

An LBA Approach to the English Middle Construction *

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1 Preliminary Remarks

The aim of this paper is twofold. One is to examine previous analyses of the English middle construction (see examples given under (1)) and point out their problems. The other is to offer an alternative analysis. The alternative analysis has two characteristics. First, its theoretical basis is on Lexically Based Algebra (hereafter LBA; see Brame (1997), Brame & Kim (1998) for details). The alternative analysis incorporates Labelled Deductive Systems (LDS) model of utterance interpretation (see Kempson (1996) for details). Previous analyses are unsatisfactory for two reasons. The first reason is that they fail to account for properties and constraints essential to the middle construction. The second reason is that they also fail to unify phonology, syntax, semantics and pragmatics in a single system. On the other hand, the alternative analysis is explanatory and integrational, thereby showing superiority over the previous analyses discussed in this paper.

(1)

- a. The book sells well.
- b. This pen writes smoothly.
- c. Math theses type slowly.¹ (Fiengo (1980:49))
- d. Hay loads easily. (Ackema & Schoolemmmer (1994:72))

2 Previous Observations

This section reviews previous observations in two steps. The first step deals with the classification of middle sentences in the specific subject vs. nonspecific subject dichotomy. The second step consists of two subsections, first of which discusses semantics-syntax interfacial conditions, whereas the

second deals with a pragmatics-syntax interfacial condition imposed on the middle construction.

2.1 Classification

Middle sentences can be grouped into two types, nonspecific subject (NS) middles and specific subject (SS) middles. The chart given below provides characteristics of each of the two types.

(2) Classification and characteristics

Defining characteristics	NS Middles	SS Middles
1. subject	nonspecific	specific
2. tense/aspect	simple present	progressive/past
3. implicit Agent	generic	specific
4. description	stative	specific ongoing/bygone events

NS middles take the simple present tense, while SS middles allow either the past tense or the progressive aspect. NS middles and SS middles exhibit the Agent, but the Agent cannot appear in the agentive *-by* phrase.² In NS middles the Agent is implicit, whereas in SS middles the Agent is either implicit or overt. The implicit Agent of SS middles is specific, but in NS middles it is generic (i.e. people in general). SS middles describe a specific ongoing event or a bygone event, while NS middles express state.

Defining characteristic 2 readily accounts for the fact that unlike NS middles SS middles lack modality.³ Modal verbs have no *-ing* or *-ed* forms. Defining characteristic 1 together with 4 explains the fact that the nonspecific subject is incompatible with the progressive aspect. Consider a couple of examples given below.

(3)

- a. *Bureaucrats are bribing easily. (Keyser & Roeper (1984))
- b. *Chickens are killing easily. (ibid)

Specific subjects are, however, compatible with the progressive aspect as shown below (cf. Iwata (1999:531)).

(4)

- a. These bureaucrats are bribing easily
- b. These chickens are killing easily.

There are two pieces of evidence that the implicit Agent is a defining characteristic of the middle construction. First, the implicit Agent comes into view in the interpretation of NS and SS middles. Second, the implicit Agent makes a significant contribution to the interpretation of middle sentences expressing a specific event (cf. Iwata (1999:538)). Compare (5) with (6).

(5)

- a. *This car was handling smoothly (while I was sleeping in the back seat).
- b. *This car handled smoothly (while I was sleeping in the back seat).

(6)

- a. According to what the driver told me, this car handled smoothly while I was sleeping in the back seat.
- b. This car must have handled smoothly while I was sleeping in the back seat, because I slept all the way without waking.

The examples in (5) are unacceptable if the clause in the parentheses is taken into account. This is attributable to a manifest logical absurdity. The Agent here is the speaker, who cannot perform the two separate actions at the same time: the driving of the car and the sleeping in the back seat. On the other hand, in the well-formed examples in (6) the absurdity is nullified. The Agent in these cases is not the speaker but the driver.

2.2 Semantics-syntax interfacial conditions

Two semantics-syntax interfacial conditions are essential. First, the Agent of NS and SS middles performs an action described by the verb in consonance with the inherent/generally known properties of the entity denoted by the subject. The observation that imperative middles are inadmissible (cf. Keyser & Roeper (1984)) naturally follows from the above condition together with defining characteristic 3 in (2). The implicit Agent in imperatives is the specific “you” and it can appear as the grammatical subject. Moreover, imperatives do not exhibit the close connection between the Agent's manner of action and the intrinsic/general property denoted by

the subject. Therefore, the following examples cannot be interpreted as middle sentences.

(7)

- a. *Wax, floor (smoothly)!
- b. *Translate, Greek (quickly)!

The above semantics-syntax interfacial condition gives a natural explanation for Keyser & Roeper's (1984) observation that middles do not occur in the small clause of perception verbs. In perception small clauses, the subject is the Agent of the action denoted by the bare infinitive/present participle/past participle. This property is incompatible with the middle construction, whose subject is the Theme. Examples in (8) substantiate the incompatibility. Notice that in example (8a), the word *bureaucrats* is taken to be the Agent of the verb *bribe* contra to the expected interpretation of the middle construction, hence giving rise to a thematic role clash. The same line of logic applies to (8b). NS and SS middles highlight the relation between the Agent's manner of action and the inherent/general property denoted by the grammatical subject. Neither (8a) nor (8b) satisfies this condition.

(8)

- a. *I saw bureaucrats bribe easily.
- b. *I saw the floor wax easily.

