PROCESSING OF WH-MOVEMENT BY SECOND LANGUAGE LEARNERS

BY

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Abstract

This study examined whether, similar to native speakers of English, native Korean learners of English are able to process sentences with wh-dependencies incrementally, using grammatical constraints on wh-islands. Participants completed two self-paced reading experiments using a moving window self-paced reading paradigm (Just, Carpenter & Wooley, 1982). Experiment 1 examined whether the parser processes sentences incrementally and Experiment 2 examined whether the parser accurately avoids positing gaps at illicit positions within relative clause islands despite the presence of a gap licensing verb. The results showed that Korean learners of English show evidence of incremental parsing in the form of filled gap effects, similar to the patterns shown by native speakers (Stowe 1986, Canales 2012). Also similar to native speakers, Korean learners of English avoid positing gaps in positions prohibited by syntactic islands. Thus, our findings suggest that L2 learners are able to use the same syntactic information in their on-line processing as is used by native speakers, contra the claims of the Shallow Structure Hypothesis (Clahsen & Felser, 2006 a,b). Furthermore, our study provides evidence that L2 learners have access to such abstract syntactic information even when their native language does not instantiate wh-movement or island constraints as in English.

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1.   Introduction and Motivation

Recent studies in second language acquisition have examined the ability of L2 learners to process language similarly to native speakers. Offline tasks reveal that many L2 learners are able to correctly judge the relative grammaticality of given wh- sentences. Thus, they may be able to recognize that (1b) is a grammatical transformation of (1a), while (1c) is ungrammatical.

(1)

        a. Alex asked the girl with curly hair to buy him lunch.

        b.   What did Alex ask the girl with curly hair to buy him ____?

        c. *What did Alex ask the girl with ____ to buy him lunch?

However, recent proposals have questioned whether learners are able to use such knowledge in the course of on-line processing. Central to this debate is the Shallow Structure Hypothesis (Clahsen & Felser 2006a,b) which claims that, unlike native speakers, L2 learners do not rely on abstract syntactic constraints in on-line sentence processing. Proponents of the Shallow Structure Hypothesis (SSH) suggest that learners use semantic or pragmatic cues, as opposed to syntactic structure in their sentence processing. For instance, research has shown that native speakers' processing is facilitated by intermediate gaps, while L2 learners do not benefit from such intermediate gaps (Marinis et al. 2005).   In fact, the SSH claims that learners are unable to use abstract syntactic structure in L2 sentence processing, regardless of whether those structures or constraints are also instantiated in the L1 (Felser, Roberts, Gross & Marinis 2003; Papadopoulou & Clahsen 2003; Williams, Möbius, & Kim 2001).

If the Shallow Structure Hypothesis is correct, then no evidence should exist that L2 learners use abstract syntactic constraints in on-line processing tasks. However, such evidence against the Shallow Structure Hypothesis does exist in a number of tested sub-domains,

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including the focus of the present experiment, the processing of sentences with wh-movement (Omaki & Schulz 2011; Aldwayan et al. 2010; Canales 2012). In English, sentences with a wh-expression are formed when that wh-element is displaced from its canonical position (2).

(2)

      a.   The student was hiding *in the closet*.

      b.   The teacher wondered *where* the student was hiding _____.

There are abstract syntactic island constraints (Ross 1967) governing which elements of a sentence may be moved and which movements are not allowed by the grammar. An example of a syntactic island is a relative clause, as in (3), where movement out of the relative clause is not permitted.

(3)

      a.   She met [the old man that bought the painting].

      b.   *What did she meet [the old man that bought _____]?

Neither native speakers nor learners are typically aware that island constraints exist and thus any evidence that learners are using these rules in online sentence processing is unlikely due to conscious analysis of syntactic structure.

      The current study investigates whether L1 Korean learners of English are able to use such abstract syntactic knowledge in on-line sentence processing. This study builds on previous research which has shown that Najdi Arabic and Spanish learners of English process sentences with wh-dependencies similar to native English speakers (Aldwayan 2010, Canales 2012). While these previous studies have contributed to the debate surrounding the Shallow Structure Hypothesis (SSH), they have not addressed the full extent of open questions which remain regarding the SSH and thus further research in the area is warranted. In particular, there is a

need to further examine the extent to which L2 learners whose native language does not instantiate wh-movement or island constraints, such as Korean, show evidence of access to these abstract syntactic island constraints.

2.   Literature Review

L2 acquisition research originally focused primarily on the Critical Period Hypothesis (Johnson & Newport 1989), which claimed that learners are unable to acquire a second language to a native-like level after a certain age. In comparison, recent L2 research has more narrowly focused on explaining why some L2 learners are still able to demonstrate native-like proficiency in some structures even when they acquire the language after the 'critical period.' One such theory is the Shallow Structure Hypothesis (Clahsen & Felser 2006a,b) which allows for native-like accuracy in off-line tasks, but not for native-like on-line processing. Specifically, the Shallow Structure Hypothesis claims that L2 grammar is deficient. That is, L2 learners are not able to use abstract syntactic structures in on-line processing, only semantic and pragmatic information. For instance, when presented with a sentence containing a displaced wh-element, such as in a wh-question (4), L2 learners will recognize that *who* originated in the position following the matrix verb *see* because the NP *who* matches the thematic role and argument assignment properties of *see.*

(4) Who did [the doctor with the patient] see____ yesterday?

However, L2 learners will not associate *who* with the position following the matrix verb using abstract syntactic information about wh-gaps or *wh-* islands, as it has been argued that native speakers do. Thus in (4), whereas native speakers will not posit gaps in illicit positions, such as within the complex noun phrase island *the doctor with the patient*, learners, who do not have

access to such island constraints, will attempt to posit a gap at any position in which a gap would otherwise be licensed by argument assignment, such as following the preposition *with*. In terms of off-line grammaticality judgments, the Shallow Structure Hypothesis allows for the possibility that learners may still perform with native-like accuracy, but proposes that L2 learners reach these accurate judgments using different mechanisms than native speakers.

There are a number of studies which support the Shallow Structure Hypothesis. To investigate whether learners process their second language similarly to native speakers, Marinis et al. (2005) examined L2 learners' ability to use intermediate gap positions to facilitate processing of the actual gap site in filler-gap sentences. According to transformational theories of grammar (e.g. Chomsky, 1995), each complementizer phrase between the filler gap and the surface position of the filler contains a silent copy of the filler, known as successive cyclic *wh-*movement. Thus, in (5a) *who* originates in the position following *pleased* and has a surface position following *manager*, but there is also a phonologically silent copy of *who* following *claimed*.

(5)
       a. The manager *who$_i$* the consultant claimed *e'$_i$* that the new proposal had pleased *e$_i$* will hire five workers tomorrow.
       b. The manager *who$_i$* the consultant's claim about the new proposal had pleased *e$_i$* will hire five workers tomorrow.

Marinis et al. (2005) extended a native speaker study by Gibson and Warren (2004) to investigate the role of intermediate copies in the processing of sentences involving wh-dependencies, using L2 learners of various L1 backgrounds, including Chinese, Japanese, German and Greek. Similar to Gibson and Warren (2004), Marinis et al. found that native speakers' processing of the region containing *pleased* and the actual gap position *e$_i$* was faster, and thus benefitted from, the presence of an intermediate gap position *e'$_i$* in (5a) in comparison

to the same position in (5b). However, L2 learners did not show any significant difference in

reading times at the region containing *pleased* in (5a) as compared to (5b), suggesting that

learners did not benefit from an intermediate gap. Marinis et al. used these results to argue that

the learners are not able to use syntactic gaps in their processing, similar to the claim given in the

Shallow Structure Hypothesis.

Felser and Roberts (2007) also found no evidence of learners' ability to access underlying

syntactic structure in a cross-modal picture priming task. In this task, while learners were

reading sentences, semantically related (6a-b) or unrelated (6c-d) picture targets were presented

at either the gap (6a-c) or pre-gap (6b-d) position. Participants were asked to judge whether the

object or animal shown in the target picture was alive or not alive.

