

39. Semantic access during Turkish and English visual word processing in translation students: A case of semantic Simon paradigm

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Abstract

The present study aimed to investigate semantic meaning activation in L1 and L2 during low-level word processing, i.e., case judgment tasks using the semantic Simon paradigm. Turkish-English bilingual participants who were divided into two “translators” and “bilinguals” were asked to judge target words’ letter cases by responding “animal” to uppercase targets and “occupation” to lowercase targets. The findings of the study were in line with the previous results in which faster responses were obtained both in the first language (L1) and second language (L2) when the verbal response corresponded to the semantic category, although semantic content was irrelevant to the task itself. In other words, faster responses were observed in congruent condition (e.g., verbal response “animal” to DOG) than incongruent condition (e.g., verbal response “animal” to SOLDIER). There was not any significant effect of the group (either translator or bilingual) on both response times and accuracy. Groups’ mean response times did not differ significantly from each other both in L1 and L2. Consequently, the present study supports the view that semantic access and form-to-meaning mappings may occur automatically and fast in L2 as they do in L1, and it may be possible that lexical representations of words in both languages may develop direct semantic access while student translators process the words visually.

Keywords: semantic Simon paradigm, semantic access, form-to-meaning mapping, first language, second language

Çeviri öğrencileri Türkçe ve İngilizce kelimeleri görsel olarak algılamakta ortaya çıkan semantik erişim: Semantik Simon yaklaşımı

Öz

Bu çalışmanın amacı, semantik Simon etkisini kullanarak büyük harf/küçük harf olarak karar vermeyi içeren bir test ile kelimelerin beyinde alt düzeyde işlem görmesi sırasında birinci dil (anadil) ve ikinci dilde (yabancı dil) görülen semantik anlam aktivasyonunu incelemektir. Türkçe-İngilizce dil çiftine sahip katılımcılar çevirmenler ve çift dilliler olmak üzere iki gruba ayrılıp katılımcılardan deney sırasında gösterilen kelimelere büyük harfle yazıldıysa “hayvan” küçük harfle yazıldıysa “meslek” şeklinde cevap vermeleri istenmiştir. Çalışmanın bulguları bu konudaki önceki çalışmaları desteklemektedir. Bu da kelime için verilmesi gereken cevap kelimenin anlamıyla örtüştüğünde hem anadilde hem de yabancı dilde verilen cevapların daha hızlı olduğudur. Deney tasarımında ekranda gösterilen kelimelerin anlamlarının önemli olmamasına rağmen kelimenin yazılış biçimiyle anlamı uyuşan durumlarda (büyük harfle yazılan KÖPEK kelimesine “hayvan” cevabı) verilen cevaplar

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uyuşmayan durumlarda (büyük harfle yazılan ASKER kelimesine “hayvan” cevabı) verilen cevaplara göre daha hızlı olmuştur. Hem cevaplama süreleri hem de doğru cevap yüzdesi açısından iki grup arasında belirgin bir fark gözlemlenmemiştir. Her iki grubun da ortalama cevaplama süresi anadilde ya da yabancı dilde farklılık göstermemiştir. Bunların ışığında çalışmanın sonuçları beyinde kelimelerin anlamsal boyutuna erişimin ve biçim-anlam örtüşmesinin yabancı dilde de anadilde olduğu gibi otomatik ve hızlı olabileceğini desteklemektedir. Buna göre çeviri öğrencileri kelimeleri görsel olarak algımlarken ve işlerken bu kelimelerin her iki dildeki sözcüksel gösterimleri doğrudan semantik erişimine imkân sağlayabilir.

