



Syntactic Priming: Is Shared Semantic Content an Obligation?

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Abstract

Syntactic priming has been suggested to be an efficient paradigm in studying mental language representations. However, further research is needed to explore the underlying mechanisms. Recently it is suggested that argument-based constructions are present at both the syntactic and discourse levels of representation predicting that priming effect does not occur in the absence of shared semantic content. The study used a pre-test and post-test approach within a quasi-experimental design to investigate whether sentences with no shared semantic content, but similar syntactic structure, could prime one another in L2 written production tasks. Ninety students at the University of Tabriz participated in the study and were divided into intermediate or upper-intermediate groups based on their proficiency test performance. Both groups narrated a silent movie in the pre-treatment phase. In the treatment phase, the participants were primed with motion phrasal verbs by reading and rating a booklet including pictures followed by phrasal motion verbs describing them. Immediately afterward, they were required to narrate a silent movie. It was hypothesized that if semantically unrelated structures could prime one another as is supported by some reported findings, priming participants with motion phrasal verbs would boost non-motion phrasal verb usage in the treatment phase. However, the authors failed to find a significant difference between the performance of participants in the pre-treatment vs. post-treatment phase. The findings support the claim that syntactic similarity is not sufficient to trigger structural priming, and shared semantics seems to be required, and are justified with regard to semantic roles and compositional vs. non-compositional meaning.

Keywords: Structural Priming, Syntax, Semantics, L2 production, Semantic roles

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Introduction

Storing and processing language-related information in the brain has been studied with regard to different levels of representation. These levels include phonetics (the physical properties of speech sounds), syntax (the structure of sentences), semantics (the meaning of words and sentences), and discourse (the use of language in communicative contexts). In this vein, a controversial topic in the field of language studies pertains to whether syntactic and semantic information of lexical items are distinct or combined. Priming paradigm has been deployed as a reliable technique in cognitive science to study these mental representations of language.

Literature Review

Syntactic Priming

Syntactic priming refers to the idea that speakers tend to reuse the structures they have recently processed (Bock & Griffin; 2000; Goldberg, 1996) and has long been an established mechanism in cognitive psychology both in L1 (e.g., Bannard, et al., 2009; Kidd, 2012; Saffran, 2002) and L2 (e.g., Segalowitz, 2008; Shin & Christianson, 2012). The paradigm is used not only in exploring the underlying mental representations of language (e.g., Branigan & Pickering, 2017), but also is investigated as a potential learning mechanism (Kaschak, Kutta, & Jones, 2011), and this way the paradigm can be considered as a significant and promising technique for L2 learning which is the reason why applied linguists are interested in exploring the underlying mechanisms and the potential applications of the paradigm to L2 settings.

However, At the core of the current research, syntactic priming is supposed to be a promising technique for exploring the way linguistic information is stored in speakers' minds, and whether access to the language information happens at separate levels of representation or at a joint level at the (syntax-semantics) interface.

Underlying Mechanisms of Syntactic Priming

One of the long-standing issues regarding syntactic priming is the nature of the underlying features of the representations that trigger the priming effect with some researchers suggesting that it is the shared syntax that is responsible for the priming effect (e.g., Bock, 1986; Branigan & Pickering, 2017; Chen et al., 2022; Rowland et al., 2012) and with others arguing that semantic similarity is needed for any similar syntactic production to occur (e.g., Bidgood et al., 2020; Federenko et al., 2020; Ziegler et al., 2019). Similarly, there has been a lot of controversy over the idea that either there are different levels of representations in speakers' minds i.e., lexical, syntactic, and semantic levels (Chomsky, 1995), or linguistic patterns (either in L1 or L2) are already paired with meanings so that choosing one lexical item would restrict the other choices the speakers would come up with (Fillmore, 1968; Goldberg, 2003; Lakoff, 1970; Levelt, 1989). Those advocating the first view argue for the separation of syntax and lexicon while proponents of the second view argue

that choosing one lexical item activates other information that the form is already paired with which in turn restricts the choice of upcoming items in the sentence. In other words, according to the second view, syntactic and semantic information are interrelated.

