Effects of Word Concreteness on Translation-Ambiguous Word Learning

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Previous research has shown a learning disadvantage for translation-ambiguous words in L2 learners. This study seeks to explore this relationship, primarily focusing on the role of word concreteness and multiple training methods on word learning. Results in multi-day translation production tasks show learning benefits for more concrete words and interactions between various factors and training method. Additional word characteristics shown to benefit translation-ambiguous word learning are examined.

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1.0 INTRODUCTION

Commonplace throughout language use in multilinguals is translation ambiguity, i.e. when a word in one language can be translated into multiple different words in another language (Tokowicz, in press). Translation ambiguity can arise in multiple ways, such as when a word in one language has multiple meanings that translate into different terms for each specific meaning in another language (meaning ambiguity): The English term "bark" means both a layer on woody plants and the sound produced by a dog. As a result, the translation of the term "bark" will most likely not encompass both meanings (Tokowicz, in press). This can also occur when a single term in one language can be translated into multiple words in another language (form ambiguity): The English "sky" can translate into either "lucht" or "hemel" in Dutch (Degani & Tokowicz, 2010). In the present study, we examine the role of multiple word characteristics, specifically translation similarity and concreteness, and training methods on translation-ambiguous word learning

The effects of translation ambiguity have been the topic of study, both in the realm of language processing and language learning (see Tokowicz, in press, for a review). Tokowicz and Kroll (2007) found that translation-ambiguous words took longer to produce and were produced less accurately than translation-unambiguous words in a translation-production task. Tokowicz (in press) argues that the reason for this could be because of competition between several possible options for translation, which causes interference during the task.

Language learning also shows effects of translation ambiguity, with translation-ambiguous words being harder to learn (Degani, & Tokowicz, 2010). Degani and Tokowicz performed a translation-ambiguous word learning study by training participants with Dutch-English translation pairs that were form ambiguous, meaning ambiguous, or unambiguous from English into Dutch. Their results show that translation-ambiguous words are harder to learn than unambiguous words, and that form-ambiguous words are more difficult to learn than meaning-ambiguous words. The difference between meaning and form ambiguous words could be accounted for by supposing that meaning ambiguous words can use one-to-one mappings between languages, whereas form ambiguous words will not, because new leaners will not be aware of the subtle distinctions between the translations (and were not taught them in this study).

Further research by Degani, Tseng, and Tokowicz (in press) shows learning of translation-ambiguous words is affected by training method. They manipulated training by either teaching translations on the same day (trained together) or on different days (trained apart). Translation-ambiguous words learned together show less of a disadvantage than translation-ambiguous words learned on different days. By training translation ambiguous words together, one gains benefits in allowing for mappings between L1 and L2 to be correct from an early time, as opposed to learning apart. By learning translation-ambiguous words at different times, one already has made mappings from L1 to L2 that are ineffective for translation ambiguity. This requires one to later revise the mappings, which they (Degani et al., in press). posit as being detrimental to learning

Related to the form and meaning ambiguity distinction discussed in Degani and Tokowicz (2010), Bracken, Degani, Eddington, and Tokowicz (in prep) examined the nature of translation similarity using a measure called Translation Semantic Variability (TSV). TSV is a

measure which ranges from 1-7, showing the level of semantic similarity between both translations of a translation-ambiguous word, with pairs close to 7 being highly related, and with those close to 1 being unrelated. Bracken shows a relationship between TSV and translation-ambiguous word learning, such that words with multiple translations that are more semantically similar are recognized more accurately, and at a faster speed, in a translation recognition task. This measure (TSV) allows for more subtle distinctions between translation-ambiguous word pairs than a categorical description of words as being form or meaning ambiguous.

In an early study of the effects of translation ambiguity on language processing, Tokowicz and Kroll (2007) studied the interaction between word concreteness and translation ambiguity in language processing. Word concreteness is a term used to describe if the referents of words are concrete objects like "table" or more abstract conceptions like "love." Tokowicz and Kroll showed that, because of differences in conceptual representation, concrete words have less of the disadvantages associated with translation ambiguity than more abstract words do and that unambiguous words, regardless of if they are abstract or concrete, are processed with similar reaction times.

