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The Effect of the Semantic Depth of Spanish
Verbs on Processing Demands of
Filler-Gap Relationships in
Noun Clauses

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A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of
Master of Arts

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ABSTRACT

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This study explored the relationship between syntax and semantics in an effort to provide evidence against a strict theory of the Autonomy of Syntax. The evidence was provided by an acceptability survey given to 20 native, adult Mexicans who ranked both declarative and wh-questions which manifested a filler-gap relationship where the gap was located in an embedded noun clause. The main verbs were controlled for semantic depth by being ranked within verbal categories according to external evidence of markedness or semantic depth. The primary hypothesis was that semantically deeper verbs would add to the already increased strain on working memory associated with filler-gap processing, thereby resulting in decreased acceptability. The results of the survey showed that, while this hypothesis held true to some degree, further research will be required to confirm the results and to further understand the intricate interactions between syntax and semantics.

Keywords: Autonomy of syntax, semantic depth, markedness, wh-movement, filler-gap, processing, working memory

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Chapter 1– INTRODUCTION

Statement of the Problem

In his 1957 book *Syntactic Structures*, Noam Chomsky penned the now-famous sentence in (1):

(1) Colorless green ideas sleep furiously (p. 15).

This sentence was meant to prove that syntax and semantics work independently of one another. Instinctively, a native English speaker can recognize that (1) satisfies certain syntactic rules, and this knowledge is available in spite of the lack of any interpretable meaning. In this one instance, semantics have been manipulated to the point of absurdity without affecting the syntactic integrity of the sentence. In a literal reading of (1), the adjectives are contradictory and completely incompatible with the abstract subject which, being inanimate and even incorporeal, is incapable of doing the action indicated by the verb. Even though (1) conveys no interpretable information, the ordered pattern of adjective, noun, verb, adverb is familiar enough that (1) sounds or feels like a real sentence.

However, this is not to say that all sentence structures remain intact regardless of semantic chaos, nor does it prove that syntax and semantics are completely and in all ways immune to influence one from the other. Note that Chomsky's example follows a fairly basic and common pattern. But would acceptable syntactic structures be as readily identified if a meaningless jumble of words represented a question, a prepositional phrase, or an embedded clause? For example, a sentence like (2):

(2) Why didn't she like the man that she met in the lobby of the hotel she stayed in in
Phoenix?

poses no real difficulty in interpretation and is a perfectly well formed sentence. But can the same be said if we replace each element with arbitrary lexicon while maintaining the syntax, as in (3)?

(3) Where didn't they paint the liberty that twisted us of the mountain against the spaceship you danced between under the lake?

The question then becomes, have we affected something besides interpretability or has the grammatical acceptability of this sentence remained unscathed? Clearly, (3) is not the most complex syntactic structure available in English. Recursive structures could be applied again and again. As the syntactic complexity increases, will there come a point at which semantic disregard would prove to be too much for the syntactically intricate sentence?

Justification of the Problem

Chomsky's sentence in (1) contributed much to the discussion about the "Autonomy of Syntax" (although Chomsky himself did not use that term) (Barsky, 1997, p.157). Compelling arguments for and against the theory have been offered by many linguists, some of which we will explore in the second chapter. The goal of this study is to provide further evidence against the autonomy of syntax by showing a direct and gradient link between semantics and syntax. This will be accomplished by establishing a continuum of denotative specificity among similar verbs. In other words, my experiment is designed to show that gradual changes in semantics will lead to gradual decline in syntactic acceptability, thus furthering our understanding of the nature of the relationship between lexical semantics and syntax.

Delimitation of the Problem

The goal of this study is to explore the relationship between syntax and semantics as evidenced in more complex structures than the one seen in example (1). Specifically, I will focus

on noun clauses, mainly when embedded in wh-questions, but also in declarative sentences. The syntactic interpretation of these sentences depends upon proper processing of filler-gap relationships. In order to maintain the clearest and most relevant filler-gap contexts, I will limit the wh-words to *qué*.

It should be noted that, although I borrow certain terms from research regarding wh-movement, the actual theory of wh-movement, what it entails or does not entail, and the implications of any specific wh-theory are beyond the scope of this study. In using these terms, I am facilitating the discussion of how the interlocutor understands a wh-question without pledging allegiance to any specific theory about how or why the question came to be structured that way.

To facilitate semantic analysis, I will limit the verbs that introduce the noun clause to three categories: verbs of diction (commonly known as *verbi dicendi*), verbs of cognition (commonly known as psych verbs), and verbs of volition. This will facilitate a ranking, or in other words, a consideration of the differences in the amount of specific lexical information associated with each verb root. It is expected that as the denotative specificity of the verbs under consideration increases, the grammatical acceptability of the sentence will decrease, as measured by an acceptability survey. It is further expected that the wh-questions and their declarative counterparts will reveal a comparable continuum, but that the highest (most acceptable) rating for the wh-question group will be slightly lower than the highest for the declaratives, with a similar difference at their low point. In other words, in each wh-question and declarative pair, the declaratives will receive a higher score. For example,

(4) *¿Qué dijo Pedro que comió ella?*

is expected to be less acceptable than its declarative counterpart,

(5) *La novela que₁ dicen que₂ fue escrita por ese hombre no lo fue.*

This result is expected because “the lack of a specified, identifiable referent associated with a *wh*-interrogative filler potentially presents an additional cognitive challenge” (Hofmeister, Jaeger, Sag, Arnon, & Snider, 2007, p. 186). So, *que₁* in (5) should be easier to process than is *qué* in (4) because in (5) we already know that *que* refers to *la novela*.

In this way I expect to demonstrate that incremental changes in lexical semantics correlate with changes in the syntactic integrity of the sentence, as evidenced by an acceptability survey. This will provide further evidence for the connection between syntax and semantics.

Chapter 2 – REVIEW OF THE LITERATURE

The Autonomy of Syntax

Before examining some of the evidences for and against the autonomy of syntax, perhaps it would be wise to be clear as to what the theory claims and what it does not claim. Newmeyer (2009) defines the autonomy of syntax as follows: “The rules (principles, constraints, etc.) that determine the combinatorial possibilities of the formal elements of a language make no reference to constructs from meaning, discourse, or language use” (p. 176). The proposition that this study challenges is that no syntactic rule can make reference to meaning. Or, in other words, lexical semantics cannot serve as the basis, motivation, or even a consideration for constructing or defining syntactic rules.

Later, in what appears to be an attempt to soften this claim, Newmeyer clarifies:

There would be no ‘autonomous syntacticians’ if, in order to qualify as one, one had to reject rules linking form and meaning.

In a nutshell, to motivate the autonomy of syntax, it is necessary to demonstrate the correctness of the following two hypotheses:

(6) a. There exists an extensive set of purely formal generalizations orthogonal to [independent of] generalizations governing meaning or discourse.

b. These generalizations ‘interlock’ in a system (p. 178).

It is interesting here that Newmeyer concedes that there are rules “linking form and meaning”, but, as we must gather from the use of “orthogonal” in (6a), he rejects any relationship of causality. In other words, the theory of autonomy dictates that semantic considerations cannot motivate syntactic rules. This is the theory of autonomy against which I will argue. I do not intend to prove, nor do I believe it possible to prove, the opposite end of the argument—that

syntax has no autonomous features and is always and completely dependent on semantics. I argue instead for a sort of middle ground, where syntax is allowed to (and indeed, required to, at times) reference semantics in the formation of its rules.

One does not need to look far to find evidences for the autonomy of syntax that are far more convincing than Chomsky's arbitrary sentence about green ideas. A simple consideration of the different kinds of aphasia, for instance, lends considerable credence to the notion. In the case of expressive (or Broca's) aphasia, patients can still express themselves, but with only the most basic syntax. This type of aphasia involves the use of meaningful words, but grammatical elements such as modal verbs and inflections are absent (Joynt, 2012). In other words, semantic linguistic ability remains intact while syntactic capabilities are severely limited, so a patient with Broca's aphasia might say something like, "Daughter...sing...choir..." Wernicke's aphasia, on the other hand, has exactly the opposite effect on speech. Syntactic structure is unaffected while the patient experiences anomia, or great difficulty remembering the names of simple things, such as colors. Circumlocution is common in such patients (Haines et al., 2012). So, a patient with Wernicke's aphasia, in response to a question like, "Why didn't you come to the party?" might say something like "Well, I couldn't get the children into the shoe, you see, so the mountain all came crashing down." One possible implication would be that syntax and semantics operate in independent parts of the brain, because injury to one area seems to affect one linguistic area more than another.

One interesting study that might seem to support the idea that syntax and semantics operate in separate areas in the brain comes from Kuperberg, et al. (2003). The aim of this study was to address several weaknesses and contradictions apparent in previous attempts to differentiate syntactic and semantic processing on the neurological level. To accomplish this, the

authors measured brain activity of subjects while presenting them with sentences that were either semantically or syntactically anomalous, as in (7):

(7) a. We couldn't sleep because the baby would remember. (semantically anomalous)

b. We couldn't sleep because the baby would cries. (syntactically anomalous)

Unsurprisingly, given what we know about aphasia, syntactically anomalous sentences triggered brain activity in a different locus than the semantically anomalous sentences. Consider the graphs below, taken from the study, where each dot represents an electrode placement and the darker areas represent the areas of most brain activity.