Anahtar kelimeler: semantik Simon etkisi, semantik erişim, biçim-anlam örtüşmesi, anadil, yabancı dil

1. Introduction

The Simon paradigm is essentially a location-oriented task that is commonly used for investigating low-level visual processing. In a typical Simon task, participants are asked to press a key on right or left to stimuli whose locations are irrelevant to the task. The Simon effect is generally measured with the difference between accuracy and response times between congruent and incongruent trials (Amso & Casey, 2009). In their experiment, Simon and Rudell (1967) demonstrated that there was a strong relationship between stimulus and response compatibility, which has been considered the “Simon effect”. In their experiment, subjects pressed the right or left key while responding to the words “right” or “left”, which were presented either to participants’ left or right ears. It was found that responses were faster when the content of the word corresponded to the ear it was heard. For example, when “right” was heard in the right ear, the responses were faster than when it was heard in the left ear. The experiment yielded that information processing was affected by the irrelevant feature of the stimulus; in this case, the ear in which the word was heard. In another experiment (see Craft & Simon, 1970), participants were asked to respond to red and green lights by pressing keys either on their left or right. When the red light is presented, participants must press the left key, and the right key must be pressed for the green light regardless of whether the light is presented on the right or left side of the display. It was believed that responses to red light would be facilitated when it was presented on the left compared to when it was presented on the right. It was shown that for the green light, responses were faster when it was presented on the right side (Duscherer, et al., 2008).

As can be understood from the example experiments mentioned above, there are three important factors in a traditional Simon task. First of all, a relevant stimulus feature, for example, its colour, word category, etc.; secondly an irrelevant stimulus feature that has to be ignored; in spatial versions of the Simon task, the location must be ignored i.e., whether the stimulus is presented on the right or left of the display; thirdly a relevant response; a common approach is the response keys on right or left (De Houwer, 1998). Apart from spatial Simon experiments, different versions of the task were developed, such as the affective Simon paradigm (see De Houwer, 2003; De Houwer et al., 2001; De Houwer & Eelen, 1998; Tipples, 2001) and the semantic Simon paradigm (see Duyck & De Houwer, 2008; De Houwer, 1998). The Semantic Simon paradigm was initially proposed by De Houwer (1998) following three types of experiments. In these experiments, words in two different semantic categories were presented to the participants. Participants were asked to respond to the target words by saying the name of one of the semantic categories. In experiment 1, the language of the words (Dutch or English); in experiment 2, the letter case of the Dutch words (upper or lower case); in experiment 3, the grammatical category of the Dutch words (noun or adjective) were considered relevant features. Faster and more

accurate responses were gathered when the semantic category of the stimulus corresponded to its semantic meaning. In other words, participants were faster in their responses when the semantic content of the word was in line with the prompted response type (saying “animal” to the words in upper cases such as “HORSE”) (De Houwer, 1998). As can be understood from these examples, in the semantic Simon paradigm, irrelevant and relevant features of stimuli are not similar in terms of spatial location but similar with regards to their semantic meanings. The semantic Simon paradigm provides an opportunity to observe the effect of irrelevant features on the responses based on the semantic meaning of the target words. Therefore, it could be a useful tool in investigating automatic semantic processing and semantic access in language comprehension and processing both in the native language (L1) and second language (L2).

