Processing and Language Acquisition:
Reflexive Pronouns in English and Korean[*]

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Abstract

This paper offers a new perspective on the interpretation of reflexive pronouns in Korean and English. Whereas most previous work has assumed a parameter-based grammatical contrast, I propose that the two languages differ from each other in terms of how they go about processing referential dependencies: whereas English relies primarily on sentence-based structural processing, Korean has recourse to a pragmatically oriented procedure. Evidence from language acquisition, in the form of on-line processing by children, is used to construct a new picture of how knowledge of reflexive pronouns unfolds in the course of development.

Key words: processing, language acquisition, reflexive pronouns, Universal Grammar

1. Introduction

Two key questions arguably lie at the heart of contemporary research on language, awaiting answers if the field is to move forward: Why do languages have certain properties rather than others? How are the properties appropriate to a particular language acquired during the course of childhood?

Contemporary work in linguistics offers essentially two types of answers to these questions. On the one hand, there is the answer offered by classical Universal Grammar (UG): an inborn system of grammatical principles permits limited variation across languages via parametric options; language acquisition consists largely of parameter setting. On the other hand, there is what might be called the 'emergentist' answer:[1] a simple processor lies at the heart of the language faculty; its interaction with factors such as working memory, pragmatics, and other aspects of cognition explains the design and acquisition of

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[1] Emergentism is an approach to explanation that seeks to understand the properties of phenomena, including language, in terms of the interaction of more fundamental forces and propensities.

linguistic systems (e.g., O'Grady 2008). The purpose of this paper is to explore the latter type of answer by developing a suggestion about how a processing-based approach to language can shed light on the interpretation and acquisition of reflexive pronouns ('binding') in English and Korean.

I use the term 'processing' in the traditional broad sense to refer to a series of actions that brings about a result. In the context of cognitive science, these actions correspond to mental operations, as when a particular pattern of vibrations on the eardrum is interpreted by the auditory system as the sound of a piano, or a particular pattern of light on the retina is interpreted by the visual system as the image of a tree. More to the point, processing is also crucial for language, as when a sentence such as *Jerry accidentally cut himself* is interpreted by the linguistic system as a description of an event in which both arguments of the transitive predicate correspond to the same individual.

A signature difference between English and Korean in this regard has to do with the location of the NP that serves as antecedent for the reflexive pronoun. In English, the antecedent typically has to occur in the same minimal clause as the pronoun; in Korean, there is no such requirement.

(1) English (local antecedent required)
   a. Local antecedent:
      I believe that [S **Tom** dislikes **himself**].

   b. Non-local antecedent:
      ***Tom** believes that [S I dislike **himself**].

(2) Korean (local antecedent not required)
   a. Local antecedent:
      나는 **[S Tom이** 자기를 과신한다고**]** 믿는다.
      Na-nun [S **Tom-i caki-lul** kwasinhanta-ko] mitnunta.
        I-Top   Tom-Nom self-Acc   overtrust -COMP believe
      'I believe that Tom has too much confidence in himself.'

   b. Non-local antecedent:
      Tom은 **[S** 내가 **자기를** 과신한다고**]** 믿는다.
      Tom-un [S nay-ka **caki-lul** kwasinhanta-ko] mitnunta.
      Tom-Top   I-Nom   self-Acc   overtrust -COMP believe
      'Tom believes that I have too much confidence in himself.'

In the next section of this paper, I will make a proposal about how the interpretation of reflexive pronouns in English and Korean is shaped by processing factors unique to each language. Section 3 turns to the problem of language acquisition, with a focus on the developmental profile that seems to characterize the emergence of interpretive strategies for coreference. As we will see, this profile fits well with the processing-based analysis of reflexive pronouns proposed in section 2.

2. A processing account of reflexive pronouns

It is a matter of complete consensus that processing takes place simultaneously in many different domains and at many different levels when we use language. For example, in order to understand even a simple sentence such as *He ate it*, two very different types of processing are called for.

On the one hand, sentence-level (or structural) processing focuses on the form and composition of the utterance, including the lexical properties of its component words, their linear relationship to each other, and their morphological form. Based on this information and on previous experience, action by the sentence-level processor reveals that *He ate it* describes an eating event, in which the referent of *he* serves as agent and the referent of *it* as theme.

