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## Abstract

Sentence processing research has shown that monolingual speakers of English primarily make use of syntactic information when interpreting sentences. However, there is reason to believe that bilingual speakers of English prefer to use semantic information when interpreting the same sentences. Researchers have posed the *shallow structure hypothesis* in order to put to test these differences in processing. One way to test the shallow structure hypothesis would be to replicate Garnsey, Pearlmutter, Myers, and Lotocky (1997) using proficient second language speakers of English. An ERP study would be employed in order to enhance timecourse research. Before conducting such a study, a norming study had to be conducted to determine whether the target nouns following a group of direct object bias and sentential complement bias verbs were considered to be plausible or implausible completions by native speakers of English. In this norming study 41 participants were presented with a series of sentence fragments. Then, they either indicated that the fragments were plausible or completed them to make them plausible.

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## Table of Contents

Abstract.....	i
Acknowledgments.....	ii
Table of Contents.....	iii
Background.....	1
Monolingual Literature.....	9
Bilingual Literature.....	13
Method.....	16
Participants.....	16
Materials.....	16
Procedure.....	17
Analysis.....	18
Results.....	19
Discussion.....	54
References.....	58
Appendix A.....	59

## 1. Background

Understanding sentences seems like a very simple task but every time we read or hear a sentence, a complex series of processes take place that lead to comprehension. In fact, our very ability to take in a rapid stream of words, understand them, and integrate them into a meaningful sentence is quite remarkable. This ability is made even more impressive by the fact that we often face temporarily ambiguous sentences.

Temporarily ambiguous sentences are sentences whose meaning is not immediately clear, but becomes clear with subsequent textual information. Ambiguity can be caused by either lexical items (i.e., lexical ambiguity) or by sentence structure (i.e. syntactic ambiguity). Lexical ambiguities occur when we read sentences that have a word with multiple meanings. For instance, in the sentence *The fisherman went to the bank*, the word *bank* could mean either “the side of a body of water” or “an institution where money is kept”. On the other hand, syntactic ambiguities occur when one sequence of words has multiple meanings. This sometimes happens in newspaper headlines and the result can be rather amusing, as in *COMPLAINTS ABOUT NBA REFEREES GROWING UGLY*. In this case, the intended meaning is that the complaints are starting to get ugly, but it could also be interpreted as saying that the referees themselves are getting ugly.

One type of syntactic ambiguity that has received much attention in the psycholinguistic literature is the so-called Direct Object (DO) vs. Sentential Complement (SC) ambiguity. In these sentences, readers face a temporary ambiguity at the noun phrase following a verb because the syntactic function of the noun phrase is unclear. Take, for example, sentence (1) below. The noun phrase *the fireworks* could be the entity upon which the verb is acting (e.g., what the man saw are the fireworks). In linguistic terms, this noun phrase is known as the Direct Object.

Conversely, the same noun phrase could be serving as the subject of another clause (e.g., the subject of the embedded clause “the fireworks were illuminating the city from his window”).

(1) *The man saw the fireworks...*

a. *...from his window.*

b. *...were illuminating the city from his window.*

When a reader initially reads *the fireworks*, the syntactic function of the noun phrase is ambiguous between a DO interpretation and a SC interpretation. It is only once the reader continues reading the sentence, that it becomes clear what the correct interpretation of the noun phrase is. In other words, the ambiguity gets resolved before the reader reaches the end of the sentence. The temporary nature of the ambiguity gives it its name: “temporarily ambiguous sentences”. These ambiguities can cause the reader to “garden path”, which means that they must go back and reanalyze the sentence because their initial interpretation was incorrect.

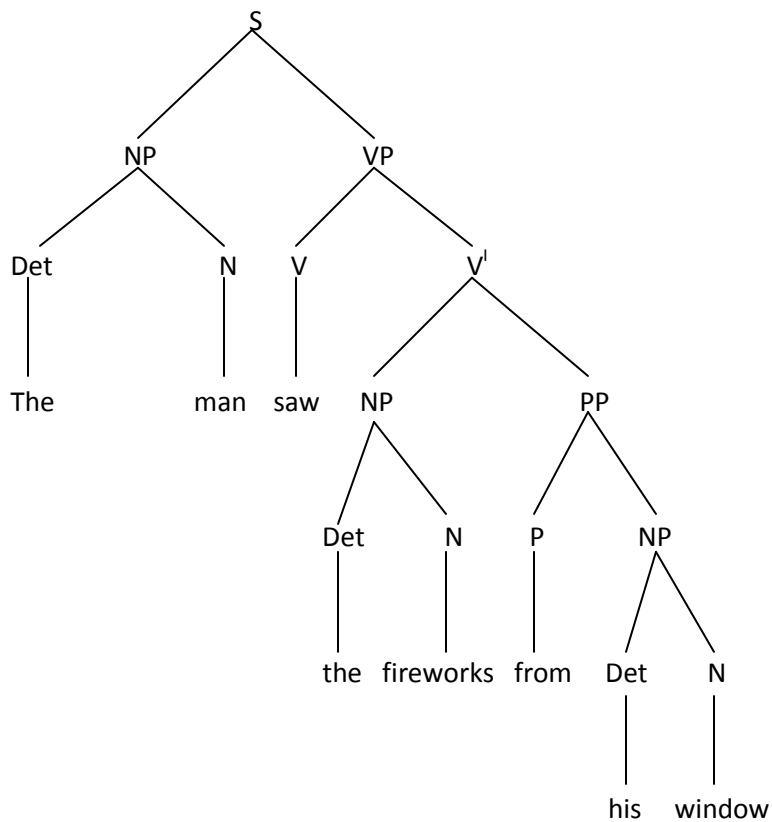
One central question in the psycholinguistic literature is: how do readers choose the correct interpretation of *the fireworks*? In other words, how do they choose between the DO and the SC interpretation? In English, the use of the complementizer *that* makes it clear that the correct interpretation of fireworks is “subject of the embedded clause” (e.g., *The man saw **that** the fireworks were illuminating the city*). However, studies have shown that the word *that* is often omitted. Because readers face such ambiguities so frequently, researchers have proposed two models for how readers disambiguate these types of sentences.

The first model is known as *the two-stage model of language comprehension*. According to Frazier (1978), readers’ interpretations are guided by the application of a principle called *Minimal Attachment*. According to Minimal Attachment, when readers are faced with a syntactically ambiguous construction, they solve the ambiguity by selecting the simplest possible

