

Is Syntax Separate or Shared Between Arabic and English? Syntactic Priming in Arabic-English Bilinguals

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Abstract—Syntactic priming refers to the likelihood that a particular structure is repeated when preceded by an utterance with the same or a related syntactic structure. Experimental studies that demonstrate syntactic priming have attracted the attention of scholars because syntactic priming provides insightful information about the way language is processed in the human cognitive system, facilitates dialogue and informs linguistic theories about the knowledge of language that is activated via syntactic priming. In this study, we investigate syntactic priming in 15 Arabic-English bilinguals through the *Confederate-Scripted Dialogue Game* technique, targeting four structures: active, passive, double-object (DO), and prepositional-object structures (PO). The results of the study indicate that the syntax of Arabic-English bilinguals is separate for each language. Participants tend to use the active structure regardless of the structure of the prime sentence. The findings of this study illustrate how the syntax of two unrelated languages (Arabic and English) is represented and processed in bilingual brains, contributing to the fields of bilingualism, syntax, psycholinguistics, and second language acquisition.

Index Terms—psycholinguistics, syntax, priming, Arabic, English

I. INTRODUCTION

Repetition is a key concept in experimental psychology. It occurs when people repeat an activity that they have just done or have seen others doing. Repetition also occurs in language, people tend to repeat what they have heard themselves say or what they have heard other people say. Studies have shown that people tend to repeat words (Brown et al., 2000), meanings, sounds and sentences (Bock, 1986a).

In the past three decades, linguists and psychologists have investigated a form of repetition they call *syntactic priming*, which is the likelihood of speakers repeating the underlying basic structures that they have articulated or heard other people articulate (Pickering & Ferreira, 2008). This means that people tend to repeat a particular structure when they hear others produce it or a related syntactic structure.

The first experimental evidence for syntactic priming dates back to Bock's (1986b) study of syntactic priming in production. Her three experiments found evidence that the syntactic features of an utterance are primed independently of the utterance content. Namely, themes, words, and sound patterns between the prime sentence and the target sentence do not explain the occurrence of syntactic priming. Rather, the resemblance in the structure between the prime and target sentences is the cause of syntactic priming.

Bock's (1986b) experiments were based on disguised memory tasks in which participants repeated prime sentences with four different structures: transitive active sentences (I), transitive passive sentences (II), dative sentences with a prepositional object (III), and dative sentences with a double object (IV), and then described target pictures that are completely unrelated to the prime sentences. Examples of the four structures are as follows:

- I. One of the players kicked the ball.
- II. The ball was kicked by one of the players.
- III. A car dealer sold some cars to an agent.
- IV. A car dealer sold an agent some cars.

Participants were more likely to describe pictures using an active sentence after hearing a structure like (I) (e.g., John is eating an apple) than after hearing structure (II) and more likely to use a passive sentence after hearing structure (II) (e.g., An apple is eaten by John) than after hearing structure (I). Similarly, participants were more likely to produce a dative sentence with a prepositional object (e.g., The daughter gave flowers to her mother) after hearing structure (III) than after hearing structure (IV) and more likely to use a dative sentence with a double object (e.g., The daughter gave her mother flowers) after hearing structure (IV) than after hearing structure (III). The results showed that structural priming is an automatic cognitive process that makes speakers repeat the structure of the prime sentences spontaneously and without awareness, reflecting a hidden effect that makes a speaker choose a particular structure among other possible structures that would express the same thought.

After Bock's (1986b) study, many scientists carried out experimental studies that demonstrated syntactic priming because they argued that syntactic priming provides insightful information about the way language is processed in the

human cognitive system (Branigan et al., 1995) and they claimed that syntactic priming facilitates dialogue because speakers do not exert effort in processing syntactic structures that have just been used by other speakers (Branigan et al., 2000b).

Furthermore, Pickering and Branigan (1999) argued that syntactic priming informs linguistic theories about the knowledge of language that is activated via syntactic priming. They claimed that syntactic priming informs about a lemma stratum that is shared in both comprehension and production and that priming activates knowledge of language itself that is stored at this level.

As explained above, most experimental studies on syntactic priming exposed participants to prime utterances, and the effect of these sentences was measured on target sentences. These experimental studies demonstrated syntactic priming through spoken sentence completion (Branigan et al., 2000a), sentence recall (Potter & Lombardi, 1998), and spoken picture description (Bock & Griffin, 2000). The results of these studies revealed that a syntactic structure tends to be congruent with that of the preceding utterance and that priming becomes stronger between prime and target sentences when lexical items are repeated than when lexical items differ (Pickering & Branigan, 1998).

Syntactic priming has been investigated in the discourse of monolingual speakers of English, Dutch (Hartsuiker & Kolk, 1998; Hartsuiker et al., 1999), German (Ruf, 2011; Köhne et al., 2014), and Spanish (Gamez & Shimpi, 2016). On the other hand, syntactic priming has been investigated across related languages such as English and Spanish (Hartsuiker et al., 2004), German and English (Loebell & Bock, 2003), and Mandarin and Cantonese (Cai et al., 2011), and unrelated languages such as English and Korean (Kim & McDonough, 2008) and English and Thai (McDonough & Chaikitmongkol, 2010).