Second, NS and SS middles contain an "evaluation-of-action" adverb such as *well*, *comfortably*, *with great ease*, *without trouble*, etc. (cf. Sakamoto (2001:97)). Evaluation-of-action adverbs describe the Agent's experience in performing an action on the entity denoted by the subject. However, the human Agent's manner of action in NS and SS middles has no relevance to the change of state or the action denoted by the verb (cf. Sakamoto (2001:103)). Therefore, adverbs modifying qualities, abilities or attitudes of the human Agent are prohibited as the following examples illustrate.

(9)

- a. *This knife cuts skillfully/deliberately.
- b. *The truck handles expertly/carefully.

2.3 Pragmatics-syntax interfacial condition

There is one pragmatics-syntax interfacial condition, which has to do with defining characteristic 1 and 4 in (2). These attributes in unison have the effect that SS middles allow bygone events, where the subject is specific. This observation has a point of contact with a syntax-pragmatics interface. Notice that the following example is felt to be anomalous in the absence of appropriate context.

(10) ?The curry digested surprisingly easily last night.

This example becomes acceptable by filling up appropriate information (i.e. the underlined clauses).

(11) I have poor digestion so curry does not digest easily. But the curry digested surprisingly easily last night because I took a couple of peptic tablets before dinner.

The above line of reasoning provides a natural explanation for the claim that middles containing a definite past moment expression are unacceptable (cf. Keyser & Roeper (1984:38)). Consider their examples given below.

(12)

a. ?Yesterday, the mayor bribed easily, according to the newspaper.

b. ?At yesterday's house party, the kitchen wall painted easily.

The grammaticality of these sentences improves if the hearer is supplied with the underlined suitable information as shown in (13).

(13)

a Yesterday, the mayor bribed easily because the Mafia threatened him into taking the bribe the previous day, according to the newspaper.

b. At yesterday's house party, the kitchen wall painted easily because there were plenty of good paintbrushes as well as high-quality paint, and most of all the weather was fine.

The subsequent section examines previous analyses. It will be shown that none of the previous analyses is satisfactory. Factors contributing to the inadequacy are three. First, the analyses overlook interfacial properties. Second, idiosyncratic individual properties are for the most part left unaccounted for. Third, the previous analyses fail to integrate the

components of grammar in a principled and systematic fashion.

3 Previous Analyses and Their Problems

Three approaches are selected for scrutiny: generative grammar, lexical-conceptual structure, and cognitive grammar approaches. Representative analyses are examined and then evaluated in terms of the theory internal viewpoint and the point of view of integration.

3.1 Generative grammar approach and its problems

The generative grammar approach to the middle construction can be classified into two major types: syntactic analyses and lexical analyses. Fagan's (1992) analysis is a good representative of the latter. Syntactic analyses fall into three types: NP-movement analysis (cf. Stroik (1992); Hoekstra & Roberts (1993)), NP-movement with verb raising analysis (cf. Fujita (1996)), and non NP-movement analysis (cf. Ackema & Schoorlemmer (1994, 1995)). Let us begin with the syntactic analysis. The NP-movement analyses assume that the internal θ -role is assigned to the object, which is moved to the derived subject position by Move- α . Consider S-Structure representations (15a) and (15b) for middle sentence (14).

(14) Walls paint easily.

(15)

a. [_{IP} walls_i [_T I [_{VP} pro [_{V'} paint t_i easily]]]] (H&R 1993)

b. [_{IP} walls_i [_T I [_{VP} [_{VP} [_{V'} paint t_i easily]] PRO]]] (Stroik 1992)

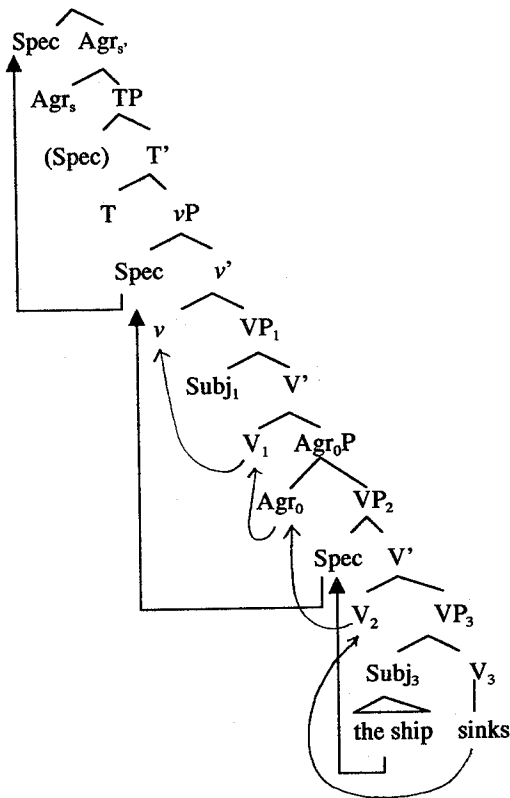
Ackema & Schoorlemmer (1995:174) argue against the NP-movement analyses in two respects. First, (15b) violates the PRO theorem (cf. Chomsky (1981:60)), which prohibits PRO as a pronominal anaphor to be governed. Notice that S-Structure (15b) contains two potential governors for PRO: I and V. Second, the small pro raises a question. There is no compelling empirical evidence for the syntactic presence of pro, the bearer of the subject θ -role. Languages such as Spanish and Italian exhibit the small pro, but English does not.

