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Optimality-Theoretic Lexical Mapping Theory:
A Case Study of Locative Inversion

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ABSTRACT

*Locative inversion verbs seem to share the same argument structure and grammatical function assignment (i.e., <th-*OBJ *loc-*SUBJ*>) cross-linguistically. This article discusses the nature of argument-function linking in LFG and demonstrates how the Lexical Mapping Theory (LMT) rendered in Optimality-Theoretic (OT) terms, where argument-function linking is governed by universal violable constraints that consistently favor the unmarked function, accounts for locative inversion straightforwardly. Within this OT-LMT, locative inversion is due to a universal morphosyntactic constraint, and language variation in locative inversion is due to the difference in its relative ranking. This account also offers a potential explanation for the markedness of the locative inversion construction.*

Keywords: algorithms; case study; semantic matching; very high-level languages

INTRODUCTION

The locative inversion construction, as shown in Figure 1, cross-linguistically has similar characteristics in discourse information packaging, which allows the more familiar information to precede the less familiar information (Ackerman & Moore, 2001b; Birner, 1994; Cheng, 1983; Tan, 1991). Between the canonical construction in Figure 1a and the inverted form of 1b, along with the switch of focus from the locative to the theme, is the change in syntactic function assignment. An example from Chinese is given in the figure. The theme role in Figure 1a is assigned the subject function and locative an oblique function; the canonical linking is, thus, <*th*-SUBJ *loc*-OBL>. In the inverted Figure 1b, however, the locative is the subject, while the theme now occupies the object

Figure 1.

a. Amei zuo zai tai-shang.
Amei sit at stage-top
'Amei is sitting on the stage.'

b. Tai-shang zuo-zhe Amei.
stage-top sit-ASP Amei
'On the stage is sitting Amei.'

Figure 2.

a. A-lendo-wo ku-ba-bwer-a ku-mu-dzi. (p.3 (2b))
2-visitor-2 those 17 SB-REC-PST-come-IND 17-3-villiage
a' 'Those visitors came to the village.'

b. Ku-mu-dzi ku-ba-bwer-a a-lendo-wo. (p.3 (1b))
17-3-villiage 17 SB-REC-PST-come-IND 2-visitor-2 those
b' 'To the village came those visitors.'

Figure 3.

a. Tai-shang kanqilai zuo-le henduo ren.
stage-top appear sit-ASP many person
'On the stage appears to be sitting many people.'

b. Tai-shang you zuo-zhe henduo ren ma?
stage-top YOU sit-ASP many person Q
'Is it the case that on the stage was sitting many people?'

position (Her, 1990; Huang, 1993; Huang & Her, 1998; Tan, 1991).

This <*th*-OBJ *loc*-SUBJ> argument-function "mismatch" was first identified and convincingly argued for in locative inversion verbs in Chichewa (Bresnan, 1994; Bresnan & Kanerva, 1989) and in English (Bresnan, 1989; Tan, 1991). Examples in Figure 2 are from Bresnan and Kanerva (1989).

The subjecthood of the inverted locative phrase *tai-shang* "stage-top" in Figure 1b is evidenced by the fact that it is a bare NP and occupies the usual position for subjects. This is further confirmed by the usual raising test. As shown in Figure 3, *tai-shang* "stage-top" is, indeed, the raised subject, while the "demoted" theme in the post-verbal position, also a bare NP, must be recognized as the object (see Figure 3).

Chinese data thus further confirm Bresnan's (1994) observation that cross-linguistically, locative inversion verbs share an identical argument structure <*th loc*> and the function assignment of the canonical <*th*-SUBJ *loc*-OBL > in Figure 1a and the inverted <*th*-OBJ *loc*-SUBJ> in Figure 1b. This article aims mainly to account for the syntactic assignment of the argument roles in locative inversion verbs.

In any syntactic theory that aims at characterizing UG, it would be a considerable compromise to simply leave the syntactic assignment of argument roles to lexical idiosyncrasies (Pesetsky, 1995). This article focuses on how the syntactic as-

signment of argument roles is accounted for universally in the syntactic theory of Lexical Functional Grammar (LFG). This article is organized as follows. The first section discusses how argument-function linking is accounted for by the lexical mapping theory (LMT) in LFG. We will also demonstrate how certain versions of this theory do not account for the locative inversion data from Chinese and English straightforwardly. Furthermore, we will demonstrate how the theory can be improved upon for more consistency and computational efficiency. In the second section we propose a revised LMT formulated as declarative constraints in Optimality-Theoretic (OT) terms. The locative inversion data from Chinese is then accounted for in the third section. The fourth section consists of a discussion on the implications of this study, and the fifth section concludes the article.

The goal of the article is, thus, twofold: (1) to come up with a universal lexical mapping theory based on violable declarative constraints in OT terms; and (2) to account for Mandarin locative inversion within this comprehensive OT-LMT.