On the other hand, and simultaneously, pragmatic processing focuses on the setting, what is being talked about, who is talking to whom, and so forth. Its specific objective in the case of *He ate it* is to identify the referent of *he* and the referent of *it*, neither of which is evident from the composition of the sentence itself.

Sentence-level processing	Pragmatic processing
focuses on the form, meaning, & arrangement of words	focuses on what is being talked about, who is talking to whom, the setting, etc.

The particular proposal that I wish to make here is that the interpretation of reflexive pronouns in English is largely handled by the sentence-level (structural) processor, whereas the interpretation of their principal Korean counterpart is the responsibility of the pragmatic processor. As I will try to show, the properties of reflexive pronouns in the two languages fall out from the manner in which they are processed. First, though, it is necessary to provide some general background on the workings of the sort of sentence-level processor that I have in mind.

2.1 How the sentence-level processor works

In accord with the consensus in the field, I assume that the processor operates in an incremental manner—interpreting each word as it is encountered and integrating it into the semantic representation for the sentence. In the system I propose, a canonical transitive sentence in an SVO language such as English is processed in the manner illustrated in (3).

(3)   Robin met Terry.

    a. The nominal *Robin* is assigned a referent, represented here as the index *r*.

        Robin

          r

        Based on its position, the referent of *Robin* is identified as likely first argument of a predicate that is to follow.

          PRED

          <r ...

          ↑

        The referent of *Robin* corresponds to first argument of an anticipated predicate.

    b. The transitive verb *meet* is encountered and its two-place predicate-argument structure is accessed.

        Robin met

          MEET

          <r _>

    c. The nominal *Terry* is assigned a referent (represented by the index *t*), and is immediately interpreted as the predicate's second argument.

        Robin met

          MEET

          <r t>

          ↑

        The referent of *Terry* corresponds to the verb's second argument.

The end result is a semantic representation consisting of the predicate MEET, and its arguments *Robin* and *Terry*. This is of course not a full representation of the meaning of the sentence *Robin met Terry* (for example, it contains no information about number, gender, tense, aspect, or modality), but it will suffice for now.

    Processing works more or less the same way in SOV languages such as Korean, as the example in (4) helps illustrate.

(4)   기수가 미희를 만났다.
        Kisoo-ka Mihee-lul manna-ss-ta
        Kisoo-Nom Mihee-Acc meet-Pst-Decl
        Kisoo met Mihee.

   a. The nominal *Kisoo* is assigned a referent.

   Kisoo-ka
       k

   Based on the nominal's case, its referent is identified as likely first argument of a predicate that is to follow.

   PRED
   <k ...
      ↑
   The referent of *Kisoo* corresponds to first argument of an anticipated predicate.

   b. The nominal *Mihee* is assigned a referent.

   Mihee-lul
        m

   Based on the nominal's case, its referent is identified as likely second argument of a predicate that is to follow.

   PRED
   <k m...
       ↑
   The referent of *Mihee* corresponds to second argument of the anticipated predicate.

   c. The transitive verb *manna-ss-ta* is encountered; its lexical entry is accessed and matched with the already constructed argument structure.

   Kisoo-ka Mihee-lul manna-ss-ta
                      MEET
                      <k m>

As in English, the processor produces an appropriate (partial) semantic representation, consisting of the predicate MEET and its two arguments, *Kisoo* and *Mihee*.

2.2 English reflexive pronouns

The standard analysis of English reflexive pronouns such as *himself* and *herself* assigns them two key properties—locality (their antecedent must be in the same minimal clause) and c-command (the antecedent must be in a structurally higher position). Thus *himself* in (5) must refer to Richard's brother, not to Richard or to Robert.

(5)   Robert thinks [$_S$ [**Richard's brother**] trusts **himself**].

On the view I adopt, these two properties follow from the fact that the primary objective of the sentence-level processor is to do its work as quickly and efficiently as possible, before details of the sentence's composition are lost. To see this, let's begin with the simple sentence in (6).

(6)   Richard trusts himself.

