Why Left-to-Right Grammar?: Evidence from Korean

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This paper aims to explain Korean native speakers' strong preference for incremental, left-to-right structure building based on the following core phenomena: (i) left-right asymmetry; (ii) striking preference for early association; (iii) dislocation and context-sensitivity. I claim that those phenomena reflect the procedural aspects of linguistic competence, which are hard to capture/explain in a static grammar formalism. In this paper, based on these observations, I argue for the necessity of a grammar formalism which assumes left-to-right incrementality as the core property of syntactic architecture. Though the nature of discussion is theory-neutral, to formalise procedural competence, I will adopt Dynamic Syntax (DS: Kempson et al. (2001), Cann et al. (2005)) and provide an account based on DS. By adopting a left-to-right framework, I believe that we can bridge some unnecessary gap between COMPETENCE and PERFORMANCE, meeting the ultimate goal of any linguistic theory, that is, to achieve the appropriate explanatory adequacy. In this paper, I argue that structure building, both in comprehension and production, is driven by the native speaker's need to optimise their structure, which is expressed as a strong tendency to build any meaningful, communicative proposition as quickly as possible with a minimised structure-building effort (cf. Hawkins (2004)).

1. Empirical challenge in the grammar

1.1. Beyond Descartes' problem

The mystery of human language lies in the way humans construct their linguistic message in a systematic way across languages.[1] Even very small children can freely produce sentences they have never heard. This is known as Descartes' problem. However, such freedom is not unrestricted. One of the core abilities of native speakers of a language is the ability to tell whether a given sequence of words is well-formed or ill-formed in their mother tongue. This provided strong evidence to generative grammarians that the logic of

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structure, namely, syntax, constitutes the core part of human language. In this paper, I want to bring up another aspect of natural language syntax. It is that native speakers do not equally produce ALL the logically possible well-formed strings in real language use. In addition, they do not understand with equal efficiency all the logically possible well-formed strings. Instead, they show a strong preference, expressed as efficiency or frequency, for certain well-formed strings both in understanding and in their own production. The same tendency is also found in typological variation as well as in language change. Neither diachronic nor synchronic variation displays ALL the logically possible alternatives, but mostly a certain very limited set of variations.

This paper aims to answer WHY it is so and WHAT it tells us about the architecture of mental grammar. Ever since Chomsky (1965), generative grammarians have believed the existence of core, abstract, universal and innate properties[2] of human languages used by an ideal speaker which could well answer the Descartes' problem. I will call it CORE GRAMMAR in this paper for simplicity of discussion. This paper shares the same belief on the existence of the core grammar, yet questions the exact nature of such grammar. I claim that a strict and radical gap between innate knowledge of a language, known as *competence*, and behavioral variation, known as *performance* is the result of looking at the grammar from a static point of view, ignoring its procedural, time-sensitive and dynamic nature. I will show that such an unnecessary gap can be bridged and that we can provide a more sensible/elegant syntactic account by adopting a grammar with a left-to-right growth mechanism.

In particular, based on the three phenomena we will discuss, I will show dynamic aspects of the core grammar, which reflect PROCEDURAL COMPETENCE and are expressed as left-to-right incremental growth of a linguistic structure. I argue that left-to-right syntactic architecture is essential in explaining procedural competence, as it can naturally capture/explain incremental growth of a linguistic structure. Non-linear, static grammar formalisms are hard to pin down in those phenomena, since they are yielded as consequences of incremental growth of a structure, as we shall see.

Particular evidence is to be given from Korean, known as a strict verb-final and (relatively) free word-order language. Nevertheless, most of the issues and challenges that we will discuss are not just applicable to some very limited number of languages, but also can be extended to verb-final languages in general, which comprise about 40% of world languages according to the World Atlas of Language Structures (WALS) Online. Indeed, I believe that the properties that we will discuss are manifestations of natural language syntax. In this paper, I will focus on the following aspects and questions to examine the properties of the core grammar.

(1) <u>(a) Freedom at Left and Restriction at Right</u>

[2] Similarly, Chomsky described I-language with the following terms: *the 'pure' manifestation of the language faculty that would arise in the mind/brain of a child placed in an idealized homogeneous speech community of one of the varieties of what we loosely and probably incoherently call 'English', etc.* (Chomsky 1987:31), recited from Wasow (2002:142).

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Why are expressions at the left periphery interpreted more freely than those at the right periphery?
(b) Early Syntactic Association
Why do native speakers STRONGLY prefer early syntactic association and put the arguments in the same local domain?
(c) Dislocation Mystery and Context Sensitivity
Though early association is strongly preferred, why do native speakers sometimes use dislocation (even across a clause boundary)?

In the following, in Section 2, I will discuss each phenomenon and the result of some empirical investigations. In Section 3, I will introduce Dynamic Syntax (Kempson et al. 2001, Cann et al. 2005, Kempson and Cann in this volume) briefly and provide a DS analysis. In section 4, I will conclude.

2. Core phenomena

2.1. Freedom at left and restriction at right
In Korean, expressions at the left periphery can be interpreted more flexibly. For instance, a sentence-initial dative NP *Komtoli-hanthey* 'to a bear' in (2) can be interpreted in the three possible structures hosted by a verb *malhaysseyo* 'said' (= 2a), *mantwule-cwukessta* 'make-give' (= 2b) or *yaksokhayssta* 'promised' (= 2c).

(2) THREE POSSIBLE INTERPRETATIONS AT THE LEFT PERIPHERY
Komtoli-hanthey tokki-nun taramjwui-ka mass-iss-nun cake-lul
bear-dat rabbit-top squirrel-nom taste-exist-adn cake-acc
mantwule-cwukessta-ko yaksokhayssta-ko malhayss-eyo.
make-will.give-comp promised-comp said-decl
(a) 'A rabbit said to a bear that a squirrel promised that he will make and give him a delicious cake.'
(b) 'A rabbit said to somebody that a squirrel promised to a bear that he will make and give him a delicious cake.'
(c) 'A rabbit said to somebody that a squirrel promised that he will make and give a bear a delicious cake.'

However, interpreting expressions becomes gradually more restricted. So, in (3), *komtoli-hanthey* can have just two possible interpretations. Yet, as it gets close to the verb, only one interpretation becomes available as in (4)-(5):

(3) TWO POSSIBLE INTERPRETATIONS
Tokki-nun komtoli-hanthey taramjwui-ka mass-iss-nun cake-lul
rabbit-top bear-dat squirrel-nom taste-exist-adn cake-acc
mantwule-cwukessta-ko yaksokhayssta-ko malhayss-eyo.
make-will.give-comp promised-comp said-decl
(a) 'A rabbit said to a bear that a squirrel promised that he will make and give him a delicious cake.'

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(b) 'A rabbit said to somebody that a squirrel promised to a bear that he will make and give him a delicious cake.'
(c) ???'A rabbit said to somebody that a squirrel promised that he will make and give a bear a delicious cake.'

(4) ONLY ONE POSSIBLE INTERPRETATION JUST BEFORE A MATRIX VERB

Tokki-nun	taramjwui-ka	mass-iss-nun	cake-lul	mantwule-cwukessta-ko
rabbit-top	squirrel-nom	taste-exist-adn	cake-acc	make-will.give-comp
yaksokhayssta-ko	komtoli-hanthey	malhayss-eyo.		
promised-comp	bear-dat	said-decl		

(a) 'A rabbit said to a bear that a squirrel promised that he will make and give him a delicious cake.'
(b) ???'A rabbit said to somebody that a squirrel promised to a bear that he will make and give him a delicious cake.'
(c) ???'A rabbit said to somebody that a squirrel promised that he will make and give a bear a delicious cake.'

(5) ONLY ONE POSSIBLE INTERPRETATION AT THE POST-VERBAL, RIGHT PERIPHERY

Tokki-nun	taramjwui-ka	mass-iss-nun	cake-lul	mantwule-cwukessta-ko
rabbit-top	squirrel-nom	taste-exist-adn	cake-acc	make-will.give-comp
yaksokhayssta-ko	malhayss-eyo	komtoli-hanthey.		
promised-comp	said-decl	bear-dat		

(a) 'A rabbit said to a bear that a squirrel promised that he will make and give him a delicious cake.'
(b) ???'A rabbit said to somebody that a squirrel promised to a bear that he will make and give him a delicious cake.'
(c) ???'A rabbit said to somebody that a squirrel promised that he will make and give a bear a delicious cake.'