Let us consider next the NP-movement with verb raising analysis. Fujita (1996:171) assumes that the middle formation involves NP-

movement with overt verb raising as illustrated in derivation (17) for sentence (16). In (17) *the ship*, which bears the nominative Case feature, moves up to [Spec, Agr_SP] before Spell Out. In the absence of [Spec, Agr₀P] in overt syntax, the NP-movement proceeds via [Spec, VP₂], which is a $\bar{\theta}$ -position in the agentive causative structure (17). On the other hand, the verb *sinks* raises overtly to the head of vP (Voice Phrase) for the checking of morphological features. The verb raising can skip the implicit Agent subject in [Spec, VP₁] because [Spec, vP] and [Spec, VP₁] are taken to be equidistant.

(16) The ship sinks easily.

(17) Agr_S P



Fujita (1996:171) defends his analysis on the basis of two claims. First, the lack of the Causer subject interpretation in the middle construction follows from Minimal Link Condition (MLC) and the θ -Criterion. By the MLC (cf. Chomsky (1993;1994); Chomsky and Lasnik (1993)), the overt NP-movement of *the ship* must proceed via [Spec, VP₂]. This does not violate the θ -Criterion because [Spec, VP₂] does not count as the Causer subject position. Second, a middle verb always precedes an accompanying verb as shown in (18). This follows from the assumption that the middle verb is moved overtly to the v position. Since an adverb is adjoined to Agr₀P, the middle verb always ends up preceding the adverb.

(18)

- a. The ship sinks easily.
- b. (?*) The ship easily sinks.
- c. One can {sink the ship easily/ easily sink the ship}.

Fujita's analysis raises a couple of problems with respect to syntax-semantics discrepancy in the middle construction. First, his assumption that *the ship* is the subject with nominative Case feature is unjustifiable. Semantically, *the ship* is the Theme and it should be considered the object of *sink* as (18c) exemplifies. Second, Fujita assumes two covert elements: the implicit Agent and [Spec, Agr₀P]. In the middle construction, the implicit Agent is suppressed and the object appears in the subject position. This syntax-semantics discrepancy is not explained in Fujita's analysis in a clear and straightforward fashion. More crucial is the fact that his analysis fails to account for syntactic, semantic, and pragmatic idiosyncratic properties discussed in section 2.

Let us now turn to the third type of the syntactic analysis. Ackema & Schoorlemmer's (1995) non-movement analysis assumes structure (19), in which the grammatical object is base-generated in the D-Structure subject position. The logical subject is assumed to be semantically present but it is not projected in syntax.

(19) [_{IP} walls_i [_I I [_{VP} pro [_v paint t_i easily]]]]

Four assumptions are essential here. First, following Jackendoff (1990), predicate arguments are projected to syntax from a level of

Conceptual Structure (CS). Second, following Fagan (1988, 1992), the logical subject at CS is not syntactically projected because it is a semantically arbitrary argument. Third, a verb can never lose its capacity to assign an external θ -role. Fourth, following Grimshaw (1990), Ackema & Schoorlemmer assume that if a usual subject argument of a verb is not projected to syntax, the hierarchically next highest argument in CS will project as an external argument. Ackema & Schoorlemmer draw two conclusions. One is that there is no convincing evidence for the syntactic presence of the subject of middle verb. The other is that there is no syntactic NP-movement in the derivation of middle sentences.

As Ackema & Schoorlemmer note, the non-movement analysis raises at least a couple of problems. First, middle formation (MF) of resultatives is problematic, because there are middles from transitive verb-resultative combinations of which the transitive verb itself cannot undergo MF, as shown by Rapoport (1993:175). Another problem is that “verb-resultative combinations with an intransitive verb seem to undergo MF, as argued by Goldberg (1991:72) contra Carrier & Randell (1992), in which case the grammatical subject does not seem to be an argument of the verb (Ackema & Schoorlemmer (1995:186, fn.15))”. Seen from the integrational point of view, Ackema & Schoorlemmer's analysis is unsatisfactory since the analysis fails to account for the syntactic, semantic and pragmatic properties in a unified fashion.

Let us now examine Fagan's (1992) analysis as a representative of the lexical analysis. She employs a set of lexical-rules as illustrated below.

(20) Middle Formation (MF) in English (Fagan (1992:197))

- a. Assign *arb* to the external θ -role.
- b. Externalize (direct θ -role).
- c. +[___AdvP]
- d. Semantics: ‘be able to be Xed’
- e. Condition: V is not an achievement or state; V is not ditransitive.

Fagan's analysis explains the syntax-semantics disparity between the grammatical subject and logical subject in terms of (20a) and (20b). The analysis incorporates two general observations. One is that the middle

construction requires a manner adverbial. The other is that NS middles exhibit modality. Following Vendler's (1967:107) classification of verbs, Fagan aptly identify verbs eligible for the MF. Only accomplishment verbs (cf. *paint, make, build, etc.*) and activity verbs (cf. *swim, dance, drive, etc.*) can undergo the MF.

Although Fagan's treatment partially achieves unification by bringing syntax and semantics on common ground, it poses at least three problems. First, (20d) accounts for the modality of NS middles in general, but SS middles do not exhibit this property as discussed in section 2. Second, her analysis fails to incorporate two essential semantics-syntax interface conditions considered in section 2.2. Third, seen from the point of view of unification, Fagan's analysis does not come close to the desired goal of bringing phonology, syntax, semantics, and pragmatics into a unified whole in one system.