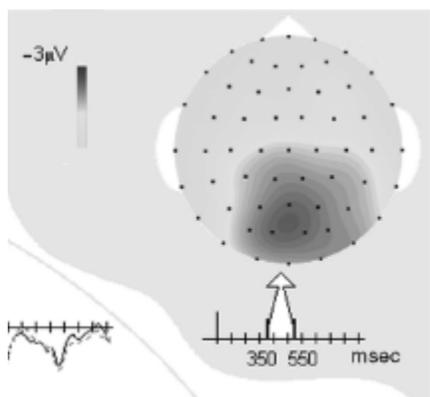


Figure 1. Brain activity when presented with a syntactically anomalous sentence (Kuperberg et al., 2003, p.276).

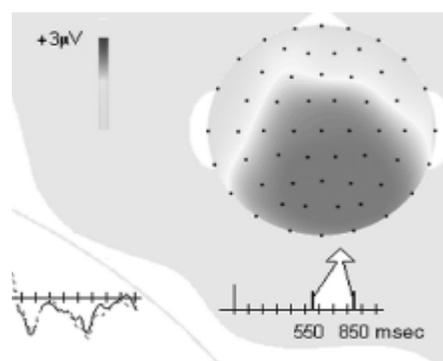


Figure 2. Brain activity when presented with a semantically anomalous sentence (Kuperberg et al., 2003, p. 278).

Figures 1 and 2 show that the brain reacts differently to each type of anomaly, which might seem to corroborate the autonomy of syntax.

Note, however, the significant overlap. It is as impossible to completely separate syntax from semantics in the brain as it is in theory. With any exposure to language, the brain will try to find meaning, for that is the purpose of language.

The theory of the autonomy of syntax is, however, anything but unquestioned. Several compelling arguments for a semantically influenced view of syntax are presented in Anderson

(2005), and here I will review some of the most convincing. First, let us consider the example of German adverbial placement, which has clear parallels in other languages. Anderson notes that in German, comitative adverbial phrases normally precede instrumental ones, as in the following example:

- (8) a. Er hat (zusammen) mit einem Freund mit einem Kleintransporter
He has (together) with a friend with a minivan
 den Schrank herbeigeschafft.
the wardrobe hither brought.
 ('He (has) brought the wardrobe here with (the help of a friend in a mini van.')
- b. (?) Er hat mit einem Kleintransporter (zusammen) mit einem Freund den Schrank herbeigeschafft (p. 230).

Upon considering this example and its implications, some might easily consider the difference to be purely syntactic, claiming that the different adverbial types simply possess different syntactic characteristics or precedence. However, if syntax were truly and completely blind to semantics, it could not distinguish between the adverbial classes in order to rank their syntactic order. And, as Anderson (2005) notes, "such semantically grounded discriminations in word order are not uncommon" (p. 230).

Anderson's next argument in favor of a semantically-grounded syntax is based on an example that, although by itself is perhaps susceptible to criticism, nevertheless demonstrates a sound principle. Consider the following sentence adapted from Anderson (2005):

- (9) *On Tuesday I saw Jane leave on Wednesday.

I consider this to be a somewhat weak example because it is not impossible to imagine a context that reconciles the apparent disagreement of time. For instance, a clairvoyant could be announcing that he saw Jane's departure a day before it happened. Without any sort of context, the sentence is admittedly difficult to process, because the two verbs in the sentence are

immediately related and yet marked for different times. Note, however, that this does not pose a problem in all such sentences.

(10) On Tuesday I urged Bill to leave on Wednesday.

The syntactic difference between these two examples (the use of the bare infinitive *leave* vs. the periphrastic infinitive *to leave*, as well as the acceptability) cannot be attributed to syntactically different verbs, since both *saw* and *urged* are full verbs, which should take the periphrastic infinitive *to leave*. Anderson attributes the difference to the special category of verbs which he calls ‘verbs of direct perception’.

(11) I saw Bill leave. I heard Bill leave. I felt Bill tremble (pp. 231-232).

This syntactically different classification of whether to insert a periphrastic or bare infinitive is governed by semantic distinctions, and is thereby in violation of Newmeyer’s claim of syntactic autonomy.

Anderson’s next example comes from the distribution of the personal *a* in Spanish. The personal *a* is generally required when a direct object represents a definite human being, as opposed to, for example, inanimate objects (provided the subject is animate); this grammatical marker is obviously sensitive to semantic distinctions.

As an aspect of its functional motivation, the distribution of *a* can be sensitive to the semantics, particularly the extent to which the two arguments occupy the same position on the ‘animacy hierarchy’, since in Spanish, the subject and object can occur in any order, as evidenced in (12):

(12) a. Dibujaba a la niña el niño.

b. Atravesó (*a) la procesión un camión (p. 234).

Additionally, according to Anderson, the use of ‘a’ in (12b) is deemed ungrammatical by many Spanish speakers because the semantics of the sentence renders such clarification unnecessary.

The verb *dibujar* in (12a) provides an interesting context for furthering Anderson’s argument. If we change the sentence to avoid any ambiguity between subject and object, we find another case of semantics governing the presence or absence of the personal *a*. Consider the difference between the following sentences:

(13) a. Yo dibujé una niña.

b. Yo dibujé a la niña.

The *niña* in (13a) can only be referencing a drawing of a girl. By contrast, the *niña* in (13b) refers to the model, not the drawing. The presence of the personal *a* is required by the animate object but is incompatible with an inanimate object (unless ambiguity requires it, as shown above). An autonomous view of syntax would have to rule out this kind of information (Real AcademiaEspañola, 2009, p. 2643).

The most compelling argument for the non-autonomy of syntax offered by Anderson may well be the most general. That is the idea that syntax, at its very core, in its very purest form, relies upon categorical differences that are inherently and unavoidably semantic. In other words, it is impossible to construct any sort of syntactic representation without mention of certain basic syntactic building blocks such as nouns and verbs. Without *semantic* distinctions between events (verbs) and entities (nouns) it is impossible to discuss word order, for it is impossible to distinguish types of words. Thus, the attempt to make syntax truly autonomous of semantics is self-destructing, for, in removing any recognition of semantic distinctions, one also removes the

most basic vocabulary needed to discuss syntax, the word categories upon which any grammar is built.

Goldberg (1995), in expounding a construction grammar approach, provides the following examples of “implausible verb senses”:

(14) He sneezed the napkin off the table.

(15) She baked him a cake.

(16) Dan talked himself blue in the face (p. 9).

Goldberg notes that, intuitively, the lexical entries for the verbs use in (14)-(16) should not allow the complements that they have taken in these examples. A syntactic explanation for such an anomaly would require, essentially, two lexical entries for each verb, the extra entry accounting for the anomalous transitivity shown in (14). In other words, such a distinction would imply that there are two homonymous lexical entries that have identical lexical meanings but different subcategorization features (Goldberg, 1995, p. 10). Goldberg argues that ditransitive constructions as exemplified above are acceptable due to analogy with similar constructions based on truly ditransitive verbs (resultative constructions). However, not all verbs are eligible for insertion into this pattern. Consider what happens when we manipulate the previous examples:

(17) ? He baked the napkin off the table.

(18) ? She sneezed him a cake.

In these examples, the construction has not changed. However, in contrast with examples (14)-(16), the overall acceptability of the sentence has decreased—again, in spite of syntactic equality. Thus, implausible verb senses are admissible only when the overall sentence makes sense, a condition incompatible with the theory of the autonomy of syntax. One might note as well,

especially with example (14), that while the transitivity of the verb is implausible, the sentence itself is perfectly natural. The same cannot be said of examples (17) and (18).

Before moving on to the next section, let us briefly examine two more arguments posed by Jackendoff (2005) that support the notion of a semantically governed syntax. First, he gives the compelling example of “prepositional passives”, where the grammaticality of the sentence seems to be dependent on whether or not the sentence reflects a canonical use of the object.

(19) a. The bed was slept in/on/??under/??beside by John.

b. The telescope was looked through/??inside by the technician (p. 6).

One might argue that the alternative prepositions are still acceptable, but it seems clear that they are at least less acceptable than the canonical ‘in’ and ‘through’. Any attempt to syntacticize the differences in grammaticality in the examples above must either admit to some semantic considerations in rule formation (which would contradict the theory of the autonomy of syntax as defined above by Newmeyer) or add arbitrary stipulations and exceptions, which would weaken the explanatory power of any theory.

The second set of examples from Jackendoff (2005) that will be mentioned here forms the springboard for the present study.

(20) a. What_i did Bill say/??grumble that Harry would like t_i for lunch?

b. The man who_i Bill said/*grumbled that Harry met t_i ordered a bagel.

c. This book is longer_i than you said/*grumbled that it was t_i (p. 9).

Jackendoff explains that the difference in grammaticality here has to do with a purely semantic difference in representation. Even though the two verbs in question (*say* and *grumble*) both represent speech acts, *grumble* has the additional property of denoting manner. Using data similar to that of (20a) and (20b), the goal of the present study is to give additional evidence that

ungrammaticality results from semantic differences and cannot be explained away by appealing purely to syntax.