One of the early demonstrations of syntactic priming was the experiment conducted by Bock (1986). The participants in the study were presented with pictures that could be described by either an active or a passive structure. They opted for the passive structure “The church is struck by lightning” rather than an active alternative “Lightning is striking the church” after being primed by a sentence that shared form but not semantic content with the prime. The author concluded that semantics is not necessary for priming effect to occur. Hare and Goldberg (1999) in a similar experiment replicated the study with structures sharing syntactic constituent structures with datives but sharing semantic content with ditransitive structures. The assumption was that in case structural priming was stimulated by syntax alone participants would have produced more dative responses. On the other hand, if semantic information had a role, more ditransitive structures would be produced. She concluded that semantic content was obligatory for syntactic priming.

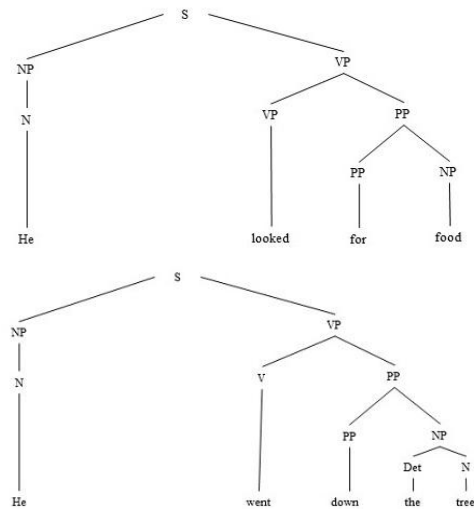
Bock (1986)’s study was replicated recently in Chen et al., (2022) who conducted the study as closely as possible to the original study and reported the same results.

However, Ziegler et al. (2019) put forth the idea that if two sentences with no semantic similarity could prime each other, structural priming would have occurred in the absence of shared semantic information. However, the authors argued that the sentences used in the Bock (1990) study shared semantic information which could be responsible for the reported priming effect. The point was that the intransitive locative structures used as primes in the study included two lexical elements (“by” and “be” verb) similar to the components of passive structures. The authors pointed to the fact that all priming structures used in the study shared semantic content with the target structures and argued that it was the drawback of the study. The hypothesis led the authors to propose that if what Bock (1990) argued for was responsible for the reported priming effect, the sentence “The 747 has landed near the airport control tower” would prime passive structures in the same way as the sentence “The 747 was altered by the airport’s control tower” since the two sentences shared the same content-less syntactic trees. However, if the lexical item “by” could affect the production of subsequent sentences in a way different from “near” the reported priming effect would have involved not only syntax but also semantics. In order to test the hypothesis, the authors primed the participants in their study with structures containing “by” phrases and structures which did not. The authors concluded that shared syntax alone was not sufficient for the syntactic priming effect to occur. To sum up, the reported literature concerning the issue indicates mixed results and there is a need for further research addressing different structures to shed light on the unresolved issue.

Following Ziegler et al. (2019), for the present study, we argued that if shared syntax was sufficient for syntactic priming to occur, structures encompassing motion events as “He fell down the tree” could prime structures “As he looked for food” which included phrasal verbs expressing non-motion events. The hypothesis

was that since the two sentences shared content-less syntactic structures even in the absence of shared semantic content the priming effect should be observed. What interested the researchers in using the two categories of phrasal verbs was the idea that the two types were different in terms of compositional meaning. While phrasal verbs expressing motion events have compositional meaning, the other category that is phrasal verbs expressing non-motion events did not. Therefore, the two categories were considered as appropriate candidates to be investigated. The point is illustrated in Figure 1.

Figure 1
Syntactic Trees for Motion and Non-Motion Verbs



It should be mentioned that assigning constituents of two sentences to similar surface syntactic roles does not necessarily mean they would entail similar semantic roles. Providing evidence in support of each of the hypotheses will suggest a different view of the underlying mental representations and the way they are related.

There are two features of the structures that justify syntactic priming involving semantics. The two features will be discussed with regard to two related but distinct hypotheses. First of all, the linguistic approach to semantics proposed by Fillmore (1977) will be used to discuss the discrepancy. Considering the semantics of the two sentences mentioned as examples in previous sections, we argue the way the semantic roles of the constituents of the two example sentences “He looked for food” and “He went down the tree” differ in terms of the number of the required arguments and their thematic roles. The verb in the first sentence is transitive and has a verb-particle-object structure ([V Prt OBJ]) while the verb in the second sentence is intransitive and has a verb-particle-location structure ([V Prt Location]). Once more, it should be reminded that the two sentences yield the same syntactic tree structures and are syntactically similar. Considering the issue from this

perspective is associated with case grammar and the hypothesis put forth by Fillmore (1977). According to the case grammar, semantic roles refer to the different functions that a noun phrase can have in relation to the action or state conveyed by the dominant verb in a sentence which is distinct from the grammatical role the lexical item possesses in the sentence. This way, two lexical items having the same surface syntactic role might have different and unrelated semantic roles. The study by Fillmore (1977) mainly emphasized semantic aspects and how they impact syntax, which marked a departure from Chomsky's previous approach (Chomsky, 1994) which heavily prioritized syntax and the idea that it operates independently.

