Prosodic Reflexes of Second Occurrence Focus in English and Korean

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1. Introduction

The primary purpose of communication is to convey information. It is unsurprising, then, that we expect the delivery of information to be systematic. Speakers make assumptions about the hearer's knowledge state and behave accordingly, structuring sentences to integrate new information with given information. This kind of structure is known as information structure (IS) (e.g. Büring 2007, Chafe 1976, Halliday 1967, Krifka 2008, Lambrecht 1996, Roberts 1996), which is "a universal of human discourse" (Roberts 1996:92). Consider the brief dialogue in (1).

(1) a. What is his name?
b. His name is Paul.

In (1b), *Paul* is an answer to the *wh*-question and therefore is new information, while the remaining part is given information because it repeats content from the question. In the context of the dialogue, the answer is divided into two parts: *focus* and *ground.* The informative part (*Paul*) is the focus and the referent part (*his name is*) is the ground.

Newness is not the only source of focus; focus can also derive from contrastiveness. Contrastive focus, as illustrated in (2), will also be of relevance to this study.

(2) a. Between pizza and noodles for lunch, which do you prefer to have?
b. I prefer to have pizza.

In (2b), *pizza* contrasts with *noodles* in the set: {pizza, noodles}. *Pizza* here receives contrastive focus since it is picked out between the two items.

Focus is usually associated with phonetic prominence (hereafter "prominence"). This is based on the assumption that focus is a semantic/pragmatic phenomenon and its phonetic realization is a focal accent, which takes the form of prominence. Capital letters in (3) represent prominence, which is used here as a cover term for pitch, duration, and intensity.

(3) a. Who remembered Sue?
b. PAUL remembered Sue.
c. #Paul remembered SUE.

It is shown that the answer with prominence on *Paul* is appropriate to the question, but the prominence on *Sue* is not as fitting. The question-answer pair (3) demonstrates that the answer is deemed congruent when a focused element (*Paul*) is prominent, but it is incongruent when a referent element (*Sue*) is prominent. Conversely, it is found that given information exhibits deaccentuation, defined as the absence of prominence (Avesani and Vayra 2005, Terken and Hirschberg 1994).

Normal focus seems to virtually always be prominent, but there is a special kind of focus that might not always be prominent. This kind of focus is *second occurrence focus* (hereafter "SOF"), when a semantically-focused element is repeated in the discourse. The basic question of this dissertation is whether SOF indeed receives prominence. Consider (4), where the subscripts F and SOF indicate the focused and SOF constituents, respectively.

(4) a. Eva only gave xerox copies to [the GRAduate students]$_{F}$.
b. (No,) PEter only gave xerox copies to [the graduate students]$_{SOF}$. (Partee 1999:31)

(4a) means that Eva gave xerox copies to the graduate students and no one else. The constituent associated with *only, the graduate students,* is an exhaustive choice between many potential beneficiaries. Accordingly, it receives contrastive focus and is therefore prominent. What about the SOF constituent in (4b)? It is still contrastive, as evidenced by its association with *only*, and therefore still semantically focused. On the other hand, it is also given information since it is repeated from the previous information. In this case, there is a conflict between the prosodic demands of focus, by which SOF should be prominent, and of givenness, by which SOF should be deaccented.

The question of whether or not SOF is in fact prominent is relevant to the deeper theoretical question of whether focus is primarily a semantic or pragmatic phenomenon. The semantic approach argues that there is a grammatical rule linking the placement of focus to the element associated with *only* (Beaver and Clark 2002, 2003, 2008, Jacob 1984, Lee and Nambu 2012). If the semantic view is correct, SOF, although given, should receive prominence. Alternatively, the pragmatic approach stresses that the placement of focus is determined not by the lexical entry of *only* but rather at the discourse level (Büring and Hartmann 2001, Dryer 1994, Kadmon, 2001, Lee 2012, Schwarzschild 1997, Sudhoff 2010). If the pragmatic approach is correct, SOF that is given information should be deaccented. SOF can help disentangle semantic and pragmatic accounts of focus because it is a case where the predictions of the two approaches differ.

It remains unclear whether the prominence of SOF is greater than that of non-focus – often labeled as broad focus, in which no single constituent receives prominence in a sentence. No previous research has reported on the phonetic details across the four prosodic conditions: focus, SOF, non-focus, and givenness. The basic strategy in approaching the question is to compare SOF directly with focus, non-focus, and givenness through production and perception experiments. Since focus, SOF, non-focus, and givenness are different categories in IS, they thus play different roles in discourse, which in turn should be differentiated by prosody.

This dissertation pursues a prosody-based approach, which assumes that the acoustic and perceptual correlates of SOF are quantifiable. I analyze the outcomes to see if SOF indeed receives prominence. Here, prosody plays a key role in settling the debate under discussion. The answers in (3b-c) demonstrate that the same string of words does not provide detailed information in the IS categories, such as focus and ground. Prosody is the only source that enables us to distinguish the IS categories here. Accordingly, prosody itself contributes semantically to the sentence interpretation process in some instances, wherein prosody reflects pragmatic meaning in a discourse.

This dissertation conducts cross-linguistic research by investigating English and Korean. The two languages are typologically different, as one is a language with lexical stress and without phrasal

pitch accent, and the other a language with phrasal pitch accent and without lexical stress. An interesting, crucial point can be made by learning the differences between non-focused and focused constituents in English and Korean. When there is no focused element in a sentence, English does not mark pitch accent (Remijsen 2003). But, when there is a focused element in a sentence, the focused element is marked by a nuclear pitch accent (Birch and Clifton 1995, Gussenhoven 2007, Welby 2003, Xu and Xu 2005). This results in a large pitch difference between the two conditions. On the contrary, every prosodic phrase in Korean does have a phrasal pitch accent, even in the absence of focus (Lee and Xu 2010); thus making a subtle difference between non-focused and focused constituents. Therefore, I hypothesize that the prominence degree of signaling focus in English may be greater than that of Korean. If this hypothesis is confirmed, then it is likely that the surface prosodization of SOF differs as well between English and Korean. Even if the prominence of SOF were shown in English, it may be masked in Korean due to the small room available for SOF, implying that SOF may behave differently depending on the prosodic typology. This is the motivation for comparing different prosodic systems in this dissertation.

In sum, this dissertation intends to examine whether SOF receives prominence by using a prosody-based approach. It is assumed that prosody reflects distinct categories in IS, and therefore this study will identify the prosodic hierarchy of IS categories by measuring the relative prominence of focus, SOF, non-focus, and givenness. The findings of this study will help settle the debate between semantic and pragmatic accounts of focus, i.e. whether focus is a pragmatic phenomenon or it is pragmatically driven. Another goal of this dissertation is to compare English and Korean prosodic systems' ways of representing SOF.

In the next section, I discuss the relevant theoretical background. First, I consider a prosodic mapping between new information and prominence and between given information and deaccentuation. Next, I describe different phonetic realizations of focus in English and Korean.

2. Research background

2.1. Prosodic mapping: new information to prominence and given information to deaccentuation.

It is well known that new information is prominent mediated by focus and given information is deaccented by ground (Bock and Mazzella 1983, Eady and Cooper 1986, Lee 2012, Nooteboom and Kruyt 1987, Xu and Xu 2005). But, some may not concur that there is a one-to-one prosodic mapping between new information and prominence and between given information and deaccentuation. As pointed out in Nooteboom and Kruyt (1987), such a relationship is not always found when texts are read out on the radio or on television. Nonetheless, numerous studies have shown that the appropriate placement of prominence and deaccentuation plays an important role in speech utterances (Bock and Mazzella 1983, Eady and Cooper 1986).

I here introduce three studies. Bock and Mazzella (1983) investigated the role of intonation in the context of English dialogues. In their experiment, only the location of focus was altered while the syntactic structure of the sentences remained the same. Their results indicate that the comprehension process for sentences where new information is prominent is shorter than the comprehension process for sentences where neutral or given information is prominent. Nooteboom and Kruyt (1987) manipulated the pitch contours of new and given information in Dutch and conducted an acceptability judgment test. In their experiment, both given and new information were designed to receive prominence in one context but were designed to be deaccented in the other. Their results

demonstrate that it is preferred when new information is prominent and when given information is deaccented. In a similar manner, Lee (2012) examined the prosodic correlation between the focusing adverb *ozik* 'only' and focus/givenness in Korean. When the element associated with *ozik* is new, it is shown to be prominent by focus, and when the corresponding constituent is given, it is shown to be deaccented by ground. The similarity between Nooteboom and Kruyt's and Lee's experiment is that the naturalness level of the target sentence increases when new information is prominent and when given information is deaccented, but in the opposite situation, the naturalness level decreases.

The above experiments show evidence that the appropriate placement of prominence and deaccentuation affects both naturalness and comprehension in speech utterances. Bock and Mazzella (1983) argue that the difference between given and new information by intonational means plays a pivotal role in speech utterances. Therefore, it is natural to assume that there is a one-to-one prosodic mapping between new information and prominence and between given information and deaccentuation.

The way of signalling focus at the phonetic level varies by language. In what follows, I illustrate different phonetic realizations of focus in English and Korean.

2.2. Different realizations of focus by language

The phonetic realization of focus differs by the intonational phonology of the language – e.g. languages are largely divided into either "head-prominent" or "edge-prominent" (Jun 2011). The head-prominence languages are so-called stress-timed languages, such as Dutch, English, German, Greek, and Swedish, in which focus occurs on the primary stressed syllable marked by a nuclear pitch accent (e.g. Birch and Clifton 1995, Gussenhoven 2007, Welby 2003, Xu and Xu 2005). In these languages, mechanisms encoding focus differ between the syntactic/semantic level and the phonetic level. At the syntactic/semantic level, the whole NP such as *Johnathan* (Figure 1) is marked by focus. At the phonetic level, only the primary stressed syllable of the focused constituent is prominent (Cohan 2000, Xu and Xu 2005).