Though Korean is regarded as a strictly verb-final language, it is very easy to find right-peripheral expressions. According to the picture-description test that we will discuss in 2.2, when the 7-9 year old children want the dative NP to be interpreted within an embedded clause, 87% of the time, they placed *wh*-dative NP either just in front of a verb or after a verb. See Figure 3.

Yet, in such cases, they are STRONGLY preferred to be interpreted in its closest local structure. Therefore, (6a) sounds very odd and ungrammatical, unlike (6b). Kiaer (in press) shows that in the grammaticality judgement test, 70% of the time, native speakers (n=33)[3] found sentences as in (6b), where the dative NPs CAN be incorporated to the closest leftward structure, very natural. In these cases, the dative NPs CANNOT be incorporated to the closest leftward structure, since the host verb is a transitive verb.

(6) a. Ditransitive verb and transitive verb sequence PLUS dative NP

???Hena-nun	Jina-ka	sakwa-lul	cwuessta-ko	saynggakhaysseyo
H-top	J-nom	apple-acc	gave-comp	thought

[3] *n* in this paper means the number of participants.

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Mina-hanthey.
M-dat
Intended reading: 'Hena thought that Jina gave an apple to Mina.'

b. Transitive verb and ditransitive verb sequence PLUS dative NP
Hena-nun Jina-ka sakwa-lul mekessta-ko malhaysseyo Miina-hanthey.
H-top J-nom apple-acc ate-comp said M-dat
Intended reading: 'Hena said to Mina that Jina ate an apple.'

Post-verbal expression and the verb often form an intonational unit with the preceding verb as Park (2003) showed. Park (2003) discussed that between the verb and its post-verbal argument, the Intonational Phrase (IP) boundary tone[4] may be shared or copied. See the pitch tracks from Park in Figure 1 for the example (7).

(7) Etise mandu-ni? ku-kapang
where make-Q the-bag
'Where did they make it, the bag?'

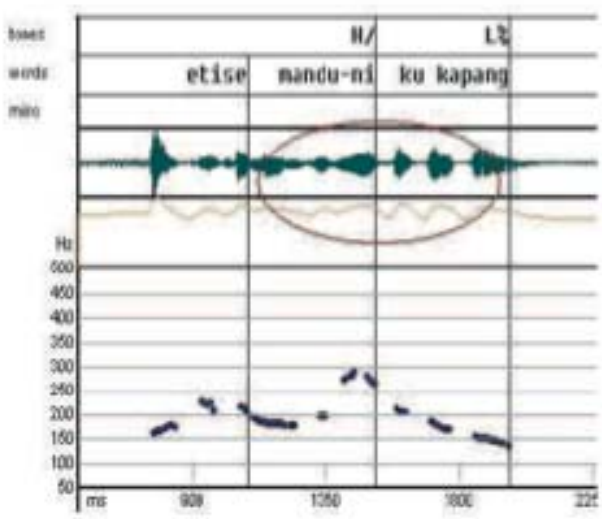


Figure 1: Pitch Track from Park (2003)

The circled line is drawn by me and it refers to an intonational unit between the verb and its post-verbal argument. As we can see, the boundary marking (%) doesn't occur after the verb but after the post-verbal NP.

Why do expressions at the left or sentence-initial position have more freedom in terms of choosing its host structure, compared to the expressions at the right or sentence-final position? Since the freedom of interpretation decreases GRADUALLY from left-to-right as a structure unfolds, it is difficult to answer the question within a binary feature-based framework as we shall discuss more in 2.4.2. The fact that structural freedom decreases from left-to-right, regardless of the location of a verb, clearly shows us that a syntactic

[4] In this paper, IP refers to the Intonational Phrase.

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structure is being built from left-to-right, rather than waiting for a verb and remaining un-built.

Left-right asymmetry of structure building has been a puzzle in the grammar, ever since it has been first discussed by Ross (1967) as a Right Roof Constraint. However, it occurs to me that indeed the phenomenon as such is not the reflex of specific aspects of Korean syntax, but instead it is a manifestation of the general/universal aspect of linguistic structure building. This component of syntactic competence is impossible to capture if we disregard the left-to-right growth property of a syntactic structure.

2.2. Early syntactic association

In the last section, we have observed that expressions occurring at the left periphery have more freedom than those at the right periphery. However, the empirical data we will discuss in this section show that native speakers STRONGLY prefer to interpret or understand the sentence-initial, left-peripheral expression within the FIRST-available, CLOSEST LEFTWARD structure in the left-to-right, time-linear understanding – instead in ANY arbitrary structure. Consider (2) again.

(2) THREE POSSIBLE INTERPRETATIONS AT THE LEFT PERIPHERY

Komtoli-hanthey	tokki-nun	taramjwui-ka	mass-iss-nun	cake-lul
bear-dat	rabbit-top	squirrel-nom	taste-exist-adn	cake-acc
mantwule-cwukessta-ko	yaksokhayssta-ko	malhayss-eyo.		
make-will.give-comp	promised-comp	said-decl		

(a) 'A rabbit said to a bear that a squirrel promised that he will make and give him a delicious cake.'
(b) 'A rabbit said to somebody that a squirrel promised to a bear that he will make and give him a delicious cake.'
(c) 'A rabbit said to somebody that a squirrel promised that he will make and give a bear a delicious cake.'

Sentence-initial dative NP CAN be interpreted in all three structures hosted by *mantwule-cwukessta* 'made-and-give', *yaksokhayssta* 'promised' and *malhayss-eyo* 'said'. Yet, native speakers of Korean STRONGLY prefer (8a) reading over all possible readings. According to Kiaer (in press), when native speakers of Korean (n=33) were asked a question such as (8b) after hearing (8a), 96% of the time, they answered in such a way which implies the sentence-initial dative NP being interpreted in the matrix clause together with the following topic marked NP.

(8) ONE DOMINANT INTERPRETATION AT THE LEFT

a.

Komtoli-hanthey	tokki-nun	taramjwui-ka	matiss-nun	cake-lul
bear-dat	rabbit-top	squirrel-nom	delicious-adj	cake-acc
mantulecwuessta-ko	malhaysseyo.			
made.gave-comp	said			

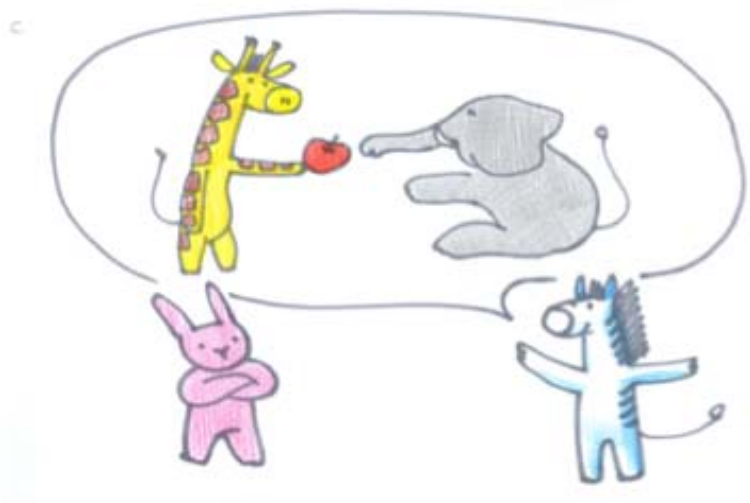
(i) 'A rabbit said to a bear that a squirrel made a delicious cake for him (= rabbit).
(strongly preferred: 96% of the time)
(ii) 'A rabbit said that a squirrel made a delicious cake for a bear.'

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b. Taramgui-ka nwukwu-hanthey matiss-nun cake-lul
squirrel-nom who-dat delicious-adj cale-acc
mantulecwuessta-ko-yo?
made.gave-comp-Q
'Who did the squirrel make the cake for?'
If the answer is a bear: (i) reading is chosen.
Yet, if the answer is a rabbit: (ii) reading is chosen.

In the following, at first I will provide a series of evidence which shows native Korean speakers' strong preference for early syntactic association both in comprehension and production. Then, I will provide the procedural competence these phenomena reflect.

Comprehension-and-Production Test The aim of the test was to investigate whether native speakers of Korean UNDERSTAND and also SPEAK incrementally, by observing their interpretation of a dative NP *nwukwu-hanthey* 'to whom'. Two groups have participated in the test. One group was high school students (aged 17-18, n=118) and the other group was primary school students (aged 7-9, n=20). Both groups were asked to look at the picture and answer the question as in (9).