When the bilingual language processing literature was reviewed, the main focus of the study was on the investigation of similarities and differences between languages. However, there are many aspects of bilingual language processing that could be studied, such as semantic processing or word recognition. It seems that there are two dominant views concerning word processing and semantic access; the revised hierarchical model (RHM) and the Interactive Action Model. According to the revised hierarchical model (RHM), a model proposed by Kroll and Stewart (1994), L2 word forms are assumed to have no access to their semantic meanings in contrast to L1 words. Form-to-meaning mappings in L2 occur through association with their L1 translation equivalents (as cited in Duyck & De Houwer, 2008, p. 961). However, we can also find counter arguments for this model which mainly derive from semantic effects in forward or backward translation studies. In a bilingual Stroop task, La Heij et al. (1996) found that congruent colour words (the colour of the ink corresponded to the word) were translated faster than incongruent cases. Similarly, Duyck & Brysbaert (2004) investigated the translation of number words. They found that it took longer while translating the number words in large quantities, which could be an indicator of semantic access; therefore, they concluded that there exists a strong form-to-meaning mapping in L2 words, as well. In another study, Duyck and Houwer (2008) utilized the semantic Simon paradigm in order to investigate a low-level processing with bilingual words which was inspired from the monolingual semantic Simon task of De Houwer (1998). With this bilingual Simon task, they aimed at studying bilingual word processing and the existence of L2 form-to-meaning mappings. They used a case-letter judgment task in L1 and L2 (Dutch & English) with two semantic categories, animals and occupations; saying “animal” to uppercase targets or saying “occupation” to lowercase targets. Faster responses were observed in congruent conditions (saying animal to LION) in both languages, which was regarded as the evidence of L2 form-to-meaning mappings because a case-letter judgment task does not require any semantic access. According to the Interactive Action Model, on the other hand, (McClelland & Rumelhart, 1981), when a word is presented visually, its orthographic, phonological, and semantic representations get activated in both L1 and L2 because it is believed that bilingual lexicon may include entries from both languages (as cited in Van Assche et al., 2011, p.89). Therefore, form-to-meaning mapping and semantic access can be observed actively in bilinguals. Motivated by the study of Duyck and Houwer (2008) on semantic access in bilinguals in which the semantic Simon paradigm was applied, the present study aims to replicate and extend their results with an addition of a new dimension to the experiment design. The present study investigates the semantic access in both native and second languages using the semantic Simon paradigm with the participation of two different groups; namely, translators and bilinguals. It is hoped that this experimental design and the use of English and Turkish target words will shed more light on the understanding of form-to-meaning mapping and semantic access in language processing.

2. Methodology

2.1. Participants: Twenty translation students participated in the study voluntarily. They were all assumed to participate in the tasks with their full concentration. Two different groups were formed, and each group included ten participants. **Group I** included ten 4th year translation students in their last academic year. They were assumed to have enough translation skills and experience. The participants in this group had translation practice from and into Turkish for more than two years. **Group II** consisted of ten 1st year students who just started their university education, and they had no previous experience in translation and acquired no previous training on translation. Therefore, Group II was regarded as “bilinguals”. The mean age of Group I was 23.7 ranging from 21 to 35, and the mean age of Group II was 18.8 ranging from 18 to 20. All participants were native speakers of Turkish and they reported that they used Turkish in their daily life and conversations. In terms of their English, participants reported that they learned English as their second language and started to receive English education around the age of 9 or 10 and most of the participants (17 out of 20) pursued their high school education in the language section. To measure the English Language Proficiency level of the participants in both groups, grammar, vocabulary and reading sections of ECCE, 2013 design, Examination for the Certificate of Proficiency in English were administered. There were 100 questions in total in which there were 35 grammar, 35 vocabulary and 30 reading questions. The mean score of Group I was 85.9 (SE=1.94) and the mean score of Group II was 83.7 (SE=1.78). There was not any significant difference between the English Language Proficiency scores of the subjects $t(18)=0.835$, $p>.05$ which demonstrates that language proficiency may not be a confounding factor.

2.2. Apparatus: Semantic Simon paradigm was utilized to investigate the semantic access in native and second language. The semantic Simon Task experiment was administered to the participants in front of a computer screen running e-prime studio. During the experiment, participants were left alone in the room until they completed the task in a silent environment.

2.3. Stimuli: The stimuli used in the study were as similar as possible to those of De Houwer (1998, experiment 2) and those of Duyck and De Houwer (2008). Stimuli consisted of 32 L1 (Turkish) target words and their 32 L2 (English) translation equivalents. Half of the stimuli were animal names; the other half were occupation names (see Appendix 1). Two or three-syllable words were chosen. Cognates (i.e., words that are identical across languages in terms of meaning and orthography; e.g., Turkish-English: film, pilot, etc.) were excluded. As can be seen in the Table 1 below, for each semantic category, L1 and L2 targets were analysed in analyzed the frequency of use and the number of letters (see Appendix 2). The frequencies of the selected Turkish words were confirmed in “Turkish National Corpus”, and the frequencies of the selected English words were confirmed in “CELEX lemma database”. As can be seen in the reported p values in the Table 1, no significant difference was found between the L1 and L2 words for each semantic category in terms of the number of letters and the word frequency ($p>.05$).