3.2 Iwata's (1999) lexical-conceptual analysis and its problems

Following Jackendoff's (1987a, 1987b, 1990) theory of conceptual structure, Iwata (1999:542) postulates a middle formation of verbs. The middle formation involving the verb 'handle', for example, is illustrated in (21). Here X represents the Agent, and Y denotes the Theme.

(21) [HANDLE ([X]_i, [Y]_j)] ⇒ [HANDLE ([X], [Y]_i)]

The subscript *i* indicates the subject position, while *j* denotes the direct object position. The syntactic absence of the external argument is accounted for by eliminating the index *i* of X. As a result, the Agent becomes 'implicit' without being removed. By changing the index *j* of Y to *i* the Theme becomes an external argument.

Iwata's analysis bears at least three problems. First, it fails to account for the semantics-syntax interfacial conditions discussed in section 2.2. Neither does it explain the pragmatics-syntax conditions discussed in 2.3. Third, from the point of view of integration, Iwata's analysis is far from satisfactory. It does not unify the syntactic, semantic, and pragmatic properties of the middle construction in one system.

3.3 Sakamoto's (2001) cognitive grammar analysis and its problems

Sakamoto's (2001) study produces three results. First, the middle construction is semantically related to the unaccusative and the unergative, all of which share the same syntactic form of [NP-V]. Second, middles are taken to be intransitive constructions under Langacker's (1999) cognitive network model. Third, the gist of middles is captured in five properties: (i) A certain property of the entity denoted by the subject determines how the change of state proceeds; (ii) The entity denoted by the subject acts like a real Agent; (iii) A certain property of the entity denoted by the subject determines how the action proceeds; (iv) A certain property of the Instrument determines how the action proceeds; (v) A certain property of the Setting⁴ determines how the action proceeds (cf. Sakamoto (2001:108)).

Although Sakamoto's analysis offers consequential observations from the speaker-oriented point of view, it shows an organizational shortcoming and a theoretical problem. First, the above five properties boil down to one proposition: The Agent-like subject of SS middles determines how the change of state or the action proceeds. (This observation is incorporated into the integrated analysis advanced in section 4 as a semantics-syntax interfacial condition.) Second, Sakamoto's analysis is nonintegrational and fails to unify syntactic, semantic, and pragmatic properties into one system in a principled fashion.

4 A Lexically Based Algebraic Analysis

A short sketch of theoretical framework will help the reader grasp the unified analysis of the middle construction advanced later in this section. I have devised a unified grammar model called **SA-Model**. This model is a theoretical extension of Lexically Based Algebra (cf. Brame (1997) and Brame & Kim (1998)). The model incorporates Labelled Deductive Systems (LDS) model of utterance interpretation by Kempson (1996). The **SA-Model** can be defined as a quadruple.

(22) Definition

SA-Model=(*LEX*, *GC*, *WFC*, *LDS*)

LEX is defined as follows (cf. Brame and Kim (1998)):

(23) Definition: Let $LEX=(LEX!, \otimes, 1, \text{ and } T)$ be a lexically based production algebra. We say that LEX generates or produces the language L provided that the following equation is satisfied.

$$L=\{x \mid [x, \varphi] \in LEX! \ \& \ \varphi \in T\}$$

$LEX!$ is a set of lexes. \otimes symbolizes a binary function. 1 signifies an identity element. T denotes a set of types. By Lexical Composition (24) a string of syntactic words is created by combining lexes in $LEX!$ (See Brame & Kim (1998) for details). Combining syllablelexes in LEX produces a string of phonological words (See Aniya (2000) for details).

(24) Lexical Composition (LC)

$$\otimes: LEX! \times LEX! \rightarrow LEX!$$

$$[x, \varphi] \otimes [y, \psi] = [x \wedge y, \varphi \bullet \psi]$$

GC is a set of grammatical conditions involving phonology, morphology, syntax, semantics, and pragmatics.

(25) $GC = \{PhonC, MorpC, SynC, SemC, PragC\}$

$$PhonC = \{phoc_1, \dots, phoc_n\}$$

$$MorpC = \{morpc_1, \dots, morpc_n\}$$

$$SynC = \{sync_1, \dots, sync_n\}$$

$$SemC = \{semc_1, \dots, semc_n\}$$

$$PragC = \{pragc_1, \dots, pragc_n\}$$

As shown above, each element in GC is a set, which in turn contains grammatical conditions. In a full-fledged exposition, the grammatical conditions are defined and spelled out.

WFC is a well-formedness criterion, which evaluates the grammaticality of products on the basis of GC as defined below.

(26) Definition. Let $p \bullet x = y$ be a well-formedness algebra with the following terms.

- i. Let p be a lexical composition product, and assign p value 1.
- ii. If p violates GC , then assign x value 0, otherwise value 1.
- iii. If y is 1, then p is well-formed; if y is 0, then ill-formed.

The example under (27) illustrates WFC in action in phonology. An English sequential constraint on segments prohibits [ŋ] at the word initial position, therefore the string [ŋɑɾə] is assigned the value 0, which gives rise to the

equation $1 \bullet 0 = 0$. As a result, $[\eta\alpha\tilde{r}\tilde{e}]$ is declared ill-formed by (26iii).

(27) Example

$$\begin{array}{rcccl}
 [\eta\alpha\tilde{r}\tilde{e}] \bullet 1 = 1 \bullet 1 = 1 & & & & \text{(well-formed)} \\
 \uparrow & \uparrow & & \uparrow & \\
 p & \bullet & x & = & y \\
 \downarrow & & \downarrow & & \downarrow \\
 [\eta\alpha\tilde{r}\tilde{e}] \bullet 0 = 1 \bullet 0 = 0 & & & & \text{(ill-formed)}
 \end{array}$$

Labelled Deductive System (*LDS*) model of utterance interpretation (cf. Kempson (1996: 569)) provides a general method for combining two sorts of information in a single system. The model constructs the speaker's proposition on the basis of information provided by words, which drive the hearer to identify what that proposition might be. We shall see *LDS* in action in actual examples later in this section.