II. SYNTACTIC PRIMING IN ARABIC-ENGLISH BILINGUALS

One of the most asked questions among psycholinguists is whether the syntax of bilinguals is separate for each language or shared for both languages. Namely, do bilinguals have one or two stores for the syntax of the languages they speak? In addressing this question, many researchers have been inspired by the work of Hartsuiker et al. (2004), who argued that Spanish-English bilinguals have a shared syntax because they uttered more passive descriptions in English after they heard a Spanish passive structure than after they heard a Spanish active structure or a Spanish intransitive structure. Thus, Hartsuiker et al. (2004) concluded that bilinguals have one shared store for syntax, not two separate stores for each language, and they proposed the shared-syntax model.

Another study that investigated syntactic priming in bilinguals was conducted by Loebell and Bock (2003) with fluent German-English bilinguals. Participants were asked to describe pictures in German after hearing an English sentence, and to describe pictures in English after hearing a German sentence. The prime structures were datives (double-object and prepositional-object datives) and transitives (active and passives). The results of the experiments showed that participants produced German dative sentences after hearing prime English datives and produced English datives after hearing prime German datives. On the other hand, German and English active structures primed in both directions. For the passive structures, there was no tendency to use the same form, which is attributed to the assumption that priming is less likely to occur in a higher-frequency form than in a lower-frequency alternative (Bock & Griffin, 2000).

The production of passives during syntactic priming activities was investigated by Kim and McDonough (2008) in relation to the effect of lexical items on the priming of passive structures. The Korean learners of English in their study described pictures using more passive structures when they were prompted by verbs that had been produced in prime sentences. This study provided evidence that lexical items affect syntactic priming.

Flett et al. (2013) attempted to determine the structures that affect the production of bilinguals by studying syntactic priming in proficient speakers of English whose L1 was either German or Spanish. Both German and Spanish speakers of English exhibited the same patterns of priming. Spanish speakers of English produced double-object sentences after they listened to a double-object sentence, although their L1 does not allow this structure. The results showed that the L1 structure does not affect the structure of L2 and that speakers tend to use the same structure of the prime sentences regardless of whether they have the structures in their L1. The study of Flett et al. (2013) is relevant to the present study because both studies investigate syntactic priming using prepositional-object and double-object structures. However, the present study investigates whether activating both Arabic and English during an experiment facilitates syntactic priming given that Arabic, unlike Spanish, has the four structures (I-IV), which are utilized in our experiment.

In other words, Arabic allows double-object structures, giving participants the opportunity to choose between a double-object structure and a prepositional-object structure when involved in a task that requires the description of a dative action (see Table 1). Moreover, Flett et al. (2013) experimentally investigated the priming of structures in L2 English, which might have inhibited the participants' use of L1 because they did not need it. In the current study, participants are required to activate both Arabic and English because they listen to a description of a picture in Arabic and then describe the picture in English.

The study of Fleischer et al. (2012) is closely related to the present study. They investigated syntactic priming in Polish-English contexts and concluded that bilinguals construct an independent level of syntactic information during speech in which emphasis is represented. The results of the study indicated that Polish speakers of English tend to produce passive English sentences after they listen to a passive or OVS sentence in Polish.

All the presented studies investigated syntactic priming across different languages but not between Arabic and English. In this study, we investigate syntactic priming in Arabic-English bilinguals. Syntactic priming between Arabic and English has not been studied extensively. To our knowledge, Grosvald and Khwaileh (2019) first investigated syntactic priming in Arabic, exploring syntactic priming in comprehension among Arabic-English bilinguals. They found that syntactic priming occurs within languages but not across them. Their study had some limitations. First, it discussed only the passive construction and excluded dative constructions which are key constructions for understanding syntactic priming. Second, it focused on the comprehension level rather than the production level, suggesting the need to explore syntactic priming in Arabic using production-based tasks. Third, it required the comprehension of written Modern Standard Arabic (MSA), which is problematic because of the diglossia associated with the Arabic language. Written Arabic is more formal than spoken Arabic. Namely, written Arabic does not reflect natural and spontaneous MSA. Ferguson (1959) explained that diglossia occurs when a speech community learns a variant of a language that is used in written and formal spoken occasions but not in ordinary daily conversations. Therefore, in this study we investigate syntactic priming in spoken Arabic rather than written Arabic. We also examine syntactic priming at the production level rather than the comprehension level using production-based tasks. Moreover, this study is broader than that of Grosvald and Khwaileh (2019) because it targets four structures (active, passive, double-object datives and prepositional-object datives), rather than only passive and active structures.

III. INTELLECTUAL MERIT

Arabic and English are two of the most widely spoken languages in the world; Arabic is the most widely spoken Semitic language and English is the most widely used Germanic language and the lingua franca of modern times. Therefore, tracing the effect of syntactic priming in the speech of Arabic-English bilinguals is expected to make a major contribution to the study of these two widely spoken languages and to the shared-syntax and separate-syntax accounts. Moreover, the current study provides information about two languages belonging to unrelated families, bridging the gap in the literature and increasing understanding of the nature of language production in the speech of Arabic-English bilinguals. In addition, this study serves as a basis for further investigation of the comprehension and processing of language in bilingual contexts and also for future studies that trace behavioral syntactic priming in more natural contexts such as conversations and interviews.