Secondly, the authors argue that although the verb and particle used in the sentence "He went down the tree" retain their original out-of-context meaning while the particle in the sentence "He looked for food" loses its core out-of-context meaning and combines with the verb to form a rather new meaning. Decomposing the two parts of the phrasal verb *look for* will reformulate their meanings into a rather different meaning. This idea is associated with compositional vs. non compositional meaning which is another major difference between the two sentences which according to the authors might play a role in inhibiting the priming effect.

Combining the two above-mentioned ideas into a single hypothesis, Eddington et al., (2010) suggested that argument-based constructions seem to be present as both levels of representation and access rather than syntax-based components. The Goldbergian strand of construction-grammar (Goldberg, 1995) that he referred to contains not only abstract predicates but also argument roles and meaning relations integrated into a single unit, and this way is accessed as a whole rather than on a purely syntactic basis.

Further research addressing the issue regarding various notions surrounding the topic is needed to bring further clarity to the matter. Although there are a number of studies investigating the issue from different issues in L2, to the best of our knowledge there are few studies addressing the issue from an L2 perspective.

The present study was designed to explore the underlying components of structures that stimulate structural priming with a specific focus on the possibility of motion phrasal verbs priming non-motion phrasal verbs. It was hypothesized that in case motion phrasal verbs could prime non-motion phrasal verbs then syntactic priming would occur in the absence of shared semantic similarity between the prime and target which in turn would suggest separation of syntax and lexicon. To investigate the issue, the present study deployed the presentation of priming phrases with motion phrasal verbs as the independent variable to see its effect on non-motion phrasal verbs usage in L2 written production tasks as the dependent variable.

Therefore, the research question of the study was formulated as follows:

Research question: Will priming participants with phrasal verbs expressing motion events lead to more use of phrasal verbs expressing non-motion concepts?

Method

In order to test the hypothesis of whether there are separate levels of representation for semantic and syntactic information, the study drew upon a pre-test

and post-test design to investigate if exposing participants to non-motion phrasal verbs would lead them to use non-motion phrasal verbs in written production tasks.

Participants

One hundred fifty-seven students participated in the study from the University of Tabriz. They were divided into four groups. Fifty-four of the students were studying English language and literature and were enrolled in either developed writing or research methods courses. The other 103 students were from the faculties of Electrical and Computer Engineering or Mechanical Engineering, and they were taking English as a general and compulsory course. All of the participants had taken English lessons in high school, and some had taken English courses in private language school institutes. The participants' ages ranged from 18 to 24 ($M = 21.5$), and all reported normal or corrected to normal vision. The Oxford Quick Placement t-test was attached to their final exam paper, and the students were put into the either intermediate or upper-intermediate group accordingly. The data for students who failed to score above the minimum requirements was excluded from further analysis though they were allowed to take part in all sessions. This way the data for a total of 90 students was used for analysis.

Materials

Data Collection Materials

In order to collect data, the researchers used the short films “Banjo Frog and Chafe’s Pear Film”. The films were absent of dialogue and feature a considerable number of motion events, providing participants with ample opportunities to narrate them using phrasal motion verbs. “Banjo Frog” depicts the journey of a frog trapped in the back of a truck and is transported to a garbage dump, with various motion events occurring such as “climbing a tree”, “going back to the dump”, and “falling out of the truck”. Similarly, “Chafe’s Pear” showcases a gardener in his garden picking pears, with motion events transpiring like “going down the tree to put the pears in the basket” or as “boys passing by the tree”.

Priming Materials

Children’s book “Frog, where are you?” by Mercer Mayer was used to prime participants for the study. The story is about a boy and his dog finding a frog and bringing it home. The frog escapes from the jar as the boy and his dog sleep. The boy and his dog go around the area to find the frog. This way, the book depicts various types of motion events, such as climbing, falling, and carrying away. The book was modified for the purpose of current research, and each picture was accompanied by a description. Out of the 22 pictures, 14 utilized phrasal verbs in their descriptions while the remainder was used as fillers. The phrasal verbs used for the purpose of priming are listed in Table 1.2:

Procedure

Students in three intact classes of general English courses and two classes of advanced writing and research methods participated in the study. The data was gathered over the course of two designated sessions for the midterm assessment.