Let us now view how the **SA-Model** provides a unified analysis. We take "*Math theses type slowly*" in (1c) as an example and show its production, recognition, and semantics-pragmatics interpretation. The analysis has to account for in unison the properties of middle sentences discussed in section 2. The discussion will proceed following the procedural steps given under (28).

(28) Procedures

- a. By Lexical Composition (LC) the phonological production, recognition, and resolution of the example are provided.
- b. By LC the syntactic production, recognition, and resolution of the example are provided.
- c. By LC the phonological and syntactic products are unified.
- d. *LDS* provides a semantics-pragmatics interpretation of the example.
- e. By LC the phonology, syntax, semantics, and pragmatics of the example are unified.
- f. **WFC** evaluates the grammaticality of the product on the basis of *GC*.⁵

Two charts, (29) and (30) given below illustrate the production and recognition in phonology and syntax, respectively for the example *Math theses type slowly*.

(29) Phonological account

PRODUCTION	RECOGNITION	RESOLUTION
$[\lambda, 1]$ $[m\text{æ}\theta, \leftarrow \Sigma \sigma \rightarrow]$	$[m\text{æ}\theta \theta\text{isiz tajp sloli}, \leftarrow \Sigma]$ $[m\text{æ}\theta^{-1}, \leftarrow \sigma \Sigma \rightarrow]$	$[m\text{æ}\theta \theta\text{isiz tajp sloli}, \leftarrow \Sigma]$ $[\lambda, \leftarrow \Sigma \Sigma \rightarrow]$
$[m\text{æ}\theta, \leftarrow \Sigma \sigma \rightarrow]$ $[\theta\text{isiz}, \leftarrow \sigma \sigma \rightarrow]$	$[\theta\text{isiz tajp sloli}, \leftarrow \sigma]$ $[\theta\text{isiz}^{-1}, \leftarrow \sigma \sigma \rightarrow]$	$[m\text{æ}\theta \theta\text{isiz tajp sloli}, \leftarrow \Sigma]$ $[\lambda, \leftarrow \sigma \sigma \rightarrow]$
$[m\text{æ}\theta \theta\text{isiz}, \leftarrow \Sigma \sigma \rightarrow]$ $[tajp, \leftarrow \sigma \sigma \rightarrow]$	$[tajp sloli}, \leftarrow \sigma]$ $[tajp^{-1}, \leftarrow \sigma \sigma \rightarrow]$	$[m\text{æ}\theta \theta\text{isiz tajp sloli}, \leftarrow \Sigma]$ $[\lambda, \leftarrow \sigma \sigma \rightarrow]$
$[m\text{æ}\theta \theta\text{isiz tajp}, \leftarrow \Sigma \sigma \rightarrow]$ $[sloli}, \leftarrow \sigma]$	$[sloli}, \leftarrow \sigma]$ $[sloli^{-1}, \sigma \rightarrow]$	$[m\text{æ}\theta \theta\text{isiz tajp sloli}, \leftarrow \Sigma]$ $[\lambda, \leftarrow \sigma \sigma \rightarrow]$
$[m\text{æ}\theta \theta\text{isiz tajp sloli}, \leftarrow \Sigma]$	$[\lambda, 1]$	$[m\text{æ}\theta \theta\text{isiz tajp sloli}, \leftarrow \Sigma]$

(30) Syntactic account

PRODUCTION	RECOGNITION	RESOLUTION
$[\lambda, 1]$ $[Math\ theses, \leftarrow S^M D^{\uparrow} V \rightarrow]$	$[Math\ theses\ type\ slowly, \leftarrow S^M]$ $[Math\ theses^{-1}, \leftarrow VD^{\downarrow} S^M \rightarrow]$	$[Math\ theses\ slowly, \leftarrow S^M]$ $[\lambda, \leftarrow S^M S^M \rightarrow]$
$[Math\ theses, \leftarrow S^M D^{\uparrow} V \rightarrow]$ $[type, \leftarrow VD^{\downarrow} A^{d \rightarrow}]$	$[type\ slowly, \leftarrow VD^{\downarrow}]$ $[type^{-1}, \leftarrow A^{d \leftarrow} DV \rightarrow]$	$[Math\ theses\ type\ slowly, \leftarrow S^M]$ $[\lambda, \leftarrow VV \rightarrow]$
$[Math\ theses\ type, \leftarrow S^M A^{d \rightarrow}]$ $[slowly, \leftarrow A^{d \leftarrow}]$	$[slowly, \leftarrow A^{d \leftarrow}]$ $[slowly^{-1}, A^{d \rightarrow}]$	$[Math\ theses\ type\ slowly, \leftarrow S^M]$ $[\lambda, \leftarrow A^{d \leftarrow} A^{d \rightarrow}]$
$[Math\ theses\ type\ slowly, \leftarrow S^M]$	$[\lambda, 1]$	$[Math\ theses\ type\ slowly, \leftarrow S^M]$