Farley, Ramonda, and Liu (2012) showed that words with single translations are learned better if they are concrete. They speculated that the reason for this is the imagery that concrete words invoke that abstract words do not, which is known as the dual-coding theory (Paivio & Desrochers, 1980). Their findings are consistent with this explanation of the benefit. Van Hell and Mahn (1997) also examined the role of concreteness in foreign word acquisition by training participants in either keyword mnemonic or rote rehearsal conditions. Overall, concrete words were learned better than abstract words regardless of training condition.

This study addresses the issue of word concreteness as it applies to translation-ambiguous word learning by training translation-ambiguous words of varying concreteness either simultaneously or on consecutive trials. A comparison of simultaneous and consecutive trained of translation-ambiguous words has not yet been done. Based on the findings of Degani et al. (in press), this training manipulation can address whether there may be a mapping benefit when immediate information is given; simultaneously learned items can plausibly receive a learning benefit, compared to consecutively learned words, if this is the case.

It is predicted that translation-ambiguous words will show worse learning than translation-unambiguous words based on the results of previous studies (Degani & Tokowicz, 2010; Degani, et al., in press). Consistent with studies showing concreteness effects in translation-ambiguous word processing and studies showing general concreteness advantages for L2 word learning, it is anticipated that more concrete words will be learned better than more abstract words (Farley, Ramonda, & Liu, 2012; Tokowicz & Kroll, 2007.; van Hell & Mahn, 1997). Finally, it is predicted that translation-ambiguous words with high TSV ratings will be learned better than those were lower TSV ratings, based on previous work by Bracken et al. (in prep).

2.0 METHOD

2.1 Participants

Sixteen students (7 females, 5 males, 2 undisclosed genders; mean age of 19.93) from the University of Pittsburgh subject pool participated in this study, receiving credits towards an

Introduction to Psychology research participation requirement. All participants were right-handed native speakers of American English and had no previous knowledge of Dutch or German. Additionally, three of these participants were excluded from the free recall analyses because of audio recording problems or because they did not return for one of the translation task sessions. Participants filled out a language history questionnaire after participation in the final session.

2.2 Design

The study used a 2 ambiguity status (translation ambiguous vs translation unambiguous) within-subjects design. In addition, translation ambiguous words were trained either simultaneously (both possible translations presented at once) or consecutively (both translations being presented on consecutive trials). Training type was manipulated within-subjects.

2.3 Stimuli

Forty-eight German words were trained during this experiment (24 translation-ambiguous German words and 24 translation-unambiguous German words). These German words and their translations were chosen from a set of previous translation norms (Eddington, Degani, & Tokowicz, 2012). Translation-ambiguous words were matched (all Fs < 1) on German and English length, concreteness of translations, from the MRC database (Wilson, 1988) and translation log SUBTL word frequency (Brysbaert & New, 2009), and German TSV (Eddington et al., 2011).

The translation-ambiguous words were split into two lists. The two lists of translation-ambiguous words were counterbalanced for the training portion of the study (requiring four training versions), such that each translation was presented an equal number of times as both the first and second translation. Additionally, each translation was presented an equal number of times in the consecutive and simultaneous conditions. These lists were matched according to the means of German length, English translation length, log English word frequency (SUBTL), TSV, and translation concreteness (all *F*s < 1). An error in counterbalancing resulted in the German word Versuch's translations being presented in the same order for three versions, instead of two.

2.4 Procedure

This experiment took place over the course of three sessions (Monday, Wednesday, and Friday of the same week). During the first session, participants were instructed to learn the translation pairs and were trained on the German and English stimuli. E-Prime was used for stimulus presentation. For translation-unambiguous words, each trial began with a screen showing only a fixation cross. Participants pressed the space bar on the computer to initiate the training trial. On each trial, a German word and its corresponding translation would appear after a brief (100 ms) blank screen. This screen, showing the translation pair was shown for 8 seconds. After 8 seconds, the trial ended, and a fixation cross appeared, at which time the participant could begin the next trial.