(6) Fred chased the squirrel to which the nice monkey explained . . .
    a. *Identical, gap position*
     . . . the game's difficult rules [SQUIRREL] in the class last Wednesday.
    b. *Identical, pre-gap position:*
    . . . the game's [SQUIRREL] difficult rules in the class last Wednesday.
    c. *Unrelated, gap position:*
    . . . the game's difficult rules [TOOTHBRUSH] in the class last Wednesday.
    d. *Unrelated, pre-gap position:*
    . . . the game's [TOOTHBRUSH] difficult rules in the class last Wednesday.

The investigators hypothesized that if participants have access to syntactic gaps, then the

antecedent (*squirrel)* should be reactivated at the trace or gap position. Such reactivation at this

position would then facilitate the alive or not alive judgment, resulting in a faster response time

when the target picture is presented at the gap versus pre-gap position. Additionally, if the

antecedent is reactivated at the gap position, it should have a facilitating effect on the 'aliveness'

judgment such that identical targets are processed faster than unrelated targets. Felser and

Roberts found that native speakers did indeed have faster response times when the target was

presented at the gap position as opposed to the non-gap position, while there were no significant

effects of position in the learner group. Additionally, they found that learners responded faster to the identical targets, regardless of presentation position. They used these results to support the claim that learners do not process sentences using syntactic gaps.

The Shallow Structure Hypothesis also states that learners rely on non-syntactic information such as plausibility cues in their on-line sentence processing. There is evidence that learners use plausibility in on-line processing. Williams' (2001) used a 'stop-making-sense' task to show that learners process sentences incrementally using pragmatic plausibility cues.

(7)   Plausible
        a. Which friend did the gangster hide **the car** for _____ late last night? (plausible)
        Implausible
        b. Which cave did the gangster hide **the car** in _____ late last night? (implausible)

Learners indicated that the post-verbal noun phrase in the implausible condition (7b) was the position in which the sentence stopped-making-sense more often than they made the same judgment for the same position in the plausible (7a) condition. Additionally, both native speakers and L2 learners slowed down at the potential gap position in both extraction conditions in comparison with the same position in non-extraction conditions. While evidence that learners use plausibility information in online processing supports the proposal made by the Shallow Structure Hypothesis, it does not exclude the possibility that L2 learners also have access to and use syntactic structures in their processing.

Such unconscious knowledge of abstract syntactic gaps was the focus of Stowe (1986) which examined how native speakers of English use syntactic gaps in on-line sentence processing. In the first of two experiments, monolingual participants completed a self-paced reading task which contained wh- extraction (8b) and declarative sentences (8a) (Stowe 1986).

(8) Declarative
   a.   My brother wanted to know *if* **Ruth** will bring **us** home to Mom at Christmas.
   Wh- Extraction
   b.   My brother wanted to know *who* **Ruth** will bring **us** home to _____ at Christmas.

The goal of this first experiment was to examine whether native speakers' processing is incremental. If processing is incremental, as soon as the parser encounters the displaced wh-element, the 'filler' *who* in (8b), it will actively search for the canonical 'gap' position of this filler. In fact, the parser will attempt to posit a gap at each potential gap position throughout the sentence until the actual gap position (e.g. following *to*) is encountered. The potential gap positions in the extraction condition include the embedded subject position, occupied by *Ruth,* the direct object position, licensed by the verb *bring* and occupied by *us,* and the actual gap position following the preposition. Because an incremental parser is actively positing gaps at each potential position, it will be 'surprised' if the potential gap position is already *filled* with lexical material. Upon encountering a *filled gap*, reading times will slow as the parser is forced to reanalyze the origination of the displaced wh-element. Thus, Stowe (1986) examined whether reading times in the wh-extraction condition would increase at potential gap positions that were filled with lexical items (e.g. *Ruth*, *us*) in comparison to those same positions in the declarative structures which had no gaps, but were otherwise identical in structure.

As predicted, Stowe found evidence of a slowdown in reading time at the direct object position (e.g. *us*) in the wh-extraction condition when compared to the same position in the declarative condition. These results were used as evidence supporting the theory that native speakers' parsers originally analyzed *who* in (8b) as the direct object of *bring* and thus the participants' processing slowed at the *filled gap* position because the parser had to reanalyze the role of *who*. Stowe argued that these results indicated that the participants were able to use

syntactic knowledge of filler-gap dependencies to actively posit gaps in on-line sentence

processing.

Stowe (1986) also examined whether the native parser is able to use knowledge of

abstract syntactic island constraints to avoid positing gaps in grammatically unlicensed positions,

such as Complex Noun Phrase Islands.

(9) Declarative
      a. The teacher asked ***if*** <u>the silly story about **Greg's** older brother</u> was supposed to
         mean anything.
   Wh-extraction
      b. The teacher asked ***what*** <u>the silly story about **Greg's** older brother </u>was supposed
         to mean.

In this second experiment, if the parser incrementally posits gaps at each potential gap licensing

position, without regard to island constraints, then there should be evidence of a slow-down at

the position following the gap-licensing preposition *about* (e.g. *Greg's*) in the wh-extraction

condition (9b) as compared to the declarative condition (9a). If, however, the native parser is

utilizing syntactic island constraints in order to avoid positing gaps in illicit positions, there

should be no evidence of a slowdown within the Complex NP island, even though a potential gap

licensor, the preposition (e.g. *about*) exists within this island.   In comparing reading times at the

critical position (e.g. *Greg's*) in the wh-extraction condition (9b) to the declarative control

condition (9a), Stowe found no significant differences. Thus, the evidence suggests that native

speakers do not posit gaps in grammatically unlicensed positions.

In order to determine whether second language learners process language similarly to

native speakers as reported by Stowe (1986), Aldwayan et al. (2010) investigated whether native

Najdi Arabic learners of English also use abstract island constraints in their on-line processing of

sentences with wh-dependencies. Similar to the design of Stowe (1986), the researchers tested

the participants in two experiments, the first of which examined whether L2 learners process

sentences incrementally, slowing down at potential gap positions which were already filled with lexical material. The sentences, while designed specifically for the Aldwayan et al. study, were similar to those used in Stowe's (1986) first experiment. In Experiment 1, the critical, filled gap position (e.g. *us/Sam*) followed the embedded verb (e.g. *photograph*) which is a potential gap licensor (10).

(10) Declarative
    a. My brother asked if Barbara will photograph **us/Sam** beside Mom at the graduation.
    Wh-extraction
    b. My brother asked who Barbara will photograph **us/Sam** beside _____ at the graduation.

The results of their first experiment indicated that, similar to the findings of Stowe's (1986) first experiment, learners and native speakers both show evidence of incremental processing, slowing down at the object filled gap (*us/Sam*) position. However, while the results from this first experiment show that learners process sentences incrementally, these results alone do not provide sufficient evidence to determine whether such L2 learners are using syntactic or non-syntactic information in their processing. Rather, the results from Aldwayan et al.'s (2010) second experiment, also based on Stowe's (1986) second experiment, were used to determine if L2 learners respect the Complex NP island constraint in their on-line processing. In Aldwayan et al.'s second experiment, they compared native speakers' and learners' processing of wh-extraction sentences containing Complex NP islands in subject positions (11b) to similarly structured, declarative sentences (11a). In these sentences, the preposition within the Complex NP island (e.g. *about*) acts as a potential gap licensor and, thus, the critical region is the filled prepositional gap (e.g. *John's*) within the island.

(11)   Declarative
        a. My sister wondered if [the boring comments about **John's** used car] were
            intended to entertain the group.
      Wh-extraction
        b. My sister wondered *who* [the boring comments *about* **John's** used car] were
            intended to entertain _____.

Recall that once the incremental parser encounters the wh- filler *who,* it will actively begin positing gaps at each potential gap position until it arrives at the actual gap position. One of the potential gap positions in (11b) follows the potential gap licensor *about*. However, this preposition is within the Complex NP island *the boring comments about John's car*. Thus, a parser which is using island constraints will avoid positing gaps at this position. Stowe's (1986) Experiment 2 found evidence of such use of island constraints in native speakers and Aldwayan et al. (2010) sought to replicate these results with L2 learners.