LEXICAL MAPPING THEORY

LFG mainly posits three distinct, parallel planes of grammatical description: the argument structure, the functional structure, and the constituent structure (Bresnan, 2001; Dalrymple, 2001; Falk, 2001). The argument structure, or a-structure, consists of the predicate's thematic and non-thematic argument roles, while the constituent structure, or c-structure, represents the configurational structure, which is the surface structure and allows no syntactic derivation. The functional structure, or f-structure, is the locus of grammatical information, such as grammatical functions (e.g., SUBJ and OBJ), case, person, number, gender, and so forth. The linking of these structures, each with a distinct formal nature, is constrained by correspondence principles. The lexical mapping theory (LMT) is the UG component that constrains the linking between a-structure roles and f-structure functions. The f-structure thus can be viewed as the interface level that links the a-structure and the c-structure. An argument role thus is linked to a grammatical function in the f-structure, which, in turn, is linked to a certain c-structure configuration. The lexical mapping theory (LMT) is the subtheory within LFG, which constrains the syntactic assignment of a-structure roles.

The pioneering work by Levin (1987) started the exploration of more principled accounts to replace the earlier stipulated function-changing rules in LFG. The first comprehensive formulation of LMT was proposed in Bresnan and Kanerva (1989). Since then, even though the essential underpinning assumptions have remained largely stable, the issue of argument-function linking, especially its precise formulation, has yet to be resolved (Butt & King, 2000). A number of different versions of the theory have been proposed (Ackerman, 1992; Ackerman & Moore, 2001a; Alsina, 1996; Bresnan, 1989, 2001; Butt, Dalrymple & Frank, 1997; Her, 1998; Huang, 1993; Zaenen, 1987), among others. A review of these existing versions is clearly outside the scope of this article[1]. Instead, we will outline mainly the version that seems to be the most widely circulated, found in Chapter 14 of Bresnan (2001), which, in turn, is based largely upon Bresnan and Zaenen (1990)[2].

Figure 4. Thematic hierarchy

agent > beneficiary > experiencer/goal > instrument > patient/theme > locative

Figure 5.

a. *break*	<	*x*	*y*	>	(*x* = *ag*, *y* = *th*)
b. *give*	<	*x*	*y*	*z*	> (*x* = *ag*, *y* = *go*, *z* = *th*)

Figure 6.

TOP	*FOC*	**SUBJ**	**OBJ**	**OBJ**$_\theta$	**OBL**$_\theta$[4]	*ADJUNCTS*

Figure 7. Feature decomposition of argument functions

	-*r*	+*r*
-*o*	SUBJ	OBL$_\theta$
+*o*	OBJ	OBJ$_\theta$

[±*r*] = *(un)restricted* [±*o*] = *(un)objective*

The Theory of A-Structure

Conceptually, LMT consists of two components: the theory of a-structure and the mapping constraints. LFG assumes a universal hierarchy among a-structure roles in terms of their relative prominence in the event denoted by the predicate. This scale descends from the most prominent agent role to the least prominent locative role (Bresnan & Kanerva, 1989, 1992)[3] (see Figure 4).

The most prominent role in an a-structure is called the "logical subject" and is designated $\hat{\theta}$ (pronounced "theta-hat"). In Figure 5, the two-place predicate *break* requires two argument roles in a-structure, agent (also $\hat{\theta}$) and theme; the three-place predicate *put* requires agent (again the $\hat{\theta}$), goal, and theme. Roles in a-structure, by convention, descend in prominence according to the thematic hierarchy.

Grammatical functions (GFs) that can be linked to argument roles are called *argument functions*. In Figure 6, LFG distinguishes argument functions (shown in bold) from non-argument functions (in italics).

It is important to note that in structure-oriented theories, such as Transformational Grammar (TG) and all its later incarnations, notions such as subject and object are secondary and are derived from structural configurations. In contrast, in relation-oriented theories, such as Relational Grammar (RG) and LFG, these are primary notions in syntax. However, in LFG, argument functions are further decomposed by two binary features: [*r*] (whether the function is *restricted* to having an argument role) and [*o*] (whether the function is *objective*) (see Figure 7).

In this system, each argument function is composed of exactly two features and natural classes can be identified, as shown in Figure 8. Furthermore, assuming the minus feature to be the unmarked value, a markedness hierarchy also can be obtained.