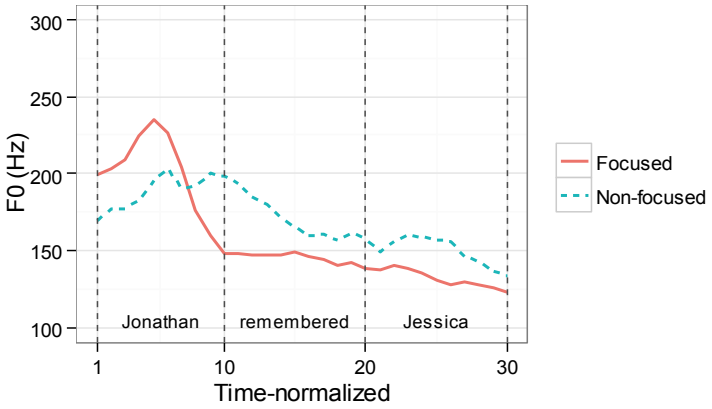

Figure 1: Time-normalized average F0 contours of 36 repetitions of the sentence *Jonathan remembered Jessica* by six speakers (Modified from Lee 2009).[1]

Figure 1 displays the prosodic differences between a non-focused and focused constituent in English. The sentence in the non-focused condition (dotted line) is generated in isolation, i.e. no

[1] In this figure, the dotted vertical line demarcates each word of the sentence. Each word was time-normalized and averaged with ten equidistant points using Xu's ProsodyPro Praat script (2005-2013).

single constituent is designed to be prominent. The sentence in the focused condition (solid line) is generated by a prompt question ("Who remembered Jessica?") from which *Jonathan* is prominent by focus. There is a clearly distinct difference between the two conditions. When *Jonathan* is prominent, a higher F0 peak occurs on the focused NP, and subsequently there is a huge drop. The F0 drop continues until the end of the utterance: this is called *deaccentuation* – the F0 contour is almost flat with no apparent F0 peaks. From Figure 1, there is another noticeable difference between the phonetic and the syntactic/semantic level. Although the whole NP *Jonathan* is syntactically and semantically focused, only the primary stressed syllable of *Jonathan* shows prominence at the phonetic level. Note that the F0 peak that is supposed to occur on the first syllable is likely to be delayed due to inertia (See Xu and Xu (2005) for details). Whatever the reason, the key point is that in English, deaccentuation begins right after the F0 peak of the focused constituent.

Figure 2 shows the prosodic differences between a non-focused and focused constituent in Korean. The way of eliciting non-focus and focus is the same as English. The sentence in the non-focused condition is uttered in isolation. The sentence in the focused condition is uttered by answering the question ("Who is eating dumplings?") from which *Minsuga* receives prominence by focus.

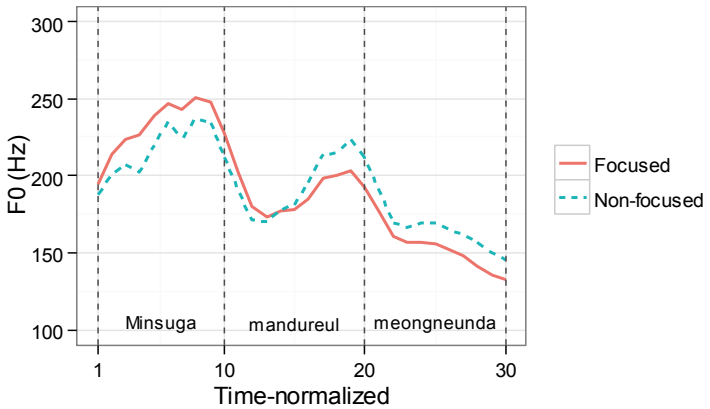

Figure 2: Time-normalized average F0 contours of 36 repetitions of the sentence *Minsuga mandureul meongneunda* ('Minsu is eating dumplings.') by six speakers (Modified from Lee and Xu 2010).[2]

The term *prosodic phrasing* needs to be defined first. Prosodic phrasing indicates a grouping of words in an utterance. In normal speech, the sentence *Minsuga mandureul meongneunda* is demarcated by three accentual phrases such as {Minsuga}{mandureul}{meongneunda}, where a curly bracket represents each accentual phrase (henceforth AP). The AP can be formed presumably by every single word of an utterance (Jun 1993, Schafer and Jun 2002), indicating that the number of words can be equal to that of APs. In Figure 2, each phrase, except the sentence-final one, exhibits a rising F0 contour toward the edge of each phrase. The F0 peak by prominence suggests evidence that each word demarcates a separate AP.

When *Minsuga* is prominent by focus (Figure 2), a strong phrase boundary takes place to reflect focus at the edge of the focused area, where a focused constituent shows a larger pitch range than its non-focused counterpart. In Korean, the whole focused constituent (*Minsuga*) is prominent, as opposed to English, where only the primary stressed syllable shows prominence.

In edge-prominence languages, given information is characterized by dephrasing, which is the absence of accentual phrase boundaries (Ladd 1996). Consider the following examples.

[2] In this study, I Romanized Korean sentences using the Revised Romanization of Korean.

(5) a. sachon-eonni ireum-i mueo-ni → {sachon-eonni}{ireum-i}{mueo-ni}
cousin-old sister name-NOM what-Q
'What is sister-cousin's name?
b. sachon-eonni ireum-i suni-ji → {sachon-eonni ireum-i}{suni-ji}
cousin-old sister name-NOM Suni-DECL
'Sister-cousin's name is Suni.' (Jun 1993:199)

In (5a), the NP *sachon-eonni* 'cousin-old' forms its own AP. However, since that of (5b) is given information, it cannot form its own AP. Instead, the NP is attached to the following phrase, and thus the two phrases form one AP. In this case, the NP *sachon-eonni* is not demarcated by prosodic phrasing at the edge of a word: this is called *dephrasing*. Jun (2011) argues that dephrased phrase such as *sachon-eonni* in (5b) are realized with a substantially lowered/reduced pitch range. Ladd (1996) states that dephrasing corresponds to deaccentuation; the two differ by surface prosodizations but reflect the same underlying effect.

Before turning to the next section, I prove the hypothesis that there is a difference in magnitude of signaling focus between English and Korean. To test this hypothesis, I measured mean peak F0 values of the two prosodic conditions in each language, calculated the mean difference (mean difference: 33.4 Hz (English), 15.3 Hz (Korean)) and conducted a pairwise t-test. The result supports the hypothesis that English features a larger magnitude of signaling focus than Korean ($t[35] = 2.34$, $p < 0.05$). The result implies that there may also be a difference in magnitude of signaling SOF between English and Korean.

3. Research topic: SOF

This section discusses the relevant theoretical concepts and issues and methodological issues pertaining to SOF. I first examine the focusing adverb *only*, followed by two theories of focus: semantic and pragmatic. Lastly, I review previous work on SOF.

3.1. Focusing adverbs.

There is a common agreement that the meaning of a sentence changes by the type of focusing adverbs such as *only*, *also*, or *even* (Hartmann and Zimmermann 2008, Krifka 2006). Consider (6).

(6) a. Paul only loves Jane.
b. Paul also loves Jane.
c. Paul even loves Jane.

The three above sentences all contain the assertion that Paul loves Jane. However, the truth conditional meaning varies depending on which focusing adverb is used. For example, (6a) means that Paul loves no one else other than Jane. (6b) means that Paul loves someone else other than Jane. (6c) means that Paul loves someone else other than Jane, but (6c) differs from (6b) in that the assertion signaled by *even* is unlikely.

It is also held in common that sentence meaning is dependent on which element is associated with a focusing adverb in a double object construction such as (7).

(7) a. Jan only gave Bill money.
b. Jan only gave Bill money. (Beaver et al. 2007:249)

The underlines in (7) represent the element associated with *only*. When *money* is associated with *only* (7a), the sentence means that the one thing that Jan gave Bill was money. Alternatively, when *Bill* is associated with *only* (7b), it means that the one person that Jan gave money to was Bill. A question arises here about how to distinguish the two meanings at the Phonetic Form (PF) level. A fairly uncontroversial idea is that the two meanings are distinguished by the placement of focus. In (7a), *money* receives prominence, and in (7b), *Bill* does. The examples shown in (7) demonstrate that the focusing adverb *only* is associated with focus – widely known in the literature as "association with focus."

3.2. Two theories of focus

Although the focusing adverb *only* is known to associate with focus, as noted previously, a longstanding debate over the two theories of focus centers on whether the element associated with *only* is indeed prominent or not. I here examine the two theories of focus in turn.

The semantic approach postulates that there is a grammatical rule linking the placement of focus to the element associated with *only*. This indicates that there must be a prominent element within the scope of *only*. Sentences in (8) share the same string of words, but only differ by the distribution of focus.

(8) a. John only gave [his DAUghter]$_F$ a new bicycle.
b. #[JOHN]$_F$ only gave his daughter a new bicycle. (Jackendoff 1972)

It is shown that (8a) is appropriate since *his daughter* associated with *only* receives prominence by focus. However, (8b) seems inappropriate since there is no prominent element within the scope of *only*, rather the external NP *John* that is outside the scope of *only* receives prominence. This example suggests that the focusing adverb *only* requires prominence in its scope.

In relation to this rule, Beaver and Clark (2003) employed a phonetically reduced pronoun *'im* to test whether or not it is able to be associated with *only*.[3] Consider the following context and example (Beaver and Clark 2003:343).

(9) Context: You had many discussions with Sandy, but what I want to know is the extent to which you talked about Fred. Of all the times you talked with Sandy, how often was Fred the person you talked about?

(10) #I [ONly]$_F$ discussed'im with Sandy.

Only in (10) is prominent by focus since it is the answer to the *wh*-question, *how often*. Based on the context, the sentence (10) is, however, deemed incongruous since the reduced pronoun *'im* associated with *only* is not prominent. This suggests that the element associated with *only* be prominent or to a lesser extent not be uttered with deaccentuation.

Lee and Nambu (2012) conducted an experiment testing whether or not there must be a prominent element in the scope of *ozik* 'only' in Korean. The results show that when a sentence is in

[3] In this sentence, *'im* is a reduced form of *him*.

isolation such as (11)[4], it is favored when the element associated with *ozik* receives prominence, and it is disfavored when the equivalent element is dephrased. These results seem to support the semantic approach that there must be a prominent element within the scope of *ozik*.

(11) In isolation
Na-neun ozik [MANDU-REUL]$_F$ joaha-mni-da
I-top only dumplings-Acc like-Hon-Decl
'I only like [dumplings]$_F$.' (Lee and Nambu 2012:154)

In contrast to the semantic approach, the pragmatic stance asserts that there is no absolute correspondence between the placement of focus and the element associated with *only* (Dryer 1994, Lee 2012, Rooth 1992). That is, there is no grammatical rule restricting that the element associated with *only* is always prominent. Consider (12).

(12) #John only introduced Bill to [SUE]$_F$ and he only introduced Bill to [CAthy]$_F$. (Dryer 1994:3)

In this sentence, *Sue* and *Cathy* are focused. When this sentence is in isolation, it seems contradictory since both *Sue* and *Cathy* cannot be associated with *only* at the same time. What about the same structure used in context? Consider the following context and example (Dryer 1994:3).

(13) Context: Is it true that there is nobody that John introduced only [BILL]$_F$ to, that he introduced someone other than Bill to everybody?

(14) No, John only introduced Bill to [SUE]$_F$ and he only introduced Bill to [CAthy]$_F$.