(9) Condition A: Dative NP Subject (NOM) Subject Object Verb Verb
Nwukwu-hanthey ellukmal-i khirin-i sakwa-lul cwun-ta-ko
who-dat zebra-nom giraffe-nom apple-acc give-decl-comp
hayss-e?
said-Q
(i) 'To whom did the zebra say that the giraffe was giving an apple to the elephant?'
(Expected answer: a rabbit)
(ii) 'To whom did the giraffe give an apple, according to what the zebra said to the rabbit?' (Expected answer: an elephant)

Condition B: Dative NP Subject (TOP) Subject Object Verb Verb
Nwukwu-hanthey ellukmal-un khirin-i sakwa-lul cwun-ta-ko

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who-dat zebra-top giraffe-nom apple-acc give-decl-comp hayss-e?
said-Q
(i) 'To whom did the zebra say that the giraffe was giving an apple to the elephant?' (Expected asnwer: a rabit)
(ii) 'To whom did the giraffe give an apple, according to what the zebra said to the rabbit?' (Expected answer: an elephant)

In principle, sentence-initial dative NPs CAN be interpreted in the same or different clause with the immediately following NP. Yet, the result of this comprehension test shows in both groups native speakers STRONGLY prefer to interpret the dative NP in the SAME clause, signalled by the immediately following NP, though in principle they CAN be interpreted freely in other clauses. (As for high school students, such tendency was observed 87% for condition A and 86% for condition B and as for primary school children, such tendency was observed 97% for condition A and 93% for condition B of the time.) No significant effect was observed between Condition A and B.

In this comprehension test, the clause, where both the dative NP and the following nominative or topic-marked NP were interpreted, was the matrix clause. Yet, one cannot generalise that the first-available structure for the sentence-initial dative NP is always a matrix clause. Consider (10). Even if the first two lexical items are the same with the Condition A sentence of (9), the sentence-initial dative NP and the following nominative NP are most likely to be interpreted in an embedded clause this time. That is, (10a) reading is much preferred to (10b), unless the prosodic break intervenes between the sentence-initial dative NP and the following nominative NP.

(10) First-available structure is the embedded clause
Nwukwu-hanthey khirin-i sakwa-lul cwun-ta-ko ellukmal-i
who-dat giraffe-nom apple-acc give-decl-comp zebra-nom
malhayss-e?
said-Q
(a) 'To whom did the zebra say that the giraffe was giving an apple to the elephant?' (Expected answer: a rabbit)
(b) 'To whom did the giraffe give an apple, according to what the zebra said to the rabbit?' (Expected answer: an elephant)

After the comprehension test, the same subjects participated in the production test. As for high school students, they had to write a question, inducing the answer written already in their questionnaire. The answer was either the recipient animal or the animal listening to the story. As for primary school children, being paired in two, they were instructed to ask a question to the other student, inducing the answer circled in their pictures. The answer could also be either the recipient animal in the bubble or the animal listening to the story. Primary school children's question/answer practices were recorded for further prosodic analysis.

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Both groups' production patterns show some interesting results. Let's first look at the result from high school students. (11) shows preferred structural sequences and preferred syntactic association patterns in those sequences.

(11) Early Association at Left Periphery

Left-peripheral Sequences	Occurrence	Preferred Association
(a) Nom-Dat-Nom	424	{Nom-Dat}-Nom
(b) Dat-Top-Nom	134	{Dat-Top}-Nom
(c) Top-Dat-Nom	1486 (37% of the total)	{Top-Dat}-Nom

Although ambiguous readings are plausible (i.e., immediate or non-immediate reading) in NP sequences given (11a-c), native speakers UNANIMOUSLY preferred to associate the dative NP to the ALREADY available, LEFTward structure, unfolded by proposition-unfolding particles such as nominative or topic-marked NPs, not by a verb. Besides, about 45% of the time (1807 occurrences), the participants placed dative NP before either an embedded or a matrix verb. In these cases, the construal of dative NPs is not ambiguous: dative NPs are to be interpreted in the on-going propositional structure, to be completed by the upcoming verb.

Let's also look at the data we gathered from 7-9 year old children. As for the primary school students' data, when the answer animal was that of listening to the story, inducing the matrix clause reading of the *wh*-dative NP, the *wh*-dative NP occurred mostly in the left-periphery (83% of the time) as in Figure 2. (S1 means the first lexical item in the sentence.)

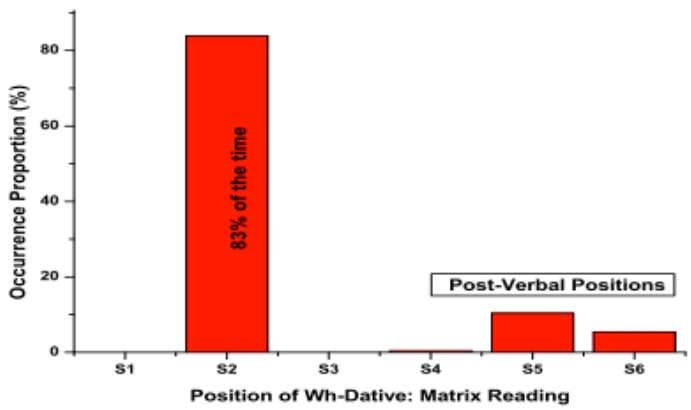


Figure 2: Left-peripheral Dative NPs: Matrix Clause Reading

Yet, when the answer animal was the recipient animal inside a bubble, inducing the embedded clause reading of the *wh*-dative NP, the *wh*-dative NP occurred most likely just before a verb or after a verb (87% of the time) as in Figure 3. In those cases, the participants were most likely to pronounce a verb and a post-verbal lexical item in the same intonational unit, as Park (2003) observed.

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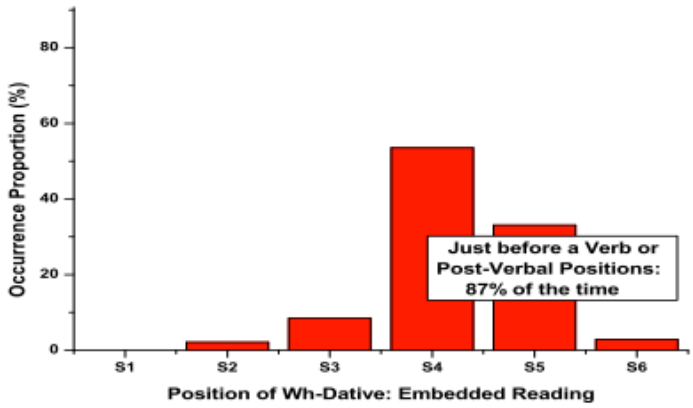


Figure 3: Right-peripheral Dative NPs: Embedded Clause Reading

What is very striking here is that in both groups even if left-peripheral dative NPs can be interpreted freely in any level of embedding, native speakers strongly prefer to use left-peripheral dative NPs when they intended the matrix clause interpretation, yet right-peripheral dative NPs when they intended the embedded clause interpretation. In this way, it seems that native speakers avoid any possible ambiguity. I claim that such disambiguation in production is the consequence of resource-sensitive structure building along with early syntactic association at the left periphery. In other words, these production patterns show that native speakers do NOT arbitrarily build a syntactic structure but do it in the most efficient way. Here some fundamental question could arise. In the tenet of generative grammar, an ideal speaker is implicitly assumed to have the capacity to understand and speak all the logically possible forms with similar efficiency. Under this assumption, it is hard to explain why certain forms are more efficient and therefore more frequent than other possible forms. Such efficiency/frequency effects are often ignored or regarded as only "accidental". Yet, it is counter-intuitive to see the above results being merely coincidental. Rather, I believe the data we discussed manifest the linguistic competence of Korean native speakers and beyond.

At the left periphery, where structural ambiguity could arise, native speakers of Korean preferred to resolve the dative NP in the FIRST AVAILABLE propositional structure. This structure is not necessarily a matrix clause or a particular level of embedded clause as we have seen. It is the first available, CLOSEST LEFTWARD structure in the left-to-right, time-linear understanding.

Yet, the first available, CLOSEST LEFTWARD structure can be defined in left-to-right architecture only. So, theorising syntactic competence, expressed through early syntactic association is not easy in non-linear, static grammar formalisms. The syntactic competence we observe in this section is that native speakers make syntactic association incrementally just by having a sequence of particles, without the full knowledge of the upcoming structure. To capture/explain early syntactic association and the notion of first available structure, a grammar formalism should assume left-to-right incremental growth of a structure in its backbone. In the case of Korean, I propose that the constructive use of particles and some routinised structure-building processes enable such incremental

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structure building. Particularly, I argue that nominative particles (*-ka*/*-i*) and topic particles (*-un*/*-nun*) are those particles which unfold a proposition. I will return to this in 3.3.