Animals					
	L1 Turkish	SE	L2 English	SE	<i>p</i>
Number of Letters	4.8750	.22127	4.5625	.34118	.448
Word Frequency	19.5294	2.86334	25.1875	4.17355	.272
Occupations					
	L1 Turkish	SE	L2 English	SE	<i>p</i>
Number of Letters	5.4375	.22302	6.1250	.32755	.093
Word Frequency	33.4194	9.50917	35.2500	7.17432	.879

Table 1: Characteristics of Stimuli (Means)

3.4. Procedure: The experiment was composed of two sessions with a time interval between the two sessions (10 days). In the first session, participants performed a case-judgment task with L1 targets, and in the second session with L2 targets. During the case-judgment task, participants were instructed to respond in their native language, namely Turkish. In each session, half of the participants were instructed to respond “hayvan” (animal) to words written in upper-case letters, and “meslek” (occupation) to words written in lower-case letters; the other half of the participants responded in the reverse way; thus, counterbalancing was achieved. Half of the stimuli in each semantic category were written in lower case and the other half were written in upper case. Target words which were in lower or in upper case remained constant across languages. All of the stimulus items were presented randomly in the experiment. In the experiment, participants were instructed to respond solely based on the case of words, whether they were written in lower or upper case. Before the real task, participants were asked to perform eight practice trials. As in the real experiment, the practice trials were prepared in the same way; half of the stimuli were animal, half of them were occupation words written either in lower or upper case. The whole experiment was designed on e-prime studio. Each trial started with a fixation cross for 500 msec. and then target words appeared in the middle of the screen. Target words remained on the screen for 3000 msec. which was stated as the maximum response time in Duyck and De Houwer’s study (2008). Participants responded to the targets orally and their responses were recorded. The same procedure was administered in both sessions. After participants completed L2 session (2nd session), they were asked to fill in the translation equivalents of targets in order to make sure that they all knew the meanings of the words in English.

3. Results

Performances in practice trials were not analysed. Trials with background noise, and trials for which there was no response were not included in the statistical analysis. The proportion of case-judgment errors on the remaining trials was 3.35%. All response times were measured by means of the program called “audacity”. The onset of the responses was regarded as response times (RT). All response times that were lower or higher than 2 Standard Deviations (SD) of the average were excluded. The experiment had mixed design in which independent variables were congruency (congruent vs. incongruent), language (L1 vs. L2) and group (translator vs. bilingual), and the dependent variable was response times in congruent and incongruent cases. Mean response times were analysed by means of a repeated measures ANOVA. When the data were analysed, it was found that there was a main effect of congruency ($F(1, 18)=6.60, p<0.05, \eta^2=.269$). Reaction times in the congruent condition were significantly shorter ($M=757.106$ msec; $SE=17.347$) than in the incongruent condition ($M=793.966$ msec; $SE=26.370$) regardless of language and group. The main effect of language was not significant ($F(1, 18)=.011, p>.05$,

$\eta^2=.001$). All participants regardless of their groups responded faster in the congruent condition ($M=755.575$ msec for L1 words, $SE=22.121$, and $M=758.636$ for L2 words, $SE=18,962$). No main effect of group was found ($F(1, 18)=.588$, $p>.05$, $\eta^2=.032$); both translators and bilinguals responded faster in the congruent condition in both languages compared to their responses in the incongruent condition which can be seen in Table 2 below.

Group	Congruency	Language	Mean RT	SE
Translators	Congruent	L1	753.790	31.284
		L2	746.929	26.817
	Incongruent	L1	778.425	44.114
		L2	758.155	42.093
Bilinguals	Congruent	L1	757.361	31.284
		L2	770.343	26.817
	Incongruent	L1	817.798	44.114
		L2	821.487	42.093

Table 2: Groups' Mean Response Times (msec)

The analysis yielded that there was no significant interaction between congruency and language ($F(1,18)=.333$, $P>.05$, $\eta^2=.018$). In addition, there was no significant interaction between congruency and group ($F(1,18)= 1.743$, $P>.05$, $\eta^2=.088$). When the planned contrasts were analysed, a significant difference was found only between incongruent and congruent conditions ($F(1,18)= 6.608$, $P<.05$, $\eta^2=.269$). Mean reaction times in both conditions in terms of language can be seen in Table 3.