The formula $[Math\ theses, \leftarrow S^M D^{\uparrow} V \rightarrow]$ in the first row of the left column in (30) carries two pieces of essential information. First, the superscript M of the intrinsic type $\leftarrow S^M$ represents a middle sentence. Second, the argument type $D^{\uparrow} V \rightarrow$ shows that the subject *Math theses* selects a transitive verb with its object. Lexical Composition executes two types of concatenation: ordinary and type. By ordinary concatenation, *Math theses* and *type* are combined to form *Math theses type*. While the two types, $D^{\uparrow} V \rightarrow$ and $\leftarrow VD^{\downarrow} \rightarrow$ are combined to form 1 by the type composition (see (31a) and (31b)). This involves two cancelling out operations: Right/Left Type Reduction (R/L

TR) and Orthogonal Type Reduction (OTR). Notice that V^{\rightarrow} and $\leftarrow V$ represent the intrinsic type of the verb *type*; while D^{\uparrow} and D^{\rightarrow} represent the argument type of the covert object (the gap) of *type*. (As we shall see shortly below, the association between the covert object and the grammatical subject is done in the semantics-pragmatics interpretation.) Notice also that the verb *type* selects a manner adverbial as its argument in accordance with a syntactic subcategorization restriction.⁶

$$(31) [\text{Math theses}, \leftarrow S^M D^{\uparrow} V^{\rightarrow}] [\text{type}, \leftarrow V D^{\rightarrow} A^{d \rightarrow}] = [\text{Math theses type}, \leftarrow S^M A^{d \rightarrow}]$$

$$a. V^{\rightarrow} \bullet \leftarrow V = 1 \quad (\text{Right/Left Type Reduction})$$

$$b. D^{\uparrow} \bullet D^{\rightarrow} = 1 \quad (\text{Orthogonal Type Reduction})$$

$$(32) [\text{Math theses type}, \leftarrow S^M A^{d \rightarrow}] [\text{slowly}, \leftarrow A^d] = [\text{Math theses type slowly}, \leftarrow S^M]$$

We now wish to unify phonology and syntax. This can be achieved without any theoretical elaboration. The associative law and the inverse will suffice. Consider the equations in (33), where S signifies syntactic product and P represents phonological product. The unified products P and S are computed differently but they are substantially the same. (33a) exemplifies unification via syntactic recognition, whereas (33b) illustrates unification via phonological recognition.

(33)

$$a. S^{-1} \bullet (S \bullet P) = (S^{-1} \bullet S) \bullet P = 1 \bullet P = P$$

$$b. P^{-1} \bullet (P \bullet S) = (P^{-1} \bullet P) \bullet S = 1 \bullet S = S$$

The following corresponding examples will illustrate the idea behind the above equations.

(34)

$$a. [\text{Math theses type slowly}^{-1}, S^{\rightarrow}] \bullet ([\text{Math theses type slowly}, \leftarrow S] \bullet [\text{mæ}\theta \text{ \theta isiz tajp sloli}, \leftarrow \Sigma]) = ([\text{Math theses type slowly}^{-1}, S^{\rightarrow}] \bullet [\text{Math theses type slowly}, \leftarrow S]) \bullet [\text{mæ}\theta \text{ \theta isiz tajp sloli}, \leftarrow \Sigma] = 1 \bullet [\text{mæ}\theta \text{ \theta isiz tajp sloli}, \leftarrow \Sigma] = [\text{mæ}\theta \text{ \theta isiz tajp sloli}, \leftarrow \Sigma]$$

$$b. [\text{mæ}\theta \text{ \theta isiz tajp sloli}^{-1}, \Sigma^{\rightarrow}] \bullet ([\text{mæ}\theta \text{ \theta isiz tajp sloli}, \leftarrow \Sigma] \bullet [\text{Math theses type slowly}, \leftarrow S]) = ([\text{mæ}\theta \text{ \theta isiz tajp sloli}^{-1}, \Sigma^{\rightarrow}] \bullet [\text{mæ}\theta \text{ \theta isiz tajp sloli}, \leftarrow \Sigma]) \bullet [\text{Math theses type slowly}, \leftarrow S] = 1 \bullet [\text{Math theses type slowly}, \leftarrow S]$$

slowly, \leftarrow S]=[Math theses type slowly, \leftarrow S]

Alternative associative groupings are shown in (35) together with corresponding examples in (36).

(35)

a. $S^{-1} \bullet (S \bullet P) = S^{-1} \bullet SP = 1 \bullet P = P$

b. $P^{-1} \bullet (P \bullet S) = P^{-1} \bullet PS = 1 \bullet S = S$

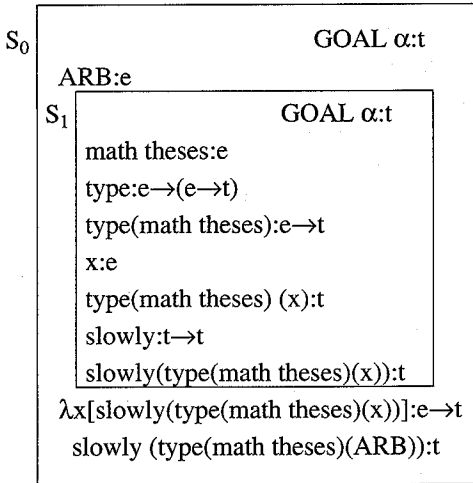
(36)

a. [Math theses type slowly $^{-1}$, $S \rightarrow$]•[Math theses type slowly $m\alpha\theta$ θ isiz tajp sloli, \leftarrow S \leftarrow Σ]=[$m\alpha\theta$ θ isiz tajp sloli, \leftarrow Σ]

b. [$m\alpha\theta$ θ isiz tajp sloli $^{-1}$, $\Sigma \rightarrow$]•[$m\alpha\theta$ θ isiz tajp sloli Math theses type slowly, \leftarrow $\Sigma \leftarrow$ S]=[Math theses type slowly, \leftarrow S]

Therefore, we have algebraically unified phonology and syntax. The semantics-pragmatics unification will be discussed next.