The predictions for Aldwayan et al.'s (2010) Experiment 2 are as follows. If, as the Shallow Structure Hypothesis predicts, learners are simply assigning thematic roles at all possible argument assigning positions, irrespective of island constraints, then they will attempt to posit a gap at the position following the potential gap licensor *about*, resulting in slower reading times at this illicit gap position (*John's*) in the wh-extraction condition, as compared to the declarative condition. However, native speakers, having access to syntactic island constraints will not posit gaps within the Complex NP island, resulting in no significant differences in reading times between the two conditions for native speakers. The results did not support the Shallow Structure Hypotheses. Rather, L2 learners, like native speakers, avoided positing illicit gaps within the Complex NP island, as evidenced by no significant differences in reading times at the critical position (*John's*) in the wh-extraction condition as compared to the declarative

condition, indicating that L2 learners are also able to utilize abstract syntactic island constraints in their on-line processing.

In a follow-up study to Aldwayan et al. (2010), Canales (2012) found evidence that, like native English speakers and Najdi Arabic learners of English, native Spanish learners of English process sentences incrementally and utilize syntactic island constraints in on-line processing. Canales (2012) modified the stimuli in Aldwayan et al. (2010) to ensure that the critical region in both Experiments 1 and 2 used a verb (*film, followed)* as the potential gap licensor preceding the critical region (*Tom, Henry)*, as in (12-13). This eliminated the potential confound present in Aldwayan et al. (2010) in which the potential gap licensor in Experiment 1 was a verb, while the potential gap licensor in Experiment 2 was a preposition.

(12) *Experiment 1*
      Declarative
      a. The instructor wondered if Chris will <u>film</u> **Tom** with Susan at the reception.
      Wh-extraction
      b. The instructor wondered who Chris will <u>film</u> **Tom** with ____ at the reception.

(13) *Experiment 2*
      Declarative
      a. My brother questioned if the journalist that <u>followed</u> **Henry** last Saturday
          provoked the guard at the store.
      Wh-extraction
      b. My brother questioned who the journalist that <u>followed</u> **Henry** last Saturday
          provoked at the store.

Similar to the results of Aldwayan et al. (2010), Canales (2012) found that, for Experiment 1, native English speakers and native Spanish L2 learners both showed evidence of a filled gap effect in the form of slower reading times in the spillover region, following the object filled gap position. Contrary to the predictions of the Shallow Structure Hypothesis, and similar to the findings of Aldawayan et al. (2010), Canales (2012) Experiment 2 found that neither L2

learners nor native speakers posited gaps within relative clause islands as evidenced by an absence of slower reading times at the grammatically unlicensed potential gap position.

Additionally, while Aldwayan et al. (2010) only found a significant subject filled gap for learners in Experiment 2 Canales (2012) found significant subject filled gap effects for both learners and native speakers in Experiment 2. As discussed in Canales (2012), subject gaps are particularly relevant to the Shallow Structure Hypothesis because they occur in a position which precedes the thematic role assigning verb and thus cannot be driven by thematic role assignment. Thus, Canales (2012) also provides strong evidence that L2 learners have access to abstract syntactic knowledge in on-line sentence processing. The present study aims to build on this evidence by replicating these results with L2 learners whose native language does not have wh-movement or island constraints similar to English.

Omaki and Schulz (2011) also found converging evidence that second language learners are able to use syntactic island constraints in on-line processing. These researchers extended the work of Traxler and Pickering (1996), who found that native speakers actively create gaps in on-line processing and, upon encountering a wh-filler, attempt to integrate such fillers at each potential gap position.

(14)   Non-island
       a. We like the city/book that the author *wrote* unceasingly and with great dedication about _____ while waiting for a contract.
       Relative clause island
       b. We like the city/ book that the author [RC who *wrote* unceasingly and with great dedication] saw _____ while waiting for a contract.

Specifically, Traxler and Pickering (1996) found that native speakers demonstrate a plausibility mismatch effect in which eye gaze duration is longer at the embedded verb *wrote* when the implausible object *city* was used, in comparison to when the plausible object *book* was

used in the non-island condition (14a), but not in the relative clause island condition (14b).

These results suggest that native speakers attempt to associate the filler (*city/book*) with the

embedded verb (*wrote*) and experience a processing slowdown when there is a plausibility

mismatch between the filler and the verb. However, the native speaker's parser only attempts

this association when permitted by the grammar, as in the non-island conditions. Omaki and

Schulz (2011) investigated whether advanced Spanish-speaking learners of English also avoid

active gap creation within relative clause islands as in (14b), where the verb *wrote* is not

followed by a potential gap. As the SSH predicts that any active gap creation by learners is

based on shallow structural representations, learners should process the position following *wrote*

similarly in both (14a) and (14b), irrespective of the presence of relative clause islands. In

contrast, Omaki and Schulz found that both the native speakers and the L2 learners actively

created gaps in the non-island condition, but neither group created gaps in the island condition.

Thus, Omaki and Schultz (2011) provides additional evidence that advanced L2 learners, like

native speakers, actively create gaps and utilize island constraints in their online processing.

Contradictory findings regarding the Shallow Structure Hypothesis merit further

investigation of learners' ability to process language using the same syntactic processes as native

speakers. Both of the most recent studies which provide evidence against the Shallow Structure

Hypothesis (Canales 2012; Omaki & Schultz 2011) test native Spanish speaking learners of

English. Thus, there remains a need to test learners from a wider range of native languages, in

particular, native speakers whose L1 does not instantiate wh-movement. Otherwise, the use of

Spanish native speakers alone introduces the possible interpretation that only L2 learners with

wh- movement and similar island constraints in their native languages will show evidence of

using syntactic island constraints in their on-line processing, as both English and Spanish are

typologically similar. The Shallow Structure Hypothesis claims that L2 learners do not have

access to syntactic information in on-line sentence processing, regardless of the features of their

L1. However, if, as some of the evidence discussed above suggests, this is too broad of a claim,

then controlling for the L1 is essential in determining the conditions under which L2 learners are

able to process their L2 using mechanisms similar to those employed by native speakers.

2.1 *Focus of the current study and research questions*

While there may be some evidence that learners are able to process their L2 similarly to

native speakers, further research is needed to determine specifically which L2 learners, under

which conditions are able to use the same mechanisms as native speakers in on-line processing.

The current study aims to extend Canales (2012) using an L2 group whose native language does

not instantiate wh-movement and thus does not have the same island constraints as does English.

The goal is to determine whether L2 learners, whose L1 does not instantiate wh-movement, nor

the same island constraints as English, are able to utilize syntactic information in their on-line

sentence processing.

As the Shallow Structure Hypothesis predicts that no L2 learners will be able to use

syntactic information to process sentences, learners who have similar syntactic constraints in

their L1 should still not be able to access those structures or constraints in their L2 processing.

However, testing speakers of an L1 which does not have similar syntactic structures and

constraints as the L2 could help to delineate when access to syntactic mechanisms is possible, if

the broad interpretation of the Shallow Structure Hypothesis is shown to be unmotivated. Thus,

this study will test highly proficient L1 Korean learners of English.

The specific research questions that will be addressed in the current study are: (1) Are

Korean L1 learners able to make use of abstract syntactic structures in their online processing of

L2 English *wh-* filler gap sentences? (2) Specifically, do Korean learners of English actively

posit gaps in on-line processing (Experiment 1)? (3) Do Korean learners of English avoid

positing gaps in grammatically unlicensed positions (Experiment 2)?

3.   Linguistic Background

   3.1 *Wh -properties in English*

   Critical to the current study, English has wh-movement, while Korean is a wh- in situ

language. As discussed previously, wh- movement in English can refer to movement out of

matrix or embedded clauses to form either matrix or embedded questions (Adger 2003). Recall

that the moved *wh-* word is referred to as a *filler*, while the position it is moved from is known as

a *gap* (15).

   (15)
        a. *Who* did Ryan think that he would go to the zoo with _____?
        b. Jae-ik asked *who* [the employee that worked in the mall] saw us with ___when
            she was shopping yesterday.