Furthermore, I argue that early syntactic association, indeed evidenced by synchronic, diachronic, and typological syntactic variations (See Kiaer (in press)), results from the following goal in syntactic structure building. The insight for (12) is from Hawkins (2004). I will return to this in 3.1.

(12) Goal of Linguistic Structure Building:
(For an efficient communication), native speakers aim to *optimise* their syntactic structure building (both production and comprehension) by achieving the meaningful, communicative proposition as quickly as possible with minimised structure-building effort.

2.3. Dislocation mystery and context sensitivity

We have seen in the last section native speakers' strong tendency for early syntactic association. Here, a puzzling question arises. If it is so, then why is it the case that long-distance dependency or any form of dislocation ever exists in all languages. In particular, if we assume (12), long-distance dependency should NOT exist, because it causes syntactic association being DELAYED. Nevertheless, even if those forms look inefficient, they ARE used and sometimes PREFERRED in certain cases. In this section, we will discuss why it is the case and what it tells us about the grammar.

Most grammar formalisms concentrated on *how* to explain long-distance dependency formation, neglecting the question on *why* such seemingly inefficient syntactic phenomena widely exist across languages. To answer this question, we need to extend the target of natural language syntax to be beyond a single-sentence level.

Sentences with dislocation are not preferred in general. As we have seen in the last section, NONE of the time, native speakers produced long-distance dependency in their production. Yet, when an appropriate context is given where the current structure NEEDS to be linked/associated to receive an interpretation, context-sensitive or anaphoric expressions are often fronted and dislocated from their local structure, even across a clause boundary. Consider (13) and (14).

(13) Context:
a. Do you know the tall person who comes to the library every day?
b. To that tall guy, Jina said that she has once lent her chemistry notebook.
c. Jina said that she has once lent her chemistry notebook to that tall guy.

(14) Context:
a. Tosekwan-e mayil o-nun khi-ku-n saram al-ci?
library-at everyday come-and height-tall-adn person know-Q
'Do you know the tall person who comes to the library every week?'
b. Ku-saram-hanthey Jina-ka hwahwakchayk-ul pilriecwuess-tay.

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the-person-dat J-nom chemistry.book-acc lent-said
'To that tall guy, Jina said that she has once lent her chemistry notebook.'

c. Jina-ka hwahwakchayk-ul ku-saram-hanthey pilriecwuess-tay.
J-nom chemistry.book-acc the-person-dat lent-said
'Jina said that she has once lent her chemistry notebook to that tall guy.'

(13c) like structures are much more frequent than the structures like (13b). Likewise, (14c) like structures are much more frequent than the structures like (14b). Nevertheless, when a context such as (13a) or (14a) is given, (13b) and (14b) become even more natural than (13c) and (14c). (14b) is an example with long-distance dependency, where an embedded clause subject as well as the complementiser *-ko* is dropped and the matrix verb is simplified. Examples like (14b) are regarded difficult to understand in the generative grammar (Saito 1992), yet indeed are very natural and easily observed in spoken Korean.

In fact, context-sensitive or anaphoric items tend to occur at the left periphery – sometimes, even across a clause boundary. According to the 10-million words Sejong corpus search, the topic-marked anaphoric pronoun *ku-kess-un* or its shortened form *ku-ken* 'the-thing-top' have been found 7,734 times. Strikingly, in all times *ku-kess-un* or *ku-ken* (the-thing-top) hardly appeared in the sentence-medial, final or right-peripheral positions, though in principle they CAN occur at ANY place. Most times, they occurred between the two sentences – at the end of one sentence and the beginning of the other sentence, where their accessible context is close.[5] Among the 7,734 cases, I have extracted only two examples where the other argument precedes *ku-kess-un* or *ku-ken* 'the-thing-top' at the beginning of a new sentence. This result directly reflects context-sensitivity of natural language syntax. In a strict sense, no syntactic account can be given to why *ku-kess-un* or *ku-ken* 'the-thing-top' strongly prefers to occur at the left-periphery. In a single-sentence level, one may attempt to provide a feature such as *+front* to those lexical items. Yet, note that though they strongly prefer to be located at the left-peripheral position, the sentences with right-peripheral or sentence-medial *ku-kess-un* or *ku-ken* 'the-thing-top' do also yield a GRAMMATICAL sentence. Just as in left-to-right asymmetry phenomena, given that context-sensitivity is the general aspect of natural language syntax, rather than an attribute from a set of lexical items, if we try to provide a feature-based account, we will then end up with numerous unnecessary features.

I argue that the motivation behind the leftward dislocation, known as long-distance dependency, is to maximise the use of previous context in current syntactic structure building in order to increase efficiency of communication. Leftward dislocation provides a way of building a CROSS-sentential syntactic structure in an incremental manner. By placing context-sensitive, anaphoric expressions ahead, hearers can quickly resolve the semantic value of those expressions and efficiently enrich their on-going structure through the preceding context.

[5] I did not regard this position as being right-peripheral, since those expressions were not incorporated into the previous sentence, but into the upcoming sentences.

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Consider another pair of examples given in (15)-(16). In both examples, (b) sentences are odd, unlike (a) sentences, due to gender mismatch. In Koran, some family relational words are gender sensitive. *Enni* 'sister(F)' should be used when it refers to a girl's sister. On the other hand, *nwuna* 'sister(M)' should be used if it refers to a boy's sister. Both (b) examples are bad because *Jina* is a typical girl's name in Korean. Hence, instead of *nwuna* 'sister(M)', *enni* 'sister(F)' should have been used.

(15) Gender mismatch in a simple sentence (b)
a. Enni-hanthey Jina-nun note-lul pilriecwuess-e.
sister(F)-dat J-top note-acc lent-decl
'Jina lent a note to her sister(F).'
b. ???Nwuna-hanthey Jina-nun note-lul pilriecwuess-e.
sister(M)-dat J-top note-acc lent-decl
'??Jina lent a note to his sister.'

(16) Gender mismatch in a complex sentence (b)
a. Enni-hanthey Jina-nun note-lul pilriecwuess-tay.
sister(F)-dat J-top note-acc lent-said
'Jina said that she lent a note to her sister(F).'
b. ???Nwuna-hanthey Jina-nun note-lul pilriecwuess-tay.
sister(M)-dat J-top note-acc lent-said
'??Jina said that she lent a note to his sister.'

(15) is a simple sentence and (16) is a complex sentence with long-distance dependency. Yet, regardless of the level of embedding or the existence of long-distance dependency, the grammaticality judgement of BOTH pairs of sentences seems to be made when the gender mismatch is observed at the beginning of a sentence. This is clearly far ahead of the time when information such as the type of a sentence (i.e., declarative, question, relative clause, etc.) or the number of embedding becomes available. It will be only at the very end of a sentence when native speakers recognise any sort of long-distance dependency. Consider (17). In (17b), even though native speakers understand the sentence-initial dative NP *Enni-hanthey* 'sister(F)-dat' as the argument of the embedded clause, they cannot RESIST interpreting *Enni-hanthey* 'sister(F)-dat' and the following NP *Jina* together in the same clause unfolded by a topic-marked NP *Jina-nun*. This is also why (17c), which SHOULD be grammatical is in fact UNgrammatical.

(17) a. Grammatical Sentence without Dislocation
Jina-nun Kiho-ka nwuna-hanthey note-lul pilriecwuess-tay.
J(F)-top K(M)-nom sister(M)-dat note-acc lent-said
'Jina said that Kiho lent a note to his sister.'
b. Should be Ungrammatical, yet Grammatical
Enni-hanthey Jina-nun Kiho-ka note-lul pilriecwuess-tay.
sister(F)-dat J(F)-top K(M)-nom note-acc lent-said
'Jina said that Kiho lent a note to her (Jina's) sister.'
c. Should be Grammatical, yet Ungrammatical
???Nwuna-hanthey Jina-nun Kiho-ka note-lul pilriecwuess-tay.

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sister(M)-dat J(F)-top K(M)-nom note-acc lent-said
Intended reading: 'Jina said that Kiho lent a note to his sister.'

The gender mismatch phenomena we see above shows that even grammaticality judgement occurs incrementally from left-to-right. It also shows that a syntactic structure is built incrementally regardless of the type of a structure or the number of embedding. Also, no matter whether a whole sentence is composed of a simple clause or a complex clause, native speakers tend to front the given lexical item to help the listeners to link the two sentences. In this way, dislocation/long-distance dependency can also increase the efficiency of real-time understanding and can be understood as the extension of left-to-right growth of a syntactic structure at the cross-sentential level. This seems to be the basis of dislocation or what is know as long-distance dependency. Therefore, it is hard to grasp the driving force of dislocation or long-distance dependency in a single sentence level.