The Labelled Deductive Systems (LDS) model of utterance interpretation unifies semantics and pragmatics in a principled fashion. Consider the box formula shown under (37). The semantics-pragmatics interpretation begins from the inner box S_1 and then proceeds to the box S_0 . The temporal logic is at work here: P is true at time S_i . In S_1 , Modus Ponens applies to the minor premise *math theses*: e and the major premise *type*: $e \rightarrow (e \rightarrow t)$. These combine to yield *type (math theses)*: $e \rightarrow t$. Likewise Modus Ponens applies to *type (math theses)*: $e \rightarrow t$ and x : e producing *type (math theses)(x)*: t . Once again Modus Ponens applies to *type (math theses)(x)*: t and *slowly*: $t \rightarrow t$ yielding *slowly (type (math theses)(x))*: t . The value of x is determined in the box formula S_0 . By employing λ -abstract, the premise λx [*slowly (type (math theses)(x))*]: $e \rightarrow t$ is built up. Applying Modus Ponens to the formula the variable x is replaced with ARB, the arbitrary implicit Agent. The resultant formula at the bottom of box S_0 preserves a record of which assumption has been drawn and from where. This reflects the pragmatic intuition that the hearer is using the interpretation just built up to reconstruct the meaning of the sentence *Math theses type slowly*.

(37) Semantic-pragmatic interpretation of *Math theses type slowly*

The above *LDS* analysis accounts for the four essential properties of the middle construction. First, the grammatical subject is associated with the object of *type*. Second, the syntactically implicit external argument is interpreted as an arbitrary entity, i.e. ARB. Third, assuming the thematic argument tier (Theme/Goal/Location) (Agent) for transitive verbs, the implicit argument is identified as the Agent. Fourth, the verb *type* selects two arguments: the Theme and the Agent. Here the former is *math theses*, whereas the latter is the ARB.

We have seen that semantics and pragmatics are unified in the *LDS* model. We have also seen previously in (33)-(36) the unification of phonology and syntax. Therefore, the four components of grammar are reduced to two interfacial facets: phonology-syntax and semantics-pragmatics. The two can be combined to form one. Once again the associative law together with the inverse leads us to the goal. Consider the equations under (38). Here SP means the semantics-pragmatics unified formula, while SP^{-1} means its inverse. P denotes the phonology-syntax unified formula, whereas P^{-1} denotes its inverse. The unified products P and SP are obtained making access to different paths but the products are

substantially the same.

(38)

$$a. SP^{-1} \bullet (SP \bullet P) = (SP^{-1} \bullet SP) \bullet P = 1 \bullet P = P$$

$$b. P^{-1} \bullet (P \bullet SP) = (P^{-1} \bullet P) \bullet SP = 1 \bullet SP = SP$$

Therefore, the different facets of grammar are defined in tandem unifying phonology, syntax, semantics and pragmatics on common ground.

The remaining task is to show the grammaticality of the sentence *Math theses type slowly*. The sentence satisfies defining characteristics of the middle construction. It satisfies the conditions specified in section 2, as well as Sakamoto's syntax-semantics interfacial constraint discussed in section 3.3. Therefore, by *WFC* defined in (27) the sentence is assigned the value 1, hence it is declared well-formed as illustrated in (39).

$$(39) \textit{Math theses type slowly} \bullet 1 = 1 \bullet 1 = 1$$

5 Concluding Remarks

Unlike single component-oriented previous analyses, the LBA analysis advanced in this paper enjoys at least five advantages over the previous analyses discussed in section 3. The foremost advantage is its capacity of integrating five major components of grammar: phonology, morphology, syntax, semantics, and pragmatics. The second advantage is that the properties unique to the middle construction are explained and incorporated into the unified system of **SA-Model**. The third advantage is that the LBA analysis enjoys mathematical precision. The fourth advantage is that the production and recognition mechanisms reflect the speaker-hearer's computation in language production and recognition. The fifth advantage is that the relation between the gap and the grammatical subject is accounted for in a general fashion by employing Orthogonal Type Reduction (OTR).

Notes

*I wish to thank Peter Skaer and an anonymous reviewer for their comments and stylistic corrections on an earlier version of this paper. Any errors or shortcomings remaining in the present paper are of course my own.

1. Out of context this example may not sound as good as others. But given a proper context it

- will become OK: “You know it is easy to type business correspondence, but math theses type slowly.”
2. The *for*-phrase in middles is possible as the following examples substantiate (cf. Sakamoto (2001:103)). The *for*-phrase in middles, however, introduces a Beneficiary role rather than an Agentive role (Iwata, 1999).
 - (i) a. *This book reads easily by anyone.
b. This book reads easily for anyone.
 - (ii) a. *This bread cuts easily by anyone.
b. This bread cuts easily for anyone.
 3. A middle sentence is often paraphrased by a sentence containing the modal *can* as shown below (cf. Sakamoto (2001:87)).
 - i. This car drives easily.
 - ii. People in general can drive this car easily.
 4. The term ‘setting’ is used here to mean the setting where events happen. In the following examples the subject specifies the Setting (cf. Sakamoto (2001:105)).
 - (i) This lake fishes well. (Yoshimura (1995:255))
 - (ii) This music dances better than the other one. (Van Oosten (1986:84))
 5. I assume that *WFC* applies not only at the sentence(s) level but also at the word, phrase, and clause levels. I am not prepared to develop this idea further, therefore it is reserved for future study.
 6. A postverbal manner adverbial of middles may be deleted given an appropriate situation, where the speaker and hearer share the same knowledge (cf. Ackema & Schoorlemmer (1994:71)). Due to space limitation, I will not go further on this topic.