IV. PURPOSE OF THE STUDY

The purpose of this study is to test the shared-syntax account through the use of syntactic priming between Arabic and English. We trace the structure of sentences produced by Arabic-English bilinguals immediately after hearing a particular grammatical form in an attempt to determine whether Arabic-English bilinguals have a separate or shared syntax. If the participants repeat the structure of a previously used structure, then syntax is shared between Arabic and English, indicating the existence of a single store for syntax. On the other hand, if the participants do not repeat the structure of a previously targeted structure, then the syntax of each language is separate and they have separate stores: one for Arabic syntax and another for English syntax (see Pickering & Ferreira, 2008; Hartsuiker et al., 2004). Moreover, through our experiment, we attempt to explain how languages are represented and processed in bilingual brains in the same manner that semantic priming and lexical priming provide information about the mental lexicon of bilinguals (Dong et al., 2005).

V. RESEARCH QUESTIONS

In this study, we aim to answer the following questions:

1. Does syntactic priming occur in the production of Arabic-English bilinguals?
2. Is syntax separate or shared in the brains of Arabic-English bilinguals?
3. If syntactic priming occurs in the production of Arabic-English bilinguals, which syntactic constructions are primed the most: active, passive, double-object or prepositional-object constructions?

VI. TARGET STRUCTURES

We trace syntactic priming in the production of Arabic-English bilinguals using active, passive, double-object, and prepositional object prime sentences. These four structures are chosen because they have been used in many studies on syntactic priming (Hartsuiker et al., 2004) and because both English and Arabic have the four structures but with considerably different realizations.

The formation of the passive in English is realized using the verb “to be” with the past participle, whereas MSA forms the passive with either inflections or a periphrastic passive (Grosvald & Khwaileh, 2019). Ryding (2005) stated that the inflectional (or internal) passive is formed through a change in the vowels; for example, ‘dureb-a ضَرِبَ it was beaten’ is the passive of ‘darab-a ضَرَبَ he beats’. On the other hand, the periphrastic passive is formed by using the verb ‘tamma تَمَّ completed or finished’ followed by a nominal verb as in ‘tamma esdar ketab اِصْدَارَ كِتَاب a book has been

published'. In the present study, we use prime sentences with both forms of Arabic passive constructions in the prime sentences.

For double-object and prepositional dative constructions, English has a dative lexical alternation between them. The double-object construction in "I gave my mother a present" alternates with the prepositional dative construction in "I gave a present to my mother". On the other hand, Arabic has five ditransitive constructions that result from either the lexical content of the root or the derivational modification of the root. Ryding (2011) explained the five ditransitive structures of Arabic as follows:

1. The dative-alternation construction where the beneficiary argument shifts place, with preposition deletion, is often based on the notion of "giving."
2. Causative constructions where a valency-changing derivation modifies the lexical root, e.g.,
Form IV *aḥḍara*—to bring (Cause-to-come)
Form IV *aṭ'ama*—to feed (Cause-to-taste)
3. Verbs of permission or denial, e.g.,
mana'a—to forbid
manaḥa—to grant
4. Verbs of perception and cognition (*af'al qalbiyya*), e.g.,
'adda—to consider, deem
i'tabara—to consider, deem
wajada—to find, deem
5. Verbs of transformation (*af'al al-taḥwīl*), e.g.,
ṣayyara—to convert
ittakhadha—take, adopt (as)
ja'ala- to make
'ayyana—to appoint
tawwaja—to crown

(Ryding, 2011, pp. 286-287)

All five ditransitive structures of Arabic are used in the experiment. Table 1 summarizes the four constructions in both MSA and English used in this study. It also gives the word order in both languages, where S is a subject, V is a verb, DO is a double object sentence and PO is a prepositional-object sentence (the beneficiary or recipient is assigned as obj 1 in Table 1).

TABLE 1
EXAMPLES FOR THE FOUR STRUCTURES USED IN THE STUDY (ACTIVE, PASSIVE, DO AND PO)

	Active			Passive		Double object (DO)		Prepositional object (PO)			
				Inflectional	Periphrastic						
Arabic	قرأ علي الكتاب	Qara Ali alketab	read Ali The book	قرأ الكتاب	تمت قراءة الكتاب	أعطى علي سارة الكتاب	Ata Ali Sarah Alketab	Gave Ali Sarah the book	أعطى علي الكتاب لسارة	Ata Ali alketab li Sarah	gave Ali the book to Sarah
	V S O			V O	V O	V S obj1 obj2			V S obj2 obj1		
	Ali read the book'			The book is read	The book is read	Ali gave Sarah the book			Ali gave the book to Sarah		
English	John reads the book			The book is read		John gave Sarah the book			John gave the book to Sarah		
	S V O			O V		S V obj1 obj2			S V obj2 obj1		

VII. METHOD

Participants

Fifteen female native speakers of Arabic volunteered to participate in the study. All were students at the department of English, Ahad Rufaidah, King Khalid University, Saudi Arabia. All spoke Arabic as their mother tongue and had been studying English for at least three years. Their GPA was between 4 and 4.99 out of 5. Each participant signed a consent form before participating in the experiment (Appendix 1).

Experiment

To determine whether Arabic-English bilinguals have a separate or shared syntax, we conducted an experiment to examine syntactic priming in the production of Arabic-English bilinguals, in which we used different target structures to investigate which structures tend to be repeated the most. We used the *Confederate-Scripted Dialogue Game* technique, a method used in many syntactic priming studies such as those of Hartsuiker et al. (2004) and Fleischer et al. (2012). Participants were told that they were involved in a dialogue game and a picture description task in which they were requested to describe a picture and their responses were analyzed relative to the structure of a prime sentence that was uttered before they described the picture.