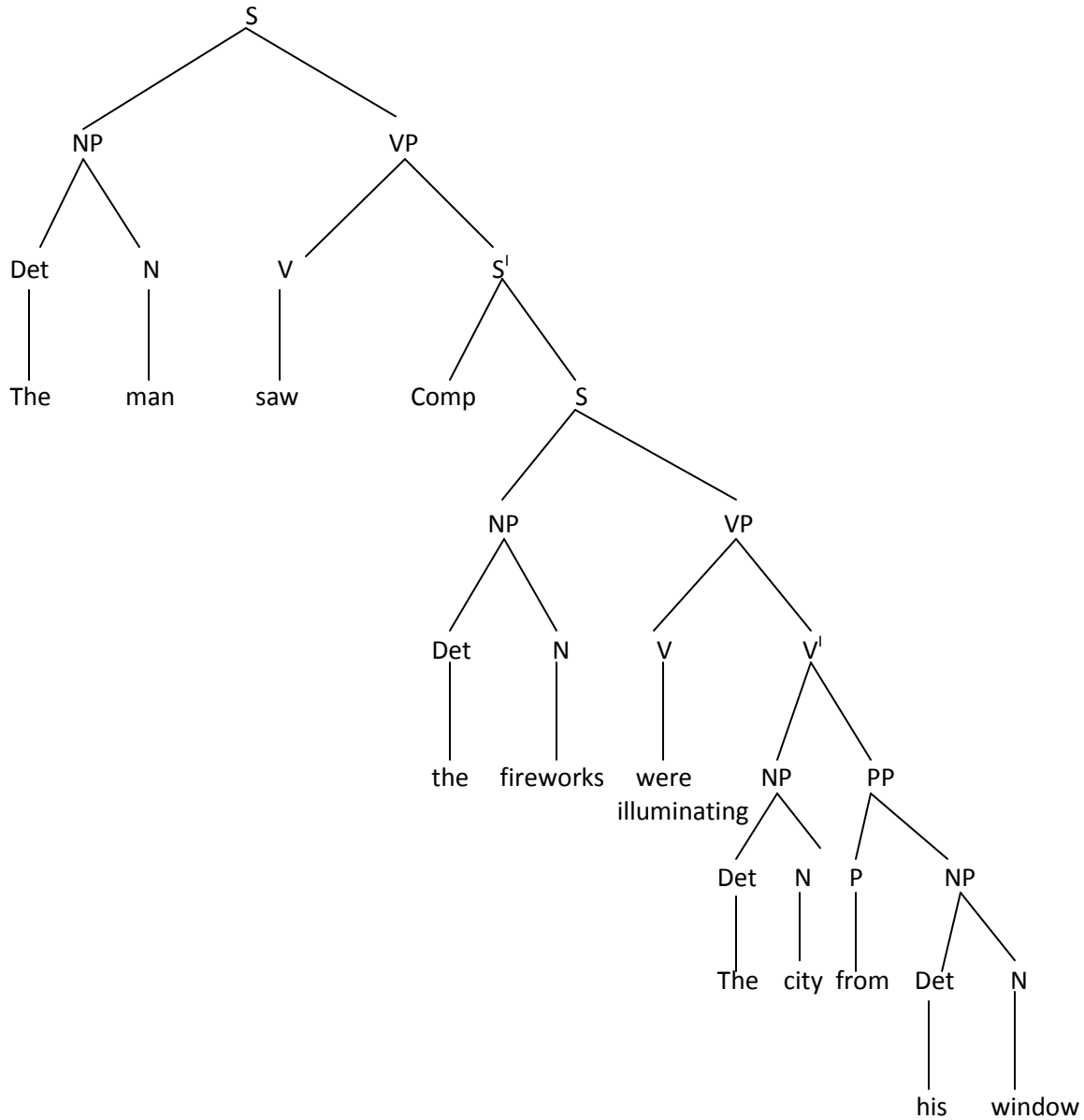
structure. Because direct-object structures are syntactically simpler than sentential complement structures in terms of number of nodes (see Figure 1), one clear prediction is that in (1a), Minimal Attachment would guided readers to interpret the ambiguous noun phrase *the fireworks* as a direct object. This choice results in a correct syntactic analysis. However, in (1b) is does not, because the ambiguous noun phrase is not functioning as a direct object, but rather as the subject of the following clause. When readers find evidence that their initial analysis is incorrect (i.e., at the point when they reach the so-called *disambiguating region* “were illuminating”), they will be forced to reanalyze the sentence and assign a subject interpretation to *the fireworks*.

Figure 1

a.



b.



The second model proposed by researchers is known as the *constraint-based lexicalist model*. In this model, multiple factors are used to assign an interpretation to a syntactically ambiguous noun phrase. Two of these factors include *verb bias* and *plausibility*.

Verb bias refers to the tendency that particular verbs have to be followed by a particular complement. For example, verbs like *accept*, *hear*, and *see* are said to be direct-object (DO) bias



verbs. These verbs can be followed by a number of different complements, as is shown in the following examples (complements are underlined):

- (2) The man *accepted* the error when he read the comments (direct-object complement)
- (3) The man *accepted* the error could have been prevented (sentence complement)
- (4) The man *saw* the fireworks when he stepped outside (direct-object complement)
- (5) The man *saw* the fireworks were illuminating the city (sentence complement)

Although each of the verbs in examples (1-4) can be followed by different types of complements, when speakers use these verbs, they more often use them with a direct object. Hence, these are known as direct-object bias verbs.

Verbs that are said to have a sentential complement (SC) bias include *admit*, *believe*, and *figure*. Again, these verbs can be followed by different complements, as shown in the following examples (complements are underlined):

- (6) The man *admitted* the mistake when he read the comment (direct object complement)
- (7) The man *admitted* the mistake was grievous (sentential complement)
- (8) John *believed* the man after he saw his credentials (direct object complement)
- (9) John *believed* the man was wrong (sentential complement)

In examples (6-9), it is evident that SC-bias verbs can be used with different kinds of complements, but when these verbs are used by speakers, they are more commonly used with a sentential complement.

Finally, verbs that are said to have an Equi (EQ) bias include *announce* and *doubt*. These verbs can also be used with different complements, as shown in the following examples (complements are underlined):

- (10) The man *announced* his retirement at the office party (direct object complement)

(11) The *announced* his retirement was imminent (sentential complement)

(12) Thomas *doubted* the man who was interviewed (direct object complement)

(13) Thomas *doubted* the man would arrive (sentential complement)

Unlike DO bias and SC bias verbs, when used by speakers, these verbs do not favor any type of complement over another.

One important methodological question in the literature concerns how to determine a verb's bias. In some cases, researchers conduct corpus analysis to tally the number of times particular verbs are used with specific complements. Other times, researchers conduct norming studies. To illustrate the latter procedure, Garnsey, Pearlmutter, Myers, and Lotocky (1997), determined the verb bias of 100 English verbs by administering a questionnaire in English to 100 participants. The questionnaire contained each verb in a sentence fragment composed of a grammatical subject followed by the verb, as in *Debbie remembered \_\_\_\_\_*. Participants were asked to write a completion that was semantically plausible (i.e. that made sense) for each sentence. Verbs were classified as DO-bias if they were used at least twice as often with direct object completions as with sentential complement completions. Verbs were classified as SC-bias if they were used at least twice as often with sentential complement completions as with direct-object completions. Verbs were classified as EQ-bias if the difference in usage between DO completions and SC completions was no greater than 15%.

In the psycholinguistic literature (e.g., Garnsey et al., 1997 and Wilson & Garnsey, 2009), verb bias has been found to affect how readers construct a syntactic analysis for sentences. For example, in *The man saw the fireworks were illuminating the city*, readers slow down when they reach the disambiguating region "were illuminating." In addition, in eye-tracking experiments, readers show more regressive eye movements when they reach the disambiguating region,

indicating that they have difficulty integrating the newly encountered material. Likewise, readers are slower to read the disambiguating region “when he” in a sentence like *The man believed the story when he read the newspaper*. According to *constraint-based lexicalist models*, this is so because readers’ expectations about the likely complement for the verb are not met. In the first case, when readers arrive at *saw*, which is a DO-bias verb, they expect *the fireworks* to be a direct object. However, upon reaching the disambiguating region *were illuminating*, they realize that their initial interpretation was incorrect because *were illuminating* indicates that *the fireworks* is, in fact, the subject of an embedded clause. This triggers reanalysis, which causes an increase in reading time. In the second case, when readers arrive at *believed* they expect that *the story* will be the subject of an embedded clause because *believe* has an SC-bias. But, the disambiguating region *when he* indicates that *the story* is actually a direct object. So, again, readers are forced to reanalyze. These findings are precisely what constraint-based lexicalist models predict, because they postulate that verbal information has an immediate effect of how readers conduct syntactic analysis of the sentence.