As opposed to the sentence (12), the sentence (14) is deemed congruous in this context. In this case, *Bill* associated with *only* has been previously mentioned in prior context and thus is realized with deaccentuation, while *Sue* and *Cathy* are focused and therefore prominent due to the nature of novelty. The example (14) shows that the element associated with *only* does not always have to be prominent. Instead, the element associated with *only* can be deaccented depending on the context. If the semantic approach is correct, the two occurrences of *Bill* in (14) should be prominent regardless of context by the association with *only*.

What about Korean examples regarding the pragmatic stance of focus?

(15) In isolation
Na-neun ozik [DAEHANHANGGONG-EUL]$_F$ iyongha-mni-ta
I-top only Korean Air-Acc take-Hon-Decl
'I only take [Korean Air]$_F$.'

(16) In context[5]
저는 뉴욕에 있는 콜럼비아 대학교에 다닙니다. 하지만 부모님이 한국에 살고 계셔서 방학이면 부모님을 뵙기 위해서 한국에 갑니다. 저는 대한항공 마일리지 카드를 갖고 있기 때문에 다른

[4] Abbreviations used in this dissertation proposal: Acc (Accusative), Comp (Complementizer), Cop (Copular), Decl (Declarative), Hon (Honorific), Prs (Present), Pst (Past), Q (Question), Top (Topic).
[5] I only provided the Korean texts and English translations.

항공사는 이용하지 않습니다. 그래서 방학에 한국에 갈 때마다, #저는 오직 [대한항공을]$_F$ 이용합니다.

I am attending Columbia University in New York. However, since my parents live in Korea, I go to Korea to see them every school vacation. Because I have a Korean Air membership card, I don't take other airlines. So, whenever I go to Korea, #I only take [KOREAN AIR]$_F$. (Lee 2012:111)

When the sentence (15) is uttered in isolation, it is likely that the element associated with *only* is prominent conforming to the results of Lee and Nambu (2012). However, in Lee (2012), the same string of words certainly exhibited a different prosodic phenomenon when embedded in context such as (16). *Korean Air* was found to be dephrased despite the association of only since it is given information. Therefore, the examples like (14) and (16) support the pragmatic side, casting doubts on the assumption that the element associated with *only* is always prominent.

To sum up, the proponents of the semantic approach argue that when the sentence is uttered in isolated context, the element associated with *only* is prominent (e.g. Jackendoff 1972, Lee and Nambu 2012). Here, *only* itself is sufficient to get prominence on a related element. On the other hand, the advocates of the pragmatic approach claim that when the sentence is embedded in context where the element associated with *only* is given information, it is deaccented although semantically focused (e.g. Dryer 1994, Krifka 1995, Lee 2012, Partee 1999, Rooth 1992). It seems likely that the two views of focus are not in conflict; rather, they are complementary. However, it is too early yet to decide since the proponents of the pragmatic approach have not provided compelling evidence. In some cases, they inferred their arguments using their intuitions instead of experimental data (Dryer 1994, Krifka 1995, Partee 1999, Rooth 1992) and in another, the experimental design was found to be flawed (Lee 2012). In the sentence structure used in Lee (2012), the target word *Korean Air* in (16) occurs after the new information *only*. In this context, *only* receives focus due to the nature of novelty. The problem with this experimental design is that the target word in the post-focus area is typically under the influence of dephrasing. Here, there may be potentially confounding factors since SOF may actually be dephrased by ground or the prominence of SOF may be masked due to dephrasing. In order to increase the validity of a study, SOF needs to be reexamined with the inclusion of the area where dephrasing is absent.

Several studies have investigated SOF, but they did not reach a consensus on the phonetic realization of SOF. Different studies have reported on different results. I review previous work on SOF and discuss the possible causes of the discrepancies.

3.3. Previous work on SOF and issues

While the prosodic realization of a focused constituent is relatively straightforward, a continuous controversy exists over whether or not the SOF constituent receives prominence. Although several studies have examined the prosodic status of SOF, the results are not yet conclusive. Partee (1999) argues that SOF is not prominent even though it is semantically focused. In the same vein, Krifka (1995) argues that SOF is "completely destressed." Consider the following examples.

(17) a. Eva only gave xerox copies to [the póor students]$_F$.
b. No, [Peter]$_F$ only gave xerox copies to [the poor students]$_{SOF}$.
c. ?No, [Peter]$_F$ only gave xerox copies to [the pòor students]$_{SOF}$.
(Modified from Krifka 1995:17-8)

Note that Krifka distinguishes between focus and SOF by sentence stress. In (17), the acute accent (´) indicates primary stress and the grave accent (`) secondary stress. When the SOF constituent is destressed (17b), it is deemed favored. However, when the SOF constituent bears secondary stress (17c), the degree of acceptability tends to decrease. Therefore, the example (17b) demonstrates that the exact copy of an earlier focused constituent should be deaccented. Here, Partee's and Krifka's claims support the pragmatic view of focus since the element associated with *only* is not prominent. Note that their work was solely based on their intuitions and was not supported by experimental data. Any arguments regarding SOF should be supported by appropriate experimental work. We are relatively sensitive to pitch, but are not sensitive to duration and intensity. Since intuitions do not provide fine-grained details, a well-designed experiment is required to ensure more reliable inferences.

Recently, several experimental studies have been geared towards characterizing SOF (e.g. English: Beaver et al. 2007, German: Féry and Ishihara 2009, Korean: Lee 2012, Taiwan Mandarin: Chen and Pan 2009). Beaver et al. set up minimal pairs to figure out whether SOF is indeed prominent. Consider (18) and (19) (Beaver et al. 2007:262).

(18) a. Both Sid and his accomplices should have been named in this morning's court session.
b. But the defendant only named [Sid]$_F$ in court today.
c. Even the state prosecutor only named [Sid]$_{SOF}$ in court today.

(19) a. Defense and Prosecution had agreed to implicate Sid both in court and on television.
b. Still, the defense attorney only named Sid in [court]$_F$ today.
c. Even the state prosecutor only named Sid in [court]$_{SOF}$ today.

In (18c), *Sid* is SOF, and *court* is given, whereas in (19c), *Sid* is given and *court* is SOF. Using these minimal pairs, Beaver et al. measured the acoustic differences between two occurrences of *Sid* in each of the final sentences and also measured *court* in the same way as just *Sid*. The results show that SOF is characterized with longer duration and greater intensity than given information but not with a pitch accent. These findings demonstrate that the prosodic status of SOF would fall somewhere in between a given and focused constituent. The findings of Beaver et al. support the semantic view of focus since SOF shows some level of prominence due to the semantic association of *only*.

Although the results of Beaver et al. yielded important aspects of SOF, there are two unresolved issues. First, they only made a comparison between SOF and givenness. But, to find out the exact nature of SOF, it should be compared to focus, non-focus, and givenness by measuring the relative prominence across the four prosodic conditions. Second, in their experiment, SOF occurred only in the post-focus area. As stated before, deaccentuation begins right after the primary stressed syllable (or F0 peak) of a focused constituent, and continues toward the end of a sentence. This may be the reason why SOF was not realized with higher F0 than givenness – they also recognized this matter. Since Beaver et al. did not include SOF in the pre-focus area, it is still puzzling whether or not SOF indeed lacks a pitch accent in English.

In regards to the SOF effect in Korean, Lee (2012) examined the prosodic correlation between the focusing adverb *ozik* 'only' and focus/givenness. The study was done by a perceptual experiment in which the pitch contours of target sentences were manipulated using Praat. As shown in Figure 3, three prosody models were provided: *OzikH* (the focusing adverb has prominence), *ObjectH* (the object has prominence), and *DoubleH* (both the focusing adverb and the object have prominence).

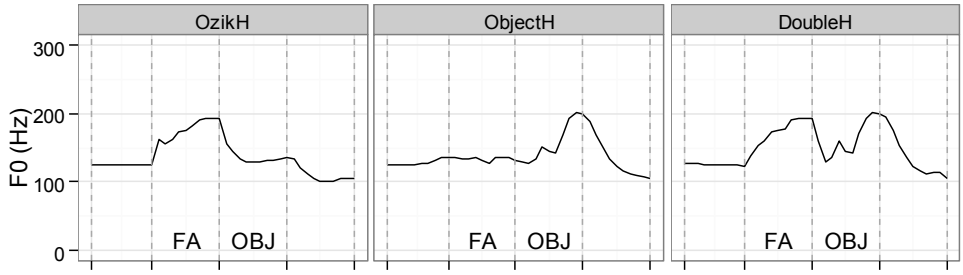

Figure 3: The time-normalized F0 contours of the sentence *Jeoneun ozik gichareul tamnida* 'I only take the train.' FA and OBJ denote the focusing adverb (*ozik* 'only') and the object (*gichareul* 'the train'), respectively (Adapted from Lee 2012:97).

Target sentences include examples such as: *Jeoneun ozik gichareul tamnida*. 'I only take the train.' and *Jeoneun ozik daehanhanggongeul iyonghamnida*. 'I only take Korean Air.' The target sentences are embedded in two competing contexts (20)[6], in which focus or givenness on the element associated with *ozik* (i.e. *kichalul* 'the train', *tayhanhangkongul* 'Korean Air') is elicited. Note that the target sentences embedded in the two competing contexts are morpho-syntactically identical.

(20) a. Discourse-new focus (The element associated with *ozik* 'only' is discourse-new.)
I am attending Hannam University in Daejeon. However, my parents live in Seoul, my younger brother lives in Busan, and my older brother lives in Daegu. So, on major holidays, such as Christmas and New Year's Day, I may go to Seoul, Busan and Daegu to visit my family. When going to Seoul to see my parents, I only take [the train]$_F$.
b. Givenness (The element associated with *ozik* 'only' is given.)
My father works for Korail. According to Korail regulations, my family gets free train tickets. I take business trips to Seoul. So, whenever I go to Seoul, I only take [the train]$_G$.
(Lee 2012:98)

The results demonstrate that when the element associated with *ozik* is focused in discourse, *DoubleH* is shown to be most favored. However, when the element associated with *ocik* is given in discourse, *OzikH* is shown to be the best model. On the basis of the findings, Lee claims that the element associated with *ozik* does not always have to be prominent, but instead the prosodic status of the element associated with *ozik* is determined by the discourse.

Although Lee's work reveals important aspects of the Korean SOF, two issues still exist to be settled. First, Lee only utilized F0 to investigate the prosodic correlation between *ozik* and focus/ givenness. The result shows that the element associated with *ozik* lacks prominence. But, Lee's study might provide misleading information since other acoustic correlates such as duration and intensity were not discussed in the study. It is thus uncertain whether or not the element associated with *ozik* indeed lacks prominence. It is likely that the Korean SOF is produced with longer duration and greater intensity like English. The second issue is that just like the structure used in Beaver et al., the element associated with *ozik* always occurred in the post-focus area. Since *ozik* was designed to be new information, it always received prominence by focus, meaning that the F0 patterns after *ozik* were affected by the prominence of *ozik*. Therefore, it is necessary to include SOF in the pre-focus area to verify whether SOF receives prominence or lacks it.