The naïve participant and a confederate took turns describing pictures to each other. Each participant sat with the confederate, who pretended to describe a picture while actually reading Arabic sentences that were scripted on each card. The naïve participant considered whether the description of the confederate corresponded to the card. The naïve participant placed the cover-task card in a YES box if it corresponded to the confederate's description and in a NO box

if it did not correspond to the confederate's description. This cover task was used to activate the syntactic structure in the brains of the participants and to disguise the fact that the confederate was actually reading scripted sentences.

Materials

Two sets of 64 cards that depicted different actions were placed in front of the participant. One set was the naïve participant's description set, which comprised 64 pictures with an English verb printed at the top left corner of each picture. The participant was instructed to describe the action using the verb printed on the picture. The cards in the naïve participant's description set were organized into cycles comprising cards in the following order: a filler picture depicting an intransitive verb, a picture depicting an active sentence, a filler picture, a picture depicting a passive sentence, a filler picture, a picture depicting a double object construction, a filler sentence, a picture depicting a prepositional dative sentence and a filler picture. The naïve participant's description set comprised 32 experimental pictures (eight active, eight passive, eight double object, eight prepositional dative), with each experimental card preceded and followed by a filler card, and 32 filler cards depicting actions with structures other than the four target structures.

The other set was the confederate's description set, which comprised 64 cards with Arabic verbs printed at the left top corner of each picture. Thirty two cards were experimental cards and the other 32 were filler pictures. The experimental cards were organized in the same order as in the naïve participant's description set with pictures that depicted active, passive, double object, and prepositional dative structures and each experimental card was preceded and followed by a filler card.

In addition, a master list of 64 cards was designed for the confederate participant. The confederate pretended that they were describing pictures while they actually read printed sentences. The master list of the confederate comprised 32 Arabic sentences that were paired with the naïve participant's description set. The master list started with a filler Arabic sentence, which was followed by an active sentence, a filler sentence, a passive sentence, a filler sentence, a double object sentence, a filler sentence, a prepositional dative sentence, and a filler sentence, after which this order was repeated. The following is an example of a sequence of sentences in the experiment:

1. أكل الولد التفاحة
(active) The boy ate an apple.
2. عولج المريض
(passive) The patient was treated.
3. أحضرت الفتاة للرجل عنباً
(double object) The girl brought the man grapes.
4. أعطى الزوج المفتاح لزوجته
(prepositional object) The husband gave the key to his wife.

To avoid the shortcomings of Kantola and Gompel's (2011) experiment, in which each Swedish sentence had an equivalent English translation, which led participants to imitate previous structures rather than using the triggered structures, the Arabic sentences in the present study were semantically unrelated, enabling participants to concentrate on triggering the syntactic structure rather than the semantic meaning.

Procedure

The experiment was performed in a quiet office at the Ahad Rufaidah campus, and each session lasted for approximately 20 minutes. The entire sessions were audio-taped using the iPhone Voice Memos app. A divided tray was placed in front of each participant with a screen that prevented the naïve participant from seeing the cards of the confederate participant and vice versa (Figure 1). Participants were told that the purpose of the experiment was to study bilingual communication. The naïve participant's divided tray contained a description set, a selection set, and two response divisions, labelled, نعم YES and لا NO. The confederate tray was similar but also included a description set that had printed Arabic sentences.

Before the experiment started, each participant was asked to read and sign the consent form (Appendix 1). The confederate participant described pictures in Arabic, and the naïve participant described pictures in English. The confederate pretended to describe a picture in Arabic while actually reading a previously scripted sentence. The naïve participant was asked to consider whether the description in Arabic matched the topmost card from their selection set. If it matched the picture, the naïve participant placed the card in the YES division, and if the description did not match the picture, they placed the card in the NO division. Then, it was the turn of the naïve participant to describe the topmost card in their description set using the English verb printed on the picture, and the confederate participant considered whether the description matched the picture in their selection set and placed it in the YES or NO divisions. The purpose of the selection set for both the naïve and confederate participants was to distract the naïve participant from the fact that the confederate was reading scripted sentences and not actually describing a picture. Then, the participants continued taking turns until all cards had been placed in a YES or NO division.



Figure 1. Setup of the experiment. A divided tray with labels was placed in front of both the confederate and na'ive participant. The tray has divisions containing a description set with an English verb printed on each picture and an adjacent selection set with an Arabic verb on each picture.

Scoring

The descriptions of the na'ive participants were scored in terms of the numbers of actives, passives, double objects, and prepositional datives they used. For active sentences, the utterance should contain a noun phrase (NP), a verb phrase (VP), and another NP that acts as an object. For passive sentences, the utterance should contain an NP, a form of "to be", and the verb in the past participle form. For double-object sentences, the utterance should contain an NP that works as a subject, a verb, an indirect object that expresses the goal or the beneficiary of the action, and the direct object. For prepositional dative sentences, the utterance should start with an NP, which is followed by a VP, the direct object, and finally the indirect object starting with a prepositional phrase (PP). Scoring sheets are given in Appendix 2, where the scripted prime sentences of the confederate participants are written in Arabic and the na'ive participants' descriptions of the pictures after hearing the prime Arabic sentences are written in the designated slots.

VIII. RESULTS

The data of the study comprises 960 utterances produced by the na'ive participants, of which 480 are filler sentences, which are excluded, and 480 are targeted structures, which are transcribed in the sheets in Appendix 2. The responses of participants were classified as active, passive, DO, PO, and other, with sentences that were not among the four categories classified as other. In the following, the results of each targeted structure are explained and Table 6 and Figure 6 summarize the overall priming results for each of the four structures used in the study.