Two stage models of sentence processing and constraint-based lexicalist models sometimes make converging predictions and other times contrasting predictions. Take, for example, sentences (2) and (4) above. Both models predict ease of processing, albeit for different reasons. Two stage models predict that the temporarily ambiguous noun phrases *the error* and *the fireworks* will be interpreted as direct objects because this analysis requires the least number of nodes (see Figure 1). A similar prediction is made by constraint-based lexicalist models, in this case because the verb, which is DO bias, is followed by a direct object. However, for sentences (6) and (8), two stage models of sentence processing and constraint-based lexicalist models make contrasting predictions. Two stage models predict ease of processing because the

temporarily ambiguous noun phrases *the mistake* and *the man* should be interpreted as direct objects (this is the analysis that requires the least number of nodes). On the other hand, constraint-based lexicalist models would predict processing difficulty in these sentences. *Admit* and *believe* are SC-bias, so the noun phrases will initially be interpreted as the subjects of embedded clauses. It is only when readers arrive at the disambiguating regions *when he* and *after he*, they will realize that the noun phrases are direct objects, which will trigger reanalysis (and hence a slowdown in processing).

Another factor that has been shown to affect processing ease is plausibility. In the case of noun phrases, plausibility refers to the semantic fit of a verb and its complement. A noun phrase is plausible if it makes sense when used with the verb preceding it. For instance, in the following example (14), (14a) has a plausible direct object, whereas (14b) has an implausible direct object (noun phrases are underlined).

(14) *The soldiers believed...*

a. ...the enemy was hidden in the cave

b. ...the treasure was hidden in the cave

In (14a) constraint-based lexicalist models predict that readers are likely to interpret *the enemy* as a direct object. So, in conjunction with verb bias, plausibility could influence first analysis.

However, in (14b), because *believed the treasure* does not make sense semantically, the misfit might help to guide initial interpretation. In this case, that means that readers go on assuming *the treasure* is the subject of an embedded clause.

Several studies have put to test the predictions outlined above by the two-stage model of language comprehension and constraint-based lexicalist models. I turn to these studies below.

## 2. Monolingual Literature

Recent studies have sought to evaluate the interaction between plausibility and varying levels of verb bias in resolving temporary ambiguities. Additionally, researchers have sought to verify the validity of the constraint-based model over the two-stage model of language comprehension. Many of the findings have been conflicting, due to various extraneous variables stemming from the experiments themselves.

Garnsey et al. (1997) examined the contributions of both verb bias and plausibility to the comprehension of temporarily ambiguous sentences in a self-paced reading task and eye tracking study. Specifically, they evaluated plausibility effects at varying degrees of DO, SC, and EQ verb bias. The materials consisted of verbs that had been normed in a prior study (Garnsey et al., 1997) to determine whether they were DO-bias, SC-bias, or EQ-bias. Each noun phrase's plausibility as a DO was also determined prior to material construction.

For each of the 48 verbs that were chosen, 4 sentence versions were constructed. Within each version, items were differentiated by noun phrase plausibility and the use of *that* as a disambiguation. For instance, the item using the DO-bias verb *accept* had the following conditions (plausible direct object first):

(15) The talented photographer *accepted* (that) the *money* could not be spent yet.

(16) The talented photographer *accepted* (that) the *fire* could not have been prevented.

SC-bias verb items (e.g., *realize*) used the same format (plausible direct object first):

(17) The novice plumber *realized* (that) the *mistake* would cost someone some money.

(18) The novice plumber *realized* (that) the *tool* would cost too much for him.

Lastly, EQ-bias verb items (e.g., *know*) also followed this format (plausible direct object first):

(19) The famous novelist *knew* (that) the *material* would make some people unhappy.

(20) The famous novelist *knew* (that) the *pause* would make her seem uncertain.

Their predictions were as follows:

- (1) plausibility will not eliminate difficulty in sentences with DO-bias verbs
- (2) sentences with SC-bias verbs will not be difficult regardless of plausibility
- (3) plausibility will have a strong effect in sentences with EQ-bias verbs.

In regards to their last prediction they believed that noun phrases with implausible direct objects would eliminate processing difficulty, but that noun phrases with plausible direct objects would create difficulty.

Garnsey and her colleagues (1997) confirmed their initial predictions. They found that sentences with SC-bias did not pose significant difficulty to participants at the disambiguating region, but that sentences with DO-bias did. Plausibility had no significant effect on either bias type. Conversely, they found that plausibility had a significant effect on verbs with EQ-bias. Participants had difficulty at the disambiguation in sentences with plausible noun phrases, but not with implausible noun phrases.

Garnsey et al. (1997) interpreted their results to support the claim that participants' prior experience with verbs had a substantial influence on sentence interpretation. That is, verb bias actually had a strong influence on comprehension. They also found that verb bias and plausibility interact during comprehension. However, plausibility was not found to have a significant influence on comprehension. These experiments also reported evidence that verb bias effected processing almost immediately, which supports the constraint-based model of language comprehension.

More recent studies have further strengthened the body of data supporting constraint-based lexicalist models. Garnsey et al. (1997) has been criticized because some believed that

their results stemmed from the fact that their experimental items were all complex sentences (see examples 15-20). So, Wilson and Garnsey (2009) developed an experimental design that used syntactically simpler sentences to determine the role of verb bias at the earliest stages of sentence processing. These sentences were determined to be syntactically simpler because they use the direct object completion. Specifically, Wilson & Garnsey (2009) sought to investigate how soon verb bias affects sentence processing and the effect that verb bias has on temporarily ambiguous sentences that end up having the simpler of their possible syntactic endings.

In their materials construction, Wilson and Garnsey (2009) used verbs whose bias had been previously confirmed in the norming study conducted by Garnsey et al. (1997). However, they only included DO-bias and SC-bias verbs in their study. There were three sentence versions for every verb as shown below (disambiguating regions underlined):

(21a) The cab driver *assumed* (that) the blame did not belong to him. (SC-bias)

(21b) The cab driver *assumed* the blame since he was protecting friends. (SC-bias)

(22a) The concerned priest *asserted* (that) the belief might not be morally justified. (DO-bias)

(22b) The concerned priest *asserted* the belief during the meeting with parishioners. (DO-bias)

As shown in (21b) and (22b), one sentence version had a direct object continuation. These can be said to be the “simpler sentences”. The other two versions had a sentential complement completion (see (21a) and (22a)), but one was left temporarily ambiguous while the other was disambiguated with the complementizer *that*.

This study concluded that verb bias does, indeed, have an early effect on decision making when processing sentences. In fact, based on first-pass reading times, evidence suggests that verb

bias almost immediately effects sentence processing. Additionally, items with direct object continuations (i.e., (21b) and (22b)) were read more slowly when they followed verbs with SC-bias than verbs with DO-bias. This suggests that verb bias does have a significant effect on sentences with simpler syntactic structure. In short, Wilson & Garnsey (2009) provides further evidence supporting constraint-based lexicalist models' predictions.

The vast majority of the data from psycholinguistic literature seems to point to the fact that monolingual English speakers utilize verb bias as a key factor in how they interpret sentences. An important question is how people who speak English as a second language (L2) process these sentences. I review this literature below.



### 3. Bilingual Literature

Research on how bilinguals process language is extremely important because there are far more bilinguals in the world. Also, there is evidence to suggest that people using their second language analyze and interpret sentences by different means than people using their first language. Recent research has sought to discover what some of these differences might be.