In an initial step, the nominal *Richard* is encountered and assigned a referent (represented here as the index *r*), which is identified as likely first argument of a predicate that is to follow.

(7)   Richard

        PRED
       <r ...
       ↑
    The referent of *Richard* corresponds to first argument of an anticipated predicate.

Next, the transitive verb *trust* is encountered and is identified as the predicate of which *Richard* is the first argument.

(8)   Richard trusts

        TRUST
        <r _>

In the following step, the processor comes upon the reflexive pronoun *himself*, identifying it as the predicate's second argument. Because it is an anaphor, it introduces a referential dependency (represented here as *x*).

(9)   Richard trusts himself

        TRUST
        <r x>
        ↑
      the referential dependency introduced by *himself*, the verb's second argument

That dependency is then resolved in a manner consistent with the usual modus operandi of the sentence-level processor, which does its work as quickly and

efficiently as possible. Thus, instead of searching discourse for an antecedent, the processor targets the index of *Richard*, already in the verb's argument grid, thereby arriving at an immediate interpretation for the reflexive pronoun.

(10)   Richard trusts himself
<div style="margin-left:6em">
TRUST
<i><r x></i>
   ↳ <i>r</i>
</div>

The drive for immediacy that guides the resolution of referential dependencies by the sentence-level processor is the key to understanding the locality property of English anaphora. Because the sentence-level processor can't look beyond the immediate opportunity to interpret the reflexive pronoun, it invariably selects a local antecedent—in essence, a co-argument of the anaphor—regardless of context and pragmatic felicity. Thus *himself* in (11) must be interpreted as the police chief, despite the implausibility of a situation in which someone summons himself.

(11)   Harry went to police station. **The police chief** had summoned **himself**.
<div style="margin-left:18em">
SUMMON
<i><p x></i>
   ↳ <i>p</i>
</div>

The 'c-command' property of English anaphora also falls out from the operation of the sentence-level processor. At the point where the reflexive pronoun is encountered in a sentence like (12), the only other index in the verb's argument grid corresponds to Richard's brother. There is thus just one opportunity for immediate resolution of the referential dependency—Richard's brother, not Richard, must be selected as antecedent.

(12)   **Richard's brother** trusts **himself.**
<div style="margin-left:9em">
TRUST
<i><b x></i>
   ↳ <i>b</i>
</div>

A similar result is required in sentences such as (13), which helps clarify the character of the locality effect that derives from the sentence-level processor's commitment to immediate action.

(13)   **A friend of Richard** trusts **himself**.

Here, *Richard* is linearly closer to the anaphor than is (the head of) the actual antecedent (*friend*), but that does not matter. At the point at which the reflexive pronoun is encountered, the processor has already constructed the partial semantic

representation in (14), with *a friend of Richard* (represented here as the index *f*) serving as the verb's first argument.

(14) **A friend of Richard** trusts ...

TRUST
$<f ...>$

Upon subsequently encountering *himself* and identifying it as the verb's second argument, the processor has just one opportunity to immediately resolve the referential dependency—by linking it to the verb's previously identified first argument (i.e., *a friend of Richard*). This is exactly the desired result.

(15) **A friend of Richard** trusts **himself**.

TRUST
$<f x>$
$\hookrightarrow f$

In sum, we have a straightforward account for the traditional insight (e.g., Jespersen 1933:111) that English reflexive pronouns typically take co-argument antecedents—a generalization that was revived decades later in work on formal syntax (e.g., Reinhart & Reuland 1991, Pollard & Sag 1992, Reuland 2011). The relevant facts follow from a basic operational feature of the sentence-level processor—it seeks to resolve dependencies as quickly (and therefore as locally) as possible.

2.3 The Korean reflexive pronoun (*caki*)

As I see it, the defining characteristic of the Korean anaphor *caki*[2] is a sensitivity to pragmatic prominence and coherence rather than to speedy local interpretation. A very striking example of this comes from the sentence in (16)— originally noted by Kang (1988:425) and the rough counterpart of the Korean version of the English sentence in (11) above.