1. Active prime sentences (SVO)

When the participants described pictures after hearing an Arabic active sentence, 104 active sentences (86.7 %), zero passive, DO, and PO sentences, and 16 other sentences (13.3 %) were observed, as shown in Table 2 and Figure 2. The total number of responses was 120. The results indicate that it is common for Arabic-English bilinguals to produce active SVO English sentences immediately after hearing an active Arabic sentence with VSO order.

TABLE 2
RESULTS FOR ACTIVE PRIME SENTENCES

Prime	Active				
	Active	Passive	DO	PO	Other
Target					
No. of responses	104	0	0	0	16

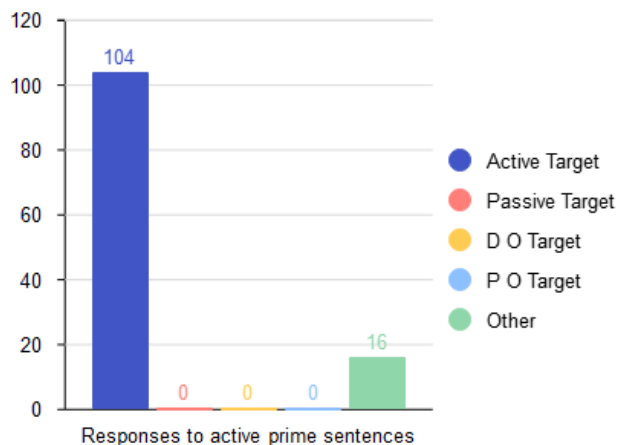


Figure 2. Participants' Responses Following Active Prime Sentences

2. Passive prime sentences

When participants heard either inflectional or periphrastic Arabic passive sentences (shown in Table 1), they produced 92 (76.7 %) active English sentences and only three passive sentences (2.5 %). They did not produce sentences using DO and PO dative structures. Twenty five (20.8%) of their responses were classified as other. It is clear that Arabic-English bilinguals preferred using active structures even if they had previously heard a passive structure. However, we noticed that participants used the word “someone” as the subject of the sentence in 11 (12%) of the 92 active sentences. This indicates that Arabic-English bilinguals use the word “someone” as a strategy to anonymize the doer of the verb without using the passive structure. The word “someone” was not used when the prime sentences were active or dative. It appeared only when the prime sentence was passive. This suggests the need for further investigation of this phenomenon in future research. Table 3 and Figure 3 show participants' responses after hearing passive prime sentences.

TABLE 3
RESULTS FOR PASSIVE PRIME SENTENCES

Prime Target	Passive				
	Active	Passive	DO	PO	Other
No. of responses	92	3	0	0	25

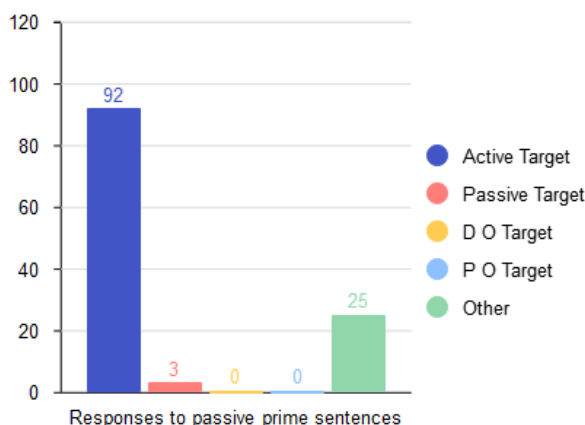


Figure 3. Participants' Responses Following Passive Prime Sentences

3. Double-object sentences (DO)

When participants heard double-object Arabic sentences before they described the pictures, they produced 48 (40%) active sentences with only one object, one passive response (0.83 %), 21 (17.5 %) double-object sentences, 25 (20.8 %) prepositional-object sentences, and 25 (20.8 %) sentences that were classified as other. The results revealed less use of active structures after DO prime sentences than after active and passive prime sentences (see Figure 6 for details). Although the prime dative sentences used the double-object structure, the participants used both DO (17.5 %) and PO (20.8 %) structures. Table 4 and Figure 4 show the participants' responses after hearing DO prime sentences.

TABLE 4
RESULTS FOR DO PRIME SENTENCES

Prime	DO				
Target	Active	Passive	DO	PO	Other
No. of responses	48	1	21	25	25

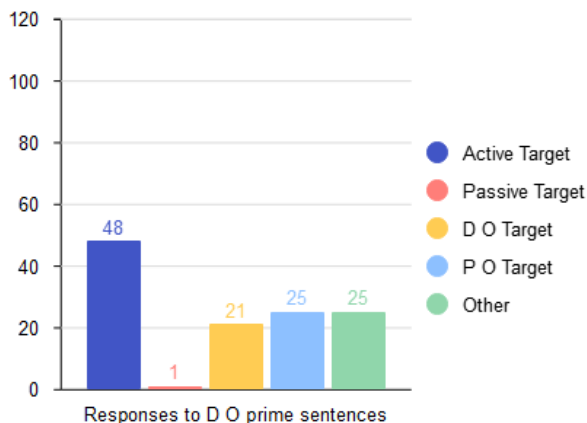


Figure 4. Participants' Responses Following Do Prime Sentences

4. Prepositional dative sentences (PO)

When participants processed an Arabic prepositional dative sentence before describing they described a picture, they produced 53 (44.2 %) active sentences using the SVO word order, zero passive sentences (0 %), seven (5.8 %) DO sentences, 40 (33 %) PO sentences and 20 (16.7%) other sentences. Table 5 and Figure 5 show participants' responses after hearing PO prime sentences. The results indicated that participants tended to use the PO structure more often (33 %) when they heard a PO prime structure than when they heard a DO prime structure (20.8 %).