Dussias and Piñar (2009) discussed several strategies that first (L1) and second (L2) language speakers use to process sentences. In one example, they discussed how L1 and L2 speakers differ when they interpret temporarily ambiguous clauses consisting of two noun phrases. They highlighted the following example (prepositions underlined):

(23a)...*the psychiatrist with the actress who was having a glass of wine*

(23b)...*the psychiatrist of the actress who was having a glass of wine*

These clauses are ambiguous because the relative clause (i.e. *who was having a glass of wine*) could be referring to either *the psychiatrist* or *the actress*. In (23a) the preposition *with* introduces what is known as a *thematic role* for the noun phrase *the actress*. This means that *with* introduces *the actress* as the main NP in the sentence. As a result, both L1 and L2 speakers predictably attach the relative clause to *the actress*. In other words, both sets of speakers believe that the person with the glass of wine is *the actress*. However, the preposition *of* in (23b) does not introduce a thematic role. So, there is ambiguity as to which NP the relative clause should be attached to, because either *the psychiatrist* or *the actress* could have the glass of wine. An important finding is that in (23b), L2 speakers do not prefer NP1 (*the psychiatrist*) or NP2 (*the actress*) attachment, which suggests that L2 speakers are not influenced by syntactic information so much as they are influenced by lexical information.

Based on many of the differences in sentence processing between L1 and L2 speakers discussed in Dussias and Piñar (2009), including those mentioned above, researchers (e.g., Clahsen and Felser (2006)) have posed the *shallow structure hypothesis*. This hypothesis predicts that L2 speakers use fundamentally different processes when interpreting sentences. Specifically, it postulates that L2 speakers do not use the “deeper” syntactic information (e.g., verb bias information discussed in 1 above) that L1 speakers use, but rather “shallower” or less detailed lexical-semantic information (i.e. plausibility). In other words, L2 speakers pay attention to meaning rather than structural cues. For instance, in example (1), repeated as (26) below for convenience, it is hypothesized that L1 speakers will use the knowledge that *saw* has a direct object bias to guide sentence interpretation, while L2 speakers will use the plausibility of *the fireworks* as a direct object to guide interpretation:

(24) *The man saw the fireworks...*

One way to test the shallow structure hypothesis is to conduct a study along the lines of Garnsey et al. (1997) with proficient second language speakers of English, using a method that is sensitive to the time-course of syntactic and semantic processing. Event related potentials, or ERPs, are the perfect candidate because they provide a reliable measure of the time-course of syntactic and semantic processing. ERPs represent electrical activity in the brain, which are a direct result of thought or perception. They are measured using electroencephalography (EEG). For the purposes of the present discussion, we will be focusing on two important brain potentials: the N400 and the P600. The N400 potential is a negative potential that occurs 400 milliseconds after the presentation of a stimulus (i.e. experimental sentence). It is indicative of a semantic anomaly. The P600 potential, which is a positive potential that occurs 600 milliseconds after the presentation of a stimulus, is indicative of a syntactic anomaly. Using ERPs is will help to

address questions of whether L2 speakers show the same patterns of sensitivity as native speakers of the target language, thanks to the fact that the N400 and the P600 provide reliable indices of syntactic and semantic processing.

One disadvantage with recording ERPs, however, is that a large number of items need to be constructed. This is so because averaging over a large number of items is needed to wash out extraneous effects that may affect brain wave patterns other than the linguistic variables being studied (e.g., ambient light, blinking, etc). Although one strategy could be to employ items available in published literature that have been previously employed by other researchers (e.g., Garnsey et al., 1997 and Wilson & Garnsey, 2009), the number of materials from such sources falls short of what is needed to conduct an ERP study. Given this, a norming study is required to determine whether the target nouns following direct object bias verbs and sentential complement bias verbs are considered to be plausible or implausible completions by native speakers of English. With this in mind, the purpose of the present study is to conduct such a norming. I turn to this study below.

#### 4. Method

##### Participants

A total of 41 monolingual speakers of American English participated in this norming study. Participants were recruited in the 2008-2009 academic year. They were all undergraduate students at the Pennsylvania State University and they received \$10.00 for their participation. All participants were given a language history questionnaire prior to the experiment in order to confirm their status as monolinguals.

##### Materials

One hundred and forty four experimental sentence fragments were created. For each fragment, there were four conditions: direct object biased verb+ plausible direct object (DOPDO), direct object biased verb+implausible direct object (DOIDO), sentential complement biased verb+ plausible direct object (SCPDO), and sentential complement biased verb+implausible direct object (SCIDO). Each fragment consisted of a primary noun phrase (i.e. the subject), a verb, and a noun phrase. The verb was the only part of each item that was variable, as in the following example (verbs underlined):

(25a) *The French explorers discovered the treasure...* (DOPDO)

(25b) *The French explorers understood the treasure...* (DOIDO)

(25c) *The French explorers indicated the treasure...* (SCPDO)

(25d) *The French explorers realized the treasure...* (SCIDO)

In this example, (25a) and (25b) are direct object biased items, while (25c) and (25d) are sentential complement biased verbs. Additionally, the noun phrase *the treasure* serves as a

plausible direct object in (25a) and (25c), whereas it is implausible in (25b) and (25d). All experimental items were constructed in an identical manner.

The experimental sentence fragments were compiled into four lists that consisted of an equal sample of conditions. All items were counterbalanced so that every participant saw all of the conditions but not repeated items. All materials were uploaded into E-Prime.

## **Procedure**

Upon arriving to the experimental session, participants were instructed that they were going to be reading a set of sentence fragments. They were then instructed that if the fragment was plausible (i.e. made sense semantically), they were to press “OK”. However, if the fragment was implausible, they were to type in a completion that made the fragment plausible. For instance, (25b) is implausible, so a participant could complete the sentence with something like “*was hidden*” in order to make the item plausible. Additionally, they were told that they could not type in a completion that changed the initial fragment. So, if a participant were presented with (25b) they could **not** complete it as follows (completion underlined):

(26) *The French explorers understood the treasure’s history had been shrouded in darkness.*

No restrictions were put on the length of the completions, they simply needed to be grammatically correct and semantically plausible.

Data collection occurred in the Spring semester of 2009.

## Analysis

Participants' responses were hand coded by two undergraduate students and one graduate student, all of whom are L1 English speakers seeking degrees in Psychology or Linguistics. All of the coding was rechecked by an expert linguist who is a faculty member at Penn State. The responses were coded in six categories (1-6):

- (1) Direct Object Completion
- (2) Direct Object Completion with Obligatory Prepositional Phrase
- (3) Direct Object Completion with Optional Prepositional Phrase
- (4) Sentential Complement Completion
- (5) Infinitive Completion
- (6) Other Completion

Inappropriate responses and missed items were coded as (0).

After the initial coding, it was observed that some of the fragments were completed even if they were semantically plausible. For instance, there was an item with the SC bias verb “*believe*” that was used as follows:

(27) *The young child believed the book...*

Although this item was semantically plausible, the majority of participants completed this item with a sentential complement. This illustrates how verb bias actually overpowers the participants' need to determine plausibility. So, after coding was finished, all of the questionable items were reanalyzed by the team of linguistics students and their faculty advisor in order to assure that this tendency did not skew the data.

## Results

Table 1 displays the complete set of items used in this norming study. It includes all of the verbs used as well as their individual verb biases. Appendix A gives descriptive properties for all verbs used in this norming study.

Additionally, Table 1 shows all of the direct object completions from the sentence fragments shown to the participants. Direct objects were judged as plausible or implausible based on how many times they were completed by participants. If an item was completed 0-3 times, it was marked as a “Plausible DO”, but if it was completed 4 or more times, it was marked as an “Implausible DO”. For clarities sake, items considered to be plausible were also checked off as “Good DO” and items that were considered implausible were checked off as “Bad DO”.