(16) **John이** 경찰서에 갔다. 서장이 **자기**를 호출했기 때문이었다.
John-i kyengchalse-ey kassta. Secang-i **caki-lul** hochwulhaysski ttaymwun-iessta.
John-Nom police station-to went. Chief-Nom **self-Acc** summon because-was
'John went to the police station. It was because the chief had summoned him.'

Here, in contrast to what happens in English, it is possible (indeed preferable) to associate *caki* with the more distant antecedent *John*. This makes good real-world sense (one is likely to summon someone other than oneself), and helps underline

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[2] I focus here on the reflexive pronoun *caki* for purposes of illustration, setting to the side the more formal *casin*. Yet another form, *caki-casin*, has locality properties that sometimes resemble those associated with English reflexives; see my discussion of (26) – (30) below.

the importance of pragmatic considerations to the interpretation of reflexive pronouns in Korean.

Other signs that *caki* is interpreted via pragmatic processing abound. As illustrated in (17), for instance, *caki* manifests a strong subject orientation (O'Grady 1987, Kim 1996, Han, Storoshenko & Walshe 2010)—an apparent empathy effect that is naturally associated with pragmatic processing.

(17)   **Tom이** Mary에게 **자기의** 공을 던졌다. (ex. from Kum-Jeong Joo)
        Tom-i Mary-eykey **caki-uy** kong-ul tency-ess-ta.
        Tom-Nom Mary-Dat self-Gen ball-Acc throw-Pst-Decl
        'Tom threw Mary self's ball.'

Another sign of pragmatic influence on the interpretation of *caki* comes from possibility of a second-person referent in certain situations, such as imperatives.[3]

(18)   자기도 먹어.
        Caki-to mek-e.
         self-too eat-SE
        'You eat too.'

This interpretation presupposes a sensitivity to a referent's role in the speech act (in this case addressee). Such information is typically not overtly encoded in the sentence; rather, it must be inferred from the setting and context, and thus lies outside the domain of sentence-level processing.

Also suggestive is the fact that *caki*'s usual subject orientation disappears when pragmatic factors make it difficult or impossible to empathize with the referent of the subject, as in the next sentence.

(19)   Inanimate subject shifts attention to the animate possessor:
        John의 과거가 **자기를** 괴롭히는것같다. (O'Grady 1987)
        John-uy kwake-ka **caki-lul** koylophinun-kes kath-ta.
        John-Gen past-Nom self-Acc   hurt   COMP-seem-Decl
        'John's past seems to hurt self.'

Here, in the absence of a pragmatically plausible subject antecedent, the processor interprets the reflexive pronoun logophorically, associating it with the individual whose point of view the sentence represents.[4]

The lack of a c-command relation between *caki* and its antecedent in sentences such as (19) is profoundly suggestive. Because the c-command requirement on anaphora is a consequence of sentence-level processing (section

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[3] Normally, however, *caki* requires a third-person antecedent—a lexical requirement that must be stipulated.
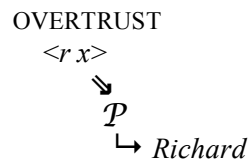
[4] I follow Sigurjónsdóttir & Hyams (1992:372) in taking a logophoric referent to be the individual 'whose thought, speech, feeling, or point of view is reported in the sentence.'

2.1), it should be characteristic of the English system, but not of Korean. This is exactly what we find: the English equivalent of (19), *John's past hurts himself,* is completely unacceptable.

In sum, the notions most relevant to the interpretation of *caki*—discourse coherence, empathy, logophoricity, and the like—involve factors above and beyond sentence-level syntax; they call for pragmatic processing. We can capture this fact by assuming that upon encountering *caki*, the sentence-level processor transfers responsibility for interpreting it to the pragmatic processor ($\mathcal{P}$), as illustrated below.

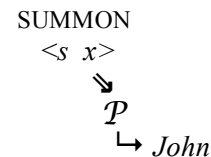(20)   **Richard가 자기를** 과신한다. ('Richard is overconfident.')
       Richard-Nom self-Acc overtrust-Prs-Decl

$$\text{OVERTRUST}$$
$$<r\ x>$$
$$\Downarrow$$
$$\mathcal{P}$$
$$\hookrightarrow \textit{Richard}$$

In this example, the pragmatic processor selects a local antecedent, just as the sentence-level processor would. But that is because the local antecedent in this case is also pragmatically prominent (and, in the absence of context, the only option). The real difference between English and Korean shows up in patterns such as (21) (= (16) above), where the antecedent for *caki* is not even in the same sentence and therefore clearly requires action by the pragmatic processor.