2.4. Explaining core phenomena: the limit and challenge

In the last section, we have observed the three core phenomena. They can be summed up as the consequences of incremental, left-to-right structure building both in a sentential and cross-sentential level, aiming for optimised syntactic structure building.

In the following, I will discuss some approaches made in grammar formalisms to capture/explain incrementality. In explaining incrementality in the core grammar, as a way to decrease any uncertainty in structure-building, Aoshima et al. (2004) have proposed *un-forced revision* and McConvile (2001) adopted the notion of *ruthless parser*. Yet, as we shall discuss, those accounts are basically limited in explaining what is driven by left-to-right, incremental growth of a structure.

2.4.1. Approaches in derivational grammars

Phillips Challenge Phillips (1996, 2003) argued that even defining a constituent may be difficult without taking linear order into consideration. The same string of words can be diagnosed as a constituent by one constituent test, but not by another constituent test. (18) shows a case of constituency conflict. (18) is from Phillips (2003). When co-ordination is taken as a test for constituency, as in (18a), *Gromit a biscuit* passes the co-ordination test and thus, is regarded as a constituent. Yet, as in (18b), taking permutability as a criterion, *Gromit a biscuit* cannot pass the movement test and thus, is not regarded as a constituent.

(18) Constituency Conflict
[Gromit a biscuit] is a constituent by co-ordination test
a. Wallace gave [Gromit a biscuit] and [Shawn some cheese] for breakfast.
[Gromit a biscuit] is NOT a constituent by movement test
b. *[VP Gomit a biscuit] Wallace gave VP_t for breakfast.

Based on constituency shift and constituency conflict phenomena, Phillips argued for the Incrementality Hypothesis as in (19).

(19) Sentence structures are built incrementally from left-to-right.

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As shown in Figure 4, Phillips assumed that syntactic relation must respect constituency at the point in the derivation when the relation is established. Yet, once this relation is licensed, constituency (between A and B) may change subsequently (i.e., be revised); and this he argued was the basis for such conflict.

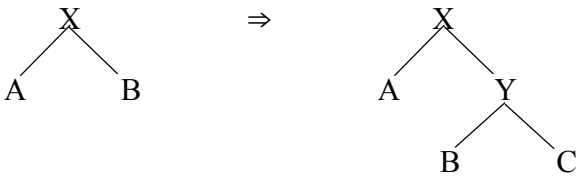


Figure 4: Incremental Constituency via Build-and-Revise Process

Given that defining constituency is a crucial matter in syntax, it is striking that such a core notion is difficult to sustain without considering left-to-right growth of a structure. Yet, explaining incrementality of a verb-final language is not so straightforward as we shall see.

Problems in Aoshima et al. (2004) In this section, I will particularly discuss problems that may arise in the generative grammar, in the attempt to explain left-to-right incremental growth of structure building.

Generative grammar-formalisms are clearly limited in their ability to explain incrementality displayed in verb-final languages like Korean/Japanese, because the logic of the formalism is not sensitive to the left-to-right linear order.

Aoshima and her colleagues (Aoshima et al. 2003, 2004) have argued that in Japanese the sentence-initial *wh*-dative NP undergoes *un-forced revision* during the on-line structure building, to be interpreted within the 'most' embedded clause. Consider their examples:

(20) Scrambled, Declarative Complementiser: Delay at *-to*

Dono-seito-ni	tannin-wa	koocyoo-ga	hon-o
which-student-dat	class-teacher-top	principal-nom	book-acc
yonda-to	tosyositu-de	sisyo-ni	iimasita-ka?
read-decl	library-at	librarian-dat	said-Q

'Which student did the class teacher tell the librarian at the library that the principal read a book for?'

(21) In-situ, Declarative Complementiser: Delay at *-to*

Tannin-wa	koocyoo-ga	dono-seito-ni	hon-o
class-teacher-top	principal-nom	which-student-dat	book-acc
yonda-to	tosyositu-de	sisyo-ni	iimasita-ka?
read-decl	library-at	librarian-dat	said-Q

'Which student did the class teacher tell the librarian at the library that the principal read a book for?'

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(22) Scrambled, Question Particle: No Delay at *-ka*

Dono-seito-ni	tannin-wa	koocyoo-ga	hon-o
which-student-dat	class-teacher-top	principal-nom	book-acc
yonda-ka	tosyositu-de	sisyo-ni	iimasita.
read-Q	library-at	librarian-dat	said

'The class teacher told the librarian at the library which student the principal read a book for.'

(23) In-situ, Question Particle: No Delay at *-ka*

Tannin-wa	koocyoo-ga	dono-seito-ni	hon-o
class-teacher-top	principal-nom	which-student-dat	book-acc
yonda-ka	tosyositu-de	sisyo-ni	iimasita.
read-Q	library-at	librarian-dat	said

'The class teacher told the librarian at the library which student the principal read a book for.'

Aoshima et al. found that both when the *wh*-phrase was in situ as in (21) and (23) or when they are scrambled long-distance as in (20) and in (22), Japanese speakers were SURPRISED to encounter a declarative complementiser *-to* in the embedded clause. Based on this result, they argued that Japanese speakers at first posit a gap in the matrix clause but revise it into the most embedded clause. According to Aoshima et al., such shift is "unforced".[6] Nevertheless, they still assumed that the motivation of such revision is feature-checking. In other words, Aoshima and her colleagues have argued that the slow-down in the embedded clause with a declarative marker is caused because of the failure in feature-checking, in particular, in failure to check the *wh*-feature. Aoshima et al. (2005) argued that this is why referential NPs in a sentence initial position do NOT undergo unforced revision, in contrast to *wh* NPs. However, given that the strength of *wh*-feature in Japaese/Korean is very weak (Grewendorf 2001), it seems strange that native speakers perceive them so radically different. It is also hard to see why native speakers can and do make distinctions between two types of NPs for the future structure building at such an EARLY stage of a structure building.

Aoshima et al. (2004) also argued that the parser prefers to satisfy requirements brought from the initial dative NP as soon as possible, hence, within the most embedded clause, since in Japanese/Korean the most embedded verb comes earliest and the matrix verb comes last. However, without getting the full picture of a structure, itis impossible to know how many embedded structures are used in the given sentence. Hence, we cannot see from which source structure such revision should take place until we get the full picture of the sentence. Aoshima et al.'s account is what generative grammars such as GB/MP can at best offer, yet is inadequate to capture/explain the essence of incremental, left-to-right structure building.

[6] Aoshima et al. (2004:42) noted, "*By unforced reanalysis, we mean a revision that is not licensed by any incompatibility of the initial analysis of the parse with subsequent material.*"

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Right Periphery Puzzle Ever since Ross (1967), locality restriction at the right periphery have been widely discussed across languages. Lasnik and Saito (1992) proposed the Proper Binding Condition to capture the ungrammaticality of (24c). According to this analysis, (24c) is derived from two-step movements: the first step is (24a) to (24b) and the second step is (24b) to (24c).

(24) a. [$_{TP}$ Taroo-ga [Hanko-ga Sooru-ni iru-to] omotteiru] (koto)
[Taroo-nom [Hanako-nom Seoul-in be-that] think] fact
'Taroo thinks that Hanako lives in Seoul.'
b. [$_{TP}$ Sooru-ni$_i$ [Taroo-ga [Hanko-ga t_i iru-to] omotteiru]] (koto)
[Seoul-in [Taroo-nom [Hanako-nom be-that] think]] fact
'In Seoul, Taroo thinks that Hanako lives t_i.'
c. *[[$_{TP}$ Hanko-ga **t_i** iru-to]$_j$ [Sooru-ni$_i$ [Taroo-ga t_j omotteiru]]] (koto)
[[Hanako-nom be-that] [Seoul-in [Taroo-nom think]]] fact
'[That Hanako is t_i]$_j$ in Seoul Taroo thinks t_j.'