Semantic Depth

In order to discuss the effect of semantic depth on processing and therefore on syntactic acceptability, it is necessary first to discuss what is meant by semantic depth within the framework of this study. In the correlation pair *lion* and *lioness*, we see a distinction that is manifest in both morphological and semantic markedness. The word *lioness* is morphologically marked in that it contains an additional morpheme, and hence additional phonological information as well. It is also semantically marked in that it also denotes the idea of female, whereas the word *lion* can be applied to both genders. For example, a lion and a lioness could be called a pair of lions but not a pair of lionesses. Thus, *lion* lacks the same level of gender specificity and is therefore less semantically marked than *lioness*. In this pair there is an evident relationship between the two types of markedness (morphological and semantic). However, the exact nature of the relationship between them, causal or otherwise, is beyond the scope of this study, and in this study all references to markedness indicate semantic depth. This study will focus only on semantic markedness, or semantic depth, meaning the denotational specificity of a given word.

Semantic depth is predicated on Peirce's idea of "intrinsic signification", or "that portion of the sign providing the positive information unique to that sign" (Robertson, 1998, p. 1). Robertson considers semantic depth an important indicator when determining markedness. So in the correlational pair *man* and *men*, the word *men* is 'marked' for plurality (Robertson, 1998, p. 4). In other words, the plurality of *men* is, within the correlational pair, unique to that sign. Note

again that the less marked *man* can stand in for the more marked *men* and can encompass the feminine as in the following examples:

- (21) a. Pride is man's downfall.
 b. man-eating shark
 c. man-to-man defense

In terms of verbs, which are more pertinent to the present study, consider the correlational pair *think* and *learn*. Thinking denotes mental activity, while learning additionally implies understanding and new information. Since *learn* carries additional and unique information, it is the more semantically marked of the pair. Unsurprisingly, *learn* is less frequent a word in English than *think*, having 12,640,466 and 47,485,437 tokens in Mark Davies' Google Book American English Corpus, respectively (Davies, 2011). This difference in frequency is because, with its additional (unique) information (markedness) it is restricted to fewer possible uses, applications, or contexts. Robertson attributes this to the Law of Inverse Proportionality, an idea that will be of great importance in the following chapter and which will be discussed in greater depth there. Additionally, as with the pairs *lion/lioness* and *man/men*, the less marked version is acceptable in contexts that would also permit the more marked, but not vice versa. Thus, because *do* can replace almost any English verb, it will be more frequent than almost any English verb.

Wh-Movement and Filler-Gap Relationships

The processing of filler-gap relationships constitutes the context or framework for examining the effect of semantic depth or markedness on syntactic acceptability in the present study. It is hypothesized that the lexical semantics of certain verbs will have an effect on acceptability ratings of certain syntactic configurations. In this section we will discuss both what

those syntactic configurations consist of and their bearing on the present study. First, let us settle the issue of terminology. What Newmeyer calls an operator-variable configuration, Chomsky calls a chain, the variable part of which he calls a trace. For simplicity, I will discuss this phenomenon in the common terms used by Goodal, or fillers and gaps. Also, although this relationship exists in multiple syntactic contexts (topicalization, comparatives, etc.), only wh-movement and relative clauses will be used in the present study. I will start by examining the structure within wh-questions.

In order to demonstrate the formation of a filler-gap relationship, consider the declarative sentence below, where x represents the missing piece of information.

(22) Juan compró x .

In order to transform this sentence into a question that asks the hearer to provide x , two transformations need to occur. The speaker must replace x with a wh-word (what we will call the filler), and that word must then be moved to the front of the clause¹. Although not all theories agree that movement occurs while forming this type of sentence, the notion of a trace where the Θ -role would normally be assigned is widely accepted. Whether or not movement actually occurs has no bearing on my research, and I will not address it here. Additionally, in using certain visual representations or terms from certain theories on wh-movement, I do not intend to communicate that I ascribe to those schools of thought. I borrow from their visual and verbal representations as a sort of pretheoretical means to discuss the topic at hand.

Chomsky argues that even after x moves, some element is left in the place of x , which he calls a trace, and which we will call a gap. “The chain is assigned a Θ -role by virtue of the fact

¹ Clearly I am limiting myself here to the least marked, most canonical sense of a question. For the purposes of this thesis I will not discuss less canonical structures, such as *in situ* fillers, for example, ¿Juan compró qué?

that one of its members (namely the trace [gap]) occupies a Θ -position” (Chomsky, 1982, p. 5).

Thus, in the question version,

(23) ¿Qué_i compró t_i Juan? ²

qué represents the direct object of the verb *comprar*, which, in an unmarked declarative sentence, would be located after its verb. In this construction *qué* is the filler and its gap (t) is found after *comprar*, in the unmarked direct object position where it receives its Θ -role. The hearer cannot understand or answer the question without, on some level, understanding the filler-gap relationship, thus understanding which piece of information is missing for the speaker and which piece of information the hearer is requested to provide. To paraphrase Goodall’s explanation, hearers cannot interpret the question until they locate the gap to which the filler corresponds (Goodall, 2004, p. 102). Thus, as in (23), *qué* indicates that the missing information is a noun, but it is not until hearers understand the Θ -role assigned to that noun (by finding the gap after *comprar*) that they are able to process the question.

We find a similar structure in declarative sentences that contain embedded noun clauses.

Consider the following examples.

(24) a. A boy came to the party.

b. I thought you liked him.

In (24a), the boy is the subject, whereas in (24b) he is the object of the verb *like*. Upon combining the sentences we have a single referent receiving different Θ -roles from different governing verbs, as follows.

(25) The boy whom_i I thought you liked t_i came to the party.

Also, some languages (i.e. English) allow for the relative pronoun to be omitted, as follows.

² The additional movement of *compró* to its position before the subject *Juan* will be addressed below, in the Processing section.

(26) The boy_i I thought you liked t_i came to the party.

So, as in (25), there is a gap after a verb which must be linked with the direct object or filler for comprehension to take place.

Most of the literature regarding wh-movement focuses on island constraints, which are certain syntactic contexts that prevent or disallow movement (Ross, 1967). For example, a filler cannot be extracted from a subject clause, as demonstrated in (27).

(27) *What_i did [the fact that Robert forgot t_i] disappointed his wife?

This sentence should mean that Robert forgot something that disappointed his wife and we want to know what he forgot. However, this syntactic context does not allow for movement and the sentence is ungrammatical.

The following examples from Gieselman, Kluender, & Caponigro (2011) demonstrate the rules governing extraction from negative clauses:

(28) a. Which project_i didn't the intern complete t_i conscientiously?

b. *How_i didn't the intern complete the project t_i? (p. 2).

Thus, extraction of an argument is acceptable, as in (28a), but extraction from an adjunct, as in (28b), is not. Rizzi (1990) proposes that extraction from negative clauses is possible only for referential expressions (e.g. *which project* in [28a]) but not for non-referential expressions (e.g. *how* in [28b]). Though the many syntactic constraints themselves are not of great importance to the present study, they serve to demonstrate the common, purely syntactic approach to understanding the limitations of filler-gap relationships.

This purely syntactic approach to understanding island constraints is common, but not universal. Gieselman, et al. (2011) used a perceived acceptability survey to rank positive and

negative questions of three types: yes/no, subject wh-questions, and object wh-questions, such as found in the following examples:

- (29) a. a. Did the politician support the bill in the caucus?
 b. Didn't the politician support the bill in the caucus?
 c. Which politician supported the bill in the caucus?
 d. Which politician didn't support the bill in the caucus?
 e. Which bill did the politician support in the caucus?
 f. Which bill didn't the politician support in the caucus? (p. 4)

In this way Gieselman et al. were able to examine the processing costs incurred by each difficult element—negation, extraction, and non-referentiality. The findings show that each of these elements constitutes some processing cost and that the sum of them is what makes (29f) the least acceptable of the set. It is this approach—the appeal to processing constraints—upon which the hypothesis of this study is founded and which will be explored more in depth in the following section.

Processing

In order to connect the filler with its respective gap, the filler must be held in working memory. It is easy to question whether or not language interpretation could actually be mentally strenuous, given the immense capacity of the human brain as well as the fact that linguistic interpretation is such a constant and so often unconscious part of our lives, but there is much evidence supporting the notion that only limited amounts of energy are available at any given time to be dedicated to linguistic processing. The evidence provided in this section will also show that both semantic considerations and wh-movement increase the processing demands of sentences, central hypotheses to the present study.

Using a Rapid Serial Visual Presentation (RSVP) test, Holmes and Forster (1972) provided evidence in favor of the Verb Complexity Hypothesis of Fodor, Garrett, and Bever (1968) by comparing the effects of simple vs. complex verbs on word recall. Within this theory, a simple verb is able to take fewer types of complements than a complex verb. For example, *meet* can be used as an intransitive, as in:

(30) We met at the restaurant.

or it can take a noun phrase object as in:

(31) I met a beautiful woman.

On the other hand, *know*, in addition to the two possible complement types above, can take a sentential complement, as in (32):

(32) a. I already know.

b. They knew the truth.

c. He knows she was lying.