Furthermore, critical to this study is the fact that movement of wh-elements in English is limited

by *wh- island* constraints (Ross 1967). For instance, movement out of a complex noun phrase is

prohibited, explaining the grammatically in (16a) in comparison to the ungrammaticality in

(16b). While movement out of a complex noun phrase island is prohibited, the entire noun

phrase can move, though the movement and gap position are indistinguishable in the surface

structure (16c).

   (16)
        a. Da'quan wondered if [$_{NP}$the house that was built for James] would still be
            standing after the storm.
        b. *Da'quan wondered who [$_{NP}$the house that was built for ____] would still be
            standing after the storm.
        c. Da'quan wondered what [$_{NP}$____] would still be standing after the storm.

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Another example of a strong island in English, from which extraction is not allowed, is a relative clause island, as in (17). Relative clause islands were used in Experiment 2 of both Canales (2012) and the current study in order to test whether L2 learners have access to abstract syntactic island constraints in on-line sentence processing.

(17)
    a. Amy chased [RC the child that/who threw the ball].
    b. Who did Mary chase [RC t]?
    c. *What did Mary chase [RC the child that/who threw t]?

3.2 *Wh- properties in Korean*

Unlike English, Korean is a *wh-* in-situ language in which questions are not formed via *wh-* movement (Sohn 1999). Rather, questions are formed by simply replacing a constituent in the declarative sentence (18a) with a *wh-* word, as seen in (18b) and (18c). Thus, no gaps are created in the formation of matrix questions.

(18)
    a. Mary 가   우리 에게   John 을   내일   공원에서

    Mary-ga   uri-ege   John-ul   neil   **kongwon**-eso

    Mary-sub [us-to] [**JOHN**-obj] [tomorrow] [**PARK**]-in

    만나냐고   물었다.

    mananyago   mulrotta.

    [to meet]   asked

    "Mary asked us to meet [John] tomorrow [in the park]."

    b. Mary 가   우리에게 John 을 내일 어디서 만나냐고 물었다.

    Mary-sub [us-to] [**JOHN**-obj] [tomorrow] [**WHERE**]-in [to meet] asked

    "Where did Mary ask us to meet John tomorrow ___?"

    c. 메리가   우리에게 누구를 내일 어디서 만나냐고 물었다.

    Mary-sub [us-to] [**WHO**-obj] [tomorrow] [**WHERE**]-in [to meet] asked

    "Where did Mary ask us to meet who tomorrow _____?"

Korean has a number of syntactic properties which are different from those of English (Sohn 1999). There is some discussion in syntax literature of *wh*-movement after 'spellout' in the LF (logical form), otherwise known as *covert* movement. However, even if such movement does exist, the Shallow Structure Hypothesis predicts that L2 learners are unable to access syntactic properties in either the L1 or the L2. Thus, regardless of any wh-movement in Korean, testing L1 Korean L2 English learners is still relevant to the hypothesis' predictions. Another unique property of Korean is *scrambling* in which the subject and other constituents can move freely for emphasis or figurative purposes, though the verb remains in final position of the sentence. There are some discourse restrictions and the subject-object-verb word order is often the preferred structure. Such scrambling does not change the *wh-* in situ properties of Korean as the *wh-* element still occurs in the same position as its referent and no gaps are created. Thus, any movement in Korean is the result of scrambling, not the creation of gaps via movement.

3.3 *Korean Embedded Questions*

Korean embedded questions are formed similarly to Korean matrix questions in that the *wh-* element replaces its referent in the sentence, without movement. Thus, structures (19a) and (19b) are fundamentally the same. The only change is that *the criminal* (19a) has been replaced by *who* in the embedded question (19b).

(19)
  a.

경찰은   Jake 와   Jill 에 관한   스캔들   기사가
Kyongchar-un   Jake- wa Jill-e kwanhan   scandal   kisa-ga
[[policeman]-sub   [[[Jake and Jill about]   [scandalous report]-sub]

그 범죄자를   보호하기   위해 숨겨졌는지   물었다.
ku pomchwecha-lul   pohoha-gi   wihe sumkyeochunnun-ji mulot-da.
[[the criminal]-obj   [to protect]] [was hidden]]   [asked]]
"The policeman asked [[if the scandalous report about Jake and Jill] was hidden to protect the criminal]]."

b.

경찰은　　　　　　　Jake 와 Jill 에　관한　　　스캔들　　기사가
Kyongchar-un　　　Jake-wa Jill- e kwanhan　scandal　　kisa-ga
[[policeman]-sub [[[Jake and Jill about]　　　[scandalous　report]- sub]

누구를　　　　보호하기　위해　숨겨졌는지　　　　물었다.
nugu-　lul pohoha-gi　wihe　sumkyeochunnun-ji　mulot-da.
[[WHO]-obj　[to protect]] [was　hidden]]　　　　[asked]]
"The policeman asked [[who the scandalous report about Jake and Jill] was hidden to protect _____]."

3.4 *'Island Violations'*

A key difference between the properties of English and Korean is the fact that *island violations* in English are not violations in Korean. Thus, while the structures in (20) are considered ungrammatical in English because a *wh*-element has been moved out of a complex noun phrase, the same sentences in Korean are considered grammatical. Specifically, in Korean, *[Jake and Jill]* can be replaced with *who* as in (20a). Similarly, either *[Jake]* or *[Jill]* individually can also be replaced with *who* as in (20b).

(20)

    a. 경찰은　　　　누구에　관한　　　　　스캔들 기사가
    Kyongchar-un　　　nugu- e kwanhan　　　scandal　　kisa-ga
    [[policeman]-sub [[[who　about]　　　　[scandalous　report]- sub]

    그 범죄자를　　　　보호하기　　위해　숨겨졌는지　　　물었다.
    ku pomchwecha lul　pohoha-gi　wihe　sumkyeochunnun-ji　mulot-da.
    [[the criminal]-obj　[to protect]] [was　hidden]]　　　　[asked]]
    * "The policeman asked [[who the scandalous report about _____] was hidden to protect the criminal]]."

    b. 경찰은　　　　　누구 와　　Jill 에　관한　　　　스캔들　　기사가
    Kyongchar-un　　　　nugu- wa　Jill- e kwanhan　scandal　　kisa-ga
    [[policeman]-sub　[[[who　and　Jill　about]　[scandalous　report]- sub]

    그 범죄자를　　　　보호하기　　위해　숨겨졌는지　　　물었다.
    ku pomchwecha-lul　pohoha-gi　　wihe　sumkyeochunnun-ji　mulot-da.
    [[the criminal]-obj　[to protect]]　　　　[was　hidden]]　　[asked]]

* "The policeman asked [[who the scandalous report about _____and Jill] was hidden to protect the criminal]]."

As with complex noun phrases, sentences which result in wh- extraction out of a relative clause island are considered ungrammatical in English (21c). However, these sentences are grammatical in Korean.

(21)

    a. Amy chased [the child that/who threw the ball].
       Amy 는 공을 던진 아이를 쫓아갔다.
    b. Who did Mary chase [t]?
       Mary 가 쫓아간 아이가 누구니?
    c. *What did Mary chase [the child that/who threw t]?
       Mary 쫓아간 아이가 던진 것은 무엇이니?

Thus, sentences with island violations in English are acceptable in Korean (Sohn 1999).

3.5 *Korean Resumptive Pronouns*

Additionally, Korean has a resumptive pronoun, *saram* (사람), meaning "person," which is required in sentences with subordinate clauses (22-23). To form a subordinate clause in Korean, the use of a noun-modifying form ㄴ/은/는 (shown in italics in the examples) plus a noun is required. Thus, the resumptive pronoun, *saram* (사람) in the case of a person or *goat* (것) in the case of object, is needed because otherwise there would be no noun to modify in the subordinate clause. Therefore in (22a), the resumptive pronoun is used to clarify that the person doing the calling was Jinsu. Similarly, when a wh-question is formed (22b), the resumptive pronoun refers to the unknown person doing the calling. Just as the resumptive pronoun is required in a declarative sentence, eliminating it from an interrogative sentence, as in (22c) is considered ungrammatical in Korean.