The translation-ambiguous word pairs were trained in either consecutive or simultaneous conditions. For the consecutive condition, the same structure described above was used, with the only difference being that each trial consisted of two translation pairs, presented such that there was a fixation cross, then translation pair 1, following by a fixation cross, then translation pair 2.

Each pair was presented for 8 seconds. For the simultaneous condition, each trial consisted of a fixation cross, followed by a screen that showed both translation pairs on the same screen. This screen was shown for 16 seconds, to match the amount of time, per translation, of the other training conditions. The full training session consisted of three cycles, resulting in each translation pair being presented three times. Other than the presentation of consecutive translation pairs, the training order was randomized by E-prime.

Participants were instructed that they would be learning German and English translation pairs and that some of them would have more than one translation. Participants were not informed of the training difference between consecutive and simultaneous trials, though sample items of these types were included in practice trials preceding the actual training.

2.4.1 Free Recall

Each participant completed a free recall task immediately after the training session. Each participant was instructed to type each word pair that they remembered into a Microsoft Excel document, with no time limit. Each response was later scored according to translation accuracy. Responses that had the correct translation correspondence and were spelled correctly (up to three letters divergence from the correct German word) were marked as correct. Swapped letters, such as “keifer” and “kiefer” were counted as if there were one letter wrong.

2.4.2 Translation

A German to English translation production task was conducted on sessions 2 and 3 using E-Prime for word presentation and the recording of reaction time. Unambiguous word trials began

with the presentation of a fixation cross centered on the computer screen. Participants then pressed a button to advance to a screen, which presented a German word. Participants vocally produced a translation into a microphone and digital voice recorder simultaneously. As soon as the participant started to produce the translation, the word disappeared and a fixation cross for the next trial appeared. Reaction time for this task was recorded, by E-prime, as the amount of time that elapsed from the word presentation to the beginning of utterance production.

For ambiguous items, a similar procedure was used, with the only difference being that the ambiguous German words were presented 2 times, consecutively, giving the participants the opportunity to provide both translations, one after the other. Translation-ambiguous German words were indicated to be ambiguous by the inclusion of a "1" or a "2" immediately after the German word. For example, the German word "Versuch" would be presented as "Versuch 1" during the participant's first opportunity to provide a translation, with the next German word being "Versuch 2." The order of German words to be translated was randomized by E-Prime. Participants were told that they would be tested on both single- and multiple-translation words. They were also informed that words with more than one translation would be designated by this "1" and "2" marking, and to only respond with one translation per trial, and that they would have the opportunity to provide both translations consecutively.

3.0 RESULTS

Data analyzed by subject used repeated measures Analyses of Variance (ANOVAs) and analyses by item used correlational tests. For the free recall task, mean accuracy served as the dependent measure, and for the translation task, mean accuracy and mean reaction time, on correct trials, served as dependent measures. Ambiguity status was used as an independent variable for all

tasks. For ambiguous words, training type and order of training were used as independent variables for both tasks. Session number was used as an independent variable for the translation task. Additionally, concreteness and TSV were used as independent variables in the correlational items analyses. Concreteness ratings for translation-ambiguous pairs were obtained by averaging the concreteness ratings of both translations. Responses bigger than 5000 ms were omitted from the analyses of reaction time.

3.1 Free Recall

Significant differences were found between translation-unambiguous (M = .15) and translation-ambiguous (M = .21) words when comparing the number of accurate recalls, $t(15) = -2.23$, p = .04. Consecutively trained translation-ambiguous words were recalled most accurately (M = .23), with simultaneously trained words having the second highest accuracy (M = .19), and words with one translation had the lowest accuracy (M = .15) with marginal significance, F (2,30) = 2.50, MSE = .01, p = .10. There were no effects of training order on the average accuracy, with consecutive trained first having the same accuracy as consecutive trained second (M = .23), $F <$ 1.