	Response Times L1		Response Times L2	
	Mean	SE	Mean	SE
Congruent	755.575	22.121	758.636	22.121
Incongruent	798.112	31.193	789.821	29.764

Table 3: Mean Reaction Times in terms of Language

4. Discussion

Following the results obtained from the data gathered, it is clear that there exists a semantic Simon effect in which faster responses were recorded for congruent conditions both in Turkish and English. Participants responded to the letter case of the words when the semantic content of the word corresponded to its semantic category, i.e., in the case of responding as “animal” to uppercase targets, saying animal when the target word DOG was presented. The semantic Simon effect was as strong in L1 as it was in L2, which replicated the findings of De Houwer (1998) and Duyck and De Houwer (2008). This provides more evidence for form-to-meaning mapping and automatic semantic access in L2 as quickly and strongly as it is in L1. It should also be noted that the case judgment task is a very reliable and accurate way of studying form-to-meaning mapping, since the semantic meaning of the targets was irrelevant in the task that was performed by the participants. It was purely visual word processing and word recognition, in other words, low-level word processing. Using the semantic Simon paradigm, automatic semantic activation both in L1 and L2 word processing was shown with a clear and strong congruency effect. Since no significant effect of language was observed, it means that the semantic content of words in L2 is as fast and accurately activated as they are activated in L1. This finding supports

the view of Duyck and Brysbaert (2004) that words in L2 might have strong and quick semantic representations at the early stages of low-level word processing. In their semantic and translation priming study with Dutch-English bilinguals, Schoonbaert et al. also suggested that L1 and L2 words are represented in a unified lexico-semantic architecture, suggesting a shared structure across languages. Furthermore, their data demonstrated that semantic information was activated quickly in L2 word processing during lexical decision and translation priming tasks (Schoonbaert et al., 2009).

On the other hand, the results of the experiment also show that there is no significant difference between translators and bilinguals while responding to congruent cases. While mean congruency response times in L1 were almost similar (Translators=753 msec, bilinguals=757 msec), when it comes to L2 targets, although no significant difference was observed, translators (M=746 msec) gave slightly faster responses to congruent cases than bilinguals did (M=770 msec). This finding indicates that translation background and experience in translation may not be a factor in semantic access in L2 words, which proves the arguments that were stated by Duyck and Brysbaert (2004), that the strength of L2 form-to-meaning mappings does not depend primarily on L2 proficiency; instead, such mappings in L2 depend on word variables for example whether the meaning of a word is overlapping across languages and whether there are cross-lingual interactions. It should also be noted that according to statistical analysis of English language proficiency, the scores of the subjects in the groups did not yield a significant difference between the two groups, which also indicates that L2 proficiency does not have a primary effect on form-to-meaning mappings.

5. Conclusion

To investigate semantic meaning access in a native and second language using the semantic Simon paradigm as a case judgment task, the present study replicates and extends earlier findings of a semantic Simon effect as well as fast and automatic semantic access in both languages. The findings of this study show that in a bilingual semantic Simon paradigm, both translators and bilinguals made faster case judgments for L1 and L2 targets when the response corresponded to the semantic content of the target (e.g., saying “animal” for DOG) than it did not correspond to the semantic content (e.g., saying “animal” for SOLDIER). The results of the study show that the semantic content of words both in L1 and L2 get activated automatically and quickly independent of the irrelevancy of the semantic content to the task. These results shed light on visual word processing and semantic access in bilinguals through a study of the semantic Simon paradigm. These findings clearly show that low-level word processing in translators is both strong and quick in both languages. With a larger sample group and a larger set of stimuli, more generalizable data could be gathered. Variation can be useful, especially among participants and groups, by adding variables such as level of bilingualism or level of translation experience, etc. In particular, participants for the bilingual group can be chosen from other language-related departments rather than the translation department. For future research, word variables could also be integrated into the experiment design to investigate their effect on semantic access at various levels. Since no significant effect of group was observed in the present study, a more detailed experiment with different groups of bilinguals could be administered to make sure that there does not exist any difference between bilingual groups with different knowledge and backgrounds. It is also believed such reliable and measurable experiment designs can be useful in investigating and elaborating language processing in bilinguals and translators, which can pave the way for a better understanding of the translation process among students as well as professionals.