As an example, item (11) is *believed*. This verb was followed by a total of 22 different possible direct objects. For instance, the DO *her spot* was considered to be an implausible DO and a bad DO because 90% of participants completed this item. However, the DO *her companion* was also considered to be an implausible, and therefore bad, DO because it was completed by 40% of the participants. This brought to light an effect of verb bias that will be discussed further in the Discussion section.

**Table 1**

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
1	accepted	DO	his guilt	0%	✓			
	accepted					his workout	40%	✓
	accepted		their dinner	20%	✓			
	accepted		the money	0%	✓			
	accepted					his teammates	36%	
	accepted		a nap	18%	✓			
2	acknowledged	DO	the heavy flow of new clients	0%	✓			
	acknowledged		the issue	9%	✓			
	acknowledged		his commitment	0%	✓			
	acknowledged					his workout	82%	✓
3	admitted	SC	the error	30%	✓			
	admitted					the robbery	80%	✓
	admitted					her companion	90%	✓
	admitted					his workout	100%	✓
	admitted					a good performance	60%	✓
	admitted		his talent	30%	✓			



Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	admitted					the reopening of his store	50%	√
	admitted					the accusations	70%	√
	admitted		his defeat	0%	√			
	admitted		her knowledge in the subject area	30%	√			
	admitted					his extended absence	40%	√
	admitted					the scene	80%	√
	admitted					his commitment	40%	√
	admitted					the scholarly journal	91%	√
	admitted					the change in tension	45%	√
4	advised	DO				his new co-worker	60%	√
	advised		the outcome	20%	√			
	advised		his obligations	10%	√			
	advised		the rental terms	20%	√			
	advised		the meal	30%	√			
	advised					the gossip	60%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	advised		a new recipe	30%	✓			
5	advocated	DO	the topics	10%	✓			
	advocated		his defeat	0%	✓			
	advocated		animal rights	0%	✓			
	advocated		the beliefs	0%	✓			
	advocated		the accomplishments	0%	✓			
	advocated					his teammate	64%	✓
6	agreed	SC				the mistake	100%	✓
	agreed					the rental terms	100%	✓
7	appreciated	DO	the ending	0%	✓			
	appreciated		his medical desires	20%	✓			
	appreciated		the merchandise	0%	✓			
	appreciated		her companion	0%	✓			
	appreciated		his collection of work	0%	✓			
	appreciated		the appointment date	20%	✓			
	appreciated		the date of the next sale	10%	✓			
	appreciated		the raise	0%	✓			
	appreciated		his guilt	9%	✓			
8	argued	SC	the issue	0%	✓			

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	argued					a new recipe	60%	√
	argued					screeching breaks	80%	√
	argued					animal rights	70%	√
	argued					the witness	80%	√
	argued					the customer	80%	√
	argued					their study session	100%	√
	argued					her penny	91%	√
9	asserted	DO	his wishes	0%	√			
	asserted		the facts	0%	√			
	asserted		the topic of the script	30%	√			
	asserted		his medical desires	10%	√			
	asserted		her knowledge in the subject area	0%	√			
	asserted		the scene	20%	√			
	asserted					her doctor	82%	√
	asserted					the new instrument	54%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	asserted					the difficult exam	73%	√
	asserted					the rough water	73%	√
10	assumed	SC				his next day's victory	70%	√
	assumed		the blame	10%	√			
	assumed					the joke	100%	√
	assumed					his coach	100%	√
	assumed					her clientele	90%	√
	assumed					the new skill	60%	√
	assumed					the crime	70%	√
	assumed					the issue	90%	√
	assumed					his theory	91%	√
	assumed					the ending	91%	√
	assumed					a new vaccine	82%	√
	assumed					the hurtful accusations	91%	√
11	believed	SC				her spot	90%	√
	believed					the issue	80%	√
	believed		the witness	30%	√			
	believed					the book	60%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	believed		the story	20%	√			
	believed					his teammates	60%	√
	believed		the customer	20%	√			
	believed					his talent	100%	√
	believed					his tools	100%	√
	believed					the game plan	80%	√
	believed					the reopening of his store	90%	√
	believed					her companion	40%	√
	believed					his coach	60%	√
	believed					his daily catch	90%	√
	believed		the woman	30%	√			
	believed					his colleague	40%	√
	believed					the scholarly journal	40%	√
	believed		her patient	20%	√			
	believed					the blame	90%	√
	believed					his customer	55%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	believed					her close friend	64%	√
	believed					the topic of the script	82%	√
12	boasted	SC				the materials	60%	√
	boasted					her doctor	90%	√
	boasted		the accomplishments	0%	√			
	boasted		her natural skill	0%	√			
	boasted					the heavy flow of new clients	50%	√
	boasted					a new vaccine	50%	√
	boasted					his collection of work	36%	√
	boasted					his daily catch	64%	√
13	bragged	SC				the theory	80%	√
14	broadcasted	DO	their victory	0%	√			
	broadcasted		the accomplishments	0%	√			
	broadcasted					her companion	36%	√
	broadcasted					his coach	55%	√
15	checked	DO	his financial status	0%	√			

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	checked		her story	0%	√			
	checked		the heavy flow of new clients	0%	√			
	checked		the data	0%	√			
	checked					the guests	36%	√
16	claimed	SC	the treasure	0%	√			
	claimed		the tip	30%	√			
	claimed					a nap	50%	√
	claimed					the accusations	100%	√
	claimed					the materials	40%	√
	claimed					the vehicle	80%	√
	claimed					the novel	80%	√
	claimed					his tools	50%	√
	claimed					the new instrument	50%	√
	claimed					his personality	80%	√
	claimed					his financial status	50%	√
	claimed					the ending	90%	√
	claimed		their victory	0%	√			

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	claimed					her penny	60%	√
	claimed		her spot	10%	√			
	claimed					her new book	40%	√
	claimed					the passengers	80%	√
	claimed		a following of customers	18%	√			
	claimed					the item	36%	√
	claimed					the final results	82%	√
	claimed					her neighbor's needs	82%	√
17	complained	SC				the solution	100%	√
	complained					the outcome	90%	√
18	comprehended	DO				her penny	70%	√
	comprehended		the new vocabulary	10%	√			
	comprehended		the remark	27%	√			
	comprehended					the customer	45%	√
	comprehended					their dinner	73%	√



Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	comprehended					his tools	82%	✓
	comprehended		a good performance	27%				
19	concealed	DO	his daily catch	10%	✓			
	concealed		his fear	0%	✓			
	concealed		their financial earnings	0%	✓			
	concealed		his bruises	0%	✓			
	concealed		the vehicle	10%	✓			
	concealed		the blame	0%	✓			
20	concluded	SC	the essay	10%	✓			
	concluded		the exam	30%	✓			
	concluded					the woman	100%	✓
	concluded					her kind nature	80%	✓
	concluded		the trick	10%	✓			
	concluded		his workout	20%	✓			
	concluded					the bedtime story	40%	✓
	concluded					the beauty pageant	70%	✓
	concluded		a good performance	0%	✓			