Mean concreteness of the translations was positively correlated, with marginal significance, with mean free recall accuracy for consecutively trained words (r = .39, p = .06) and simultaneously trained words (r = .40, p = .05). The average accuracy was non-significantly correlated with concreteness for items trained first (r = .34, p = .11), but significantly correlated with items trained second (r = .44, p = .03). There was also a significant correlation between accuracy and concreteness for translation-unambiguous words (r = .59, p = .00). Further, there

was a significant correlation between accuracy and concreteness across all translation pairs (r = .47, p = .00).

There were no significant or marginally significant correlations between TSV and average accuracy for consecutively trained pairs, simultaneously trained pairs, words trained first, words trained second, or for ambiguous words overall (all rs < .27, ps > .21).

3.2 Translation

Comparisons of accuracy by subjects reveal no significant differences or interactions based on ambiguity status (all Fs < 1). When comparing mean accuracy based on subjects when including only ambiguous words of both training type, the only significant interaction was between session number, training condition, and training order, F (1,11) = 4.84, MSE = .00, p = .05 (see Table 1 and Figure 1).

A follow-up Duncan's multiple range test showed two significant pairwise contrasts in this interaction, with simultaneously trained items being learned better than consecutively trained items in session two, for items trained second, ($M_{difference}$ = .04, p < .05) and, in session three, higher accuracy ratings for simultaneously trained items that were trained first, over simultaneously trained words trained second ($M_{difference}$ = .04, p < .05).

For reaction time in the translation task, using an analysis including both translation-ambiguous and translation-unambiguous words, reaction times were longer in session 2 (M = 1671.12) than in session 3 (M = 1320.41), F (1,13) = 27.94, MSE = 123248.44, p = .00. There were no significant differences in reaction time for correct items based on training condition, though consecutive training led to slightly faster (M = 1336.50) reaction times than simultaneous training (M = 1555.03), F < 1. There were no other significant effects or interactions.

For the translation task, analyses by item show significant correlations between the average concreteness ratings (for both translations of a German word) and accuracy for simultaneous items trained first in session two (r = .69, p = .00), simultaneous items trained first in session three (r = .56, p = .01), simultaneous items trained second in session two (r = .53, p = .01), simultaneous items trained second in session three (r = .51, p = .01). There was also a significant correlation between mean concreteness and average reaction time (of correct translation responses) for simultaneous items trained second in session three (r = -.47, p = .04). No other significant correlations were found (all rs < .44, all ps > .05)

For single translation items, there were significant correlations between mean accuracy and mean concreteness during session two (r = .64, p = .00) and session three (r = .65, p = .00). There was also a significant correlation between mean reaction time and mean concreteness for session two (r = -.53, p = .01), but not for session three (r = -.01, p = .95).

None of the correlations between mean accuracy and TSV for items were significant (all rs < .40, all ps > .06). No significant correlations were found between reaction time and TSV (all rs < .40. all ps > .09).

When using a measure of mean concreteness multiplied with TSV, significant correlations with mean accuracy were found for simultaneous items trained first in session two (r = .59, p = .00) and session three (r = .53, p = .01), simultaneous items trained second in session two (r = .54, p = .01) and session three (r = .51, p = .01), and consecutive items trained second in session two (r = .44, p =.03) and session three (r = .48, p = .02). Consecutive items trained first in session two (r = .21, p =.32) and session three (r = .34, p = .11) were not significantly correlated with this TSV and concreteness measure.

Using the same variable of mean concreteness and TSV, the only significant correlation with reaction time was found for simultaneous items trained second during session three (r = -.49, p = .03). Marginally significant correlations were found for consecutive items trained first during session two (r = -.37, p = .09) and for simultaneous items trained second during session two (r = - .39, p = .10). No other significant correlations were found (all rs < .40, all ps > .14).