In Taiwan Mandarin, Chen and Pan (2009) compared between focus and SOF using spontaneous speech data (21). In order to elicit focus, they asked the first question together with images displayed

[6] For simplification, I do not provide Korean text here.

on a computer screen. Then, subjects answered the question by putting prominence on a related phrase by focus. They proceeded to the second dialogue to elicit SOF. The results demonstrate that SOF is not distinguished from focus with respect to F0 and duration.

(21) Q1: From the five images, who do you think the nerdy followed today?
A1: The nerdy followed [the general and the beauty]$_{F}$ today.
Q2: In the other three images, the beauty arrested the general and the coach. What else did you see?
A2: The coach followed only [the general]$_{SOF}$. Chen and Pan (2009: 140)

The results of Chen and Pan are likely to arouse suspicion since the data (21) seem problematic for two reasons. First, the answer A1 and A2 are structurally different. One includes *only*, but the other does not. This structural difference itself may cause different prosody. Second, the target phrase *the general* in A2 does not seem to be SOF, rather *only the general* seems to contrast with the set: *the general* and *the beauty*.

With German data, Féry and Ishihara (2009) made a three-way distinction between focus, SOF, and givenness. Unlike other previous studies, they placed SOF in two positions: pre-focus and post-focus. For the post-focus domain, the result shows that there is a significant difference in duration in the ordering of focus > SOF > givenness, from most prominent to least. This ordering holds for the three conditions for F0, too. But note that the difference in F0 is very minimal between SOF and givenness. For the pre-focus domain, duration also shows the same ordering of focus > SOF > givenness, and so is true of F0. This is a noteworthy phenomenon that the difference in F0 between SOF and givenness is markedly increased compared to that of the post-focus domain, rendering SOF position-dependent.

The literature review clearly shows that no previous research has reported on the phonetic differences between the four prosodic conditions: focus, SOF, non-focus, and givenness. Here, an immediate question arises as to whether or not they are phonetically differentiated. They are distinct categories in IS and thus should be reflected by prosody. It is predicted that the ordering of focus > SOF > non-focus > givenness goes from most prominent to least. The findings will enhance our understanding of the prosodic hierarchy of IS categories.

3.4. Research objectives

The main goal of this dissertation is to examine whether or not SOF receives prominence in English and Korean. Based on the literature review, I formulated three research questions and the relevant hypotheses.

Q1: Is the prominence of SOF position-dependent?

The literature repeatedly demonstrates the need to reexamine SOF in English and Korean. The previous studies did not provide the most optimal setting to examine the prosody of SOF. In Beaver et al. (2007) and Lee (2012), SOF occurred in the post-focus domain where the prominence of SOF may be masked by deaccentuation (English) or dephrasing (Korean). The results of Féry and Ishihara (2009) showed that SOF in the pre-focus domain receives prominence, rendering the German SOF position-dependent. In an attempt to determine whether SOF is also position-dependent in English and Korean, I investigate SOF in two positions: pre-focus and post-focus.

Q2: Are focus, SOF, non-focus, and givenness phonetically differentiated?

The prosody of focus and givenness is relatively well understood. However, the extent of prominence of SOF and non-focus remain unclear, e.g. is SOF more prominent than non-focus? Focus, SOF, non-focus, and givenness are different IS categories and thus play different roles in discourse, which in turn should be differentiated by prosody. By grasping finer-grained prosodic details, the findings will enable us to enhance the understanding of the IS categories.

Q3: Does the prosodization of SOF differ between English and Korean?

As discovered in Section 4.2, there is a difference in magnitude of signaling focus between English and Korean. Since Korean does mark phrasal pitch accent, even in the absence of focus, the prominence difference between non-focused and focused constituents is subtle. This suggests that the Korean SOF may be masked due to the limited space available for SOF and that the prosody of SOF may differ by prosodic typology. Since no previous research has documented systematic variation in SOF between English and Korean, the findings will broaden our understanding of prosodic typology regarding the IS categories.

In conjunction with the three questions, I arrived at three hypotheses. Each consists of a null and an alternative hypothesis. The null and alternative hypotheses are mutually exclusive and exhaustive, meaning that if the null hypothesis is rejected, then the alternative hypothesis will be confirmed.

The three pairs of null and alternative hypothesis are presented below. Note that each hypothesis to each question is identified by H_1, H_2, and H_3, respectively. The null hypothesis and the alternative hypothesis are labeled as H_n and H_a, respectively.

H_{1n}: The prominence of SOF is position-dependent in English and Korean.
H_{1a}: The prominence of SOF is NOT position-dependent in English and Korean.

H_{2n}: Focus, SOF, non-focus, and givenness are phonetically differentiated.
H_{2a}: Focus, SOF, non-focus, and givenness are NOT phonetically differentiated.

H_{3n}: The prosodization of SOF differs between English and Korean.
H_{3a}: The prosodization of SOF does NOT differ between English and Korean.

4. Production (English)

4.1. Stimuli

Target sentences are developed using question-answer structure, as shown in Table 1 below. Each target sentence is cued by a prompt question to ensure that focus, SOF, non-focus or givenness is produced in the answer. This question-answer pair method has been successful in previous studies (Cooper, Eady, and Mueller 1985, Xu 1999, Xu and Xu 2005).

In developing the stimuli, I consider five conditions. First, I use a target word with a sonorant onset. This is because a sonorant eases F0 tracking (Dohen and Lœvenbruck 2005), as well as causes less disturbance and interference, observing F0 contours (Xu 1999).

Second, each prosodic condition has five sets of stimuli, varying sentences and the number of words (6-9 words without *only* or 7-10 words with *only*). One or two filler sentences are used

alternately between the test stimuli in an attempt to diminish lexical recency effects. This method was done successfully in Beaver et al. (2007). A Latin square design is used to maximize the distance between the target sentences, which will be described in detail in Section 4.2.

Third, I control the number of words in a sentence across prosodic conditions (i.e. focus, SOF, non-focus, givenness), except in the case where *only* is absent. The reasoning behind this idea is that F0 contours tend to become lower over the course of a sentence, known as F0 declination (Cohen and 'tHart 1967), and that longer utterances tend to exhibit a gradual F0 declination trend (Yuan and Liberman 2010, Shih 2000). If the number of words is not controlled, it may result in an unwanted effect of F0 declination that will interfere with the acoustic analysis.

Fourth, all target words are monosyllabic. The production stimuli will be utilized as well for the perception study. If I employ a word like *Jonathan* where stress aligns with the first syllable, deaccentuation will follow right after the stressed syllable. In other words, when *Jonathan* is focused, both prominence and deaccentuation are evidenced in the same word. This will prevent us from accurately evaluating whether a focused element is prominent or not. When a target word is monosyllabic, however, prominence can be separated from deaccentuation.

Finally, the target word is not placed in a sentence-final position where sentence type information (whether a sentence is declarative or interrogative) is signaled by prosody. To avoid sentence-type interference signaled by prosody, I intentionally place the target word in a sentence-medial position.

Table 1: The first column indicates four prosodic conditions. The second column denotes prompt questions. The third column indicates target answers. The last shows the number of words in each sentence.

Prosodic condition	SOF position	Prompt question	Target answer	#word
a. Focus		Who did Tony only flunk this semester?	Tony only flunked [the law student]$_F$ this semester.	8
b. SOF	Pre-focus	When did Tony only fail the law student?	Tony only flunked [the law student]$_{SOF}$ [this semester]$_F$.	8
c. SOF	Post-focus	Who only flunked the law student this semester?	[Tony]$_F$ only flunked [the law student]$_{SOF}$ this semester.	8
d. Non-focus		What happened?	Tony flunked the law student this semester.	7
e. Givenness		Who flunked the law student this semester?	[Tony]$_F$ flunked the law student this semester.	7

Before describing Table 1, note that in English, stress falls on the first element of compound nouns, i.e. on *law* in *law student*. Prominence mediated by focus aligns with *law* here, which is intentionally selected to have a sonorant onset. Table 1 gives the prompt questions and target answers for five prosodic conditions designed for the production experiment. In a, the target phrase *the law student* is an answer to the *wh*-question, thus receiving focus. Next, since *the law student* in b is given information, i.e. has been previously stated and is associated with *only*, it receives SOF. Note that this SOF occurring in the pre-focus area is labeled as SOF_{pre}. In c, *the law student* is also given information and is associated with *only*; this SOF occurs in the post-focus area and is labeled as SOF_{post}. In d, *the law student* is neither focused nor given; thus, it is non-focused. Lastly, since *the law student* in e is given information and is not associated with *only*, it is not SOF but given.

4.2. Experimental design

The stimuli contain five sets of five prosodic conditions (focus, SOF_{pre}, SOF_{post}, non-focus, givenness).[7] In total, there are twenty-five target sentences. The stimuli are rotated across each set of the five conditions in a Latin square design, in which order of tasks is counterbalanced to reduce the chances of the order affecting results. Each sentence occurs exactly once in each row and in each column. As noted before, the structure of the target sentences in each set is identical except in the case where *only* is absent. In order to reduce the effect of stimulus familiarity, I attempt to separate sentences with the same structure and sentences with the same conditioning as maximally as possible. I place sentences with different conditions in different sets. For example, each block, denoted by B1, B2, ... B5, has five items: S1a, S2b, S3c, S4d, and S5e where S1, S2, ... S5 indicates five sets and a lower-case letter (a, b, ... e) denotes prosodic conditions (see Table 1).

Figure 4 displays how the production stimuli are arrayed in the Latin square design. In row B1 and column I, the focus condition *a* occurs first in S1, followed by the SOF_{pre} condition *b* in S2, the SOF_{post} condition *c* in S3, the non-focus condition *d* in S4, and the givenness condition *e* in S5. Note that in each column, the first set begins with the second set of the previous column.

	I	II	III	IV	V
	S1a	S1b	S1c	S1d	S1e
	S2b	S2c	S2d	S2e	S2a
B1	S3c	B2 S3d	B3 S3e	B4 S3a	B5 S3b
	S4d	S4e	S4a	S4b	S4c
	S5e	S5a	S5b	S5c	S5d
	S1b	S1c	S1d	S1e	S1a
	S2c	S2d	S2e	S2a	S2b
B2	S3d	B3 S3e	B4 S3a	B5 S3b	B1 S3c
	S4e	S4a	S4b	S4c	S4d
	S5a	S5b	S5c	S5d	S5e
	S1c	S1d	S1e	S1a	S1b
	S2d	S2e	S2a	S2b	S2c
B3	S3e	B4 S3a	B5 S3b	B1 S3c	B2 S3d
	S4a	S4b	S4c	S4d	S4e
	S5b	S5c	S5d	S5e	S5a
	S1d	S1e	S1a	S1b	S1c
	S2e	S2a	S2b	S2c	S2d
B4	S3a	B5 S3b	B1 S3c	B2 S3d	B3 S3e
	S4b	S4c	S4d	S4e	S4a
	S5c	S5d	S5e	S5a	S5b
	S1e	S1a	S1b	S1c	S1d
	S2a	S2b	S2c	S2d	S2e
B5	S3b	B1 S3c	B2 S3d	B3 S3e	B4 S3a
	S4c	S4d	S4e	S4a	S4b
	S5d	S5e	S5a	S5b	S5c

Figure 4: A Latin square design

4.3. Subjects

[7] Please see Appendix for details.