Hence, according to the Verb Complexity Hypothesis, the complex verb *know*, when used as the main verb, should lead to more difficulty in processing than a simpler main verb like *meet* (Fodor et al., 1968, p. 455). In the RSVP test of Holmes and Forster (1972), individual and sequential words from sentences were rapidly shown to participants. Participants were then asked to reproduce as many words from the sentence as possible. Results showed that participants remembered more words of sentences when the main verb was simple, like *meet* above, than words of sentences with complex main verbs, like *know* above. The conclusion is that complex verbs pose a greater difficulty in processing, meaning that less linguistic capacity is available for committing words to memory.

A study by Deutsch, Bentin, and Katz (1994-1995) used Hebrew gender agreement and animacy to test response times and used those response times as evidence of relative processing difficulty. Participants were exposed to four types of sentences: syntactically congruent (meaning the subject and verb were marked for the same gender) and animate, syntactically congruent and inanimate, syntactically incongruent (mismatched gender markers) and animate, and syntactically incongruent and inanimate.

After brief exposure to the sentences, the participants were required to identify elements of the sentence. Their study showed that response times after inanimate and animate sentences were similar when the sentences were syntactically congruent. However, in the syntactically incongruent sentences, response time (i.e. processing demand) for an animate subject was significantly longer than for an inanimate subject (Deutsch et al., 1994-1995, p. 228). So, for example, assuming both (33a) and (33b) are incongruently matched for gender, (33a) would have incurred a greater processing cost than (33b):

(33) a. The woman saw that the boy had fallen into the pond (*boy* is animate, but *had fallen* is incorrectly marked for feminine).

b. The woman saw that the necklace had fallen into the pond (*necklace* is an inanimate, feminine noun and *had fallen* is incorrectly marked for masculine) (Deutsch et al., 1994-1995, p. 208).

This increase in processing time for animate subjects was attributed to the fact that misassigning gender to a subject that has a biological gender interrupted the meaning more than misassigning gender to a subject whose gender was purely grammatical. In other words, a sentence with an inanimate subject that was syntactically incongruent was only incongruent

syntactically, since gender of inanimate objects is purely arbitrary. With an animate subject, however, a syntactically incongruent sentence poses an additional difficulty.

Apparently, readers are more disturbed by violation of gender-agreement when the gender has a semantic/pragmatic value than when it denotes an arbitrary, pure syntactic agreement. The sensitivity of the syntactic process to the semantic meaning may indicate that the inflectional processor is exposed to semantic information of the word, and not just to its grammatical characteristics (Deutsch et al., 1994-1995, p. 229).

Thus, Deutsch et al. (1994-1995) showed that semantic differences result in differing processing times for syntactically equal sentences.

Hawkins (1999) cites the First Resort Strategy as evidence of the increased processing load of wh-phrases. The First Resort Strategy states that if a possible gap is encountered, the brain will link the filler with that gap. If, after finishing the sentence, another gap site (the correct gap or more logical gap) is found, the brain will then reparse the sentence with the intended filler-gap relationship. Consider the following examples:

(34) a. Which student did you ask Mary about?

b. Which student_{*i*} did you ask (*t_i*) Mary about (*t_i*) (p. 247)?

Thus, upon reaching the first possible gap site, the brain will begin to interpret the question as saying, “You asked some student a question. Which student did you ask?” Then, when the sentence continues with information syntactically incompatible with the first interpretation, it is reanalyzed with the filler subcategorizing for the second gap site. Thus we can assume that the strain caused by holding the wh-element in working memory is greater than the effort required to analyze the sentence twice. Additionally, and as we would expect if the previous claims are true,

performance data shows a preference for simpler filler-gap constructions within this context (Hawkins, 1999, p.250).

Processing demands explain, at least in part, why there are so many types of constraints that restrict wh-movement (adjunct island constraint, complex NP constraint, subject island constraint, etc.) (Chaves, 2012, p. 479). They also shed light on why such constraints are cross-linguistically “hierarchically organized, with grammaticality cutting off in different languages at fixed and implicationaly arranged points” (Hawkins, 1999, p.252). In other words, if one context for wh-movement is allowed, then all simpler contexts are allowed. Conversely, if one such context yields ungrammaticality, all more complex contexts will likewise be ungrammatical.

Goodall (2004) uses Spanish word order to provide compelling evidence of processing as a variable of significant influence. Momentarily excluding from consideration a discussion of Caribbean dialects, we find in Spanish the following general contrast:

(35) a. ¿Qué_i dijiste t_i tú?

b. *¿Qué_i tú dijiste t_i?

(36) a. ¿Qué_i compró t_i ella?

b. *¿Qué_i ella compró t_i?

(37) a. ¿Qué_i prescribió t_i el médico?

b. *¿Qué_i el médico prescribió t_i?

In each case, Spanish favors the option that places the gap site (t_i) as close as possible to the filler, thus reducing the strain on working memory. However, Goodall’s work proves that there is more involved here than mere distance between filler and gap; the differences above also have to do with the amount of information conveyed by the intervening subjects and processing loads. In the rejected examples, the hearer would have to hold the filler in working memory while

simultaneously processing any semantic information connected with the intervening subject. Since filler-gap relationships already put a strain on working memory, the additional strain introduced by the increased denotative specificity of the subject results in reduced grammaticality in most dialects.

Additional evidence that processing accounts for the difference in grammatical acceptability is found in the difference between (35b), (36b), and (37b). In his experiment, Goodall asked 23 participants to rate sentences from 1 (“very bad”) to 5 (“very good”). He found that the longer, more D-linked (referential) the intervening subject, the lower the acceptability of the sentence (Goodall, 2004, p. 103). Thus (35b) received a higher rating than (36b), which received a higher rating than (37b), leading to the continuum from easiest to process to most difficult to process, proposed by Goodall (2008):

(38) 2p pronoun > 3p pronoun > lexical (Goodall, 2008, p. 235).

In other words, as more interpretable information intercedes between filler and gap, grammatical acceptability decreases because the strain on working memory is increased.

Here we find the explanation for the seeming exception posed by Caribbean dialects. The notion of hierarchical organization mentioned by Hawkins applies here as well. Caribbean Spanish speakers also demonstrate the continuum in (38); they also ranked (35b) higher than (36b) and (36b) higher than (37b). So while

(39) ¿Qué tú dijiste?

may be perfectly acceptable in Caribbean varieties, the more D-linked intervening subject in

(40) *¿Qué el médico prescribió?

will still result in ungrammaticality. Although the hierarchy remains the same, the difference is that Caribbean speakers better tolerate intervening information between filler and gap and are thus able to tolerate the less D-linked subjects.

Goodall (2008) discusses the differences in intervening subjects mentioned in the previous section in terms of length and referentiality, or being D-linked. Thus, returning to examples (35)-(37), the word *tú* carries with it little intrinsic meaning; it simply denotes the interlocutor³. Spanish third person subject pronouns, at least those allowed in the context that Goodall examined, are marked for animacy and therefore gender. The third person plural verb conjugation is often used in a general way, as is the second person, which might imply a lack of markedness. However, Goodall's context of an intervening, explicit subject is incompatible with the generic use of third person plural, and therefore third person subject pronouns are more marked in this context.

In contrast, *el médico*, even void of any context, communicates the ideas of a professional with much schooling that deals in health, sickness, injury, and medicine, and is thus semantically deeper than *tú*. It is this difference in semantic depth that Goodall proposes as the cause of the difference in grammaticality, although he uses different terms. The hearer must hold the filler in working memory while simultaneously processing the additional semantics introduced with the intervening subject, which, when the intervening subject is semantically deep enough, results in a processing 'overload' and ungrammaticality.

³ Many of the social implications of using *tú* instead of *usted* would be recognizable by context only, and therefore I will not consider the contrast between these pronouns to be a semantic one.

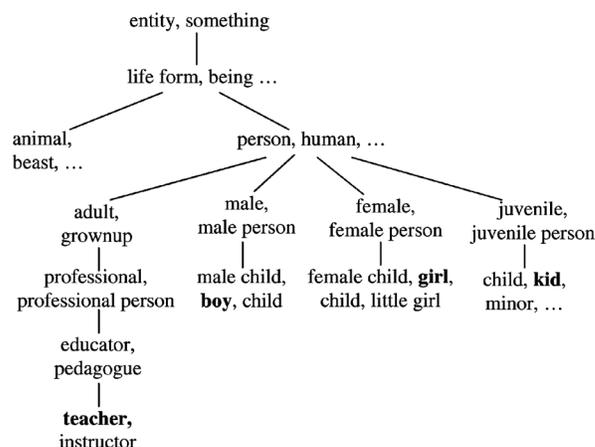
Chapter 3 – RESEARCH METHODOLOGY

Measuring Semantics

The aim of the present study is to test the hypothesis of whether an inverse proportionality holds between semantic depth and grammaticality within the context of filler-gap dependencies. Although Goodall was able to establish a ranking based on different noun types (2p, 3p, lexical), for this study it is necessary to compare verbs for their semantic markedness. In order to accomplish this, it is necessary to first derive some means of measuring or quantifying denotational specificity; a simple binary distinction between semantically deep and semantically shallow verbs would be insufficient.