(22)

    a. Jinsu is the person [who called Minsu]
       진수는 민수한테 *전화한* **사람**이다.
       [Jinsu-sub] [Minsu-to] [call-past] [person-be]

    b. Who is the person [who called Minsu]?
       민수한테 *전화한* **사람**이 누구니?
       [Minsu-to] [call-past] [person-be] [who]

    c. *민수한테 *전화한* 누구니?
       [Minsu-to] [call-past] [who]

(23)

    a. This is the man [that/who we saw at the Korean restaurant]
       이 남자가 우리가 한국 레스토랑에서 본 **사람**이다.
       [[This man]sub] [we-sub] [at Korean restaurant] [saw] [person-be]

    b. Who did we see ___ at the Korean restaurant?
       우리가 한국 음식점에서 본 **사람**이 누구지?
       [[we-sub] [at Korean restaurant] [saw] [person-be] [who]

    c. Who did we see ____ at the Korean restaurant?
       *우리가 한국 음식점에서 본 누구지?
       [[we-sub] [at Korean restaurant] [saw] [who]

4.   Method

4.1 *Participants*

    Sixty-four advanced learners of English were recruited from the University of Kansas and the surrounding community.   L2 learners completed the University of Michigan Listening Comprehension Test, a 45 question test which covers various aspects of English grammar. In order to provide a fair comparison to the L1 Spanish L2 English participants in Canales (2012) who were all advanced learners of English, L1 Korean L2 English learners in this study with scores below 34 on the comprehension test were eliminated from the data analysis. This resulted in eleven participants being excluded from the data analysis. Additionally, one participant was excluded due to significant study of another language with wh- movement and one participant was removed due to technical difficulties. Data from three participants were removed because

their background questionnaire indicated that they had significant exposure to English prior to age twelve. Significant exposure to English was defined as more than four hours a week of English tutoring or any type of English immersion experience. All 48 L2 learners who were analyzed (mean age = 30.58) were native speakers of Korean. The mean age of participants when they first arrived in an English speaking country was 24 years and 4 months. Participants included eighteen males and thirty females. Results from the L2 learners were compared to a group of 48 native English speaking controls (mean age = 21.75) used in Canales (2012) who were also recruited from the University of Kansas.

4.2 *Methodology*

Experiment 1 stimuli. In the current study, the goal of the first experiment was to determine if native Korean learners of English process sentences incrementally, similar to native speakers. Increased reading times at each potential gap position in the wh-extraction conditions, as compared to the same position in the declarative conditions, were used to test for evidence of such incremental processing. The critical gap position for this study was the object gap (*Tom)* in region 8, as highlighted in bold in (24b). Because previous studies have found inconsistent evidence for subject filled gaps (see Stowe 1986 for further discussion), we will also examine reading times at the subject position (*Chris)* in region 5.

(24)   Declarative
                1   2   3   4 5   6   7   8   9   10 11 12   13
         a. The instructor wondered if Chris will film **Tom** with Susan at the reception.
             Wh-extraction
         b. The instructor wondered who Chris will film **Tom** with _____ at the reception.

Stimuli for Experiment 1 include 20 pairs of sentences, with each pair consisting of a control, declarative sentence (24a) and a matched wh-extraction sentence (24b). These sentences are identical to those used in Canales (2012) and were presented using a Latin Square design such

that every participant read one sentence from each pair of sentences, but no participant read more than one version of a given sentence. The verbs which precede the critical region in the sentences *(photograph, meet, place, seat, find, put, film, discuss, introduce, and discover)* all require a sentential complement and were neither ditransitive nor optionally transitive (Aldwayan et al. 2010). In each sentence, the critical region was followed by a prepositional phrase which contained the actual gap position in the extraction condition. Furthermore, all proper names in the critical region were controlled for length and were three letters, half female and half male.

The predictions for the first experiment are as follows. If participants are actively and incrementally processing gaps, they should show a slow-down at the critical object filled gap position. A filled gap effect may also emerge in subject position; however previous studies have found inconsistent evidence for a subject filled gap effect (Aldwayan et al. 2010, Canales 2012; see Stowe 1986 for further discussion). According to the Shallow Structure Hypothesis, learners and native speakers may both demonstrate slower reading times at the object filled gap positions. However, learners might pattern this way not because they are accessing information regarding syntactic structure, but rather because they are assigning thematic roles (Clahsen & Felser 2006a, b), motivating the need for Experiment 2.

Experiment 2 stimuli. The goal of second experiment was to determine whether learners are able to use abstract syntactic island constraints in their on-line processing. Reading times at the critical filled gap position (e.g. *Tyler*), region 9, which is located within a relative clause island was examined in the declarative condition (25a) in comparison to the wh-extraction condition (25b). Recall that English island constraints prevent any movement out of a syntactic

island, such as a relative clause, and thus a gap is not syntactically permitted at *Tyler* in (25).

Reading times were also examined at the subject filled gap position, regions 5 and 6.

(25)   Declarative
       1   2   3   4   5   6   7   8   9   10   11   12   13
   a. My father asked if [$_{NP}$the actress that married **Tyler** last summer] kissed the
       director during the rehearsal.
       Wh-extraction
   b. My father asked who [$_{NP}$the actress that married **Tyler** last summer] kissed
       ____during the rehearsal.

Stimuli for the second experiment were taken from Canales (2012), who modified the

experimental stimuli used in Aldwayan et al. (2010) so that both Experiment 1 and 2 used a verb

for the potential gap licensor. Recall that this is different from the stimuli in Aldwayan et al.

(2010) in which the potential gap licensor in Experiment 1 was a verb, while the potential gap

licensor in Experiment 2 was a preposition.

Canales' (2012) stimuli for Experiment 2 contain a verb within a relative clause island

which licenses the potential object gap position, as in (26).

(26)   Declarative
   c. My brother questioned if [the journalist that <u>followed</u> **Henry** last Saturday]
       provoked the guard at the store.
       Wh-extraction
   d. My brother questioned who [the journalist that <u>followed</u> **Henry** last Saturday]
       provoked at the store.

In the declarative condition, the main verb is followed by an embedded *if*-clause, while in the

wh- extraction condition, the main verb is followed by an embedded *wh*-sentence. In both

conditions, the embedded clause consists of a relative clause island from which *wh-* extraction is

prohibited and the main verb (*ask, investigate, wonder, question)* can take a sentential

complement. Additionally, the gap licensing verbs are neither ditransitive nor optionally

transitive and the proper names used at the critical regions are all controlled for length at five

letters. Stimuli also included an adverbial phrase (*last Saturday*) between the licensor verb

(*followed*) and the next, gap-licensing verb (*provoked*) to allow for sufficient distance between

the two gap licensing verbs in order to analyze the spillover region. Finally, a prepositional

phrase was added to the end of each sentence "for the sake of naturalness" (54). Twenty pairs of

sentences, with each pair containing a control, declarative sentence (26a) and a matched *wh*-

extraction sentence (26b) were presented using a Latin Square design such that every participant

read one sentence from each pair of sentences, but no participant read more than one version of a

given sentence.

In the second experiment, native speakers were not predicted to show any increase in

reading times at the position following the verb that is embedded within the relative clause, due

to island constraints. However, native speakers might posit a gap at the subject position, before

the relative clause. In contrast, the Shallow Structure Hypothesis predicts that L2 learners will

slow down at all thematic role assigning positions, even those within the relative clause islands,

because they do not have access to the abstract syntactic island constraints.

4.3   *Procedure*

Participants were presented with a total of 120 sentences, consisting of 20 sentences from

Experiment 1, 20 sentences from Experiment 2 and 80 fillers, the same fillers as used in

Aldwayan et al. (2010). Similar to Aldwayan et al. (2010) and Canales (2012), stimuli for the

first and second experiments were combined and randomized, then presented to participants

using a 'moving window self-paced reading paradigm' (Just, Carpenter & Wooley, 1982).

Participants were asked to answer a question following each sentence. Questions consisted of a

repeated presentation of the previously read sentence, but one word was missing from the

sentence. Participants selected the missing word from two options by pressing the appropriate

key on the keyboard. Prior to the experiment, participants completed a practice session consisting of five practice sentences and had an opportunity to receive feedback or ask questions before beginning the experiment proper. Participants also had an opportunity to take short breaks as they completed the experiment.