I will recruit ten male and ten female participants from the University of Pennsylvania. The participants will not be informed about the goals of the experiment. They will be compensated for their participation. All of the participants will be native speakers of English with no noticeable accents.

4.4. Recording procedure

Recordings will be conducted in a sound-proof booth in the Department of Linguistics at the University of Pennsylvania. Participants will be seated in front of a computer monitor with a head-mounted microphone. During the recordings, they will listen to prompt questions through headphones and read target sentences displayed on the screen which are answers to the questions. In order to turn to the next slide, participants will press the "Next" button. Participants will be instructed not to pause during the recording and instructed to repeat the sentence when a mistake is made. Recordings will be done electronically and saved directly on a computer using Praat (Boersma and Weenik 1992-2013).

4.5. Measurements

I will use a Praat script to extract F0 contours of the test sentences (Xu, 2005-2013). Word boundaries will be marked by hand in order to extract F0 contours. In order to smooth over abrupt bumps and sharp edges of the F0 contours, a logarithmic algorithm will be conducted. I will then convert the F0 contours to semitones (st). A semitone indicates the musical interval between two neighboring notes logarithmically measured on a 12-tone music scale. Pitch is a major auditory feature of musical tones (Plack et al. 2005), and it is known as logarithmic (i.e. semitone) in nature both in terms of production (Fujisaki 2003) and perception (Nolan 2003). This is the motivation for using semitones here. The conversion will be done by applying the following equation (Xu and Wang 2009):

$$st = 12 \log_2 F0$$

F0 contours of all the target sentences will be time-normalized, using all the tokens produced by twenty subjects. After the process of F0 extraction, all target utterances will be converted to graphs for visual observation.

Furthermore, the following measurements will be taken from the target words in each prosodic condition: mean F0, maximum F0, duration, and mean intensity. In terms of aggregate measures of the target words, direct comparisons will be made across the prosodic conditions.

4.6. Statistics

In this analysis, I will make direct comparisons across five prosodic conditions (focus, SOF_{pre}, SOF_{post}, non-focus, givenness). There is one independent variable: PROSODIC CONDITION. The dependent variables are mean F0 (st), maximum F0 (st), duration (ms), and mean intensity (dB) of the target words. A one-way ANOVA with the factor PROSODIC CONDITION will be conducted on mean F0, maximum F0, duration, and mean intensity.

5. Perception (English)

The goals of this perception experiment are twofold: to determine the prosodic hierarchy between focus, SOF, non-focus, and givenness; and to examine if SOF is position-dependent, i.e. does SOF_{pre} contrast phonetically with SOF_{post}? This perception study will be conducted by manipulating recordings of the stimuli used in the production experiment.

5.1. Acoustic manipulations

As previously noted, it is assumed that the prominence of SOF falls somewhere in between focus and givenness. The acoustic values of focus and givenness are thus used as reference standards to set maximum and minimum thresholds in manipulating the prosody of SOF.

Target words in the production stimuli will be modified to generate a series of manipulations with desired SOF patterns using a TD-PSOLA (Time Domain Pitch Synchronous Overlap-Add) synthesis function through Praat (Boersma and Weenik 1992-2013). I will start by setting the maximum thresholds with F0, duration, and intensity values of the focused constituent, and the minimum thresholds with F0, duration, and intensity values of the given constituent. I expect to approximate "natural" SOF prosody starting from the minimum thresholds and increasing F0, duration, and intensity incrementally during each step until reaching the maximum thresholds. This generates gradient ranges for F0, duration, and intensity, from which listeners can identify the most natural prosody of SOF.

I will design three intermediate levels between these maximum and minimum thresholds. It is assumed that the acoustic values of non-focus lie about midway between the maximum (focus) and minimum (givenness) thresholds. The non-focused values are taken at the 50^{th} percentile (Q2). The 75^{th} percentile value (Q3) is generated midway between the maximum and the 50^{th} percentile, and the 25^{th} percentile value (Q1) midway between the 50^{th} percentile and the minimum. But note that the exact locus of the intermediate levels will change based on the production experiment results.

In the production study, participants will have only produced each sentence structure once, which will not provide sufficiently reliable values for maximum and minimum thresholds to be used in the perception experiment. In an attempt to reliably obtain the maximum and minimum thresholds, five native English speakers who previously participated in the production study will be selected based on characteristics of their performance in the production experiment. In particular, speakers will be chosen who display a large enough range between maximum and minimum thresholds to allow identification of the most optimal marking for SOF. These speakers will be reinvited to produce the stimuli that will be used in the perception experiment. They will be instructed to produce the stimuli three times. Then, I will manipulate the stimuli by transitioning from the maximum to the minimum thresholds. Between the upper and lower ends, three intermediate levels will be located.

The number of speakers to be selected (5) is intentional. As previously mentioned, there are five sets of five prosodic conditions; target sentences with the same sentence structure and the same conditioning will be separated maximally across five blocks. Each of the five speakers will be recorded producing only one of the five blocks. The idea is that it seems preferable for participants to listen to audio stimuli produced not by a single speaker but by multiple speakers. For example, participants will tire of listening to more than 200 stimuli produced by a single speaker.

At this point, it is not clear whether the SOF effect is elicited by individual components such as F0, duration, or intensity, by two combined parameters, or by all the parameters. In order to avoid potentially confounding factors that may hinder us from ascertaining the exact nature of SOF, it is

necessary to take a one-dimensional, two-dimensional, and three-dimensional approach using F0, duration, and intensity.

For the one-dimensional approach, there are three sets. In the first set, F0 and duration are set at minimum thresholds, while intensity is evenly divided into five values. In the second set, duration and intensity are set at minimum thresholds, while F0 is evenly divided into five values. In the third set, F0 and intensity are set at minimum thresholds, while duration is evenly divided into five values. In total, 15 prosodic patterns are generated by the one-dimensional approach.

For the two-dimensional approach, there are also three sets. In the first set, duration is set at a minimum threshold, while both pitch and intensity are divided into five values. In the second set, pitch is set at a minimum threshold, while both intensity and duration are divided into five values. In the last set, intensity is set at a minimum threshold, while both duration and pitch are divided into five values. This approach also produces 15 prosodic patterns.

For the three-dimensional approach, pitch, duration, and intensity are evenly divided into five values. Here, there are five prosodic patterns.

5.2. Experimental design and stimuli

This experiment design will require several subexperiments. If I take a one-dimensional, two-dimensional, and three-dimensional approach using F0, duration, and intensity at the same time, there will be 5 sets × 5 prosodic conditions (focus, SOF_{pre}, SOF_{post}, non-focus, givenness) × 35 manipulations = 875 stimuli. The number of filler stimuli needs to be equal to or greater than the number of target stimuli. So, this experiment would comprise 1750 stimuli. The implementation of such an experiment is not ideal. It thus needs to be decomposed into smaller subexperiments.

First, I will conduct a subexperiment using one parameter: F0. The purpose of this selection is to determine whether the prominence of SOF is position-dependent based on the manipulation of F0. As indicated by Féry and Ishihara (2009), SOF_{pre} shows a raised pitch range, whereas SOF_{post} features a deaccented pitch range. If this is the case in English, other parameters such as duration and intensity should be controlled, i.e. set at minimum thresholds, to isolate whether F0 is a major acoustic correlate of SOF_{post} in English. The second subexperiment will focus on duration. The purpose of this selection is to test whether SOF is position-independent based on the manipulation of duration. This is because it is found that both SOF_{pre} and SOF_{post} are realized by longer duration in German (Féry and Ishihara 2009); in English, longer duration has been found for SOF_{post} (Beaver et al. 2007), but has not been studied for SOF_{pre}. Here, F0 and intensity are set at minimum thresholds, while duration is evenly divided into five levels to test whether it is an important acoustic correlate of SOF. Nöth et al. (1991) found that intensity is not as relevant as F0 and duration to mark focus, so it will not be manipulated independently. Third, I will use all three parameters. Nöth et al. (1991) found that focus is best identified when all these parameters are simultaneously included. This experiment will investigate whether SOF (presumably SOF_{pre}) is also best represented when all the parameters are combined. Note that these three subexperiments will be conducted separately. Additionally, more subexperiments may be needed until the best prosodic marking for SOF is found. The design will also be dependent on the results of the production study. Table 2 below displays the total number of stimuli used in each subexperiment.

The stimuli will be presented to participants in a Latin square design. Each column has five blocks, and each block contains 25 manipulations. As in the production experiment design, I will separate sentences with the same structure and sentences with the same conditioning. Filler sentences will be placed between the test stimuli.

Table 2: The total number of stimuli for each perception subexperiment

Subexperiments	Sets	Conditions	Manipulations	Fillers	Total number
1st	5	5	5 manipulations for pitch	125	5×5×5+125=250
2nd	5	5	5 manipulations for duration	125	5×5×5+125=250
3rd	5	5	5 manipulations for pitch, duration, and intensity	125	5×5×5+125=250

5.3. Subjects

Thirty native English speakers with no hearing problems will participate in this perception experiment. The participants will be naïve to the purpose of the experiment. They will be recruited at the University of Pennsylvania and will be paid for their participation.

5.3. Procedure

I will conduct a rating experiment considering two measurements. First, a 7-point scale as an explicit measurement will be used ("very natural" = 7, "natural" = 6, "somewhat natural" = 5, "neither natural nor unnatural" = 4, "somewhat unnatural" = 3, "unnatural" = 2, "very unnatural" = 1). Additionally, I will measure reaction time as an implicit measurement to check how fast listeners react to a given manipulation. It is speculated that two different prosodic conditions could get the same scores on the explicit scale. But this would not necessarily indicate the same perception of naturalness. The difference may be found in reaction time.

The experiment proceeds using *Albin*, a program developed for perception experiments (Hillenbrand 2004). Figure 5 displays a screenshot of what the perception experiment will look like. At the top of the screen, the definition of the rating levels is displayed. In the middle, there is a button, which listeners use to assess the given prosody by the 7-point scale.