Technological applications such as search engines and file merging have increased interest in quantifying lexical semantics. Unfortunately, although explaining the unique semantics of any given word is relatively simple, quantifying relative semantic complexity has proven to be more difficult. One method used is lexical taxonomy, which attempts to catalogue each distinction of meaning contained in a word by means of a tree-like structure, as with the following example from Li, Bandar, and McLean (2003)

(39)



(p. 872)

According to this diagram, *boy* is four nodes away from *girl* and six from *teacher*, meaning that *boy* and *girl* are more semantically similar than *boy* and *teacher*. As Li et al. (2003) notes, a flaw in this line of argumentation is evidenced in the fact that *animal* is only four nodes away from *boy*, which would incorrectly indicate a greater similarity with *animal* than with *teacher*.⁴ In order to correct for such inconsistencies, Li proposes a complex mathematical formula. Of course, such a technique, while relatively effective in the realm of technological uses (e.g. search engines, file merging), could never be considered a perfectly complete representation of reality, if for no other reason than because each individual will associate his or her own memories and experiences with a word that a linguist simply could never begin to map. In other words, while perhaps approaching accuracy with regards to linguistic meaning, it does not account for encyclopedic meaning. More importantly for the present study, this kind of superficial schemata fails to acknowledge other information conveyed by a given word. For example, in addition to referring to a human, adult, and a professional educator, the word *teacher* conveys the idea of authority, knowledge and, in certain contexts, the lack of a PhD, the idea of being severely underpaid, and the stereotype that a teacher is usually a woman. It may invoke ideas of chalkboards, apples, and students. Thus, this diagram is helpful in understanding basic semantic differences, but rather lacking in its representation of the semantic reality of the words and therefore insufficient to demonstrate more subtle differences. Fillmore (2006) demonstrates this principle well. He argues against the traditionally accepted means of demonstrating semantic features that uses two pairs of words, as follows:

(41) man: woman:: boy: girl (p. 392)

⁴ Additionally, the hierarchical structure from Li et al. is arbitrary, meaning that the ordering or grouping of elements is not independently motivated.

The pairs in (41) imply that the relationship between *boy* and *man* is the same as the relationship between *girl* and *woman*, with the same being true of the relationships between *boy* and *girl* and between *man* and *woman*. Fillmore (2006) observes that these simplistic comparisons fail to capture the full meaning of the words.

The approach which sees the basic semantic relations as holding among words taken in isolation fails to help us become aware of the possibly quite separate ways in which individual members of these proportions are fitted onto, or frame, their reality (p. 393).

Fillmore clarifies the culturally driven difference between the change from boy to man and from girl to woman. He then notes the illogical mapping between the following word pairs:

(42) man: woman:: bachelor: spinster

Although on some level the second pair can be seen as the same as the first pair with the added distinction of not being married, the second pair of words is marked by connotative differences that do not follow naturally from the contrast.

Thus far in this chapter we have explored some of the difficulties in precisely describing semantic qualities of words. However, the present study requires a way of quantifying the amount of information contained in a given verb that would facilitate a ranking of relative semantic weight. The first step toward accomplishing this is to establish verb categories to facilitate comparison. It is much easier to contemplate the semantic differences between *make* and *build* than between *swim* and *eat*, since *swim* and *eat* have little in common and therefore lack a basis for comparison. For the specific context to be analyzed by the survey, three categories seem most natural: verbs of diction (*say, whisper, yell, etc.*), verbs of cognition (*think, believe, doubt, etc.*), and verbs of volition (*want, desire, yearn, etc.*).

The next task is determining relative semantic weights within categories. Though no direct means of measuring this is possible, that is, there is no semantic scale upon which to set the verb and measure semantic weight, there is external evidence that can be used to indirectly examine semantic weight. The first that I will discuss comes from the Law of Inverse Proportionality, which C.S. Peirce defines thus:

It is that high principle which we all learned at a tender age that one cannot eat his cake and have it too; one cannot devote a thing to a particular use without making it less available for other applications (Peirce, 1933, p. 4.314).

Robertson (1998) explains this law's application to the semantic issue at hand;

The law of inverse proportionality means that where there are few distinctive or semantic features—where there is little depth—there is substantial outward manifestation (e.g. greater frequency of occurrence, broader range of reference, etc.), and inversely, more distinctive semantic features result in less outward manifestation. In short, less depth means greater breadth, and more depth means less breadth (p. 7).

Thus, frequency becomes an indirect and inverse indication of semantic weight. Unsurprisingly, *do* is more frequent than *make* which is much more frequent than *manufacture*. Accordingly, in the present study each verbal category is ranked according to frequency, with the assumption that the most frequent is the most semantically shallow. This is accomplished by using both a frequency dictionary (Davies, 2006), which ranks the first 5,000 most frequent Spanish words, as well as the Google Books Spanish Corpora from Davies (2011). In using two measurements of frequency, I hope to gain a more accurate representation of the frequency, expecting that any discrepancies between the two sources will average themselves out.

Because attempting to measure semantic weight is such a complex and indirect endeavor, it is appropriate to include one other evidence of semantic weight, a kind of second opinion. Consider the example of the different semantic depths of the words *do* and *build*. The verb *do* is so shallow that one could ask any individual engaged in any activity, “What are you doing?” On the other hand, only certain activities would permit a question like, “What are you building?”, because *build* is so much deeper than *do*. According to the Law of Inverse Proportionality, *build* has “more distinctive semantic features” which “result[s] in less outward manifestation” (Robertson, 1998, p. 7).

At the time of the present study, www.webster.com listed thirty-three definitions for *do* but only six for *build*. *Do* is so semantically shallow that its range of possible uses is much broader than that of *build*, so the difference in frequency between the two is in keeping with the Law of Inverse Proportionality. Thus, the more semantically heavy a verb (the more lexical information that it conveys), the fewer dictionary definitions attributed to it. Accordingly, each Spanish verb used in the survey was also ranked by number of definitions according to the Real Academia Española’s online dictionary.

The following tables show the resulting order for the three categories of verbs used in the survey. Frequency Rank refers to the verbs location in the frequency dictionary, while Actual Frequency refers to the number of hits within the corpus. Survey length limited the number of verbs that could be included, so verbs were selected in order to provide a range of semantic depth within each category.

Table 1				
<i>Verbs of Diction</i>				
Order	Verb	#of Definitions	Frequency Rank	Actual Frequency
1	Decir	12	28	9,969,414
2	Responder	18	456	753,253
3	Negar	10	617	390,308
4	Contestar	7	764	211,544
5	Gritar	4	1,597	108,615
6	Susurrar	3	---	4,891

Table 2				
<i>Verbs of Cognition</i>				
Order	Verb	# of Definitions	Frequency Rank	Actual Frequency
1	Creer	7	91	767,095
2	Pensar	3	106	2,256,683
3	Aprender	5	422	660,325
4	Concluir	7	1,221	602,494
5	Dudar	4	1,252	150,768
6	Sospechar	2	1,984	104,854
7	Inferir	3	---	103,317

Table 3				
<i>Verbs of Diction</i>				
Order	Verb	# of Definitions	Frequency Rank	Actual Frequency
1	Querer	10	57	526,374
2	Esperar	6	163	1,037,765
3	Desear	3	515	145,031
4	Anhelar	3	(4,401)*	8,011
5	Ansiar	2	(3,832)*	2,058

Frequencies labeled with (*) indicate the frequency rank for the noun counterpart, since the verb frequency was low enough to not be included in the book. Frequency ranks marked as

--- indicate that neither the verb nor the noun form appeared in the book.

For the most part, it is clear that the indirect measurements of semantic depth shown in the tables mirror what one might instinctually expect. Let us first look at the verbs *decir* and *susurrar* individually. *Decir* reports a speech act, but out of context it is difficult to ascribe any additional meaning to this verb. The verb alone contains no information as to the emotion, importance, frequency, or volume of the utterance. While it may initially be assumed to report something that was uttered verbally, it may easily refer to something someone “said” in an email or a book, for example. In fact, the verb *decir* is also flexible in terms of its corresponding agent, which is not necessarily animate, as in the sentence *La Biblia dice que Dios nos ama*. In the verb *susurrar* we find quite the opposite. Much semantic information can be derived or inferred from the verb itself, without any aid from contextual clues. The verb alone contains information on the volume of the utterance, the agent (only animate agents can whisper), and the medium (one can whisper only vocally, not, for example, via email). On a more instinctual and inferred level, the verb *susurrar* seems to carry the idea of intimacy or secrecy; thus the verb conveys to some degree the emotional involvement of the participants of the whispered conversation.

One may rightly question whether or not *creer* and *pensar* are properly ranked, since *pensar* seems to be the semantically shallower of the two (instinctually and based on the large difference in actual frequency). However, evidences of semantic weight (two of the three measurements agree), and not pure instinct, were used in order to avoid just such misconceptions. Additionally, it may be noted that *creer* is the default verb for professing belief or opinion in Spanish.

In those cases where one measurement seems to contradict my ranking according to the Law of Inverse Proportionality discussed above, the other two of the three semantic

measurements are in accordance with my ranking. For example, *responder* has more dictionary definitions, which, according to the Law of Inverse Proportionality, would seem to mean that *decir* is the semantically deeper verb. However, both the frequency rating and the actual frequency, not to mention purely instinctual considerations, confirm the decision to rank the verbs with *decir* as the more semantically shallow. It is for precisely this reason that three measurements were used. Also, *responder* has meanings outside of the category of verbs of diction, which account for its high number of dictionary definitions. A similar effect is seen in *esperar*, which has a meaning outside of its verbal category for this study, thus explaining the exceptionally high actual frequency.