In (24a), the PP *Sooru-ni* 'in Seoul' is first scrambled from the embedded clause to the matrix initial position as in (24b). And then, the embedded CP [$_{TP}$ Hanko-ga t_i iru-to] is scrambled to the position preceding the PP *Sooru-ni* in (24c). The resulting sentence (24c) is totally ungrammatical. According to Saito, the ungrammaticality is caused by the unbound trace t_i in (24c). The problem, however, is that the level of S-structure no longer plays any role in movement frameworks. Indeed any restriction that relies on S-structure becomes completely inexpressible in minimalist explanations, even given Saito's own account of radically reconstructed sentences. This is because after radical reconstruction, no trace should be left at LF. The Proper Binding Condition was a S-structure condition, but in the Minimalist Program, S-structure doesn't exist any more. Saito (2003) explained the ungrammaticality of (24c) by reformulating the Proper Binding Condition as a constraint on the application of Merge. Merge combines two linguistic objects to form a constituent. The two objects to be combined by Merge must be a 'complete' constituent. A constituent which has only a part of a chain, e.g. a trace but not its antecedent, does not qualify as a constituent. In (24c), [$_{TP}$ Hanko-ga t_i iru-to] is disqualified as it is not a complete constituent. Hence, this sequence cannot be subject to Merge (See Saito (2003) for a detailed discussion). However, given the pro-drop property of Korean and Japanese, it is not clear how to decide whether a constituent is complete or not.[7]

The Proper Binding Condition debate shows a limit to non-linear grammar, capturing the property derived from left-to-right growth of a structure. Since the nature of phenomena is purely derived from left-to-right growth of a structure, grammars which are not sensitive to linear-order face the limit of providing explanatorily adequate accounts on these phenomena (See Chesi, in this volume).

2.4.2. Approaches in lexical grammars

[7] Moreover, unlike Japanese, in the case of Korean, expression could also occur after the complementiser. In picture-description task (2.2), 47 times of the time, primary school participants placed *wh*-dative NPs after the complementiser *-ko*.

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Explaining left-to-right, incremental growth of a structure in lexicalist grammars such as Combinatory Categorial Grammar (CCG), Head-driven Phrase Structure Grammar (HPSG) or Lexical Functional Grammar (LFG) is not so straightforward. See Kiaer (2007) for a detailed discussion.

First of all, in these grammars, it is assumed that the verb provides the most important combinatory information in structure building. So, within these grammars, it is impossible to assign any provisional structure in an incremental manner before the verb is reached. Consequently, it is hard to capture incremental structure building of verb-final languages in these grammars.

Among these grammars, Combinatory Categorial Grammar (CCG) particularly assumes incremental, step-by-step growth of a structure. Nevertheless, as McConville (2001) pointed out, it is hard to capture the heart of incremental, left-to-right growth in CCG, since, though it assumes step-by-step, derivational procedures, they are not sensitive to linear order. To capture incrementality in CCG, McConville assumed a *ruthless* parser to reduce any structural uncertainty. Yet this approach may not work in verb-final languages like Korean/Japanese, since some crucial structure-building information only occurs at the very end. Though native speakers build a syntactic structure incrementally, there is NO way for them (= hearers) to make the right prediction on the type of a sentence or the number of embedding for the current sentence at the beginning or left-peripheral position. Yet, just as in generative grammars, to yield a well-formed derivation in CCG, human parsers/native speakers must know the whole structure at hand at the start of structure building.

I believe that the elegant syntactic theory should be able to reflect the PARALLEL judgements that we have observed between a simple sentence without dislocation as in (15) and a complex sentence with dislocation as in (16), repeated below.

(15) Gender mismatch in a simple sentence (b)

a. Enni-hanthey Jina-nun note-lul pilriecwuess-e.
sister(F)-dat J-top note-acc lent-decl
'Jina lent a note to her sister(F).'

b. ???Nwuna-hanthey Jina-nun note-lul pilriecwuess-e.
sister(M)-dat J-top note-acc lent-decl
'??Jina lent a note to his sister.'

(16) Gender mismatch in a complex sentence (b)

a. Enni-hanthey Jina-nun note-lul pilriecwuess-tay.
sister(F)-dat J-top note-acc lent-said
'Jina said that she lent a note to her sister(F).'

b. ???Nwuna-hanthey Jina-nun note-lul pilriecwuess-tay.
sister(M)-dat J-top note-acc lent-said
'??Jina said that she lent a note to his sister.'

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Yet, in a non-linear grammar formalism, it is not easy to capture this. Baldridge (2002) among others showed how multi-modal CCG CAN indeed provide a step-wise derivation for sentences with long-distance dependency. But, he proposed two SEPARATE analyses for a short and long-distance scrambling. Particularly, as for a long-distance scrambling, he proposed some complicated type-shifting for the cross-sentential, dislocated lexical item. Yet, given that native speakers of Korean seem to understand both sentences in the same, incremental way, an analysis to posit different syntactic composition for the same sequence of lexical items seems to lack explanatory adequacy.

Karamanis (2001) modified CCG and specified the argument's syntactic position in the lexicon to capture linear-order sensitivity in Greek. For instance, the value *+FRO* denotes that there is a fronted argument involved. Yet, such approach is again, I believe, far from an explanatorily adequate account. Notice that if we adopt Karamanis' approach, the size of lexicon will be uncontrollable in relatively free word-order languages. In addition, the left-ness/right-ness is a relative and gradual notion, which cannot be captured using a binary notation such as *+FRO*. Feature-based approaches therefore will inevitably face the same problem with Karamanis (2001).

2.4.3. Towards grammar for procedural competence

What the three core phenomena reflect is the time-sensitive and also resource-sensitive nature of linguistic competence, which I will call the PROCEDURAL COMPETENCE in this paper. The procedural competence is particularly observed by (i) left-to-right and (ii) optimized structure building (See (12)). As we have seen in 2.4.2, however, capturing/explaining both properties in grammar formalisms is not easy. Firstly, it is because of the long-held assumption between *competence* and *performance*: For instance, distributional variation between grammatical forms has been regarded as nothing to do with the core grammar, no matter how significant the distributional asymmetry is, whereas any asymmetry between grammatical and ungrammatical forms have been considered relevant in shaping the core grammar. Hence, in a strictly orthodox view of generative grammar, the phenomena we have observed in this paper will not even be regarded as what syntactic theory should explain. Secondly, as we have observed, non-linear, static grammars are inadequate to explain the left-to-right growth property of natural language syntax.

In order to capture procedural competence, what we need is a grammar which can capture the left-to-right growth of a structure. In other words, we need a grammar which has the left-to-right growth mechanism as the backbone of its syntactic architecture. Also, we need to have a grammar which can explain WHY only a very limited syntactic choice becomes dominant in real use.

Though the nature of discussion is theory-neutral, to formalise procedural competence, I will adopt Dynamic Syntax (DS: Kempson et al. (2001), Cann et al. (2005)) and provide accounts for the core phenomena in the next section.

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3. Explaining core phenomena in dynamic syntax

3.1. Dynamic syntax: Left-to-right challenge

Dynamic Syntax (DS) assumes left-to-right directional derivation. Such assumption makes it possible to thread left-to-right incremental growth of a structure into the heart of the core grammar. Following Sperber and Wilson (1995), DS takes as the starting point in any structure-building, the goal to establish some PROPOSITIONAL formula as interpretation. In this paper, I revise the goal as proposed in (12), which incorporates resource-sensitive nature of natural language syntax.

(12) Goal of Linguistic Structure Building:
(For an efficient communication), native speakers aim to *optimise* their syntactic structure building (both production and comprehension) by achieving the meaningful, communicative proposition as quickly as possible with minimised structure-building effort.

That is, I argue that the goal of linguistic structure building is not just to obtain a proposition but to do so in the most optimised way. Later in this section, I will show how such optimisation process is encoded in the grammar.

The essence of DS architecture lies in the use of UNDERSPECIFICATION. It assumes that a structure is underspecified at the beginning but is updated/more specified following the linear order as more information is incorporated. This approach is close to Phillips' (1996) claim (See (19).) Yet, rather than assuming that a structure is build-and-revised from left-to-right as in Phillips, DS assumes that a structure is underspecified-and-updated/specified along the time line. By adopting structural underspecification and its subsequent update we can explain left-to-right asymmetry as observed in (2)-(4). Intuitively, at the beginning of a structure building, a provisional structure will remain largely underspecified. Yet, as it progresses, it will be more and more updated/specified. Freedom in structure building will therefore decrease as a structure grows.

In DS, three ways of structure building are assumed: (i) local/immediate update (via an operation of local *adjunction); (ii) non-local/non-immediate update (via an operation of *adjunction)[8]; (iii) general update (via an operation of generalised adjunction).

Simply speaking, DS assumes that structure can be further developed in its on-going local structural template or in the non-local template or in an arbitrary template in principle. (See Kempson et al. (2001) and Cann et al. (2005) for a formal detail.) The availability of these three options can well-capture flexible structure building at the left periphery.