(21)   **John이** 경찰서에 갔다.   서장이 **자기를** 호출했기 때문이었다.
       John-i kyengchalse-ey kassta. Secang-i **caki-lul** hochwulhaysski ttaymwun-iessta.
       John-Nom police station-to went. Chief-Nom self-Acc summon because-was

$$\text{SUMMON}$$
$$<s\ x>$$
$$\Downarrow$$
$$\mathcal{P}$$
$$\hookrightarrow \textit{John}$$

In such cases, Korean looks for a pragmatically felicitous antecedent (*John*) whereas English is compelled to select the local antecedent (chief; see the discussion of (11) in section 2.2). This contrast reflects the different processing strategies employed by the two languages.

Interestingly, English includes a class of patterns in which the interpretation of reflexive pronouns appears to require pragmatic processing, not unlike their Korean counterpart. The example below is a case in point.

(22)   **Richard** told Sally that he was very upset. Rumors about ***himself*** were circulating on the Internet.

The defining feature of these constructions is that no index is immediately available to resolve the referential dependency introduced by the reflexive pronoun, which is the sole argument of *rumor*.

(23)   rumors about **himself**$_X$
            $<x>$

There is reason to believe that under these circumstances the sentence-level processor abandons its attempt to interpret the reflexive pronoun and passes responsibility for the task to the pragmatic processor (the default in Korean).

(24)   rumors about **himself**$_X$
            $<x>$
              $\searrow$
                $\mathcal{P}$

Two key properties of these patterns now fall out: the absence of locality, as illustrated in (22), and the absence of a c-command requirement, as exemplified in (25).

(25)   [**Richard's** diary] mentioned an unsavory rumor about **himself**.

As already noted for Korean, these are signature effects of pragmatic processing.[5] Crucially, though, whereas pragmatic processing is the default strategy in Korean, it is employed in English only when the sentence-level processor is not able to arrive at an interpretation in the usual immediate way. When there is an immediate opportunity to resolve the referential dependency, as in most of the examples considered in section 2.2, that opportunity must be exploited—resulting in the usual pattern of local referential dependencies.

   The Korean reflexive pronoun *caki-casin* is similar to English *X-self* in this particular regard. When *caki-casin* occurs in direct object position, as in the following example from Kim & Yoon (2009:747), there is an immediate opportunity to resolve the referential dependency with the help of the index of its co-argument *John*. This option must be exploited, giving John as the referent of the reflexive.

(26)   **John**이 이유 없이 **자기자신을** 미워한다고 (나는 들었다).
        John-i   iywu epsi   **caki-casin-ul** miwehanta-ko (na-nun tul-ess-ta).
        John-Nom reason without self-self-Acc hate-COMP   (I-Top hear-Pst-Decl)
        'John dislikes himself for no good reason, I hear.'

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[5] This does not mean that 'long-distance' reflexives in English will always have antecedents parallel to those selected by *caki* in Korean sentences; the relative importance of topicality, empathy, and other relevant pragmatic factors may be weighted differently in the two languages.

Moreover, unlike *caki*, *caki-casin* does not sound natural in contexts such as (21), repeated here as (27), where pragmatic considerations force a long-distance interpretation for the reflexive pronoun despite the presence of a co-argument (*secang* 'police chief').

(27) **John이** 경찰서에 갔다.
      John-i kyengchalse-ey kassta.
      John-Nom police station-to went.
      'John went to the police station.'

      *서장이   **자기자신을** 호출했기 때문이었다.
      Secang-i **caki-casin-lul** hochwulhaysski ttaymwun-iessta.
      chief-Nom self-Acc summon because-was
      'It was because the police chief summoned self.'

Crucially, though, when there is no immediate opportunity to resolve the referential dependency by means of a co-argument, as in (28), a non-local antecedent is permitted.

