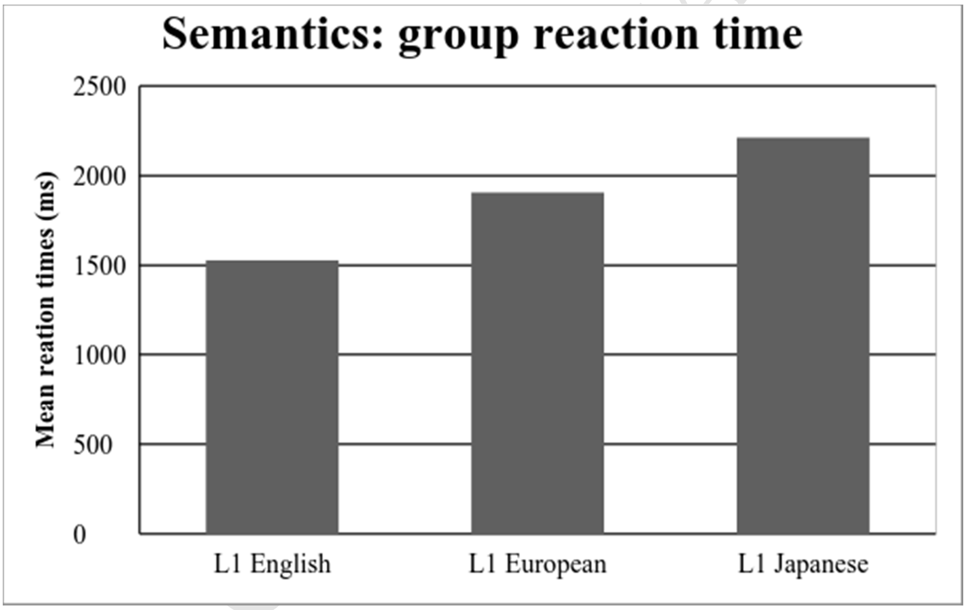

Figure 2: Reaction time for semantic judgements (y-axis) and L1 group (x-axis)

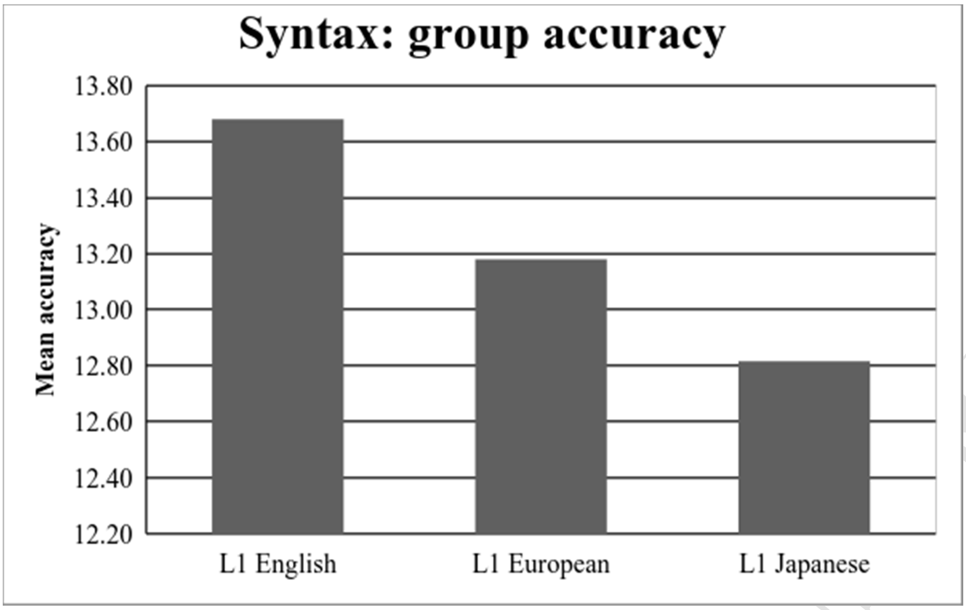

Figure 3: Accuracy scores for syntactic judgements (y-axis) and L1 group (x-axis)

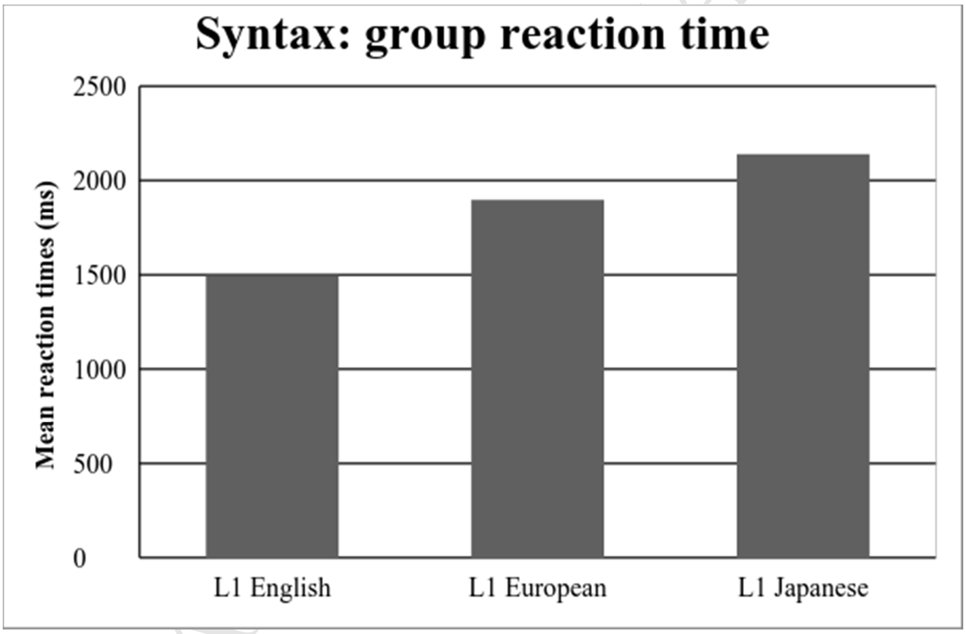

Figure 4: Reaction time for syntactic judgements (y-axis) and L1 group (x-axis)