However, as the structure-building progresses, not all options will become available. Particularly, at the right periphery, after the verb is reached, since a structural skeleton is

[8] In DS, the Kleene star (*) operator is used to characterise an underspecified tree relation. The essence of this relation is similar to the concept of functional uncertainty adopted in LFG (Kaplan and Zaenen 1989). The modality $\langle\uparrow_*\rangle$ is an underspecified modal relation, which can be extended into any functor (1) or argument (0) relation.

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already completed or in the process of being sealed off a local/immediate update option becomes available. This can well-capture why expressions at the right periphery have limited interpretations unlike those at the left periphery.

In addition, though in principle all three operations are available in its original set-up as in Kempson et al. (2001) and Cann et al. (2005), I argue that native speakers ROUTINISE the operations in a way that the most restricted option (i.e., immediate growth) is most preferred, unless other factors such as context or prosody are intervened as given in (25).

(25) Routinised Rules:
Immediate Growth >> Non-immediate Growth >> Arbitrary Growth
'Every child ate his/her apple.'

Before going on further, I will show some basic logic of DS.

3.2. Basic logic in DS

A basis for modelling the core architectural properties of DS[9] is LOFT (Logic Of Finite Tree; Blackburn and Meyer-Viol (1994)), as illustrated in Figure 5. In the LOFT, there are there core functors. First, *Tn* (= TREE NODE) functor. This indicates the address of a tree; Second, *Fo* (= FORMULA) functor. This is regarding the content of a node; Third, *Ty* (= TYPE) functor. This has all the combinatory information of a node. Consider Figure 5. In this tree, the pointer, ◇, indicates a node under development. ?*Ty*(*t*) indicates the overall goal of establishing a proposition of *Ty*(*t*) with the sub-goal of a predicate, ?*Ty*(*e*→*t*). The concept of requirement, ?X for any X, is the central concept of the framework: all requirements, whether of content, structure, or type, have to be met by the end of a sequence of parse actions. For example, the requirement for an update of content (?∃*xFo*(*x*)) in an argument node, needs to be met either by update from within the structure-building process or from context. Consider (26) and the structure projected by Bomi's answer (underlined) as in Figure 5.

[9] For more detailed formal account, see Kempson and Cann (this volume) and Cann et al. (2005).

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(26) Hemi: Semi-ka Mina-lul manna-ss-ni?
Hemi: Semi-nom Mina-acc meet-past-Q
'Has Semi met Mina?'

Bomi: Manna-ss-e.
Bomi: meet-past-decl
'(Yes, Semi) met (Mina).'

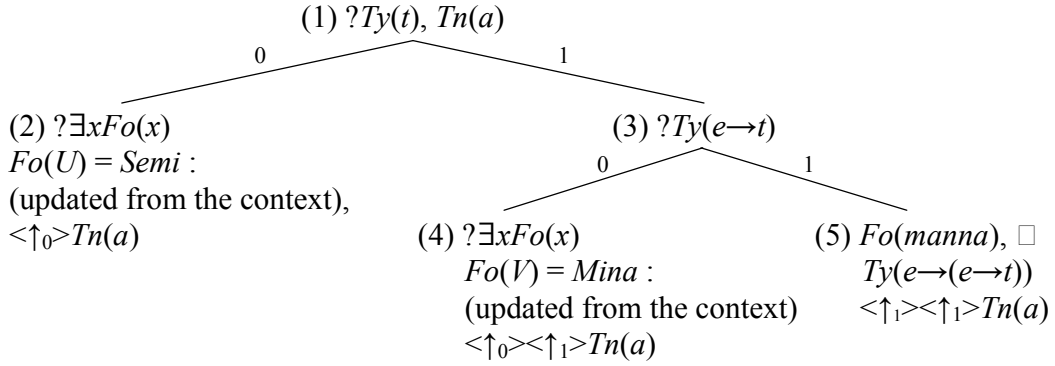


Figure 5: Propositional Structure Projected by *manna* (= 'meet')

At first, let's see the top node, labelled as ?*Ty*(*t*), *Tn*(*a*). This is the node (1) in Figure 5. What ?*Ty*(*t*) indicates is that a proposition (*Ty*(*t*)) is required (?). This is the overall goal of structure building. In fully pro-drop languages like Korean/Japanese, a verb on its own can project a propositional structure. From just the parsing of the verb, the argument structure can be projected and then subsequently, the content values of the arguments will be updated by the context. *Tn*(*a*) can be simply understood as an underspecified S node in the sense that its level of embedding whether it is a matrix or an embedded clause is underspecified.

Now, let's move from the top-node to the next node along with an argument (0) relation. This is the node (2). The node under 0 relation in the LOFT is the argument node and the node under 1 relation in the LOFT is the functor node. The argument node of {?*Ty*(*t*), *Tn*(*a*)} is labelled as {?∃*xFo*(*x*), *Fo*(*U*), <↑$_0$>*Tn*(*a*)}. This node is to be a subject node since it is the argument of a proposition. ?∃*xFo*(*x*) can be read that a formula (or content) is required for this node. In *Fo*(*U*), **U** is a place-holding meta-variable, whose content is to be updated by the context. <↑$_0$>*Tn*(*a*) refers to the modal realtion, which states that from the current node, if the parser goes up (↑) along with 0 (= argument) relation, there is a topnode (= *Tn*(*a*)), which is a proposition/sentence. The other daughter node under ?*Ty*(*t*), *Tn*(*a*) is the predicate (= VP) node. This is the node (3). This node is the functor argument of a proposition. ?*Ty*(*e*→*t*) indicates that a predicate is required. This node can be addressed as <↑$_1$>*Tn*(*a*).

From this node, two sub-nodes are further developed. First, let's move to the node along with the argument (0) relation from the ?*Ty*(*e*→*t*) node. That is the node (4). This node is to be an object node. This node is labelled as {?∃*xFo*(*x*), *Fo*(*V*), <↑$_0$><↑$_1$>*Tn*(*a*)}. *Fo*(*V*)

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is another place-holding meta-variable, projected by the verb, whose value also needs to be identified in the context. $<\uparrow_0><\uparrow_1>Tn(a)$ is the tree node address, which states that if the parser goes up along the argument (= 0) node relation and then the functor node (= 1) relation, there is a top-node (= $Tn(a)$). Another argument node branched from $?Ty(e \rightarrow t)$ is the verb node. This is the node (5). □ shows the current state of parsing. This node can be addressed as $<\uparrow_1><\uparrow_1>Tn(a)$.

Notice that the structure in Figure 5 is built/projected by a verb alone. Given that a language like Korean is a fully pro-drop language, what this structural template assumes is that a partial structure can be projected even in the absence of arguments as their content values can be retrieved from somewhere in the parsing process or from the context. In the case of above structure, the content values of a subject and an object are retrieved from the context question. Yet, as we shall see in the next section, contrary to the above example, where a provisional structure is unfolded by a predicate, a partial structure can be unfolded by case morphology even before a VERB is reached. This, we believe, in fact is the source of incremental structure building in head-final languages like Korean.

3.3. Incremental syntax via constructive morphology

Particles	Syntactic Anticipations
-ka/-i (NOM)	a. Unfold a propositional structure b. Be the subject of that structure
-nun/-un (TOP)	a. Unfold a propositional structure that is to be the ROOT structure b. Be the subject of that structure
-lul/-ul (ACC)	a. Attach to the closest leftward structure b. Be the direct object of that clause
-hanthey (DAT)	a. Attach to the closest leftward structure b. Be the indirect object of that clause

Constructive Nominal Particles In this section, I will show how DS can explain incremental structure building, even in the absence of a predicate. As we have seen in Figure 5, a propositional array CAN be unfolded with a verb alone. Nevertheless, it is not just a verb which can project a structural template. If it is so, incremental structural growth in verb-final languages will altogether remain as a serious problem: Will the native speakers of more than 40% of world languages understand/speak BACKWARDS? Kiaer (2007) discussed the constructive role of case particles in Korean, following the insight from Nordlinger (1998). Following these previous works, in this paper I argue that native speakers can incrementally build a partial structure by the use of case particles along with routinised options of structure building that we will discuss in the next section. (27) show what syntactic actions are encoded by the nominal particles. The topic markers *-nun*/*-un* has a more complicated structural anticipation. Yet, I will leave this out in this paper.