TABLE 5
RESULTS FOR PO PRIME SENTENCES

Prime	PO				
Target	Active	Passive	DO	PO	Other
No. of responses	53	0	7	40	20

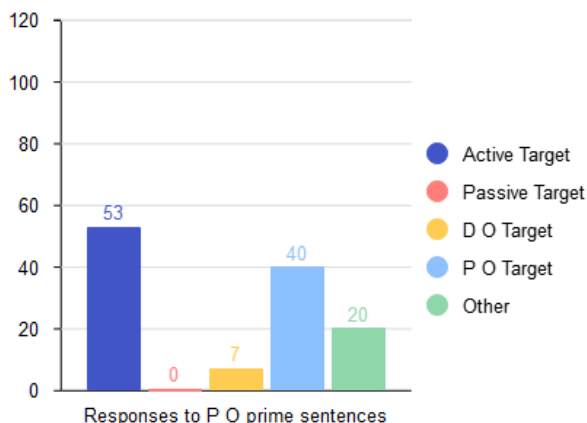


Figure 5. Participants' Responses Following PO Prime Sentences

The overall results (shown in Table 6 and Figure 6) indicated that when the Arabic-English bilinguals were exposed to active, passive or dative prime sentences, they preferred using the active structure (61.9 %) to other structures. The dative structures appeared in the data only when participants were exposed to dative prime structures. There was a preference for using the PO structure (13.5 %) over the DO structure (0.06 %) when participants were exposed to dative prime sentences. Regardless of whether or not the prime was a passive structure, the passive structure was rarely found in the data with only four instances in the entire data.

TABLE 6
PARTICIPANTS' RESPONSES FOLLOWING THE FOUR PRIME STRUCTURES (ACTIVE, PASSIVES, DO AND PO)

Prime	Active					Passive					DO					PO				
	Active	Passive	DO	PO	Other	Active	Passive	DO	PO	Other	Active	Passive	DO	PO	Other	Active	Passive	DO	PO	Other
Responses	104	0	0	0	16	92	3	0	0	25	48	1	21	25	25	53	0	7	40	20

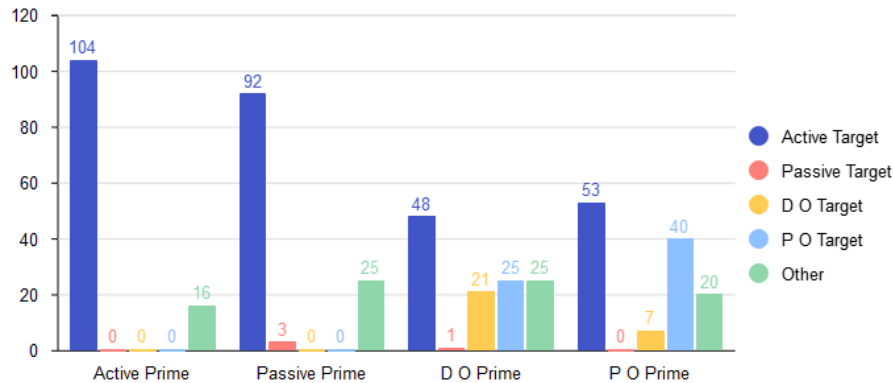


Figure 6. Total number of responses for priming for four structures: active, passive, DO and PO. The coloured bars show the number of different structures used by the participants after hearing a particular prime structure. For example, 104 active sentences (active target) were produced after hearing an active prime sentence.

IX. DISCUSSION & CONCLUSION

The magnitude and reliability of priming in transitives and datives have been investigated in many studies (e.g. Bock, 1986; Hartsuiker & Kolk, 1998; Hartsuiker et al., 1999). The majority of studies reported that datives are more likely to prime than transitives. Other studies found that transitives, mainly passives, yielded a stronger priming effect than datives (e.g., Boyland & Anderson, 1998).

However, in the present study, priming varied significantly among transitives and datives. The overall priming percentage for transitives was 86.7 % for actives and only 2.5% for passives. For datives, PO structures yielded a higher priming percentage than DO structures with a 33% priming percentage for PO structures and a 17.5 % priming percentage for DO structures. See Table 7 for the priming percentages for each targeted structure.

TABLE 7
THE PRIMING PERCENTAGES

Structure	Priming Percentage
1 Active Structure	86.7 %
2 Passive Structure	2.5 %
3 Double-Object Structure (DO)	17.5 %
4 Prepositional Dative Structure (PO)	33 %

The experiment does not provide evidence of cross-linguistic syntactic priming in production between Arabic and English except with the active structures. This aligns with Loebell and Bock's (2003) study in which German-English bilinguals tended to produce more English active sentences after German prime sentences.

On the other hand, Arabic-English bilinguals do not tend to use the English passive structure after hearing an Arabic passive structure, which also supports Loebell and Bock's (2003) finding that German-English bilinguals did not tend to use the passive form. In other words, German and English passives did not prime one another. Our results contradict those of Kim and McDonough (2008), who found that Korean EFL learners produced more passive structures when they were prompted by structures containing passive verbs.