Following the self-paced reading experiment, all participants completed two working memory tasks for a future study, which will not be analyzed in this study, and a background questionnaire. Additionally, L2 learners completed an off-line computer based auditory proficiency test, the University of Michigan Listening Comprehension Test (1972). The entire testing session lasted approximately 60 minutes for native speakers and 75 minutes for L2 learners.

4.4 *Analysis*

Overall mean accuracy rate to the comprehension questions was 93.3% for learners. Only those trials answered correctly were included in the statistical analysis and all participants included in the analysis had an overall accuracy rate of 80% or above.

Reading times above 2.5 standard deviations or below 2.5 standard deviations below the participant's mean for a given condition in a given region were excluded from the analysis. For Experiment 1, 90.67% of the data was retained in the declarative condition and 92.31% in the wh- extraction condition. For Experiment 2, 93.04% of the data was retained in the declarative, condition and 92.04% in the wh- extraction condition. This remaining data was analyzed using *t*-tests for each of the critical regions. Possible effects in Experiment 1 were expected at region region 8 (object-filled gap) and possibly five (subject-filled gap). The critical region for Experiment 2 was region nine (illicit object-filled gap within the relative clause island), with

additional effects possible at regions five and six (subject-filled gap). We interpreted a *p* value

of < .05 as significant and *p* values between .05 and .10 as marginal.

  5.   *Results*

  5.1 Experiment One.

    The goal of experiment one was to test whether, like native speakers (Stowe 1986),

Korean learners of English process sentences incrementally. If participants are parsing sentences

incrementally, then they should show evidence of a slowdown in reading times at the object

filled gap position, region 8, in the wh-extraction condition (27b) as compared to the same region

in the declarative condition (27a). The spillover region 9 was also examined for evidence of

slowdown.

  (27)   Declarative
            1   2   3   4   5   6   7   8   9   10 11 12 13
          a. My mother asked if   John will find Rob beside Dad at the restaurant.
          Wh- Extraction
          b. My mother asked who John will find Rob beside _____ at the restaurant.

The analysis of the critical region 8 indicated no significant differences in reading times (*p* =

.95). However, further analysis of the spillover region 9, which immediately follows the critical

region, did show a significant slowdown in reading time in the wh-extraction condition as

compared to the declarative condition *t*(47)=-2.08 (*p* = .0426, two-tailed paired *t*-test). Figure 1

illustrates the mean reading times in each region for the wh-extraction condition as compared to

the declarative condition in Experiment 1.
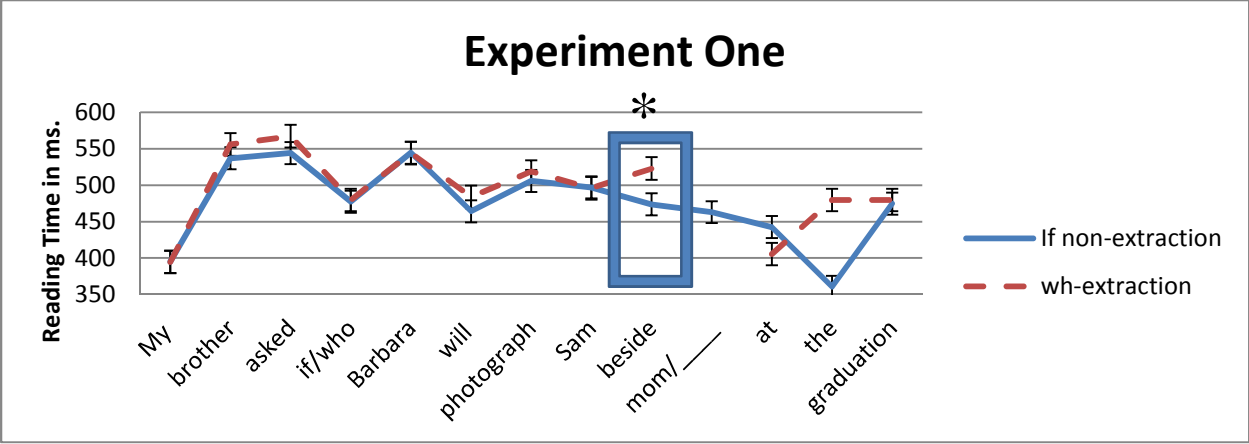
Experiment One

Figure 1. Reading times for Korean learners of English for Experiment 1.

Because some previous studies have also found evidence for filled subject gap positions (Aldwayan et al. 2010, Canales 2012), we also examined the reading times at the subject position, region five and the spillover region six for evidence of a reading time slowdown, but no significant effects emerged.

5.2   Experiment Two.

The goal of the second experiment was to determine whether Korean learners of English were able to utilize abstract syntactic information in their on-line processing and thus avoid positing gaps within relative clause islands. Following the findings of Aldwayan (2010) and Canales (2012), the prediction for the current study was that learners would show no evidence of slowdown at the critical region, region 9, the illicit gap position, in the wh- extraction condition (28b) as compared to the declarative condition (28a). In addition to the critical regions, the spillover regions 10 and 11 were also examined for differences.

(28)   Declarative
           1   2   3   4 5   6   7 8   9   10 11   12   13 14
    a.   My father asked if the actress that married Tyler last summer kissed the director during the rehearsal.

Wh-extraction
b. My father asked who the actress that married Tyler last summer kissed____
during the rehearsal.

Analysis of the critical region, region 9 did reveal a slowdown, but in the opposite

direction of the prediction. That is, participants read significantly slower in the declarative

condition as compared to the wh- extraction condition $t(47)=2.127$ ($p < .05$, two-tailed paired t-

test). Analysis of the spillover regions, however, found no significant differences between the

two conditions. Reading times in the wh- extraction condition as compared to the declarative

condition revealed no significant differences in either region 10 ($p = .11$, two-tailed paired t-test)

or region 11 ($p = .24$, two-tailed paired t-test). Because a slowdown could have occurred at the

subject position in regions 5 and 6 because a potential gap could have been predicted by the

parser before a syntactic island was encountered, these regions were also analyzed. No evidence

of a filled gap effect was found at these subject positions either. Figure 2 illustrates the mean

reading times in each region for the relative clause island condition as compared to the

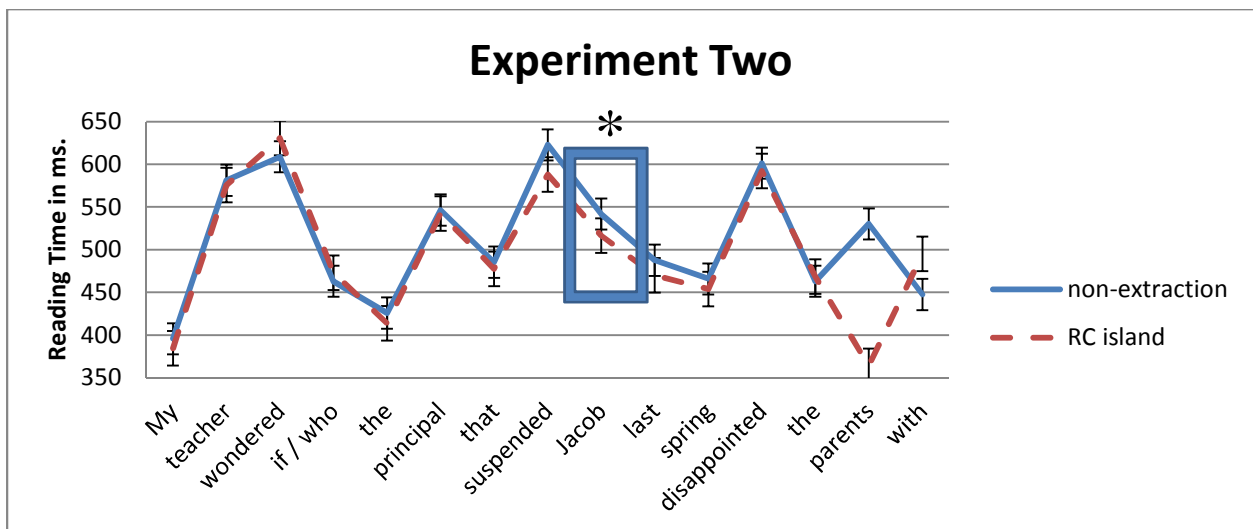declarative condition in Experiment 2.