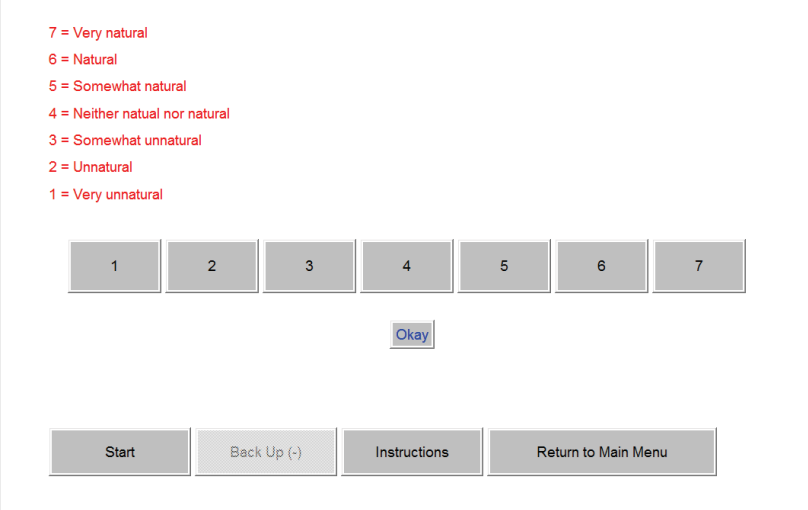

Figure 5: A preview of the perception experiment. The definition of the rating levels is displayed.

To understand the procedure of the experiment, participants will listen to a sample version of unrelated stimuli before the actual experiment begins. When participants are familiar with the test procedure, then they will proceed. During the experiment, prompt questions will be played first through headphones, and participants will listen to answers to the questions with manipulated

prosody. They will evaluate the degree of naturalness of the answers. The experiment will be conducted in a quiet room at the University of Pennsylvania.

5.4. *Z*-score transformation

Raw scores, based on a 7-point scale, are transformed to z-scores to standardize the results. Schütze and Sprouse (to appear) find this z-score transformation a useful method for reducing the potential effect of scale bias, such as when only some points on a 7-point scale are used (scale compression) or when only low- or high-end scores are employed (scale skew). Z-scores are computed independently for each listener by using the formula:

$$z = (x - M\_listener) / SD\_listener$$

In this equation, x indicates a raw score for each response by each listener, and *M_listener* and *SD_listener* denote the mean and the standard deviation of all responses by each listener.

6. Production (Korean)

The method will be the same as the one used in the production study of English with one difference. In Korean, target words do not have to be monosyllabic since both prominence and dephrasing are not evidenced in the same word. Korean speech materials used for this experiment are shown in the Appendix, together with the Revised Romanization of Korean.

7. Perception (Korean)

The method will be identical to the English perception experiment with the exception of the stimuli.

8. Implications

The findings of this dissertation will help to illustrate a better picture of information structure (IS), particularly SOF in three aspects.

First, different studies reported different results. It is certain that an important source of discrepancy is methodological. The findings of this dissertation will settle the longstanding debate between the semantic and pragmatic approaches to focus. It is predicted that the debate will be resolved with an inclusion of the area where deaccentuation (English) or dephrasing (Korean) is absent.

Second, the findings will enhance our understanding of the prosodic hierarchy between focus, SOF, non-focus, and givenness. There exists no clear picture of the prosodic hierarchy yet although they are clearly distinct categories in IS, thus playing distinctive roles in discourse. In this dissertation, the IS categories will be directly compared by measuring the relative prominence to identify the prosodic characteristics of each of the four conditions.

Third, the findings will enable to understand the prosodic typology of SOF. It is found that the way of signaling focus between English and Korean is different; English features a greater magnitude of signaling focus than Korean. This finding will also be true of SOF between these two languages,

implying that the way of signaling SOF, i.e. the prominence of SOF, may differ depending on the prosody typology.

9. Timeline

June 2013

- Set up a production experiment for English
- Conduct a production experiment
- Analyze the results

July-August 2013

- Reinvite five selected participants
- Conduct a production experiment used to manipulate five levels of prosody
- Manipulate the five levels of prosody
- Set up a perception experiment using *Albin*
- Conduct a perception experiment for English
- Analyze the results

September 2013

- Write up the production and perception experiment results for English

October 2013

- Set up a production experiment for Korean
- Conduct a production experiment
- Analyze the results

November-December 2013

- Reinvite five selected participants
- Conduct a production experiment used to manipulate five levels of prosody
- Manipulate the five levels of prosody
- Set up a perception experiment using *Albin*
- Conduct a perception experiment for Korean
- Analyze the results

January 2014

- Write up the production and perception experiment results for Korean

February 2014

- Consider similarities and differences of SOF between English and Korean
- Write up the similarities and differences

March 2014

- Write introduction
- Write conclusion

April 2014

- Combine for defense
- Defend in mid April
- Make revisions as suggested

May 2014

- Submit dissertation

References

Avesani, C. and Vayra M. 2005. Accenting deaccenting and information structure in Italian dialogues. In L. Dybkjaer and W. Minker eds., *Proceedings of the 6th DIGdial Workshop on Discourse and Dialogue*, 19-24. Lisbona.

Beaver, D. and B. Clark. 2002. The proper treatments of focus sensitivity. In L. Mikkelsen and C. Potts eds., *Proceedings of the 21st West Coast Conference on Formal Linguistics*, 15-28. Somerville: Cascadilla Press.

Beaver, D. and B. Clark. 2003. Always and only: Why not all focus-sensitive operators are alike. *Natural Language Semantics* 11: 323-62.

Beaver, D. and B. Clark. 2009. *Sense and Sensitivity: How Focus Determines Meaning*. Wiley-Blackwell.

Beaver, D., B. Clark, E. Flemming, F. Jaeger, and M. Wolters. 2007. When semantics meets phonetics: Acoustical studies of second-occurrence focus. *Language* 83:245-276.

Birch, S. and Clifton, C. 1995. Focus, accent, and argument structure: Effects on language comprehension. *Language and speech* 38:365-391.

Bock, J. K. and J. R. Mazzella. 1983. Intonational marking of given and new information: Some consequences for comprehension. *Memory & Cognition* 11:64-76.

Boersma, P. and D. Weenink. 1999-2013. Praat: Doing Phonetics by Computer. A software.

Büring, D. 2007. Intonation, semantics and information structure. In G. Ramchand and C. Reiss eds., *The Oxford Handbook of Linguistic Interfaces*, 445–474. Oxford: Oxford University Press.

Büring, D. and K. Hartmann. 2001. The syntax and semantics of focus-sensitive particles in German. *Natural Language and Linguistic Theor*y 19:229-281.

Chafe, W. 1976. Givenness, contrastiveness, definiteness, subjects, topics, and point of view. In L. Charles ed., *Subject and Topic*, 25-55. New York: Academic Press.

Chen, C. T. and H. H. Pan. 2009. The acoustical realization of narrow Focus and second occurrence focus in Taiwan Mandarin. In *Actes d'IDP 09*, 137-143.

Cohan, J. B. 2000. *The Realization and Function of Focus in Spoken*. Ph.D. dissertation. The University of Texas at Austin.

Cooper, W., S. Eady, and P. Mueller. 1985. Acoustical aspects of contrastive stress in question-answer contexts. *Journal of the Acoustical Society of America* 77: 2142-2156.

Dohen, M, and H. Lœvenbruck. 2005. Audiovisual production and perception of contrastive focus in French: a multispeaker study. In *Proceedings of Interpseech 2005*, 2413-2416.

Dryer, M. 1994. The pragmatics of focus-association with only. Unpublished manuscript, SUNY Buffalo.

Eady, S. and W. Cooper. 1986. Speech intonation and focus location in matched statements and questions. *Journal of the Acoustical Society of America* 80:402-415.

Féry, C. and S. Ishihara. 2009. The phonology of second occurrence focus. *Journal of Linguistics* 45:285-313.

Fujisaki, H. 2003. Prosody, information, and modeling-with emphasis on tonal features of speech. In *Proceedings of Workshop on Spoken Language Processing*, 5-14.

Gussenhoven, C. 2007. Types of focus in English. In C. Lee, M. Gordon, and D. Büring eds., *Topic and Focus: Cross-linguistic Perspectives on Meaning and Intonation*, 83-100. Dordrecht: Springer.

Halliday, M.A.K. 1967. *Intonation and Grammar in British English*. The Hague: Mouton.

Hartmann, K. and M. Zimmermann. 2008. Not only 'only', but 'too', too. Alternative-sensitive particles in Bura. In A. Grønn ed., *Proceedings of Sinn und Bedeutung* 12, 196–211.

Hillenbrand, J. M. 2004. Alvin experiment-control software: Full install (v 1.10, 11/30/2004). Available from: http://homepages.wmich.edu/~hillenbr/.

Jackendoff, R. 1972. *Semantic interpretation in generative grammar*. Cambridge, Mass.: MIT Press.

Jacobs, J. 1984. The syntax of bound focus in German. *Groninger Arbeiten zur Germanistischen Linguistik* 25:172-200.

Jun S-A. 1993. *The Phonetics and Phonology of Korean Prosody*. Ph.D. dissertation. The Ohio State University.

Jun, S-A. 2011. Prosodic markings of complex NP focus, syntax, and the pre-/post-focus string. In M. B. Washburn, K. McKinney-Bock, E. Varis, A. Sawyer, and B. Tomaszewicz eds., *Proceedings of the 28th West Coast Conference on Formal Linguistics*, 214-230. Somerville: Cascadilla Press.

Kadmon, N. 2001. *Formal Pragmatics: Semantics, Pragmatics, Presupposition, and Focus*. Oxford: Blackwell.

Krifka M. 1995. Focus and/or context: A second look at second occurrence expressions. Unpublished manuscript, The University of Texas at Austin.

Krifka, M. 2006. Association with focus phrases. In V. Molnar, and S. Winkler. eds., *The Architecture of Focus*, 105-136, Berlin, New York: Mouton de Gruyter.

Krifka, M. 2008. Basic notions of information structure. *Acta Linguistica Hungarica* 55: 243-276.

Ladd, D. R. 1996. *Intonational Phonology*. Cambridge: Cambridge University Press.

Lee, Y-c. 2009. *The Phonetic Realization of Contrastive Focus and its Neighbors in Korean and English: A Cross-Language Study*. MA thesis. Hannam University.

Lee, Y-c. 2012. Prosodic correlation between the focusing adverb *ozik* 'only' and focus/GIVENness in Korean. *Journal of Speech Sciences* 2:85-111.

Lee Y-c. and S. Nambu 2012. Prosody and semantics of the focus particles *always* and *only* in Korean: Theoretical implications from a perception experiment. *University of Pennsylvania Working Papers in Linguistics*. 18:151-159.