Survey Structure

The group of participants for the survey consisted of native Spanish speakers currently living in Mexico. Of the 41 surveys started, only 20 were completed, which came from participants between the ages of 18 and 40, including 9 men and 11 women. Four of the 20 participants that completed the survey spoke only Spanish while the rest had an intermediate level knowledge of English. One woman gave nearly all the sentences a score of 1 and her results were therefore excluded, resulting in 19 valid and completed surveys.

The structure for the items on the survey was inspired by the second set of examples from Jackendoff (2005), repeated in (43) below:

(43) a. What_{*i*} did Bill say/??grumble that Harry would like *t_i* for lunch?

b. The man who_{*i*} Bill said/*grumbled that Harry met *t_i* ordered a bagel.

Eighteen of the focus items resemble (43a), a wh-fronted question with a noun clause introduced by a verb from one of the three categories mentioned above. The following are examples of focus items from the survey.

- (44) a. ¿Qué dijo Pedro que comió ella? (Verb of diction)
 b. ¿Qué piensa él que dijo ella? (Verb of cognition)
 c. ¿Qué quieres que haga yo? (Verb of volition)

The remainder of this type of question used verbs of varying semantic weight to introduce the nominal clause. One question for each of the verbs listed in Tables 1-3 was included in the survey. An additional 18 items resembled (43b), a declarative sentence with a similar noun clause which was introduced by the same verbs as those used in the questions. For example,

- (45) a. La novela que dicen que fue escrita por ese hombre no lo fue.
 b. La canción que pensamos que ella escribió es muy bella.
 c. El libro que quieres que yo lea es muy largo.

In other words, each verb from Tables 1-3 had two focus items: one interrogative and one declarative. Each of the focus items was syntactically structured to be as little marked as possible, using canonical word order for that sentence type, in order to minimize the effect of any non-semantic consideration on the acceptability rating for the item in question. The remaining 14 items were distractors, comprised of wh-questions beginning with words other than *que* (and therefore manifesting different and non-focal filler-gap relationships) and declaratives with different types of embedded clauses.

Each participant was asked to rank all 50 total sentences on a scale of 1 (meaning that it was grammatically unacceptable) to 5 (meaning that it was perfectly correct). Intermediate numbers were to indicate degrees between these extremes. For ease of data recording, participants were only allowed whole integer answers; no decimal point values were available (see appendix A).

Expected Results

The primary hypothesis is that as the semantic weight of the verbs introducing noun clauses increases, grammatical acceptability will decrease due to the increase in processing demands. There are also two secondary hypotheses.

First, due to the fact that wh-interrogatives lack the degree of referentiality of fillers in declarative sentences, it is hypothesized that less semantic interruption will be required to produce a processing overload. In other words, since wh-questions are hypothesized to pose a slightly greater processing difficulty than their declarative counterparts with similar filler-gap relationships, the rating for the wh-question context should be consistently lower than the rating for the declarative context.

Second, it is expected that the inherently negative verbs (*negar* and *dudar*) will yield a lower score than is predicted by the semantic ranking explained above. This hypothesis stems from an unanticipated result in a pilot survey of a similar structure wherein *negar* and *dudar* received the lowest average score within their verbal categories, in spite of their being semantically ranked in the middle of those categories. A possible explanation is that the inherent negativity of the verbs makes them more marked (Robertson, 1998, p. 3). Since markedness and semantic weight are so closely related, the hypothesis is that this increase in markedness will cause a greater disruption of the filler gap relationships, and therefore result in lower scores for grammatical acceptability. Additionally, it is important to note that the increased markedness caused by the negative quality of the verbs might not be represented in the semantic ranking, since an increase in numbered dictionary definitions would be unlikely. Hence, the expectation of lower than originally predicted ratings. Another evidence in support of this hypothesis is one of the findings from the experiment from Gieselmann et al. (2010) discussed above, using positive

and negative versions of three types of questions. Consider the following figure showing the results of this study:

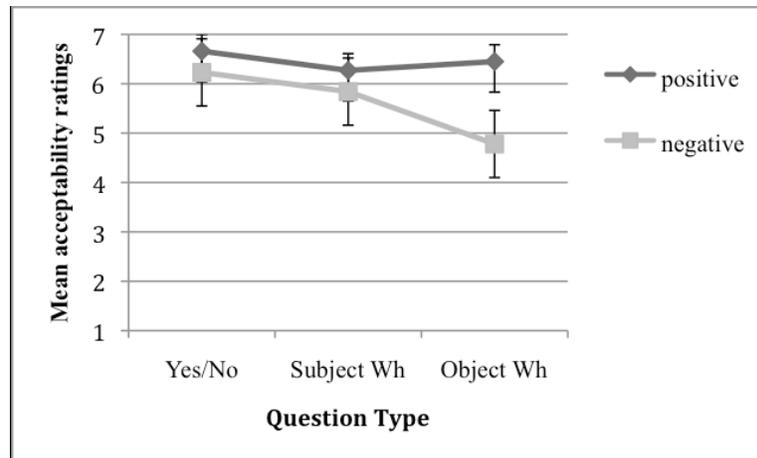


Figure 3. Results of Negation on Acceptability (Gieselmann et al., 2010, p. 6)

As this graph shows, negation consistently yielded lower acceptability ratings, especially in object extraction contexts. The present study uses only object extraction structures, and therefore the expectation that verbs of negation will yield lower acceptabilities seems well founded.

Chapter 4—RESULTS

As mentioned in the previous chapter, answers from one participant were disregarded for being evidently arbitrary. The results from the remaining 19 participants were averaged for each token verb and in each context (wh-question and declarative). These averages are shown in the tables and figures below.

Order	Verb	Average Rank	
		in wh-question	in declarative
1	Decir	3.73	3.21
2	Responder	3.58	2.36
3	Negar	3.21	2.63
4	Contestar	3.68	2.26
5	Gritar	2.94	2.63
6	Susurrar	3	2.79

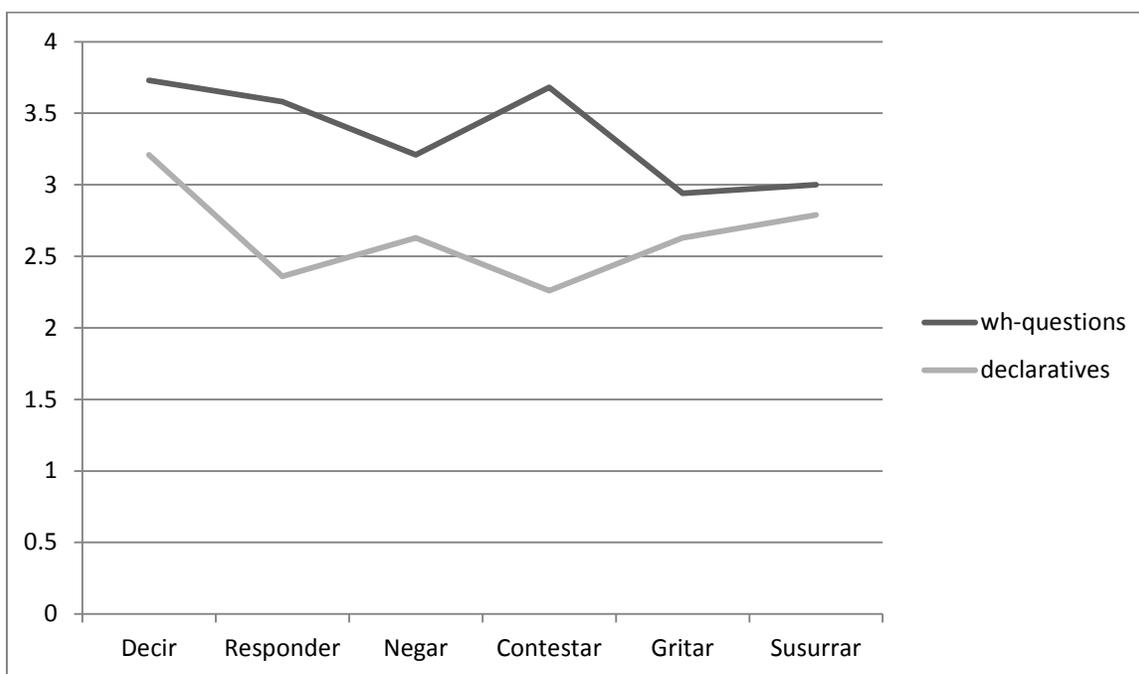


Figure 4. Average scores for Verbs of Diction

Order	Verb	Average Rank	
		in wh-questions	in declaratives
1	Creer	4.21	3.26
2	Pensar	3.79	3.84
3	Aprender	2.58	1.63
4	Concluir	3.32	3.11
5	Dudar	3.21	2.89
6	Sospechar	3.68	3.26
7	Inferir	3.37	3.05