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	concluded		the appointment date	20%	√			
	concluded		his difficult training	10%	√			
	concluded		their study session	0%	√			
	concluded					the workers	90%	√
	concluded		her story	18%	√			
	concluded					his defeat	45%	√
	concluded		his firm beliefs	27%	√			
	concluded					her spot	55%	√
21	confessed	SC				the game	90%	√
	confessed					the novel	90%	√
	confessed					the difficult exam	90%	√
	confessed					the students	90%	√
	confessed		his medical desires	0%	√			
	confessed		his guilt	0%	√			
	confessed					the essay	80%	√
	confessed					the gossip	45%	√
	confessed					the date of the next bake sale	73%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	confessed		the crime	0%	√			
	confessed					animal rights	82%	√
	confessed					his bruises	91%	√
	confessed					her new book	100%	√
22	confided	SC	the beliefs	10%	√			
	confided		his fears	9%	√			
23	confirmed	DO	the tour dates	0%	√			
	confirmed		the appointment date	0%	√			
	confirmed					the witness	60%	√
	confirmed					the customer	80%	√
	confirmed		the error	0%	√			
24	decided	SC				the prices	90%	√
	decided					the floral arrangement	80%	√
	decided					the bedtime story	80%	√
	decided					the new instrument	100%	√
	decided					their dinner	90%	√
	decided					the guests	90%	√
	decided					the difference	60%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	decided					her major	40%	√
	decided					the prerequisite material	40%	√
	decided					the injury	80%	√
	decided					the exam	90%	√
	decided					her purchase	82%	√
	decided					his usual route	100%	√
	decided		the appointment date	18%	√			
	decided					his personality	100%	√
	decided					the heavy flow of new clients	100%	√
	decided					her knowledge in the subject area	91%	√
	decided					their victory	82%	√
25	denied	DO				the prices	50%	√
	denied		the wedding	20%	√			
	denied		the accusations	0%	√			
	denied		the infesting house	27%	√			

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
26	described	DO	the lightning strike	10%	√			
27	determined	SC				the new vocabulary	60%	√
28	disclosed	DO	his theory	0%	√			
	disclosed		the prices	9%	√			
29	discovered	DO	the gift	0%	√			
	discovered		a new vaccine	10%	√			
	discovered		the remark	30%	√			
	discovered					the game	40%	√
	discovered					the infesting house	40%	√
	discovered					his tools	40%	√
	discovered		the treasure	0%	√			
30	disputed	DO				her patient	40%	√
	disputed		the change in tension	0%	√			
	disputed		the topic of the script	0%	√			
	disputed		the hurtful accusations	0%	√			
	disputed		the novel	20%	√			
	disputed					the vehicle	45%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	disputed		the theory	0%	√			
	disputed					his talent	36%	√
31	dreamed	SC				the merchandise	90%	√
	dreamed					the infesting house	90%	√
	dreamed					the game	60%	√
	dreamed		the game plan	20%	√			
	dreamed					the captain	90%	√
	dreamed					her friend's intentions	60%	√
	dreamed		the topic of the script	20%	√			
	dreamed					his next day's victory	60%	√
32	emphasized	DO	his personality	20%	√			
	emphasized		his client's innocence	0%	√			
	emphasized					the passengers	80%	√
	emphasized		her kind nature	0%	√			
	emphasized					her peer	80%	√
	emphasized		the issue	0%	√			
33	established	DO	her clientele	0%	√			

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	established		his collection of work	0%	√			
	established		his firm beliefs	0%	√			
	established		her purchase	30%	√			
	established					the students	60%	√
	established		her story	0%	√			
	established		the game	18%	√			
	established					the difficult words	45%	√
34	estimated	DO				the theory	40%	√
35	expected	DO				her knowledge in the subject area	90%	√
	expected					his firm beliefs	100%	√
	expected		his next day's victory	30%	√			
	expected		a nap	10%	√			
	expected					the new skill	80%	√
	expected					his theory	80%	√
	expected					the tip	45%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
36	explained	DO	the crime	10%	√			
	explained		his difficult training	0%	√			
	explained		the prerequisite material	10%	√			
	explained		the blame	20%	√			
	explained		the joke	0%	√			
	explained					her clientele	70%	√
	explained					the lazy employee	70%	√
	explained		the rental terms	9%	√			
37	exposed	DO	her actions	0%	√			
38	feared	DO				their financial earnings	90%	√
39	felt	DO				his difficult training	90%	√
	felt					the error	60%	√
	felt					the mistake	80%	√
	felt					the story	90%	√
40	figured	SC				the vehicle	100%	√
	figured					the lightning strike	80%	√
	figured					the gossip	70%	√



Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	figured					his theory	100%	√
	figured					their financial earnings	60%	√
	figured					the money	70%	√
	figured					the difference	36%	√
	figured					his financial status	82%	√
	figured					his colleague	100%	√
	figured					his medical desires	91%	√
41	forgot	DO	her penny	0%	√			
	forgot		the injury	20%	√			
	forgot		the materials	0%	√			
	forgot					the workers	55%	√
42	found	DO	the item	0%	√			
	found					the hurtful accusations	90%	√
	found					the increased wages	90%	√
	found		her new book	20%	√			
	found					the issue	90%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	found					his commitment	60%	√
	found					his financial status	70%	√
	found		the solution	0%	√			
	found					the exam	73%	√
	found					the beliefs	55%	√
43	guessed	DO				the workers	90%	√
	guessed					his new co-worker	80%	√
44	heard	DO	screeching breaks	0%	√			
	heard					her close friend	50%	√
	heard		his client's innocence	20%	√			
	heard					the money	100%	√
	heard					the book	60%	√
	heard					the floral arrangement	70%	√
	heard		the guests	10%	√			
	heard		her doctor	0%	√			
	heard		the new musical instrument	10%	√			
	heard		the robbery	27%	√			

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	heard		the witness	0%	√			
	heard					the merchandise	82%	√
45	hinted	SC				the plan	80%	√
	hinted					the solution	70%	√
	hinted					her work	90%	√
	hinted					the joke	50%	√
	hinted					the difficult word	60%	√
	hinted					the wedding	90%	√
	hinted					her patient	100%	√
46	hoped	SC				the appeal	100%	√
	hoped					the story	100%	√
	hoped					the gift	100%	√
	hoped					the data	100%	√
47	implied	SC				the beauty pageant	100%	√
	implied					her peer	60%	√
	implied					the robbery	80%	√
	implied					the lightning strike	91%	√
	implied					a new health regimen	36%	√
48	indicated	SC				the rental terms	80%	√
	indicated					the data	70%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	indicated					the merchandise	80%	√
	indicated					his photo	80%	√
	indicated					the remark	60%	√
49	inferred	SC				the raise	80%	√
	inferred					the dinner	90%	√
	inferred		his usual route	30%	√			
	inferred		the final results	10%	√			
	inferred		her friend's intentions	27%	√			
50	insinuated	SC				the trick	80%	√
51	insisted	SC				her natural skill	90%	√
	insisted		a nap	30%	√			
	insisted					the tour dates	80%	√
	insisted					her story	90%	√
	insisted					his client's innocence	40%	√
	insisted					the increased wages	80%	√
	insisted					the prices	100%	√
	insisted					the floral arrangement	100%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	insisted					the topics	100%	√
	insisted					her employee	100%	√
52	insured	DO				her peer	70%	√
	insured					a new diet regimen	50%	√
	insured					the story	80%	√
	insured		his usual route	30%	√			
	insured		his daily catch	20%	√			
	insured					the joke	91%	√
	insured					the game plan	64%	√
53	knew	DO				the appeal	60%	√
54	learned	DO	the new skill	0%	√			
	learned					her employee	100%	√
	learned					the robbery	80%	√
	learned					a following of customers	90%	√
	learned					her close friend	100%	√
	learned		his obligations	18%	√			