Lee, Y.-c. and Y. Xu. 2010. Phonetic realization of contrastive focus in Korean. In *Speech Prosody 2010*, 100033:1-4.

Nooteboom, S. G. and J. G. Kruyt. 1987. Accents, focus distribution, and the perceived distribution of given and new information: An experiment. *Journal of the Acoustical Society of America* 82:1512-1524.

Nöth, E., A. Batliner, T. Kuhn, and G. Stallwitz. 1991. Intensity as a predictor of focal accent. In *Proceedings of the 12th International Congress of Phonetic Sciences,* 230-233.

Partee, B. 1999. Focus, quantification, and semantics-pragmatics issues. In P. Bosch and R. van der Sandt eds., *Focus: Linguistics, cognitive, and computational perspectives*, 213-231, Cambridge University Press.

Plack, C. J., A. J. Oxenham, R. R. Fay, and A. N. Popper. 2005. *Pitch: Neural Coding and Perception*. Vol. 24. New York: Springer.

Remijsen, B. 2003. New perspectives in word-prosodic typology. Available from: http://www.iias.nl/iiasn/32/RR_new_perspectives_in_word_prosodic_typology.pdf.

Roberts, C. 1996. Information structure in discourse: towards an integrated formal theory of pragmatics. In J. H. Yoon and A. Kathol eds*., OSU Working Papers in Linguistics 49: Papers in Semantics*, 91-136.

Rooth, M. 1992. A theory of focus interpretation. *Natural Language Semantic*s 1:75-116.

Schafer, A. and S-A. Jun. 2002. Effects of accentual phrasing on adjective interpretation in Korean. In M. Nakayama ed., *East Asian Language Processing*, 223-55. Stanford: CSLI.

Schütze C, and J. Sprouse. To appear. Judgment data. In: Sharma D, Podesva R, eds., *Research Methods in Linguistics*.

Schwarzschild, R. 1997. Why Some Foci Must Associate. Unpublished manuscript, Rutgers University.

Shih, C. 2000. A declination model of Mandarin Chinese. In A. Botinis ed., *Intonation: Analysis Modeling and Technology*, 243-268, Kluwer Academic Publishers, Dordrecht.

Sudhoff, S. 2010. Focus particles and contrast in German. *Lingua* 120:1458-1475.

Terken, J. and J. Hirschberg. 1994. Deaccentuation of words representing 'given' information: effects of persistence of grammatical function and surface position. *Language and Speech* 37:125-145.

Welby, P. 2003. Effects of pitch accent position, type, and status on focus projection. *Language and Speech* 46:53-81.

Xu, Y. 1999. Effects of tone and focus on the formation and alignment of F0 contours. *Journal of Phonetics* 27:55-105.

Xu, Y. and M. Wang. 2009 Organizing syllables into groups – Evidence from F0 and duration patterns in Mandarin. *Journal of Phonetics* 37: 502-520.

Xu, Y. and C. X. Xu. 2005. Phonetic realization of focus in English declarative intonation. *Journal of Phonetics* 33:159-197.

Xu, Y. 2005-2013. ProsodyPro.praat. Available from: http://www.phon.ucl.ac.uk/home/yi/ProsodyPro/.

Yuan, J. and M. Liberman. F0 declination in English and Mandarin broadcast news speech. In *Proceedings of Interspeech 2010*, 134-137.

Appendix: materials

A. English materials

Set 1. a. Q: Who did Tony only flunk this semester?
A: Tony only flunked [the law student]$_{F}$ this semester.
b. Q: When did Tony only flunk the law student?
A: Tony only flunked [the law student]$_{SOFpre}$ [this semester]$_{F}$.
c. Q: Who only flunked the law student this semester?
A: [Tony]$_{F}$ only flunked [the law student]$_{SOFpost}$ this semester.
d. Q: What happened?
A: Tony flunked the law student this semester.
e. Q: Who flunked the law student this semester?
A: [Tony]$_{F}$ flunked the law student this semester.

Set 2. a. Q: Who did James only ask questions of last week?
A: James only asked questions of [the med student]$_{F}$ last week.
b. Q: When did James only ask questions of the med student?
A: James asked questions of [the med student]$_{SOFpre}$ [last week]$_{F}$.
c. Q: Who only asked questions of the med student last week?
A: [James]$_{F}$ only asked questions of [the med student]$_{SOFpost}$ last week.
d. Q: What happened?
A: James only asked questions of the med student last week.
e. Q: Who asked questions of the med student last week?
A: [James]$_{F}$ asked questions of the med student last week.

Set 3. a. Q: Which exam did John only fail this month?
A: John only failed [the math exam]$_{F}$ this month.
b. Q: When did John only fail the math exam?
A: John only failed [the math exam]$_{SOFpre}$ [this month]$_{F}$.
c. Q: Who only failed the math exam this month?
A: [John]$_{F}$ only failed [the math exam]$_{SOFpost}$ this month.
d. Q: What happened?
A: John failed the math exam this month.
e. Q: Who failed the math exam this month?
A: [John]$_{F}$ failed the math exam this month.

Set 4. a. Q: Who did Lisa only give assignments to this time?
A: Lisa only gave assignments to [the male students]$_{F}$ this time.
b. Q: When did Lisa only give assignments to the male students?
A: Lisa only gave assignments to [the male students]$_{SOFpre}$ [this time]$_{F}$.
c. Q: Who only gave assignments to the male students this time?
A: [Lisa]$_{F}$ only gave assignments to [the male students]$_{SOFpost}$ this time.
d. Q: What happened?
A: Lisa gave assignments to the male students this time.
e. Q: Who gave assignments to the male students this time?
A: [Lisa]$_{F}$ gave assignments to the male students this time.

Set 5. a. Q: Whose paper did Dave only pass last term?
A: Dave only passed [Lou's paper]$_F$ last term.
b. Q: When did Dave only pass Lou's paper?
A: Dave only passed [Lou's paper]$_{SOFpre}$ [last term]$_F$.
c. Q: Who only passed Lou's paper last term?
A: [Dave]$_F$ only passed [Lou's paper]$_{SOFpost}$ last term.
d. Q: What happened?
A: Dave passed Lou's paper last term.
e. Q: Who passed Lou's paper last term?
A: [Dave]$_F$ passed Lou's paper last term.

B. Korean materials

Set 1. a. Q: Minsu-ga ozik museun gwamog-eul jinan dar-e gongbuhae-t-da-go?
Minsu-Nom only which subject-Acc last month-in study-Pst-Decl-Q
'Which class did Minsu only study last month?'
민수가 오직 무슨 과목을 지난 달에 공부했다고? (Korean orthography)
A: Minsu-ga ozik [muyeognon-eul]$_F$ jinan dar-e gongbuhae-ss-eo.
Minsu-Nom only Trade Theory-Acc last month-in study-Pst-Decl
'Minsu only studied [Trade Theory]$_F$ last month.'
민수가 오직 무역론을 지난 달에 공부했어.
b. Q: Minsu-ga ozik muyeognon-eul eonje gongbuhae-t-da-go?
Minsu-Nom only Trade Theory-Acc when study-Pst-Decl-Q
'When did Minsu only study Trade Theory?'
민수가 오직 무역론을 언제 수강했다고?
A: Minsu-ga ozik [muyeognon-eul]$_{SOFpre}$ [jinandar-e]$_F$ gongbuhae-ss-eo.
Minsu-Nom only Trade Theory-Acc last month-in study-Pst-Decl
'Minsu only studied [Trade Theory]$_{SOFpre}$ [last month]$_F$.'
민수가 오직 무역론을 지난 달에 공부했어.
c. Q: Nu-ga ozik muyeognon-eul jinan dar-e gongbuhae-t-da-go?
who-Nom only Trade Theory-Acc last month-in study-Pst-Decl-Q
'Who only studied Trade Theory last month?'
누가 오직 무역론을 지난 학기에 수강했다고?
A: [Minsu-ga]$_F$ ozik [muyeognon-eul]$_{SOFpost}$ jinan dar-e gongbuhae-ss-eo.
Minsu-Nom only Trade Theory-Acc last month-in study-Pst-Decl
'[Minsu]$_F$ only studied [Trade Theory]$_{SOFpost}$ last month.'
민수가 오직 무역론을 지난 달에 공부했어.
d. Q: museun ir-i-ya?
what thing-Cop-Q?
'What happened?'
무슨 일이야?
A: Minsu-ga muyeognon-eul jinan dar-e gongbuhae-ss-eo.
Minsu-Nom Trade Theory-Acc last month-in study-Pst-Decl
'Minsu studied Trade Theory last month.'

민수가 무역론을 지난 달에 공부했어.

e. Q: Nu-ga muyeognon-eul jinan dar-e gongbuhae-t-da-go?
who-Nom Trade Theory-Acc last month-in study-Pst-Decl-Q
'Who studied Trade Theory last month?'
누가 무역론을 지난 학기에 수강했다고?

A: [Minsu-ga]$_F$ muyeognon-eul jinan dar-e gongbuhae-ss-eo.
Minsu-Nom Trade Theory-Acc last month-in study-Pst-Decl
'[Minsu]$_F$ studied Trade Theory last month.'
민수가 무역론을 지난 달에 공부했어.

Set 2. a. Q: Jongu-ga ozik eotteon jecheoleumsig-eul ibeon dar-e meogeu-rago
Jongu-Nom only which seasonal food-Acc this month-in eat-Comp
chucheonhae-t-da-go?
recommend-Pst-Decl-Q
'Which seasonal food did Jongu only recommend to eat this month?'
종우가 오직 어떤 제철음식을 이번 달에 먹으라고 추천했다고?

A: Jongu-ga ozik [noraemi-reul]$_F$ ibeon dar-e meogeu-rago chucheonhae-ss-eo.
Jongu-Nom only bluefish-Acc this month-in eat-Comp recommend-Pst-Decl
'Jongu only recommended to eat [bluefish]$_F$ this month.'
종우가 오직 노래미를 이번 달에 먹으라고 추천했어.

b. Q: Jongu-ga ozik noraemi-reul eonje meogeu-rago chucheonhae-t-da-go?
Jongu-Nom only bluefish-Acc when eat-Comp recommend-Pst-Decl-Q
'When did Jongu only recommend to eat bluefish?'
종우가 오직 노래미를 언제 먹으라고 추천했다고?

A: Jongu-ga ozik [noraemi-reul]$_{SOFpre}$ [ibeon dar-e]$_F$ meogeu-rago
Jongu-Nom only bluefish-Acc this month-in eat-Comp
chucheonhae-ss-eo.
recommend-Pst- Decl
'Jongu only recommended to eat [bluefish]$_{SOFpre}$ [this month]$_F$.'
종우가 오직 노래미를 이번 달에 먹으라고 추천했어.

c. Q: Nu-ga ozik noraemi-reul ibeon dar-e meogeu-rago chucheonhae-t-da-go?
Who-Nom only bluefish-Acc this month-in eat-Comp recommend-Pst-Decl-Q
'Which seasonal food did Jongu only recommend this month?'
누가 오직 노래미를 이번 달에 먹으라고 추천했다고?