During the first session, the movie was projected, and the students had 30 minutes to narrate it. In the second session, the students were presented with priming materials at the start of the class. The material included a booklet of pictures depicting motion events, containing both phrasal and non-phrasal verbs describing the pictures. The students were informed that the booklets would be used to create a storybook for children, and the investigator was interested in finding out whether the descriptions that followed the pictures could be appropriate descriptions for the pictures. To make sure that they would read the material and would process it, they were asked to rate how well the sentences described the pictures by circling the number on the Likert scale. After the booklets were gathered, they watched the movie. They were allowed to make notes while watching the movie. After the booklets were collected, the students were shown the first silent movie and were asked to provide a detailed narration for it. They were required to write at least 200 words and were instructed to write in detail.

Table 1: Priming Phrasal Verbs Used in the Experiment

Primes
Put in
Come out
Fall out of
Go down
Fall on
Go up
Fall off
Climb up
Carry away
Fall into
Climb over
Go away

Coding

All instances of phrasal verbs involving motion events were coded under the category of motion event and all other instances of phrasal verb usage were coded under the category of non-motion phrasal verb. The criteria for coding a verb under the motion event category was that the structure included a verb and a satellite (describing movement). It should be reminded that motion phrasal verbs all had a compositional meaning. As for the non-motion category, all instances of verbs that included a verb part and a particle that had a non-compositional meaning were counted. It was to make sure that the prime and the target structure did not share any semantic similarity. The example for this category was the word “find out”. What is more, it should be mentioned that grammatical errors that did not damage the intended meaning like wrong tense markings or incorrect forms of past tense, as well as spelling errors, were discarded.

Data Analysis

A paired t-test analysis was carried out to determine if there was a significant difference between the means of the two sets of scores in the pre-treatment vs. post-

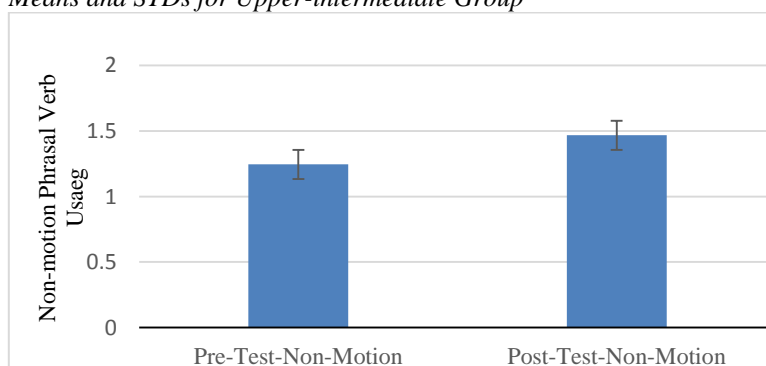
treatment production for both groups. Since the production task was free writing, the writings and the scores were corrected for length before carrying out any kind of analysis.

Results

It should be reminded that each participant performed two silent movie narration tasks, one in the pre-test and the other in the priming session. The descriptive statistics for production are reported in Table 2. Although the means for both groups in the pre-test vs. post-test showed an improvement, the difference was not significant. Figure 2 illustrates the means and STDs for the upper intermediate group.

Figure 2

Means and STDs for Upper-intermediate Group



The p-value for the upper intermediate group was (0.14 > 0.05) which meant that the difference between the two groups was not significant. In other words, the participants in the upper-intermediate group did not use more non-motion phrasal verbs after being primed by motion phrasal verbs. Table 1.2 illustrates the results for means and STDs for the intermediate group.