4.0 DISCUSSION

Our finding that translation-ambiguous words were recalled more accurately than translation-unambiguous words in a free recall task goes against previous results showing that translation-ambiguous words are harder to learn when testing with recognition and production tasks (Degani & Tokowicz, 2010; Degani, Tseng, & Tokowicz, in press). This result is consistent with other studies that show the same ambiguity advantage in a free recall task though (Degani et al., in press). A potential cause could be a difference in the amount of time that participants were exposed to German words, based on ambiguity status. This study matched the length of word presentation time to the translations, which meant that translation-ambiguous German words were seen for sixteen seconds, while translation-unambiguous words were only seen for eight seconds. Additionally, this difference could be the result of differences in attention allocation, as suggested by Degani et al. (in press), in that translation-ambiguous words could attract more attention and cause participants to use more effort in order to learn these words. This explanation is supported by research showing that low-frequency words, because of an increased amount of attention, are recalled better when presented in mixed lists (Delosh & McDaniel, 1996).

To further examine the effects of different training methods on translation-ambiguous word learning, this study taught translation-ambiguous words in either a single presentation

(simultaneous) or on back-to-back presentations (consecutive). Given the results of a previous study by Degani et al., (in press), we anticipated that words taught simultaneously would be learned better than those taught consecutively. This is based on the previously mentioned study's finding that when both translations of an ambiguous word were taught on the same day, they were learned better than when they were taught on different days.

Our study did not show differences in word learning based on training method when comparing the accuracy of translation production overall. Degani, et al. argue that teaching both translation pairs on the same day would allow participants to create appropriate mappings between L1 and L2, instead of having to revise mappings if they erroneously created single mappings for ambiguous items. In our study, both translation-ambiguous pairs were taught in a single day, which is a shorter period of time than the previously mentioned study. For this reason, it is possible that participants could create appropriate mappings in both conditions. A significant three-way interaction shows that simultaneously trained words are learned better than consecutively trained words in certain conditions. This could be because participants could structure their learning, in terms of how much time they spent on learning each word, however they found appropriate. This is different from the consecutively trained words, where participants had a set amount of time for each word, and, as a result, less freedom in how to use their time. Additionally, we found differences in training method in the correlational analyses of concreteness.

Given previous results showing a positive correlation between TSV (with high ratings showing increased similarity between multiple translations) and word learning, it was anticipated that our results would show a similar pattern (Bracken, Degani, Eddington, & Tokowicz, in prep). This pattern was not found in the current study however, as our results show no significant

correlations between these variables. A potential factor in this difference could be the testing methods, as Bracken et al. used a translation recognition task, while this study used a translation production task. Additionally, because our results did show trends in the same direction found in the study by Bracken et al., it is possible that a lack of power could be the cause of this difference.

Tokowicz and Kroll (2007) suggest that because conceptual representations for concrete and abstract words are different, the way that ambiguity interacts with these representations will not be the same. Their study examined concreteness categorically (comparing abstract and concrete words) and found that there were processing differences for translation-ambiguous words based on this distinction. Given this information, along with other work showing benefits of concreteness in L2 learning, we predicted that more concrete translation-ambiguous words would be learned better than more abstract translation-ambiguous words (Farley, Ramonda, & Liu, 2012; van Hell & Mahn, 1997).

Consistent with this prediction, we found significant positive correlations between concreteness and accuracy in a translation production task for simultaneously trained words in both sessions, though consecutively trained words only showed this correlation in session two, and only with marginal significance. This correlation was also shown for single-translation words. Farley et al. (2012) show that by training abstract, single-translation, words with an image of a possible referent of the word, e.g. showing a picture of a moose when learning the translation for "moose", the effects of the abstract disadvantage can be somewhat alleviated, lending supporting to the Dual-Coding Hypothesis, which posits that the inherent imagability of concrete words leads to the learning benefit (Paivio & Desrochers, 1980). If this is the reason that more concrete words are better learned, this can easily apply in a translation-ambiguous

word learning context. A potential concern is that the correlations that we found between simultaneously trained words were fully significant in both sessions, while the correlation with consecutive items was only found in session two, and only with marginal significance, suggesting that there could be a potential interaction between training type and concreteness.