Figure 2. Reading times for Korean learners of English for Experiment 2.

5.3 Summary of Experiments One and Two.

The results of Experiment 1 support the hypothesis that L2 learners are able to process gaps incrementally. The effects emerged in the form of a reading time slowdown in the spillover region immediately following the critical filled object gap position, region 9. These findings are similar to the pattern found for filled object gap effects in native English speakers and native Spanish L2 learners of English in Experiment 1 of Canales (2012).

The results of Experiment 2 supported the hypothesis that the L2 learners do not try to posit gaps in grammatically unlicensed positions. While the critical region 9 did show a significant difference in reading times between the wh-extraction and declarative conditions, it was in the opposite direction of the prediction. That is, reading times were faster at the illicit gap position in the wh-extraction condition and were not significantly different in any of the following spillover regions. No evidence of subject filled gaps was found in either experiment.

6.   *Discussion*

The findings of the current study are in line with previous studies on L2 learners' ability to process sentences with wh-dependencies using abstract syntactic knowledge of island constraints (Aldwayan et al. 2010, Canales 2012, Omaki & Schulz 2011). Specifically, the evidence suggests that both native speakers (Stowe 1986) and learners of English process sentences incrementally and only posit wh-gaps in grammatically licensed positions. Moreover, the current findings challenge the predictions of the Shallow Structure Hypothesis (Clahsen & Felser 2006a,b) which claims that L2 learners can utilize semantic or pragmatic cues, but are unable to access syntactic information in on-line processing.

Previous studies have shown that native speakers of English, as well as native Najdi Arabic and native Spanish learners of English, parse sentences incrementally When the parser

encounters a wh-filler, it actively searches for the gap from which this wh-filler originated. For instance, when the parser encounters a wh- filler representing a displaced NP (i.e. *who*), it attempts to posit gaps after each gap licensor (i.e. preposition, verb) it encounters. If, however, such a position is already filled with an NP, the parser will be surprised and forced to reanalyze its predictions, thus causing a slowdown in its processing of that region of the sentence. This is the logic behind the current study's design. In Experiment 1, when the parser encounters a filler (i.e. *who*) in the wh- extraction sentences, it is predicted to posit a gap at the position following the embedded verb, which is a potential gap licensor. However, as this direct object position is already filled with an NP, the parser is forced to reanalyze its predictions in order to correctly posit the gap at the actual gap position, thus causing a reading time slowdown at the filled gap position. Native Korean learners of English showed such evidence of a filled gap effect in Experiment 1 of the current study. Numerous studies have supported such incremental processing for native speakers (Stowe 1986, Gibson and Warren 2004), and the current study adds to the growing evidence that L2 learners of various L1 groups also actively process sentences (Canales 2012, Omaki & Schulz 2011, Aldwayan et al. 2010).

Though native speakers are assumed to use syntactic information in their on-line sentence processing, what information is employed by L2 learners remains controversial. The results of Experiment 1 support the hypothesis that L2 learners process sentences incrementally; however, they do not address the question of what information these learners were using as they processed the sentences. As such, Experiment 2 was designed to test whether learners use syntactic knowledge in their processing. In this experiment, participants read wh-extraction sentences which contained syntactic islands. In turn, these syntactic islands contained linguistic material which could semantically license a gap position (i.e. a verb); however extraction out of these

islands is grammatically illicit. Thus, if participants are utilizing abstract syntactic rules such as island constraints in their on-line processing, they will not posit gaps within these islands. Evidence that they avoid positing gaps in illicit positions is a lack of significant difference in reading times at the illicit gap position within the island in the wh-extraction condition as compared to the same position in the declarative condition. This is because if participants are relying solely on non-syntactic information and thus predicting a gap within the island, when they find this position already filled with an NP (i.e. *Tyler*), the parser should show evidence of longer reading times as it is forced to reanalyze the location of the filler-gap. The current study did not find any evidence of slowed reading times within the syntactic islands for sentences which contained wh-extraction. In fact, reading times at the critical region in the wh-extraction condition in Experiment 2 were actually faster in comparison to the same position in the declarative condition, a result not predicted by the Shallow Structure Hypothesis.

The results of the current study support the hypothesis that L2 learners, like native speakers, utilize abstract syntactic island constraints in their on-line processing. These results challenge theories such as the Shallow Structure Hypothesis (Clahsen & Felser 2006a,b) which would predict that, in Experiment 2, L2 learners would posit gaps following the verb within the syntactic island because they are relying on semantic information and unable to access the syntactic knowledge required to avoid positing such gaps. Utilizing semantic information alone would permit the parser to identify the wh-filler as a thematic argument of the verb, even within an island, and thus cause a filled-gap effect when this argument position is already filled with another NP. As a result, the Shallow Structure Hypothesis would predict that, unlike native speakers, learners would show significant slowdowns at the illicit gap position within the syntactic island in the wh-extraction condition as compared to the declarative condition.

However, Korean learners of English in the present study showed no evidence of such a slowdown within the islands, thus providing support to the hypothesis that L2 learners, like native speakers, rely on syntactic information in order to accurately parse sentences.

The results of the current study are particularly valuable to the discussion of what information L2 learners use in their sentence processing because of the characteristics of the languages examined. While English is a wh-movement language, with island constraints, Korean has neither the same movement nor the same island constraints. Thus, native Korean learners of English would theoretically not be able to benefit from a transfer of syntactic knowledge from their L1 to their L2. Given that the Shallow Structure Hypothesis argues that L2 learners do not have access to any syntactic information, neither from their L1 nor their L2, such consideration of learners' L1 background is not directly relevant to this theory. However, other theories such as the Failed Functional Features Hypothesis (Hawkins and Chan, 1997) do predict that the properties of the L1 are important. Specifically, the Failed Functional Features Hypothesis predicts that features not instantiated in the L1 are not acquirable to native levels in the L2 past a critical age of acquisition. Thus, it is important to examine a wide range of language pairings. Previous studies have examined only a limited combination of language pairings, including typologically similar languages such as L1 Spanish L2 English (Omaki & Schulz 2011, Canales 2012), and typologically distinct languages such as L1 Najdi Arabic L2 English (Aldwayan et al. 2010). The current study adds to the field by providing converging evidence of L2 learners' ability to utilize English relative clause island constraints in their on-line processing (Canales 2012), while also controlling for the features of the L1. Because the present findings are based on a learner group whose L1 (Korean) differs from the L2 (English) in

terms of presence of wh-movement and island constraints, transfer effects cannot fully explain the findings.

Particularly compelling evidence against the Shallow Structure Hypothesis has been that L2 learners show some evidence of subject filled gap effects (Aldwayan et al. 2010, Canales 2012). Such evidence challenges the predictions of the Shallow Structure Hypothesis because the potential subject gap position occurs prior to any linguistic material which can semantically license a gap. Thus, if the parser is positing a gap in the subject position, evidence of a filled gap effect at this position cannot be explained by thematic argument assignment. The presence of subject filled gap effects is inconsistent in the literature for both native speakers (Stowe 1986, Lee 2004) and L2 learners (Aldwayan et al. 2010, Canales 2012), however, which could explain why the present study did not find such effects. As discussed in Stowe (1986), recovering from a reanalysis of a subject filled gap may be easier than from an object filled gap because the parser may have already expected the possibility of an object gap and thus is less 'surprised' when it encounters the filled subject position. This ease of reanalysis could also explain why some learners show evidence of subject filled gap effects even when native speakers do not (Aldwayan et al. 2010, Canales 2012).

While the current study adds to the discussion of whether learners are able to access syntactic information in their on-line processing, future studies should continue to investigate which types of information and resources affect L2 learner processing. For instance, controlling for the linguistic features present in the L1 and L2 will help to determine if and when syntactic knowledge is transferred in learner processing. Furthermore, the studies discussed herein have focused on ability to utilize syntactic island constraints, but future studies should examine L2

learners' abilities to process other abstract linguistic structures in order to further define the limits of L2 processing.