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Appendix 1 Stimuli used in the experiment

		SESSION 1 (TURKISH)		SESSION 2 (ENGLISH)	
	Practice Trials	1	ASLAN	1	LION
1	BALIK	2	ARI	2	BEE
2	sincap	3	balina	3	whale
3	KUŞ	4	domuz	4	pig

4	yarasa	5	FARE	5	MOUSE
5	okutman	6	inek	6	cow
6	MEMUR	7	KAPLAN	7	TIGER
7	BAKAN	8	kartal	8	eagle
8	şoför	9	keci	9	cat
		10	KUZU	10	LAMB
	Practice Trials	11	koyun	11	sheep
1	fish	12	YILAN	12	SNAKE
2	SQUIRREL	13	MAYMUN	13	MONKEY
3	bird	14	yunus	14	dolphin
4	BAT	15	TAVUK	15	CHICKEN
5	instructor	16	tilki	16	fox
6	OFFICER	17	kasap	17	butcher
7	minister	18	ASKER	18	SOLDIER
8	DRIVER	19	garson	19	waiter
		20	CASUS	20	SPY
		21	AVUKAT	21	LAWYER
		22	rehber	22	guide
		23	hakim	23	judge
		24	BAKKAL	24	GROCER
		25	ressam	25	painter
		26	AVCI	26	HUNTER
		27	albay	27	colonel
		28	YAZAR	28	WRITER
		29	HAKEM	29	REFEREE
		30	TERZİ	30	TAILOR
		31	gardiyan	31	guard
		32	mimar	32	architect

Appendix 2 Word frequencies and number of letters of the targets

ANIMAL						OCCUPATION					
L1 TR	Lette rs	Freq u- ency	L2 ENG	Lette rs	Freque ncy	L1 TR	Lette rs	Fre qu ency	L2 ENG	Lette rs	Fre qu ency
Aslan	5	37,88	Lion	4	25	Kasap	5	6,93	butche r	7	6
arı	3	16,45	bee	3	17	Asker	5	89,0 9	soldie r	7	83
Balina	6	3,67	Whal e	5	11	Garso n	6	15,0 9	waiter	6	22
Domu z	5	10,6	Pig	3	43	Casus	5	5,69	spy	3	12

Fare	4	17,12	Mouse	5	18	Avukat	6	27,68	lawyer	6	51
Inek	4	9,04	Cow	3	40	Rehber	6	14,67	guide	5	34
Kaplan	6	8,54	Tiger	5	12	Hakim	5	99,68	judge	5	59
Kartal	6	16,2	eagle	5	9	bakkal	6	14,25	grocer	6	6
keci	4	43,21	cat	3	67	Ressam	6	31,81	painter	7	30
kuzu	4	15,26	lamb	4	21	Avcı	4	16,24	hunter	6	25
Koyun	5	35,3	sheep	5	40	albay	5	20,27	colonel	7	92
Yılan	5	24,54	snake	5	23	Yazar	5	131,46	writer	6	66
Maymun	6	9,19	monkey	6	18	hakem	5	23,27	referee	7	5
Yunus	5	22,85	dolphin	7	3	terzi	5	6,57	tailor	6	3
Tavuk	5	27,03	chicken	7	41	gardiyan	8	7,62	guard	5	52
Tilki	5	15,59	fox	3	15	mimar	5	24,39	architect	9	18