Note that the Arabic-English bilinguals tended to use active English structures in all their responses regardless of the structure of the prime sentence that preceded their answer, as can be seen from Figure 6. Therefore, the results demonstrate the absence of linguistic syntactic priming in the context of interactive language use between Arabic and English, which are completely unrelated languages, and a tendency to use the active voice.

Although it is common to find VSO, SVO, and VOS sentences in Arabic (Moubaidin et al., 2013), we used only the VSO order for the prime Arabic active sentences, which is different from the fixed SVO order of English, to determine whether word order matters in syntactic priming. This was in accordance with the argument of Bernolet et al. (2007)

that syntactic priming does not occur between English and Dutch because the word order of relative clauses in English is different from that in Dutch. On the other hand, they argued that syntactic priming occurs between Dutch and German, which have the same verb-final relative clauses. However, the results of our study indicate that syntactic priming occurs between Arabic and English active sentences even though the Arabic prime sentences followed the VSO order and the participants produced active English sentences with the SVO order.

Although this study does not support the shared-syntax account, it demonstrates the methodology of examining syntactic priming between languages. The same experiment can be performed in the opposite direction with prime English sentences instead of Arabic sentences. Moreover, it can be expanded to include more languages and more constructions.

Dataset:

“Syntactic Priming in Arabic-English Bilinguals”, Mendeley Data, V1, doi: 10.17632/275j92zx36.1
<https://data.mendeley.com/datasets/275j92zx36/1>

APPENDIX 1

Informed Consent

TITLE OF STUDY

[Bilingual Communication]

PRINCIPAL INVESTIGATOR

[Dr. Raniah Al Mufarreh]

PURPOSE OF STUDY You are being asked to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information. The purpose of this study is to investigate the communication of bilinguals (who speak both Arabic and English)

STUDY PROCEDURES The participants will be asked to take turns in describing pictures in English. The session will be audio-recorded and the data is going to be confidential. Your name and personal information will not be shown in the research. Each participant will take approximately 15 minutes.

RISKS You may decline to answer any or all questions and you may terminate your involvement at any time if you choose.

BENEFITS By participating in this research, you are helping the researcher understand how language works in the mind of bilinguals.

VOLUNTARY PARTICIPATION Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship you have, if any, with the researcher. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed.

CONSENT I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's signature _____ Date _____

Investigator's signature _____ Date _____

Participant's Initials: _____

APPENDIX 2

Active Sentences:

	Prime Sentence	Student 1	Student 2	Student 3	Student 4	Student 5	Student 6	Student 7	Student 8	Student 9	Student 10	Student 11	Student 12	Student 13	Student 14	Student 15
1	أكل الولد التفاحة															
2	احتضن الأب ابنه															
3	ركل الولد الكرة															
4	قادت الفتاة السيارة															
5	ليس الرجل الثوب															
6	كسر الطفل الزجاج															
7	سجن الضابط المجرم															
8	لعب اللاعب كرة السلة															

Passive Sentences:

	Prime Sentence	Student 1	Student 2	Student 3	Student 4	Student 5	Student 6	Student 7	Student 8	Student 9	Student 10	Student 11	Student 12	Student 13	Student 14	Student 15
1	شرب الحليب															
2	صُنع المشاعب															
3	عولج المريض															
4	خُملت الحقيقة															
5	تم طبخ الغداء															
6	تم فتح الصندوق															
7	تم توقيع العقد															

8	تم شرح الدرس																
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Double-Object Sentences:

	Prime Sentence	Student 1	Student 2	Student 3	Student 4	Student 5	Student 6	Student 7	Student 8	Student 9	Student 10	Student 11	Student 12	Student 13	Student 14	Student 15
1	أهدى الرجل الفتاة كتاباً															
2	باع الرجل الفتاة قلادة															
3	أحضرت الفتاة للرجل عنياً															
4	وجد الطالب للأستاذ عذراً															
5	سقى الرجل الزرع مائة															
6	أطعم الولد القطعة لحماً															
7	منح الملك الوزير وساماً															
8	عين المدير السيدة سكرتيرة															

Prepositional Dative Sentences :

	Prime Sentence	Student 1	Student 2	Student 3	Student 4	Student 5	Student 6	Student 7	Student 8	Student 9	Student 10	Student 11	Student 12	Student 13	Student 14	Student 15
1	أعطى الزوج المفتاح لزوجته															
2	اشتريت الأم هدية لإبنتها															
3	أرسلت الأم طعاماً لجارتها															
4	قدم الرجل هدية لزميله															
5	أصلح المهندس السيارة للرجل															
6	صنع الوالد قلعة لطفلة															