Figure 3

Means and STDs for Intermediate Group

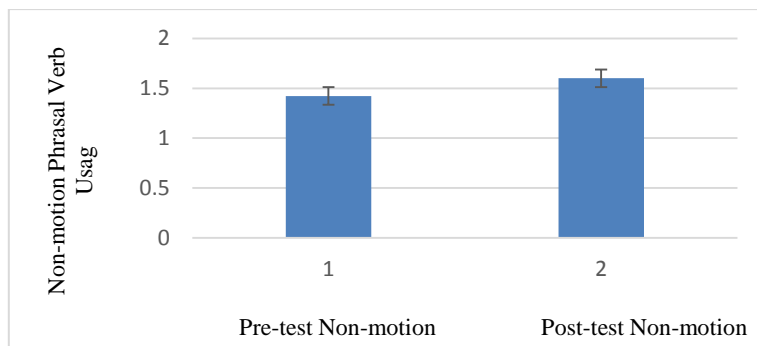


Table 2: *Paired Samples Test* of Pre-test vs. Post-test

Group			Mean	Std. Error Mean	df	Sig.(2-tailed)
Int.	Pair 1	pre.test	1.4222	0.09790	44	0.103
		post.test	1.6000	0.11192		
Up.	Pair 1	pre.test	1.2444	0.11282	44	0.142
		post.test	1.4667	0.11958		

A paired t-test was carried out to see if the difference between the mean of the two groups was significant. The p-value (0.10 > 0.05) indicated that the difference between the two groups in intermediate was not significant either. Table 2 gives the results.

Discussion

The present work was an attempt to answer the question if syntactic priming is syntactic in nature or if there are other factors at play. The idea that intransitive locatives could prime passive structures has been used as a piece of evidence supporting the hypothesis that syntactic priming occurs in the absence of shared semantic content (e.g., Bock & Loebell, 1990). However, as further research investigates the underlying mechanisms of structural priming, it is argued that shared syntax is not enough to trigger the syntactic priming effect. The present study investigated the hypothesis from a different perspective using motion vs. non-motion phrasal verbs. It was hypothesized that if what Bock and Loebell (1990) argued could account for the underlying principles of syntactic priming, and shared syntax alone was responsible for stimulating similar structures, phrasal verbs involving motion events would prime phrasal verbs from any other semantic areas. For this purpose, written productions of the narration of two silent movies were compared both before and after being primed. However, the results did not indicate a significant difference between phrasal verb usage in pre-treatment vs. post-treatment written productions, and the results support the hypothesis that shared syntax alone is not enough to trigger syntactic priming, and the overlapping meaning seems to be a requirement. However, in order to account for the findings of the present study, the semantics of motion-phrasal verbs and non-motion-phrasal verbs will be briefly discussed. The authors argue that despite having similar syntactic tree structures the two sentences differ in two significant but less apparent features, namely semantics of the arguments and compositionality.

Conclusion

Overall, we argue that if syntactic priming was purely syntactic in nature as claimed in the literature, the aforementioned differences would not restrain it. In other words, in case, the syntactic structure trees would be sufficient to trigger similar structures in language production, phrasal verbs drawing upon other semantic areas would occur in the narration task carried out by participants in the priming session. Generally, the present study provides evidence to support the hypothesis that shared semantic content is necessary for priming effect to occur.

However, further research exploring the issue from different structures as well as different production tasks is needed to support the findings.

The major drawback of the study was the limited number of participants available for the purpose of data collection. It is suggested that future research include more participants and address other structures that have similar syntactic structures but different semantics to see if the same results can be obtained.

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Appendix A

Sentences Used in Priming Booklet

1. One day a boy and his dog found a frog and put him in a jar.
2. When they went to bed at night, the frog came out of the jar.
3. In the morning, the boy and the dog found that the frog had gone away.
4. They explored everywhere.
5. The boy opened the window and yelled "Frog, where are you?"
6. Suddenly, the dog fell out of the window with the jar in his head.
7. The boy was mad, but the dog was happy.
8. They were outside searching for the frog.
9. The boy looked in a hole in the ground thinking that the frog might have gone down there.
10. The dog started howling at the bees.
11. The bees' nest fell on the ground, and the boy went up the tree.
12. The boy fell off the tree, and the bees chased the dog.
13. An owl came out and scared the boy.
14. The boy climbed up one of the big rocks.
15. A deer carried him away.
16. The boy and the dog fell off the cliff.
17. And fell into a mud puddle.
18. The boy heard a noise; maybe it was the frog.
19. "Be quiet," said the boy.
20. They climbed over the log.
21. They found the frog.
22. Baby frog had found his family.

Authors' Biographies



Ali Akbar Ansarin received his B.A., M.A., and Ph.D. degrees in English Language Teaching from Shahid Chamran University, his M.A., in Linguistics from Aligarh Muslim University, and his PhD in English Language Teaching from Panjab University. In 2001, Ansarin joined the Department of English, University of Tabriz, as an assistant professor in TEFL. Since then, he has had over 60 publications on teaching English to speakers of other languages. He has supervised quite a lot of MA and PhD students.



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