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(27)

Suppose that a sequence of case-marked NPs such as (NOM plus ACC or NON plus DAT) are parsed. The partial structures that we can obtain will be as follows:

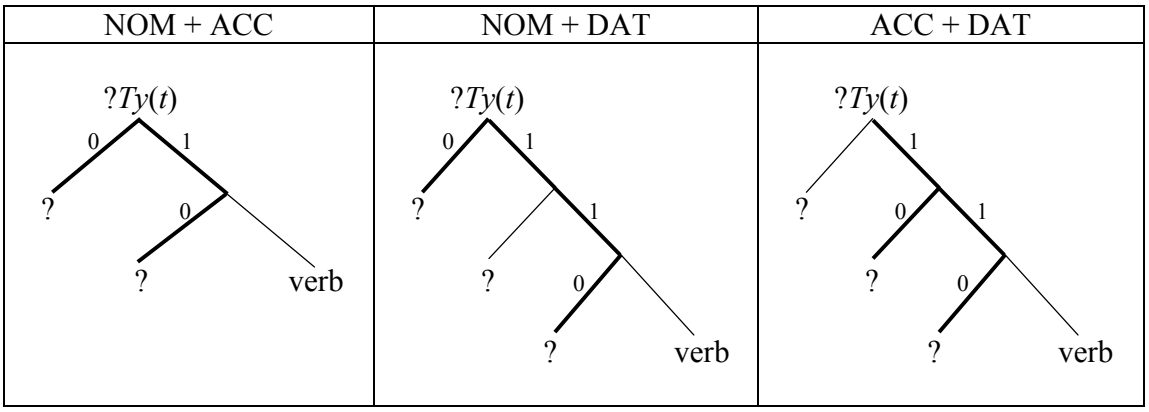


Figure 6: Partial Structures Projected via Case Particles

Through the constructive use of case particles, a partial structure will be unfolded as above. This partial structure will then be merged with the complete proposition projected by a verb.

Verbal Cluster: Completion of Structure Building Though Korean is known to be a verb-final language, expressions occur so frequently after the verb. As Park (2003) initially discussed, in such a case, the verb and the post-verbal expression are likely to form an intonational unit. This has been observed in the recording of primary school children's question/answer pairs we discussed in 2.2. Given this empirical observation, I argue that a verb cluster at the right periphery contains not only the COMPLETE propositional template, but also prosodic information such as tone which can CONFIRM the completion of the structure-building. For instance, a clear IP boundary tone (See Jun (2000)) could indicate the ending of a question, yet when such tone is missing at the verb cluster, the hearer would HOLD ON the completion of the on-going structure building. At this juncture, a post-verbal expression with the closing-off IP boundary tone could be inserted at the NOT-YET-COMPLETED structure and seal-off the current structure. (28) shows that what syntactic anticipations are encoded in the grammar by the verbal cluster.

(28)

Verbal Cluster	Syntactic Anticipations
First part of a verbal cluster: root PLUS tense	a. Unfold a complete proposition b. Update the previously unfolded partial proposition
Second part of a verbal cluster: sentence-ending particle PLUS closing-off IP boudnary tone Sentence-ending particle PLUS hesitant tone	Confirm the completion Do not yet complete the sentence

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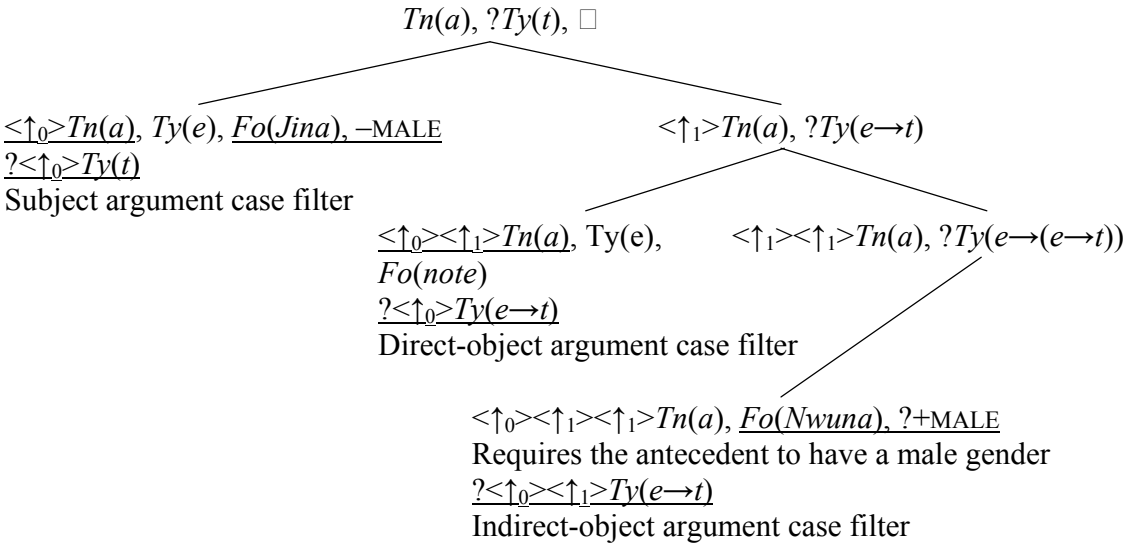
However, even if the role of case particles is crucial in unfolding a sentence, they can be so easily dropped. In particular, native speakers of Korean most likely drop case markers when the context makes the role of its argument obvious and clear. However, when the role of an argument becomes not obvious, the use of a direct object particle becomes natural. It is noticeable that in the spoken data collection of 7-9 year old children that we discussed in 2.2, NOT a single time did children DROP case particles when they were asking a question to the other child, whereas they invariably dropped the case particle when they were answering the questions.

Sample Structure Building Consider (29). (29a) is a simple sentence (without cross-clausal dislocation) and (29b) is a complex sentence (with cross-clausal dislocation). % refers to the IP boundary.

(29) a. ???Nwuna-hantehy Jina-nun note-lul pilriecwuess-e.
sister(M)-dat Jina(F)-top note-acc lent-decl
'??Jina lent a note to his siter.'
b. ???Nwuna-hantehy % Jina-nun note-lul pilriecwuessta-ko saynggakhay.
sister(M)-dat Jina(F)-top note-acc lent-comp thought
'??Jina thought she lent a note to his siter.'

Let's first think of how a structure is built for (29a). At first, the sequence of three pre-verbal NPs will yield the following partial structure given in (30). This partial structure then will be merged with the structural template projected by a verb later. If an inappropriate verb occurs, such structure building will fail (e.g., transitive or intransitive verbs). In principle, each structural relation can have three possible choices (i.e., immediate update, non-immediate update, arbitrary update). Yet, according to the routinisation as given in (25), immediate update was chosen in all structural relations. See Kiaer (2007) for a detailed step-wise derivation process.

(30) Partial structure built via *Nwuna-hantehy Jina-nun note-lul*



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Notice that this partial structure is semantically awkward, because of the gender mismatch. That is, *Fo*(*Nwuna*) requires +MALE, yet *Fo*(*Jina*) is –MALE. This shows that not structure building but also anaphoric resolution or any semantic update occurs in an incremental way.

Now, let's look at (29b). The difference between the partial structures build by (29a) and (29b) lies only in the fact that the structural relation for the dative NP is unfolded by the non-immediate relation (via *adjunction). The sentence-initial dative NP is to be interpreted in the embedded clause. Such long-distance dependency is most likely to be indicated by prosodic break or the given context. This makes the native speaker UNAMBIGUOUSLY choose to build the NP in a non-immediate clause over an immediate cause, which is a default option. The partial structure built before a verb will hence be different as below. Nevertheless, even if the dative NP is not syntactically resolved in this partial structure, due to the immediate anaphoric update for *Fo*(*Nwuna*) through *Fo*(*Jina*), the sequence still remains awkward. Just as in a simple clause structure-building, after the verb cluster is parsed, the whole structure-building will be ready for completion. Unless we assume incremental anaphoric resolution along with incremental structure building, we cannot explain semantic awkwardness of both (29a) and (29b).

4. Conclusion: Towards grammar for procedural competence

In this paper, I discussed Korean native speakers' strong preference towards incremental, left-to-right structure building and proposed the procedural competence which can bridge the unnecessary gap between competence and performance. Based on some empirical observations, this paper argues for the necessity of a grammar formalism which assumes left-to-right growth as the core property of syntactic architecture. In addition, I proposed that a core grammar should be able to capture/explain structural optimisation and the resource-sensitive nature of natural language syntax. In particular, I claim that structure building is driven by the native speaker's need to optimise their structure building by achieving the goal of linguistic building – to achieve a meaningful communicative proposition as quickly as possible with minimised structure-building effort.

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