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	learned		the story	27%	√			
	learned					the woman	100%	√
	learned					the reopening of his store	91%	√
55	maintained	DO	a following of customers	0%	√			
	maintained		their study	10%	√			
	maintained		her neighbor's needs	30%	√			
	maintained					the prerequisite material	70%	√
	maintained		her spot	0%	√			
	maintained		his talent	30%	√			
	maintained					the lightning strike	60%	√
	maintained					the captain	80%	√
	maintained		the tour dates	20%	√			
56	noticed	DO				her patient	60%	√
	noticed		the injury	0%	√			
57	observed	DO	his colleague	10%	√			

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	observed		her employee	0%	✓			
	observed		his photo	10%	✓			
	observed		the rough water	10%	✓			
	observed		his wishes	30%	✓			
58	overheard	DO	the gossip	0%	✓			
	overheard		his dog's true intentions	10%	✓			
	overheard					her major	80%	✓
	overheard					the tip	40%	✓
	overheard					the gift	70%	✓
	overheard		the game plan	0%	✓			
59	perceived	DO	the difference	10%	✓			
	perceived					animal rights	40%	✓
	perceived					a new vaccine	40%	✓
	perceived		his dog's true intentions	10%	✓			
	perceived		the change in tension	20%	✓			
	perceived					the raise	50%	✓

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	perceived					the beauty pageant	36%	√
	perceived					the plan	36%	√
60	prayed	SC				his teammates	100%	√
61	predicted	DO				the bedtime story	55%	√
62	pretended	SC				the injury	80%	√
	pretended					the error	90%	√
63	professed	DO				his increased wages	60%	√
64	pronounced	DO	the date of the next sale	10%	√			
	pronounced					her new book	80%	√
	pronounced		her major	0%	√			
	pronounced					his teammates	60%	√
	pronounced					her natural skill	40%	√
	pronounced		the reopening of his store	30%	√			
	pronounced					the crime	70%	√
	pronounced					the novel	73%	√



Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
65	proposed	DO	a new recipe	0%	√			
	proposed					their victory	60%	√
	proposed		a new health regimen	0%	√			
	proposed					her friend's intentions	50%	√
	proposed					the scene	36%	√
	proposed					his photo	73%	√
	proposed					her kind nature	55%	√
66	protested	DO	their study session	20%	√			
	protested		the beauty pageant	10%	√			
	protested		the difficult exam	10%	√			
	protested		the outcome	9%	√			
	protested		the wedding	0%	√			
67	proved	SC	the theory	20%	√			
	proved		his commitment	0%	√			
	proved					the difficult word	80%	√
	proved		her kind nature	10%	√			
	proved					her actions	90%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	proved					a following of customers	70%	√
	proved					his new co-worker	90%	√
	proved		the date of the next sale	20%	√			
	proved		his firm beliefs	0%	√			
	proved					his obligations	60%	√
	proved		the facts	27%	√			
	proved					her major	82%	√
	proved					the increased wages	100%	√
68	read	DO	his colleague	30%	√			
	read		the scholarly journal	0%	√			
69	realized	SC	the mistake	20%	√			
	realized					his obligations	40%	√
	realized					his photo	100%	√
	realized					the infesting house	90%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	realized					her close friend	90%	
	realized		her neighbor's needs	20%	v			
	realized					his bruises	80%	
	realized		the change in tension	0%	v			
	realized					the treasure	70%	
	realized					the book	90%	
	realized					the tip	90%	
70	regretted	DO	her purchase	10%	v			70
	regretted					the scholarly journal	70%	
	regretted		the new vocabulary	20%	v			
	regretted		his defeat	0%	v			
	regretted		his extended absence	0%	v			
	regretted		the solution	10%	v			
	regretted		the facts	10%	v			
	regretted		the ending	0%	v			
	regretted		the mistake	9%	v			

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	regretted					the materials	36%	√
71	remarked	SC				the accomplishments	50%	√
	remarked					the meal	60%	√
72	remembered	DO				the captain	40%	√
	remembered		the meal	27%	√			
	remembered		the floral arrangement	27%	√			
73	repeated	DO	his usual route	0%	√			
	repeated		his guilt	20%				
	repeated		a good performance	0%				
	repeated		the difficult word	0%				
	repeated					his customer	70%	√
	repeated		the difference	0%	√			
	repeated					his personality	60%	√
	repeated		her natural skill	0%	√			
74	required	DO	the data	30%	√			
75	revealed	DO	the trick	0%	√			
	revealed		the gift	9%	√			
76	said	SC				the remark	70%	√
	said					his fears	80%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
77	speculated	SC				the appeal	70%	√
	speculated					the outcome	60%	√
	speculated					the wedding	80%	√
	speculated					her work	40%	√
	speculated					the rough water	70%	√
	speculated					the item	60%	√
	speculated		his dog's true intentions	20%	√			
	speculated					her actions	82%	√
78	suggested	SC				the scene	60%	√
	suggested					the meal	60%	√
	suggested					his customer	80%	√
	suggested		a new health regimen	10%	√			
	suggested		the tour dates	9%	√			
	suggested		a new recipe	0%	√			
	suggested					the new skill	64%	√
	suggested					his extended absence	82%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
79	supposed	SC				his extended absence	90%	√
	supposed					the beliefs	80%	√
	supposed					the topics	100%	√
	supposed					the raise	80%	√
	supposed					the new vocabulary	100%	√
80	suspected	SC	the workers	30%	√			
	suspected					the women	80%	√
	suspected					the difficult exam	60%	√
	suspected					her employee	40%	√
	suspected					the lazy employee	64%	√
	suspected					his new co-worker	55%	√
	suspected					screaching breaks	73%	√
	suspected					his difficult training	82%	√
	suspected					the prerequisite material	91%	√
81	thought	SC				the guests	100%	√
	thought					his teammate	100%	√

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	thought					the plan	80%	√
	thought					the lazy employee	100%	√
	thought					his collection of work	100%	√
	thought					the hurtful accusations	100%	√
	thought					his wishes	100%	√
	thought					his client's innocence	100%	√
	thought					his next day's victory	100%	√
	thought					their financial earnings	100%	√
82	understood	DO	her friend's intentions	0%	√			
	understood					his bruises	70%	√
	understood		his neighbor's needs	10%	√			
	understood					the treasure	50%	√
	understood		screeching breaks	30%	√			
	understood		the appeal	0%	√			
	understood		the book	0%	√			

Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
83	warned	DO				the students	40%	√
	warned		the lazy employee	20%	√			
	warned					her actions	90%	√
	warned					the final results	100%	√
	warned					the essay	100%	√
	warned					the issue	60%	√
	warned					the exam	90%	√
	warned		his teammate	20%	√			
	warned					his fears	50%	√
	warned		the passengers	18%	√			
	warned					the trick	100%	√
	warned					her work	82%	√
	warned					the accusations	91%	√
84	worried	SC	the passengers	30%	√			
	worried					the rough water	100%	√
	worried					her doctor	60%	√
	worried					his teammate	80%	√
	worried					his wishes	90%	√



Item #	Verb	Verb Bias	Plausible DO	% Completed	Good DO	Implausible DO	% Completed	Bad DO
	worried					the facts	80%	√
	worried					the plan	90%	√
	worried					the topics	100%	√
	worried					the issue	80%	√
	worried					her clientele	73%	√
	worried					the students	73%	√
	worried					the captain	73%	√
	worried					her peer	64%	√
	worried					his dog's true intentions	82%	√
85	wrote	DO	his customer	0%	√			
	wrote		the final results	0%	√			
	wrote		his coach	0%	√			
	wrote		the item	30%	√			
	wrote		the essay	0%	√			

## 5. Discussion

In order to accurately read and understand sentences, a complex series of processes must take place. Indeed, the human capacity to take in a rapid stream of words, understand them, and integrate them into a meaningful sentence is rather impressive. This capacity is particularly remarkable in view of the vast amount of ambiguous sentences that readers face. Because readers face such ambiguities so frequently, researchers have proposed two models for how readers disambiguate these types of sentences.