Finally, there is some evidence that individual differences may play a role in both first and second language acquisition. The Shallow Structure Hypothesis predicts that individual differences will not affect learners' ability to utilize syntactic information in L2 on-line sentence processing because syntactic information is completely absent in learners' grammars. However, it is possible that some learners may be better able to access syntactic information in their on-line processing than others.

One possible source of variance which is particularly relevant to the study of wh-dependencies is individual differences in working memory capacity. Because the wh-filler must be stored in working memory until the actual gap is found, measures of working memory capacity may provide insight into why some studies find native-like processing in learners, while others do not. Previous evidence has indicated that working memory capacity is associated with native speakers' processing of wh-dependencies (Clahsen & Felser 2006, Felser & Roberts 2007), as well as learners' use of plausibility information (Dussias & Piñar 2010), and learners' processing of other grammatical structures in offline grammaticality judgment tasks (McDonald 2006). However, working memory effects need to be further examined in conjunction with tasks which have also provided evidence that L2 learners are able to access syntactic information. Thus, additional research is needed to determine when learners are able to use abstract syntactic mechanisms in their on-line sentence processing and whether the use of such processing mechanisms may be related to individual differences, such as working memory capacity. In order to pursue this line of research, our lab is currently investigating the effects of working memory on native and L2 learner processing of wh-movement (Johnson in progress).

7.   *Conclusions*

The results of this study contribute to the line of research examining whether L2 learners are able to use syntactic information in on-line processing. Consistent with previous findings, (Aldwayan et al. 2010, Canales 2012, Omaki & Schulz 2011) our study provides new evidence that L2 learners are able to access syntactic mechanisms in on-line sentence processing. Such converging evidence suggests that the Shallow Structure Hypothesis is not specific enough to account for the fact that on some structures, some learners do seem to process language similarly to native speakers. The use of Korean, a language in which the abstract syntactic island constraints are not instantiated in the L1, and refined stimuli which ensure that the critical comparisons have controlled for types of gap licensors, provides further information regarding when such syntactic structures are accessible. Such research contributes to the overarching question in second language acquisition research as to whether native-like acquisition of a second language is possible and, if it is, for whom and on what structures.

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Appendix 1

Stimuli: Experiment One (From Canales, 2012)

My brother asked if Barbara will photograph Ali beside Mom at the graduation.

My brother asked who Barbara will photograph Ali beside at the graduation.

My niece guessed if Kelly will photograph Kim with Edward at the parade.

My niece guessed who Kelly will photograph Kim with at the parade.

My sister knew if Roger will place Pat with Jason at the lunchtable.

My sister knew who Roger will place Pat with at the lunchtable.

My nephew revealed if Alex will put Ted near Nancy at the gathering.

My nephew revealed who Alex will put Ted near at the gathering.

My friend wondered if Julie will recommend Amy to Sarah before the deadline.

My friend wondered who Julie will recommend Amy to before the deadline.

My mother asked if John will find Rob beside Dad at the restaurant.

My mother asked who John will find Rob beside at the restaurant.

My aunt guessed if Patrick will film Sue with Kelly at the banquet.

My aunt guessed who Patrick will film Sue with at the banquet.

My grandmother knew if Adam will find Jen with Rachel at the mall.

My grandmother knew who Adam will find Jen with at the mall.

My classmate revealed if Jack will meet Moe with Sarah before the dance.

My classmate revealed who Jack will meet Moe with before the dance.

My cousin wondered if David will put Liz near Jack at the wedding.

My cousin wondered who David will put Liz near at the wedding.

The manager asked if Ethan will meet Sam with Jeff outside the office.

The manager asked who Ethan will meet Sam with outside the office.

The student guessed if Ryan will introduce Jim to Heather after the break.

The student guessed who Ryan will introduce Jim to after the break.

The teachers knew if Michael will discover Ron with Jerry during the game.

The teachers knew who Michael will discover Ron with during the game.

The secretary revealed if Shawn will introduce Lou to Jared after the speech.

The secretary revealed who Shawn will introduce Lou to after the speech.

The instructor wondered if Chris will film Tom with Susan at the reception.

The instructor wondered who Chris will film Tom with at the reception.

The boy asked if Matt will place Ben with Susie at the party.

The boy asked who Matt will place Ben with at the party.

The babysitter guessed if Christopher will discover Dan with Lindsey in the closet.

The babysitter guessed who Christopher will discover Dan with in the closet.

The manager knew if Katie will recommend Joe to Patricia after the assembly.

The manager knew who Katie will recommend Joe to after the assembly.

The girl revealed if Melissa will seat Ann by Susan at the dinner.

The girl revealed who Melissa will seat Ann by at the dinner.

The teacher wondered if Harry will seat Bob by Rachel in the classroom.

The teacher wondered who Harry will seat Bobby in the classroom.

Stimuli Experiment 2 (from Canales, 2012):

My father asked if the actress that married Tyler last summer kissed the director during the rehearsal.

My father asked who the actress that married Tyler last summer kissed during the rehearsal.

My manager investigated if the assistant that fired Kylie last June seduced the supervisor before the party.

My manager investigated who the assistant that fired Kylie last June seduced before the party.

My brother questioned if the journalist that followed Henry last Saturday provoked the guard at the store.

My brother questioned who the journalist that followed Henry last Saturday provoked at the store.

My teacher wondered if the principal that suspended Jacob last spring disappointed the parents with the news.

My teacher wondered who the principal that suspended Jacob last spring disappointed with the news.

My brother asked if the woman that defended Dylan last Tuesday slapped the thief on the face.

My brother asked who the woman that defended Dylan last Tuesday slapped on the face.

The psychologist investigated if the boy that hit Timmy last Thursday offended the teacher after the incident.

The psychologist investigated who the boy that hit Timmy last Thursday offended after the incident.

My uncle questioned if the man that visited Ellie last night irritated the neighbors with the noise.

My uncle questioned who the man that visited Ellie last night irritated with the noise.

My wife wondered if the hunter that located Jenny last Sunday contacted the police from the camp.

My wife wondered who the hunter that located Jenny last Sunday contacted from the camp.

My daughter asked if the clown that scared Eddie last Wednesday delighted the nanny with the balloon.

My daughter asked who the clown that scared Eddie last Wednesday delighted with the

balloon.

The prosecutor investigated if the accountant that fooled Maria last December defrauded the investors over the internet.

The prosecutor investigated who the accountant that fooled Maria last December defrauded over the internet.

The senator questioned if the traitor that exposed Diana last month betrayed the president after the scandal.

The senator questioned who the traitor that exposed Diana last month betrayed after the scandal.

My nephew wondered if the banker that dated Molly last year shocked the auditor with the report.

My nephew wondered who the banker that dated Molly last year shocked with the report.

The politician asked if the reporter that challenged Carol last Monday annoyed the moderator at the debate.

The politician asked who the reporter that challenged Carol last Monday annoyed at the debate.

The Sheriff investigated if the boxer that defeated Peter last March paid the referee for the championship.

The Sheriff investigated who the boxer that defeated Peter last March paid for the championship.

The reporter questioned if the politician that impressed Peggy last February insulted the senator
at the conference.

The reporter questioned who the politician that impressed Peggy last February insulted at the conference.

The agent wondered if the producer that consulted Lucas last Friday hired the musician after the audition.

The agent wondered who the producer that consulted Lucas last Friday hired after the audition.

The chief asked if the officer that interviewed James last week angered the lawyer during the trial.

The chief asked who the officer that interviewed James last week angered during the trial.

The doctor investigated if the nurse that vaccinated Aaron last April harmed the child at the hospital.

The doctor investigated who the nurse that vaccinated Aaron last April harmed at the hospital.

The director questioned if the singer that bothered Becky last season criticized the pianist after the concert.

The director questioned who the singer that bothered Becky last season criticized after the concert.

The agent wondered if the spy that shot Megan last evening kidnapped the ambassador from the hotel.

The agent wondered who the spy that shot Megan last evening kidnapped from the hotel.