This study examined multiple lexical characteristics of translation-ambiguous words and their effect on L2 word learning using multiple training methods. Results show that more concrete words are learned better than more abstract words. Similarity between the translations of translation-ambiguous words was not a significant influence on word learning, though an interaction between translation similarity and concreteness is positively correlated with word learning in more conditions than concreteness alone. Further, no difference was found between translations trained on a single trial and those trained on consecutive trials, suggesting that translation-ambiguous word pairs can be taught in a short time frame, even if not immediately together, and not receive a translation-ambiguity disadvantage.

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Table 1. Means and standard error for accuracy ratings in a significant three-way interaction between session, training method, and translation order.

	Session 2				Session 3			
	First Translation		Second Translation		First Translation		Second Translation	
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
Simultaneous	0.31	.070	0.33	.071	0.34	.068	0.29	.064
Consecutive	0.30	.077	0.28	.073	0.31	.083	0.31	.076

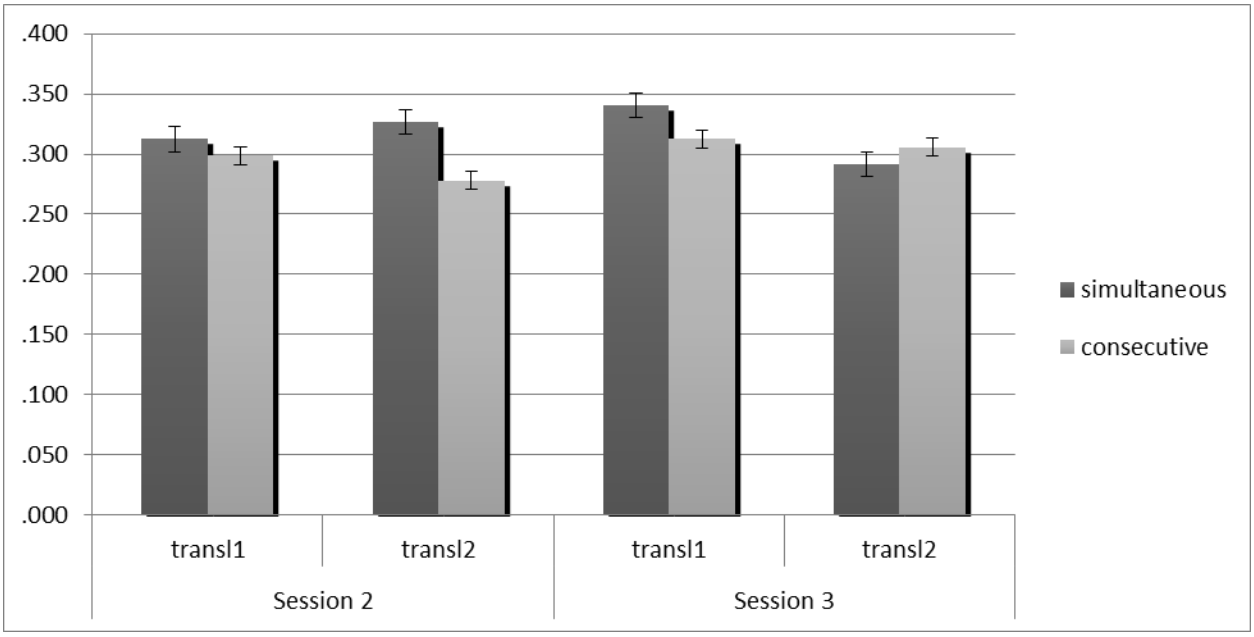

Figure 1. Three-way interaction between session, training method, and translation order for accuracy scores.