7	ترك الرجل رسالة لزوجته																
8	أعار الأب نقوداً لإبنه																

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REFERENCES

- [1] Bernolet, S., Hartsuiker, R. J., & Pickering, M. J. (2007). Shared syntactic representations in bilinguals: Evidence for the role of word-order repetition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 33(5), 931-949.
- [2] Bock, J. K. (1986a). Meaning, sound, and syntax: Lexical priming in sentence production. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 12(4), 575-586.
- [3] Bock, J. K. (1986b). Syntactic persistence in language production. *Cognitive Psychology*, 18(3), 355-387.
- [4] Bock, K., & Griffin, Z. M. (2000). The persistence of structural priming: Transient activation or implicit learning? *Journal of Experimental Psychology: General*, 129(2), 177-192.
- [5] Boyland, J. T., & Anderson, J. R. (1998). Evidence that syntactic priming is long-lasting. Paper presented at the *Proceedings of the Twentieth Annual Conference of the Cognitive Science Society*, 1205.
- [6] Branigan, H. P., Pickering, M. J., & Cleland, A. A. (2000). Syntactic co-ordination in dialogue. *Cognition*, 75(2), B13-B25.
- [7] Branigan, H. P., Pickering, M. J., Liversedge, S. P., Stewart, A. J., & Urbach, T. P. (1995). Syntactic priming: Investigating the mental representation of language. *Journal of Psycholinguistic Research*, 24(6), 489-506.
- [8] Branigan, H. P., Pickering, M. J., Stewart, A. J., & McLean, J. F. (2000). Syntactic priming in spoken production: Linguistic and temporal interference. *Memory & Cognition*, 28(8), 1297-1302.
- [9] Brown, C. M., Hagoort, P., & Chwilla, D. J. (2000). An event-related brain potential analysis of visual word priming effects. *Brain and Language*, 72(2), 158-190.
- [10] Cai, Z. G., Pickering, M. J., Yan, H., & Branigan, H. P. (2011). Lexical and syntactic representations in closely related languages: Evidence from Cantonese-Mandarin bilinguals. *Journal of Memory and Language*, 65(4), 431-445.
- [11] Dong, Y., Gui, S., & MacWhinney, B. (2005). Shared and separate meanings in the bilingual mental lexicon. *Bilingualism: Language and Cognition*, 8, 456-482.
- [12] Ferguson, C. A. (1959). Diglossia. *Word*, 15(2), 325-340.
- [13] Fleischer, Z., Pickering, M. J., & McLean, J. F. (2012). Shared information structure: Evidence from cross-linguistic priming. *Bilingualism: Language and Cognition*, 15(3), 568-579.
- [14] Flett, S., Branigan, H. P., & Pickering, M. J. (2013). Are non-native structural preferences affected by native language preferences? *Bilingualism: Language and Cognition*, 16(4), 751-760.
- [15] Gamez, P. B., & Shimpi, P. M. (2016). Structural priming in Spanish as evidence of implicit learning. *Journal of Child Language*, 43(1), 207-233.
- [16] Grosvald, M., & Khwaileh, T. (2019). Processing Passive Constructions in Arabic and English: A Crosslanguage Priming Study. *Al-‘Arabiyya: Journal of the American Association of Teachers of Arabic*, 52, 1-28.
- [17] Hartsuiker, R. J., & Kolk, H. H. (1998). Syntactic persistence in Dutch. *Language and Speech*, 41(2), 143-184.
- [18] Hartsuiker, R. J., Kolk, H. H., & Huiskamp, P. (1999). Priming word order in sentence production. *The Quarterly Journal of Experimental Psychology Section A*, 52(1), 129-147.
- [19] Hartsuiker, R. J., Pickering, M. J., & Veltkamp, E. (2004). Is syntax separate or shared between languages? Cross-linguistic syntactic priming in Spanish-English bilinguals. *Psychological Science*, 15(6), 409-414.
- [20] Kantola, L., & van Gompel, R. P. (2011). Between-and within-language priming is the same: Evidence for shared bilingual syntactic representations. *Memory & Cognition*, 39(2), 276-290.
- [21] Kim, Y., & McDonough, K. (2008). Learners Production of Passives during Syntactic Priming Activities. *Applied Linguistics*, 29(1), 149-154.
- [22] Köhne, J., Pickering, M. J., & Branigan, H. P. (2014). The relationship between sentence meaning and word order: Evidence from structural priming in German. *Quarterly Journal of Experimental Psychology*, 67(2), 304-318.
- [23] Loebell, H., & Bock, K. (2003). Structural priming across languages. *Linguistics*, 41(5), 791-824.
- [24] McDonough, K., & Chaikitmongkol, W. (2010). Collaborative syntactic priming activities and EFL learners' production of wh-questions. *Canadian Modern Language Review*, 66(6), 817-841.
- [25] Moubaidin, A., Tuffaha, A., Hammo, B., & Obeid, N. (2013). Investigating the syntactic structure of Arabic sentences. Paper presented at the *2013 1st International Conference on Communications, Signal Processing, and their Applications (ICCSPA)*, 1-6.
- [26] Pickering, M. J., & Branigan, H. P. (1998). The representation of verbs: Evidence from syntactic priming in language production. *Journal of Memory and Language*, 39(4), 633-651.
- [27] Pickering, M. J., & Branigan, H. P. (1999). Syntactic priming in language production. *Trends in Cognitive Sciences*, 3(4), 136-141.

- [28] Pickering, M. J., & Ferreira, V. S. (2008). Structural priming: a critical review. *Psychological Bulletin*, 134(3), 427-459.
- [29] Potter, M. C., & Lombardi, L. (1998). Syntactic priming in immediate recall of sentences. *Journal of Memory and Language*, 38(3), 265-282.
- [30] Ruf, Helena. (2011). *An investigation of syntactic priming among German speakers at varying proficiency levels*. Doctoral dissertation: University of Wisconsin–Madison
- [31] Ryding, Karin Christina. (2011). Arabic datives, ditransitives, and the preposition li. In Bilal Orfali (ed.), *in the shadow of Arabic. The centrality of language to Arabic culture*, 283–298. Leiden: Brill.
- [32] Ryding-Lentzner, K. (1981). Semantic Motivation for Arabic Dative-Movement. *Al-'Arabiyya*, 19-23.

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