(28) **Tom이** 고민하고 있다.
      Tom-i   kominhako iss-ta.
      Tom-Nom worry-COMP be-Decl.
      'Tom is worried.'

      자기자신이 범죄에 결부되었기 때문이다.
      Caki-casin-i pemcoy-ey kyelpwutoy-ess-ki ttaymwun-i-ta
      Self-self-Nom crime-Dat   involved be-Pst-Nom because-be-Decl
      'It's because self was involved in a crime.'

In these respects, *caki-casin* behaves more or less like English *X-self* in that a co-argument antecedent, where available, must be selected.[6]

All of this suggests a role for sentence-level processing in the interpretation of *caki-casin*, parallel to English *X-self*. However, matters are not completely straightforward: as illustrated by (29), *caki-casin* resembles *caki* in permitting a non-co-argument antecedent under certain circumstances. (A comparable example involving *caki* can be found in (19).)

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[6] English does not allow the particular pattern illustrated in (28), but this is for independent reasons: English lacks a nominative reflexive *(*heself)*.

(29)　**John의** 　과거가 **자기자신을** 괴롭히는것같다.
　　　　John-uy kwake-ka **caki-casin-lul** koylophinun-kes kath-ta.
　　　　John-Gen past-Nom self-self-Acc 　　　 hurt 　　　 COMP-seem-Decl
　　　　'John's past seems to hurt self.'

As noted earlier, no such option is permitted in the corresponding English pattern, where the sentence-level processor forces resolution of the referential dependency with the help of the verb's first argument, giving a semantically incoherent result.

(30)　 ***John's** past hurts **himself**.

The acceptability of (29) thus points to a greater role for pragmatic processing in the interpretation of *caki-casin* than in the interpretation of English *X-self*. This matter calls for additional research.

2.4 Summary

If the ideas outlined here are on the right track, two competing forces seem to shape the interpretation of reflexive pronouns—each reflecting a different type of processing. On the one hand, we have pressure from working memory to find the referent as quickly and locally as possible, resulting in action by the sentence-level processor. The effects of this pressure are crucial for understanding reflexive pronouns in English, which are interpreted immediately (and hence locally) if that option is available.

(31)　Interpretive routine for English reflexive pronouns:
　　a. Resolve the referential dependency immediately, if possible.
　　　<a x>
　　　　↳$_a$

　　b. If there is no such opportunity, invoke pragmatic processing.
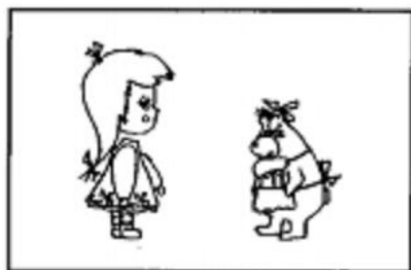　　　*<...x...>*
　　　　↘
　　　　$\mathcal{P}$

On the other hand, there is pressure to select an antecedent whose referent is contextually prominent, compatible with the flow of the discourse, easy to empathize with, and so on. Such factors, considered in the course of pragmatic processing, appear to shape the interpretation of Korean *caki*.

(32)　Interpretive routine for Korean *caki*:
　　　Invoke pragmatic processing.
　　　<...x...>
　　　　↘
　　　　$\mathcal{P}$

3. The acquisition of reflexives

An intriguing and well-documented feature of linguistic development is that children learning English correctly interpret reflexive pronouns by age 3 (e.g., Chien & Wexler 1990, Guasti 2002:285), showing a sensitivity to its usual locality and c-command properties. Thus, in a situation and context such as the one depicted in (33), from Chien & Wexler, even three year olds correctly identify Mama Bear as the antecedent for *herself*.

(33)   This is Mama Bear; this is Goldilocks.
         Is Mama Bear touching herself?

Precocity seems to characterize the acquisition of Korean *caki* as well. Even before starting school, children seem to be aware of the basic properties of the reflexive pronoun, including its default subject orientation and the possibility of both local and non-local antecedents (Cho 1985, 1989, 2009; Lee & Wexler 1987; Kim & You 2011).

Facts like these are both important and suggestive, but they do not allow us to choose between two competing views of how language acquisition works.