References

- Ackema, P. and M. Schoorlemmer. 1994. “The Middle Construction and the Syntax-semantics interface,” *Lingua* 93: 59-90.
- Ackema, P. and M. Schoorlemmer. 1995. “Middles and Nonmovement,” *Linguistic Inquiry* 26: 173-197.
- Aniya, S. 2000. “The Phonology of Wanna-construction Part II: A Lexically Based Algebraic Analysis,” *Hiroshima University Gengobunkakenkyu* V, Vol.26:1-23.
- Brame, M. 1997. Whence Infinity? Paper delivered at the University of Washington, Spring 1997.
- Brame, M. and Y.G. Kim. 1998. “Directed Types: An Algebraic Theory of Production and Recognition,” *Linguistic Analysis* 28, 3-4:117-184.
- Carrier, J. and J.H. Randall. 1992. “The Argument Structure and Syntactic Structure of Resultatives,” *Linguistic Inquiry* 23:173-234.
- Chomsky, N. 1981. *Lectures on Government and Binding*. Foris, Dordrecht.

- Chomsky, N. 1993. "A Minimalist Program for Linguistic Theory," In *The View from Building 20: Essays in Linguistics in Honor of Sylvain Bromberger*, ed. Kenneth Hale and Samuel Jay Keyser, pp.1-52. Cambridge, Mass.: MIT Press.
- Chomsky, N. 1994. "Bare Phrase Structure," *MIT Occasional Papers in Linguistics 5. MITWPL*, Department of Linguistics and Philosophy, MIT, Cambridge, Mass.
- Chomsky, N. and H. Lasnik. 1993. "The Theory of Principles and Parameters," In *Syntax: An International Handbook of Contemporary Research*, vol.1, ed. J. Jacobs, A. von Stechow, W. Sternefeld, and T. Vennemann, pp.506-569. Berlin: Walter de Gruyter.
- Fagan, S. 1988. "The English Middle," *Linguistic Inquiry* 19, 2:181-203.
- Fagan, S. 1992. *The Syntax and Semantics of Middle Constructions: A Study with Special Reference to German*, Cambridge University Press, Cambridge.
- Fiengo, R. W. 1980. *Surface Structure: The Interface of Autonomous Components*. Cambridge, Mass: Harvard University Press.
- Fujita, K. 1996. "Double Objects, Causatives, and Derivational Economy," *Linguistic Inquiry* 27, 1:146-173
- Goldberg, E. 1991. "A Semantic Account of Resultatives," *Linguistic Analysis* 21, 1-2: 66-96.
- Grimshaw, J. 1990. *Argument Structure*. Cambridge, MA: MIT Press.
- Hoekstra, T. and I. Roberts. 1993. "Middle Constructions in Dutch and English," In *Knowledge and Language*, Vol.2: Lexical and Conceptual Structure, ed. Eric Reuland and Werner Abraham, pp.183-220. Dordrecht: Kluwer.
- Iwata, S. 1999. "On the Status of an Implicit Arguments in Middles," *Journal of Linguistics* 35:527-553.
- Jakendoff, R. 1987a. "The Status of Thematic Relations in Linguistic Theory," *Linguistic Inquiry* 18:369-411.
- Jakendoff, R. 1987b. Adjuncts. Ms., Brandeis University.
- Jackendoff, R. 1990. *Semantic Structures*. Cambridge, Mass.: MIT Press.
- Kempson, R. 1996. "Semantics, Pragmatics and Natural Language Interpretation," In *The Handbook of Contemporary Semantic Theory*, ed. S. Lappin, pp.561-598. Blackwell.
- Keyser, S. J. and T. Roeper. 1984. "On the Middle and Ergative Constructions in English," *Linguistic Inquiry* 15:381-416.
- Langacker, R. 1999. "A Dynamic Usage-based Model," *Usage Based Models of Language*, ed. by Michael Barlow and Suzanne Kemmer, pp.1-64, CSLI Publications, Stanford.
- Rapoport, T. 1993. "Verbs in Depictives and Resultatives," In *Semantics and the Lexicon*, ed. by J. Pustejovsky, pp.163-184. Dordrecht: Kluwer.
- Sakamoto, M. 2001. "The Middle and Related Constructions in English: A cognitive network analysis," *English Linguistics* 18, 1:86-110.
- Stroik, T. 1992. "Middles and Movement," *Linguistic Inquiry* 23:127-137.
- Van Oosten, J. 1986. *The Nature of Subjects, Topics and Agents: A Cognitive Explanation*,

Indiana University Linguistics Club, Bloomington.

Vendler, Z. 1967. *Linguistics in Philosophy*. Ithaca: Cornell University Press.

Yoshimura, K. 1995. *Ninchi Imiron no Hoho: Keiken to Doki no Gengogaku* (Methods of Cognitive Semantics: The Linguistics Based on Experience and Motivation), Jinbun shoin, Kyoto.