A: [Jongu-ga]$_F$ ozik [noraemi-reul]$_{SOFpost}$ ibeon dar-e meogeu-rago
Jongu-Nom only bluefish-Acc this month-in eat-Comp
chucheonhae-ss-eo.
recommend-Pst- Decl
'[Jongu]$_F$ only recommended to eat [bluefish]$_{SOFpost}$ this month.'
종우가 오직 노래미를 이번 달에 먹으라고 추천했어.

d. Q: museun ir-i-ya?
what thing-Cop-Q?
'What happened?'
무슨 일이야?

A: Jongu-ga noraemi-reul ibeon dar-e meogeu-rago chucheonhae-ss-eo.
Jongu-Nom bluefish-Acc this month-in eat-Comp recommend-Pst-Decl

‘Jongu recommended to eat bluefish this month.’
종우가 노래미를 이번 달에 먹으라고 추천했어.

e. Q: Nu-ga noraemi-reul ibeon dar-e meogeu-rago chucheonhae-t-da-go?
Who-Nom bluefish-Acc this month-in eat-Comp recommend-Pst-Decl-Q
‘Which seasonal food did Jongu only recommend this month?’
누가 노래미를 이번 달에 먹으라고 추천했다고?
A: [Jongu-ga]$_F$ noraemi-reul ibeon dar-e meogeu-rago chucheonhae-ss-eo.
Jongu-Nom bluefish-Acc this month-in eat-Comp recommend-Pst-Decl
‘[Jongu]$_F$ recommended to eat bluefish this month.’
종우가 노래미를 이번 달에 먹으라고 추천했어.

Set 3. a. Q: Sora-ga ozik nugu-reul ibeon yeohaeng-e chodaeha-n-da-go?
Sora-Nom only who-Acc this trip-on invite-Prs-Decl-Q
Who does Sora only invite on this trip?
소라가 오직 누구를 이번 여행에 초대한다고?
A: Sora-ga ozik [Mina-reul]$_F$ ibeon yeohaeng-e chodaeha-n-dae.
Sora-Nom only Mina-Acc this trip-on invite-Prs-Decl
‘Sora only invites [Mina on]$_F$ this trip?’
소라가 오직 미나를 이번 여행에 초대한대.

b. Q: Sora-ga ozik Mina-reul eodie chodaeha-n-da-go?
Sora-Nom only Mina-Acc where invite-Pres-Decl-Q
‘Where does Sora only invite Mina?’
소라가 오직 미나를 어디에 초대한다고?
A: Sora-ga ozik [Mina-reul]$_{SOFpre}$ [ibeon yeohaeng-e]$_F$ chodaeha-n-dae.
Sora-Nom only Mina-Acc this trip-on invite-Prs-Decl
‘Sora only invites [Mina]$_{SOFpre}$ [on this trip]$_F$?’
소라가 오직 미나를 이번 여행에 초대한대.

c. Q: Nu-ga ozik Mina-reul ibeon yeohaeng-e chodaeha-n-da-go?
Who-Nom only Mina-Acc this trip-on invite-Prs-Decl-Q
‘Who only invites Mina on this trip?’
누가 오직 미나를 이번 여행에 초대한다고?
A: [Sora-ga]$_F$ ozik [Mina-reul]$_{SOFpost}$ ibeon yeohaeng-e chodaeha-n-dae.
Sora-Nom only Mina-Acc this trip-on invite-Prs-Decl
‘[Sora]$_F$ only invites [Mina]$_{SOFpost}$ on this trip?’
소라가 오직 미나를 이번 여행에 초대한대.

d. Q: museun ir-i-ya?
what thing-Cop-Q?
‘What happened?’
무슨 일이야?
A: Sora-ga Mina-reul ibeon yeohaeng-e chodaeha-n-dae.
Sora-Nom Mina-Acc this trip-on invite-Prs-Decl
‘Sora invites Mina on this trip?’
소라가 미나를 이번 여행에 초대한대.

e. Q: Nu-ga Mina-reul ibeon yeohaeng-e chodaeha-n-da-go?
Who-Nom Mina-Acc this trip-on invite-Prs-Decl-Q
'Who invites Mina on this trip?
누가 미나를 이번 여행에 초대한다고?

A: [Sora-ga]$_F$ Mina-reul ibeon yeohaeng-e chodaeha-n-dae.
Sora-Nom Mina-Acc this trip-on invite-Prs-Decl
'[Sora]$_F$ invites Mina on this trip?'
소라가 미나를 이번 여행에 초대한대.

Set 4. a. Q: Seonghye-ga ozik nugu-ege syanel hyangsu-reul seonmulhae-t-da-go?
Seonghye-Nom only who-Dat Chanel perfume-Acc present-Pst-Decl-Q
Who did Seonghye only present Chanel perfume to?
성혜가 오직 누구에게 샤넬 향수를 선물했다고?

A: Seonghye-ga ozik [Minyeong-ege]$_F$ syanel hyangsu-reul seonmulhae-t-dae.
Seonghye-Nom only Minyeong-Dat Chanel perfume-Acc present-Pst-Decl
Seonghye only presented Chanel perfume to [Minyeong]$_F$?
성혜가 오직 민영에게 샤넬 향수를 선물했대.

b. Q: Seonghye-ga ozik Minyeong-ege mueos-eul seonmulhae-t-da-go?
Seonghye-Nom only Minyeong-Dat what-Acc present-Pst-Decl-Q
What did Seonghye only present to Minyeong?
성혜가 오직 민영에게 무엇을 선물했다고?

A: Seonghye-ga ozik [Minyeong-ege]$_{SOFpre}$ [syanel hyangsu-reul]$_F$ seonmulhae-t-dae.
Seonghye-Nom only Minyeong-Dat Chanel perfume-Acc present-Pst-Decl
'Seonghye only presented [Chanel perfume]$_F$ to [Minyeong]$_{SOFpre}$?'
성혜가 오직 민영에게 샤넬 향수를 선물했대.

c. Q: Nu-ga ozik Minyeong-ege syanel hyangsu-reul seonmulhae-t-da-go?
Seonghye-Nom only Minyeong-Dat Chanel perfume-Acc present-Pst-Decl-Q
'Who only presented Chanel perfume to Minyeong?
누가 오직 민영에게 샤넬 향수를 선물했다고?

A: [Seonghye-ga]$_F$ ozik [Minyeong-ege]$_{SOFpost}$ syanel hyangsu-reul seonmulhae-t-dae.
Seonghye-Nom only Minyeong-Dat Chanel perfume-Acc present-Pst-Decl
'[Seonghye]$_F$ only presented Chanel perfume to [Minyeong]$_{SOFpost}$?'
성혜가 오직 민영에게 샤넬 향수를 선물했대.

d. Q: museun ir-i-ya?
what thing-Cop-Q?
'What happened?'
무슨 일이야?

A: Seonghye-ga Minyeong-ege syanel hyangsu-reul seonmulhae-t-dae.
Seonghye-Nom Minyeong-Dat Chanel perfume-Acc present-Pst-Decl
'Seonghye presented Chanel perfume to Minyeong?'
성혜가 민영에게 샤넬 향수를 선물했대.

e. Q: Nu-ga Minyeong-ege syanel hyangsu-reul seonmulhae-t-da-go?
Seonghye-Nom Minyeong-Dat Chanel perfume-Acc present-Pst-Decl-Q
'Who presented Chanel perfume to Minyeong?
누가 오직 민영에게 샤넬 향수를 선물했다고?

A: [Seonghye-ga]$_F$ Minyeong-ege syanel hyangsu-reul seonmulhae-t-dae.
Seonghye-Nom Minyeong-Dat Chanel perfume-Acc present-Pst-Decl
'[Seonghye]$_F$ presented Chanel perfume to Minyeong?'
성혜가 민영에게 샤넬향수를 선물했대.

Set 5. a. Q: Boseu-ga ozik nugu-ege boneoseu-reul jweo-t-da-go?
boss-Nom only who-Dat bonus-Acc give-Pst-Decl-Q
'Who did our boss only give a bonus to?'
보스가 오직 누구에게 보너스를 줬다고?

A: Boseu-ga ozik [Mano-ege]$_F$ boneoseu-reul jweo-t-dae.
boss-Nom only Mano-Dat bonus-Acc give-Pst-Decl
'Our boss only gave a special bonus to [Mano]$_F$.'
보스가 오직 만오에게 보너스를 줬대.

b. Q: Boseu-ga ozik Mano-ege mueos-eul jweo-t-da-go?
boss-Nom only Mano-Dat what-Acc give-Pst-Decl-Q
'What did our boss only give to Mano?'
보스가 오직 만오에게 무엇을 줬다고?

A: boseu-ga ozik [Mano-ege]$_{SOFpre}$ [boneoseu-reul]$_F$ jweo-t-dae.
boss-Nom only Mano-Dat bonus-Acc give-Pst-Decl
Our boss only gave [a bonus]$_F$ to [Mano]$_{SOFpre}$.
보스가 오직 만오에게 보너스를 줬대.

c. Q: Nu-ga ozik Mano-ege boneoseu-reul jweo-t-da-go?
who-Nom only Mano-Dat bonus-Acc give-Pst-Decl-Q
'Who only gave a bonus to Mano?
누가 오직 만오에게 보너스를 줬다고?

A: [Boseu-ga]$_F$ ozik [Mano-ege]$_{SOFpost}$ boneoseu-reul jweo-t-dae.
boss-Nom only Mano-Dat bonus-Acc give-Pst-Decl
'[Our boss]$_F$ only gave a bonus to [Mano]$_{SOFpost}$.'
보스가 오직 만오에게 보너스를 줬대.

d. Q: Museun ir-i-ya?
what thing-Cop-Q?
'What happened?'
무슨 일이야?

A: Boseu-ga Mano-ege boneoseu-reul jweo-t-dae.
boss-Nom who-Dat bonus-Acc give-Pst-Decl
'Our boss gave a bonus to Mano.'
보스가 오직 만오에게 특별 보너스를 줬대.

e. Q: Nu-ga Mano-ege boneoseu-reul jweo-t-da-go?
who-Nom Mano-Dat bonus-Acc give-Pst-Decl-Q
'Who only gave a bonus to Mano?
누가 오직 만오에게 특별보너스를 줬다고?

A: [Boseu-ga]$_F$ Mano-ege boneoseu-reul jweo-t-dae.
boss-Nom Mano-Dat bonus-Acc give-Pst-Decl
'[Our boss]$_F$ gave a bonus to Mano.'
보스가 만오에게 보너스를 줬대.