View 1: Children quickly set the parameter appropriate for their language, recognizing that the domain for interpreting reflexive pronouns is the minimal clause in English, but the entire sentence (or beyond) in Korean.

View 2: Children quickly figure out whether the job of interpreting reflexive pronouns falls to sentence-level processing or to pragmatic processing.

In order to tease apart these two views, we need more than just information about what children's interpretations are. We need information about how they arrive at those interpretations in the course of comprehension.

This very issue is addressed in an intriguing study by Clackson, Felser & Clahsen (2011), who examined the interpretation of reflexive pronouns by 40 English-speaking children aged 6 to 9 and 40 adults. In an initial experiment, Clackson et al. established that the children were successful 97% of the time in selecting an antecedent for a reflexive pronoun in the type of situation illustrated

in (33) above. The children are thus evidently aware of the locality and c-command properties associated with English reflexive pronouns, raising the question of how this came about—by UG stipulation or as the result of processing considerations, as I have proposed. A follow-up eye-tracking experiment conducted by Clackson et al. is suggestive in this regard.

In that experiment, the children and adults listened to a short passage as they looked at an array of four pictures, as illustrated in figure 1.

(34)   *Peter* was waiting outside the corner shop. He watched as *Mr. Jones* bought a huge box of popcorn for **himself** over the counter.
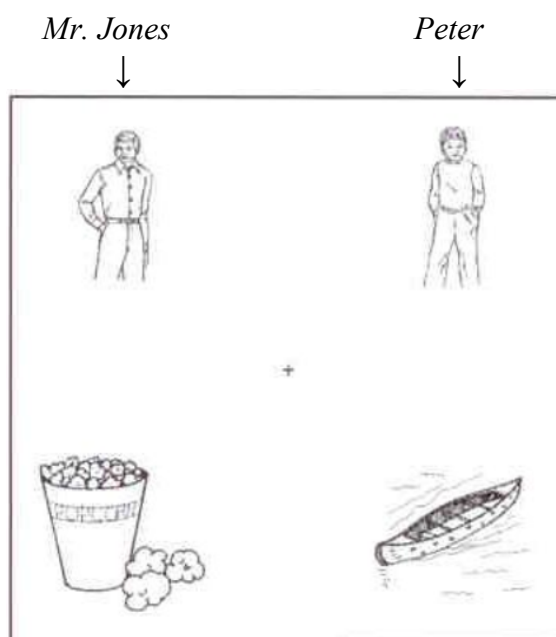

FIGURE 1. SAMPLE PICTURE FROM CLACKSON ET AL. (2011:143).

The key variable involved the direction of eye gaze at the point where the reflexive pronoun was heard. Would participants look at the discoursally prominent Peter (an illegal antecedent) or at Mr. Jones, the referent of the local NP? Clackson et al.'s results pointed toward two different types of processing activity, each competing for supremacy over the other.

The children showed signs of temporarily considering Peter as antecedent, suggesting a sensitivity to pragmatic prominence: the NP *Peter* appears first, functions as subject of the lead-in sentence, and is referred to twice before the reflexive pronoun is encountered. Evidently, the pragmatic processor is active and has fixated on Peter. Nonetheless, the children ended up picking Mr. Jones as the antecedent, which suggests not only that the sentence-level processor too is active, but that it is able to overrule the pragmatic processor.

The competition between the two types of processing appears to be fiercest in childhood: the effect of pragmatic prominence was more evident in the six and seven year olds than in eight and nine year olds, and there were only slight signs of this effect in the adult participants. The general picture that emerges from Clackson et al.'s findings can thus be described in terms of the following two steps.

First, by age 3, the sentence-level processing routine *dominates* the interpretation of reflexive pronouns. That is why interpretive judgments are correct over 90% of the time.

Second, it is not until much later that the sentence-level routine becomes strong enough to fully suppress activation of the pragmatic processor when a reflexive pronoun in encountered. That is why Clackson et al.'s eye gaze data shows competition between the two processing systems over a multi-year period in childhood.

If these remarks are on the right track, then the course of development for reflexive pronouns in English seems compatible with the general conclusion put forward by O'Grady (2013): what we think of as language acquisition is actually processing improvement—the gradual strengthening of one routine at the expense of another until the weak routine is totally suppressed.