The first model is known as *the two-stage model of language comprehension*. This model postulates that, when readers encounter a syntactically ambiguous structure, they will solve it by choosing the simplest possible structure. If readers' initial sentence interpretation is incorrect, they must go back and reinterpret.

The second model is called the *constraint-based lexicalist model*. In this model, multiple factors are used to assign an interpretation to a syntactically ambiguous noun phrase. Two of these factors include *verb bias* and *plausibility*. Verb bias, which refers to a given verb's tendency to be followed by a particular structure, has been shown to have a significant impact on sentence processing, particularly in monolinguals (Garnsey et al., (1997)). In fact, syntactic strategies such as verb bias seem to be preferred by monolinguals when they process sentences. However, there is a lack of evidence on how bilinguals process sentences.

Some studies (i.e. Dussias & Piñar, 2009) have discussed research that highlights how monolinguals and bilinguals make use of different strategies when interpreting sentences. Much of this research led Clahsen and Felser (2006) to develop the *shallow structure hypothesis*. This hypothesis predicts that L2 speakers use fundamentally different processes when interpreting sentences. In particular it predicts that monolingual language learners use syntactic strategies, such

as verb bias, to interpret sentences, while bilingual language learners use semantic strategies, such as plausibility, to interpret sentences.

One way to test the shallow structure hypothesis of bilingual sentence processing could be to conduct a study similar to Garnsey et al. (1997) using proficient second language speakers of English. Specifically, ERPs could be employed to examine the immediate effects of semantic and syntactic anomalies on sentence processing. However, in order to attain the quantity of items necessary to conduct an ERP study, a norming study was required to determine whether the target nouns following direct object bias verbs and sentential complement bias verbs are considered to be plausible or implausible completions by native speakers of English.

In the norming study, a group of 41 monolingual English speakers were presented with one of four sets of sentence fragments. Their task was to indicate whether the fragment was plausible. In case of an implausible fragment, a completion was also required. The results are provided in full in Table 1.

There were several important lessons to be learned from the difficulties encountered in this norming study. First, after participants had been run, a group of 2 undergraduate students, a graduate student, and a faculty member all took part in the coding process. As was mentioned earlier, items were coded in six categories. Due to differences in interpretation, there was a lack of agreement between coders on the application of these categories. For instance, in the following example there was disagreement on whether to code the item as 2 (Direct Object Complement with Obligatory Prepositional Phrase) or 3 (Direct Object Complement with Optional Prepositional Phrase) (participant completion underlined).

(28) *The spelling bee champion established the difficult words as impossible.*

Some coders felt that the completion *as impossible* was an obligatory propositional phrase while others felt that it was an optional prepositional phrase. In order to solve this issue, the group of coders looked at all questionable items and discussed the possible coding options until they came to a consensus. In this manner, all disputed items were resolved. However, it would be advantageous for future norming studies to define their coding categories more clearly. This would make the entire analysis easier and more accurate.

This study also highlighted the overwhelming effect that verb bias can have on monolingual English speakers. As has already been explained, participants were instructed to complete sentence fragments **only** if they were implausible. However, upon receiving participants' responses, the researchers involved in this study discovered that in some cases participants completed fragments even if they were plausible. The following examples illustrate this point (participant completions underlined).

(29) *The psychologist believed her close friend was going through PTSD.*

(30) *The college professor worried the students would not pass.*

In examples (29) and (30) *The psychologist believed her close friend* and *The college professor worried the students* are both semantically plausible sentences, yet the participants still decided to add completions. These were not isolated incidents. In fact, several sentential complement bias verbs, including *believed*, *worried*, and *admitted*, seem to have such a strong bias that they impacted how participants viewed plausibility. Indeed, this is a very interesting finding that should be studied further in future studies. But, for the purposes of this norming study, this effect of verb bias interfered with the analysis of plausibility. So, the student coders and a linguistics faculty member examined all of the items to determine which had been affected by this issue. Then, they determined whether or not the items actually were plausible. In order to avoid this

issue, future norming studies should ensure that participants know that they must only complete the sentence fragments if they are implausible on their own.

This issue also brings to light the importance of clear instructions for participants. When they arrived, participants were instructed to indicate whether the sentence fragment “made sense” by pressing “OK”. But, “made sense” is, in itself, a phrase that is open to interpretation. In other words, an item that one participant thought was implausible, another may have thought was plausible, especially if the noun phrase was ambiguous. The following example illustrates this point.

(31) *The wealthy couple figured their financial earnings*

In this item, some of the participants indicated that it was plausible, but others felt that it needed to be completed. Therefore, it would be wise for future norming studies to make their instructions as clear as possible in order to avoid any confusion on the part of the participants. Additionally, future norming studies should recruit more than 41 participants, in order to further diminish the individual effects of participants. These changes would also almost certainly improve the validity of the results.

So, now that all of the experimental items have been normed, they are ready to be loaded into the ERP software. This ERP study will seek to replicate Garnsey et al. (1997) using proficient L2 speakers of English. In so doing, it will examine the immediate effect of plausibility on bilingual language learners in order to put to test the shallow structure hypothesis. In addition to its importance in validating the materials for the ERP study, this norming study will provide valuable information for subsequent norming studies and other studies seeking to examine the effect of plausibility as a semantic strategy.

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## Appendix A

Verb Properties Table

<b>SC Bias</b>	Direct Object Bias	Sentential Complement Bias	Other Bias	<i>That</i> Preference
admitted	0.11	0.61	0.28	0.63
argued	0.11	0.35	0.54	0.89
assumed	0.1	0.9	0	0.57
believed	0.14	0.5	0.36	0.61
claimed	0.06	0.68	0.26	0.58
concluded	0.14	0.81	0.05	0.83
confessed	0.2	0.49	0.32	0.71
decided	0.02	0.15	0.83	0.69
figured	0.07	0.48	0.46	0.53
hinted	0.01	0.64	0.35	0.83
implied	0.08	0.9	0.02	0.83
indicated	0.27	0.7	0.03	0.71
inferred	0.1	0.76	0.14	0.88
prayed	0	0.37	0.63	0.8
pretended	0.01	0.25	0.74	0.52
proved	0.23	0.61	0.16	0.62
realized	0.19	0.8	0.01	0.62
suggested	0.21	0.73	0.07	0.69
suspected	0.3	0.68	0.02	0.6
worried	0	0.24	0.76	0.71

<b>DO Bias</b>	Direct Object Bias	Sentential Complement Bias	Other Bias	<i>That Preference</i>
accepted	0.97	0.02	0.01	1
advocated	0.87	0.05	0.08	1
asserted	0.66	0.31	0.03	0.94
confirmed	0.74	0.26	0	0.86
discovered	0.7	0.3	0	0.69
emphasized	0.79	0.18	0.03	0.74
established	0.94	0.06	0	1
forgot	0.37	0.03	0.6	1
found	0.9	0.07	0.03	0.86
heard	0.76	0.16	0.08	0.82
insured	0.85	0.13	0.02	0.86
learned	0.6	0.19	0.21	0.95
maintained	0.74	0.23	0.03	0.8
printed	0.77	0.01	0.22	1
proposed	0.46	0.16	0.38	0.88
protested	0.6	0.11	0.29	0.92
repeated	0.94	0.05	0.01	0.6
understood	0.91	0.09	0	1
warned	0.76	0.11	0.13	0.83
wrote	0.9	0	0.1	1



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