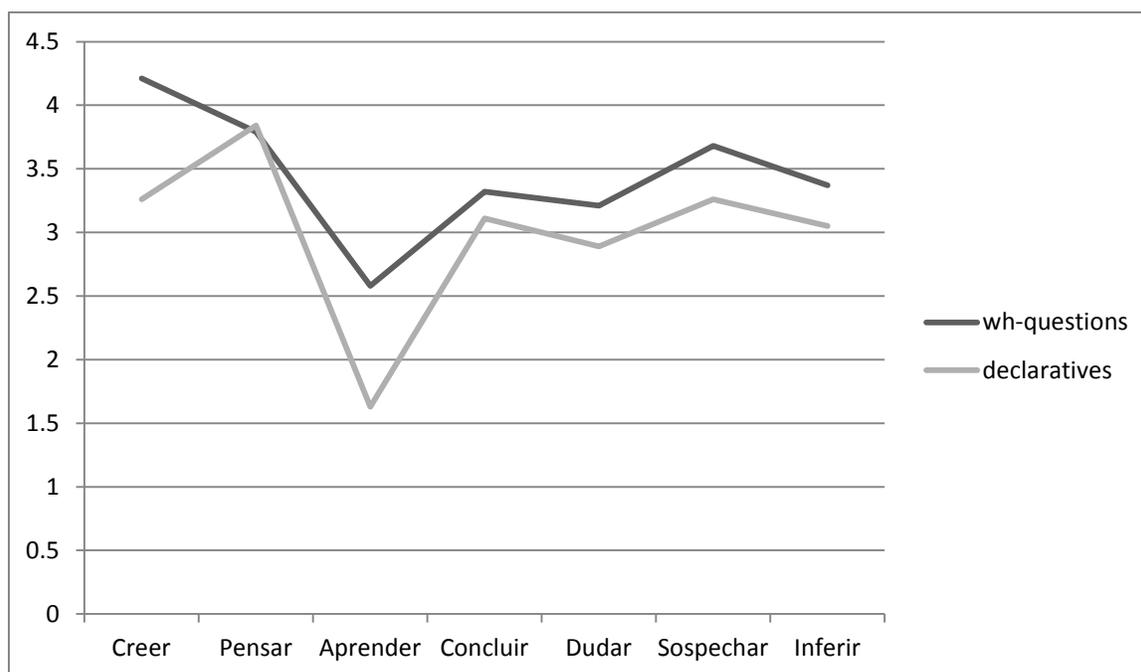


Figure 5. Average scores for Verbs of Cognition

Order	Verb	Average Rank	
		in wh-questions	in declaratives
1	Querer	4.1	3.21
2	Esperar	4.26	3.52
3	Desear	3.68	4
4	Anhelar	3.68	3.21
5	Ansiar	3.42	2.94

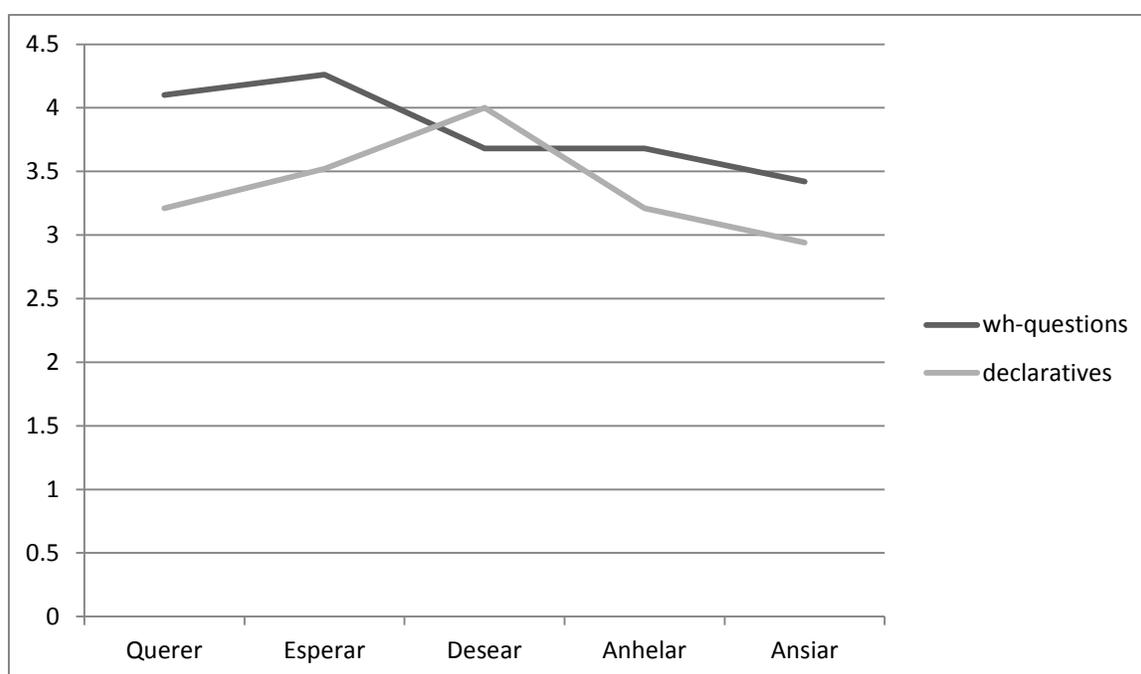


Figure 6. Average scores for Verbs of Volition

The results shown by taking the average score for each focus item from the survey do not clearly demonstrate a linear trend. However, the best fitting line as found by statistics software clarifies the pattern of the results.

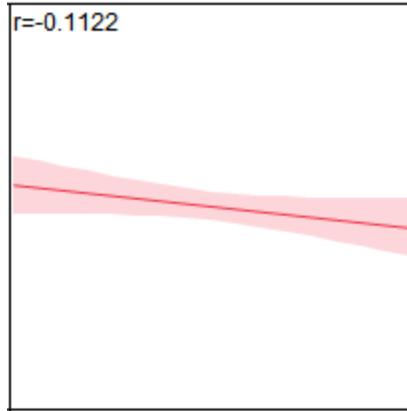


Figure 7. Fit line for Verbs of Diction

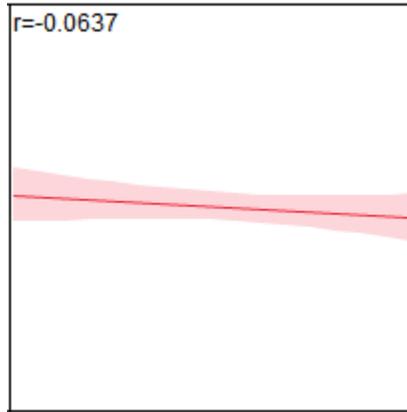


Figure 8. Fit line for Verbs of Cognition

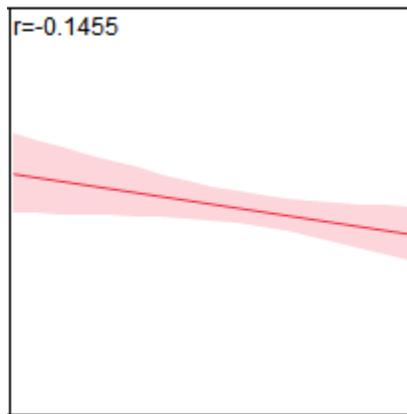


Figure 9. Fit line for Verbs of Volition

As would be expected, the slope of the fit lines (as represented in the r value) is fairly gradual, thus reflecting the gradual changes in semantic depth, and, interestingly, the three slopes are comparable. A multivariate analysis showed that the variance in score for the verbs of cognition could not be statistically attributed to semantic depth. However, the correlation between semantic depth of verbs of diction very nearly approached statistical significance ($p=.09$) and the correlation for verbs of volition was significant ($p=.045$). Thus, based on the results of this survey, it seems clear that further research is well merited and will be required in order to understand the anomalous results, most notably the results for the verbs *contestar* and *desear*. Although the results do not show the high degree of correlation that was predicted, I believe that by refining the experiment, the correlation shown with the verbs of volition would also be manifest in the other verbal categories.

In regards to the secondary hypotheses, the survey yielded unexpected results. First, whereas the non-referentiality of wh-fillers was predicted to cause lower scores in the acceptability rating, in fact, wh-questions received higher scores than the corresponding declarative sentences. The hypothesis was that since such structures already place greater demands on processing and working memory capacities, less semantic disruption would be necessary to render the sentence unacceptable. However, in all three of the verb categories represented, the declarative counterparts consistently received lower scores. One possible explanation is that since increased processing demands are unavoidable in wh-questions, a slight increase in those demands would be less noticeable than in a declarative sentence, where increased demands are less frequent. In other words, it is possible that more resources are allotted, so to speak, to processing wh-questions because wh-questions require it. Declarative sentences do not inherently require additional processing capacity and therefore an increase in

processing demands would be more jarring, causing ungrammaticality. Another explanation could be that the declarative counterparts were generally longer than the wh-questions, as in (4) and (5) from above:

(4) *¿Qué dijo Pedro que comió ella?*

(5) *La novela que dicen que fue escrita por ese hombre no lo fue.*

The additional length in (5) could, in theory, provide more information to process and thus require less additional strain to cause grammatical overload. However, two points render this explanation unlikely. Firstly, as discussed in Chapter 2, Goodall (2008) proves that distance between filler and gap (length of the sentence) does not, aside from violations of island constraints, etc., result in ungrammaticality. Consider the following example:

(46) *What_i did the man that you saw at the store the other day look like t_i?*

Distance is irrelevant and in fact can span two or more clauses, and it is for this reason that filler-relationships are frequently called ‘unbounded dependencies’. The wh-question in (46) contains more words than the longest declarative in the survey, with the filler and gap as much separated as possible, whereas the declaratives in the survey frequently manifest a gap several words before the end of the sentence. Nevertheless, grammaticality goes unquestioned. Secondly, one of the reasons that the declarative sentences were consistently longer than the wh-questions has to do with the inherent difference between wh-fillers and the fillers in declarative sentences noted by Hofmeister et al. (2007) above, the observation on which the original hypothesis was founded. The fillers used in declarative sentences have a “definite, identifiable referent” (Hofmeister et al., 2007, p. 186), which, of necessity, is morphologically longer than a wh-filler.