Very early	*Middle (age 3)*	*Endpoint (after age 12)*
Pressure from working memory encourages immediate resolution of referential dependencies by the sentence-level processor (Routine S)	Routine S	Routine S
	—	
Sensitivity to prominence and coherence encourages resolution of referential dependencies by the pragmatic processor (Routine P)	Routine P	~~Routine P~~

FIGURE 2. PROCESSING IMPROVEMENT FOR ENGLISH REFLEXIVE PRONOUNS

As summarized in figure 2, children are subject to two forces from the outset—pressure from working memory that encourages use of a sentence-level interpretive procedure focusing on immediacy, and a sensitivity to prominence that is more compatible with discourse-sensitive pragmatic processing. By age three, the sentence-level interpretive routine wins out over its pragmatic counterpart, as shown by children's high rate of correct interpretation at that time. Subsequently, the routine is gradually strengthened to the point where its pragmatic competitor is no longer activated in response to encountering a reflexive pronoun. If Clackson et al. are right, this happens by late childhood.

Of course, the picture is far from complete at this point. For one thing, Clackson et al.'s results provide no information about what happens in the very

early stages of development, as the youngest children in their study were six years old. An important issue in this regard is whether the two processing strategies are initially more or less in equilibrium, or whether the sentence-level processor might have an initial advantage. As I have noted in earlier work (O'Grady 2005:197-98), there is some reason to favor sentence-level processing, as its focus on immediacy and locality requires fewer resources than the more far-ranging activity involved in pragmatic processing. For some discussion along these lines, see Sekerina, Stromswold & Hestvik (2004), as well as Clackson et al. (p. 140 and the references cited there).[7] On the other hand, the cost of pragmatic processing is often minimal too: in the case of Clackson et al.'s experiment, the processor simply accesses a referent (Peter) that is already prominent by virtue of its early mention, its topicality, and its reactivation by the definite pronoun *he.*

Moreover, we do not yet have any information at all on how young Korean-speaking children go about processing referential dependencies. Of special interest in this regard is the question of whether there is a developmental stage during which the sentence-level processor is activated in the course of interpreting *caki*, leading children to consider a local antecedent that is ultimately rejected in the face of competition from the pragmatic processor—the reverse of what happens in English. Hopefully, work currently in progress can offer an answer to this important question.

4. Concluding remarks

As I have noted elsewhere (e.g., O'Grady 2012), a remarkable convergence of research programs is underway in linguistic theory as proponents of Universal Grammar come to acknowledge the importance of so-called 'third-factor' effects in the design and acquisition of language—the long-standing view in the emergentist tradition. Crucially, though, disagreement remains as to the precise nature of 'economy,' a vital third factor. Should it be seen as computational efficiency in the abstract sense of Principles-and-Parameters theory (e.g., Chomsky 2005:13, Berwick et al. 2011:1219)? Or can it be equated with processing cost, as proposed by Hawkins (2004) and O'Grady (2005) and as exemplified by the account of reflexive pronoun interpretation that I have outlined here?

The key claim of that account is that the reflexive pronoun systems of English and Korean, traditionally treated as classic instances of parametric variation (e.g., Wexler & Manzini 1987), are best understood with reference to two modes of

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[7] Reuland (2011:127) makes a parallel suggestion with respect to the contrast between variable binding (sentence-level) and coreference (potentially extra-sentential): 'variable binding entails closing an open expression immediately, whereas coreference allows closing the expression only after a further search through the discourse. ... keeping an expression open requires keeping it in working memory, and that ... carries a cost.'

processing, one sentential and the other pragmatic. One consequence of this approach is an explanation for why the two languages differ in the way they do: the presence of locality and c-command properties in the English system reflects the operation of the sentence-level processor, whereas their absence in Korean is a signature effect of pragmatic processing. Another consequence is a new perspective on development: learners settle on one or the other processing routine, which is then gradually strengthened over a period of years in response to ongoing experience. As noted in section 3, this scenario fits well with what recent experimental work tells us about the course of language acquisition. Both consequences point to interesting lines of inquiry for further work in this area.

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