The most plausible explanation seems to be that Hofmeister et al.'s observation of the differing nature of the respective types of fillers is correct, but the hypothesis drawn from the facts was incorrect. Consider again Goodall's continuum from (38):

(38) 2p pronoun > 3p pronoun > lexical (Goodall, 2008, p. 235)

Goodall showed that increasing the referentiality of an interceding subject would strain working memory to the point of ungrammaticality. It could be considered then, that the referentiality of a filler would, in fact, increase strain on working memory. In other words, more denotational specificity is required to be held in working memory until the gap is found, so less semantic interruption is required to produce ungrammaticality. In any case, this finding promises interesting possibilities in future research to discover the cause of the clear distinction between these two types of filler-gap contexts.

Secondly, although the results for *dudar* support the secondary hypothesis that a negative verb is more marked, thus deeper semantically and therefore more difficult to process, this is likely due, at least in part, to the fact that there was an error in the survey item in that the subjunctive should have been used and was not. The results for *negar* seem inconclusive. Therefore, further research would be required to either confirm or disprove the original hypothesis.

Future Research

In addition to perfecting the survey itself, the need for which was mentioned in the previous section, one of the primary needs in further research has to do with the subject pool. Only 19 of the completed surveys were valid, resulting in a rather small subject pool. Increasing the number of participants would help to compensate for anomalous answers. With a larger subject pool, it would be easier to correctly explain anomalies in the pattern of decreasing

acceptability by eliminating the possibility of attributing the unexpected results to one or two outlying answers. Additionally, the survey results would be much strengthened by focusing the participants more clearly to one language group. Although the principle evidenced in this thesis is linguistically universal, Goodall showed that it does not apply to exactly the same degree across dialects. Thus, the participants' experience with second languages (mostly English) should not affect the results on an individual level, although the fact that their language experience varied from participant to participant weakens the coherence of the results as a group.

To further strengthen the argument of this thesis, it would be wise to delve further into the idea of measuring syntax. Possible research questions include finding additional evidences or indicators of semantic weight and investigating more accurate measurements of frequency. After the aforementioned weaknesses of the subject pool have been addressed, it would be interesting to look at which evidences of semantic weight most accurately predict the order of the acceptability continuum, and therefore are better indicators of semantic weight.

Chapter 5—CONCLUSION

The goal of this study was to provide evidence of the close and causal relationship between syntax and semantics as demonstrated by an acceptability survey designed to show the effect of incremental changes in semantic depth on the grammatical acceptability of the sentence. The survey consisted of wh-questions as well as declaratives, all of which contained noun clauses. By manipulating the verb that introduced the noun clauses to reflect subtle semantic differences (by establishing verbal categories, examining external evidences of semantic depth, and ranking the verbs accordingly), I was able to explore how these differences affected the grammatical acceptability of the sentence. The hypothesis was that given the increased processing load required for filler-gap constructions, the increase in semantic depth of the verb introducing the clause would cause a decrease in acceptability due to processing overloads.

While the results of the survey used for this thesis were not as clear-cut or straightforward as expected, they indicate a general tendency toward supporting the primary hypothesis. This general trend is especially evident when considering the fit lines for the data set resulting from the survey results. The limited subject pool, along with other factors discussed in the previous chapter might explain, in part, why only one of the verbal categories showed the primary hypothesis to be statistically significant. Further research seems promising in the light of the results of this survey, including using a larger, more focused subject pool, refining the survey itself, and exploring additional evidences of semantic depth in order to refine the semantic ranking used.

The results of the survey used in this thesis support the viewpoint that syntax and semantics are inextricably linked in their governing of human language. Syntax exists to facilitate semantic accuracy and, conversely, semantics is dependent upon syntactic regulations.

These two linguistic fields function as a team and only as a team; they cannot exist independently. However, the exact nature of their relationship has yet to be fully understood, and thus offers many exciting research opportunities.

APPENDIX A—Survey

Le invitamos a participar en este proyecto de investigación. Soy estudiante de posgrado de la universidad de Brigham Young y hago esta encuesta como parte de mis estudios concentrados en la lingüística española. Su participación en este proyecto requiere que responda a la encuesta adjunta. Contestarla tomará aproximadamente diez minutos de su tiempo. Su participación es anónima y no nos comunicaremos con usted de nuevo en el futuro. No se pagará la participación en esta encuesta y los riesgos que supone este proyecto serán mínimos. No tiene que participar en esta investigación si no quiere. Si por alguna razón no quiere contestar alguna pregunta, no tiene que hacerlo. Estaremos listos para contestar cualquier duda que tenga referente a esta investigación. Si tiene preguntas con relación a este proyecto o si tiene problemas, no dude en contactarme, Ashlee Norris, ashleenorris@gmail.com o a mi supervisor, el Dr. Jeff Turley, Jeff.turley@gmail.com. Si tiene alguna pregunta en cuanto a sus derechos como participante en una investigación, puede contactar al Administrador del IRB en A-285 ASB, Brigham Young University, Provo, UT 84602; irb@byu.edu; (801) 422-1461. El IRB es un grupo que revisa investigaciones para proteger los derechos y el bienestar de los participantes de las mismas. La realización de esta encuesta implica su consentimiento a participar. Si decide participar, por favor responda a la encuesta adjunta y devuélvala dentro de una semana. ¡Gracias!

1. Sexo

Hombre

Mujer

2. Edad _____

3. ¿Habla Ud. otro idioma? ¿Cuál(es)?

4. ¿Como aprendió esa(s) lenguas?

Lea estas instrucciones cuidadosamente: Para cada oración, escoja el número que represente la aceptabilidad gramatical de la oración. 1= Es incorrecta. No se puede decir así. 3= Es un poco rara, pero quizás se podría decir así. 5= Es completamente correcta así.

1. El hombre que los niños aprendieron que fue invitado era muy famoso.
2. ¿Qué susurró ella que le había dado él?
3. ¿Qué espera usted que compremos?
4. ¿A qué hora quieres ir a la fiesta de Ángela el viernes?
5. La novela que dicen que fue escrita por ese hombre no lo fue.
6. ¿Qué concluyó él que debemos hacer?
7. La cirugía que la enfermera respondió que el cirujano completó muy rápido salió bien.
8. ¿Qué sospechan que queremos?
9. El hotel que infirieron que iba a visitar era muy caro.
10. La persona que grité que fue invitada no vino.
11. ¿Por qué dices que lo quiere ella?
12. ¿Qué inferiste que había hecho él?
13. ¿Qué contestaste que queríamos?
14. Quiero que vengas más temprano.
15. ¿Cómo te informó ella de ese accidente?
16. El primo que crees que visitaron es muy viejo.
17. El baile al que ella quiere asistir el sábado empieza a las ocho.
18. ¿Qué crees que oyó ella?
19. El helado que dudamos que traiga es delicioso.
20. Mi esposo piensa que Juan viene.
21. ¿Qué gritó él que compró ella?

22. Las joyas que concluyeron que robó valen mucho.
23. La canción que pensamos que ella escribió es muy bella.
24. ¿Qué aprendiste que van a hacer?
25. El caballo que esperamos que compre ella es muy caro.
26. ¿Dónde encontraste el libro que perdí?
27. ¿Qué desea ella que diga él?
28. El coche que María niega que quiere es rojo.
29. Los niños no dejaron de susurrar durante toda la clase.
30. La sala que mis padres desean que limpiemos está muy sucia.
31. El proyecto que sospechamos que ella inició empieza mañana.
32. ¿Quién te dio ese suéter que querías?
33. ¿Qué piensa él que dijo ella?
34. ¿Qué negaron que hubiera hecho él?
35. El lugar que ansía que visite yo está muy lejano.
36. El muchacho que mi hermana susurró que fue secuestrado solo tenía seis años.
37. ¿Por qué te gusta él?
38. El libro que quieres que yo lea es muy largo.
39. ¿Cómo sabes adónde irá ella?
40. El niño al que la maestra contestó que pegaron no lloró.
41. ¿Qué anhela él que le dé ella?
42. ¿Qué duda él **que dijo ella**?
43. ¿Qué quieres que haga yo?
44. ¿Qué respondiste que había hecho él?

45. ¿Adónde fuiste ayer?
46. ¿Qué ansía usted que traiga él?
47. El hombre que anhela que le quieras no está aquí.
48. ¿Qué dijo Pedro que comió ella?
49. ¿Quién piensa que lo dijo ella?
50. ¿Por qué no piensa ella que debemos ir?

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