Similar to the intrinsic classification of argument roles in Bresnan and Kanerva (1989), Bresnan (2001) assumes that the underlying lexical semantics partially de-

Figure 8. Markedness hierarchy of argument functions

SUBJ**[-*r* –*o*]** > OBJ**[-*r* +*o*]**/OBL$_{\theta}$**[+*r* –*o*]** > OBJ$_{\theta}$**[+*r* +*o*]**

Figure 9. Semantic classification of a-structure roles for function

a. patientlike roles: $\theta \rightarrow$ [-*r*]
b. secondary patientlike roles: $\theta \rightarrow$ [+*o*]
c. other semantic roles: $\theta \rightarrow$ [-*o*]

Figure 10. Passivization

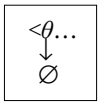


Figure 11. Mapping principles (MPs)

a. Subject roles:
   (i) $\hat{\theta}_{[-o]}$ is mapped onto SUBJ when initial in the a-structure; Otherwise,
   (ii) $\theta_{[-r]}$ is mapped onto SUBJ.
b. Other roles are mapped onto the lowest compatible function in the Markedness Hierarchy.

termine the syntactic assignment of different event participants. The universal classification shown in Figure 9 is proposed to capture these predetermined choices of grammatical function assignment.

Cross-language variation in the syntactic assignment of a-structure roles is thus subject to the above universal constraints. The agent role, for example, as a nonpatientlike role, is classified [-*o*] by Figure 9c and is thus not associated with OBJ canonically. Patient and theme roles, with the [-*r*] classification, are associated canonically with either SUBJ or OBJ. Under the assumptions in Figure 9, each role in the a-structure is assigned one and only one feature for syntactic function assignment, as morpholexical processes are not allowed to add syntactic features. Language-specific morpholexical operations are allowed, however, to alter the "lexical stock" of an a-structure by adding, suppressing, or binding thematic roles (Bresnan, 2001). Passivization, for example, suppresses $\hat{\theta}$, the most prominent role, from syntactic assignment (see Figure 10).

In summary, the theory of a-structure renders the argument roles a given predicator requires into an a-structure representation, where roles are listed in a descending order in prominence, and each role is assigned exactly one feature specification for function assignment. The second component in LMT (i.e., the universal set of mapping constraints) then determines exactly which GF each role is assigned to.

Mapping Principles

Argument-function linking is subject to certain universal constraints; otherwise, each argument role is freely mapped onto any and all GFs with compatible features. Bresnan (2001) proposes the principles shown in Figure 11.

Figure 12.

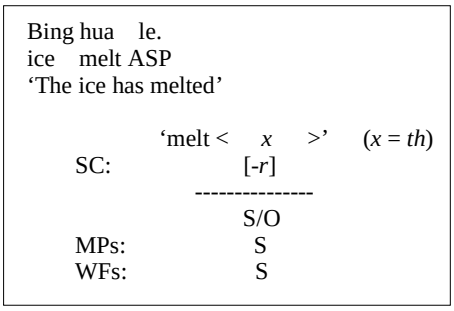
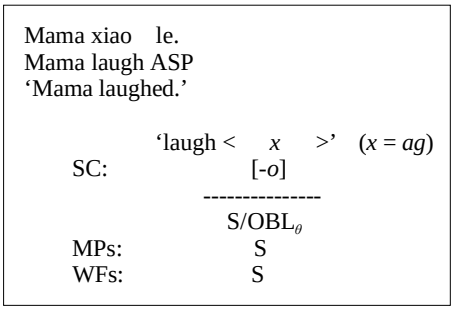


Figure 13.



Two more well-formedness conditions (WFs) are needed in addition to the mapping principles in order to further constrain the non-deterministic argument-function linking: the function-argument biuniqueness constraint and the subject condition:

- Function-Argument Biuniqueness. Each a-structure role must be associated with a unique function, and conversely.
- The Subject Condition. Every predicator must have a subject.

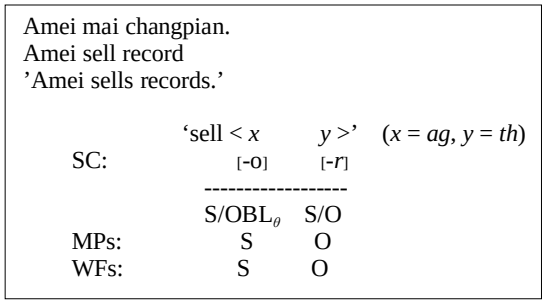
The function-argument biuniqueness constraint ensures a strict one-to-one mapping relation between roles and functions. Computationally, it forces a deterministic assignment to an "unattached" GF between the two GFs with which a role is compatible. The subject condition serves the obvious purpose to ensure that one role in a-structure must be mapped to SUBJ. This condition also forces a deterministic choice when a role's syntactic assignment is compatible with SUBJ and some other function and when all other roles in the a-structure, if any, are incompatible with SUBJ.

We demonstrate how three different types of verbs receive correct argument-function linking in the LMT just described. An unaccusative verb is given in Figure 12, while an unergative verb is illustrated in Figure 13. A typical transitive verb is given in Figure 14.

Improvement to the Conventional LMT

There are several areas at the theoretical level upon which the conventional LMT may be improved. First, the uniform underspecification of each role with exactly one syntactic feature can be relaxed to al-

Figure 14.



low the formalism to be more expressive, yet without compromising its formal power. This classification scheme also may be too rigid in that it does not allow the possibility of agentive objects, which have been observed in several languages (Bresnan, 2001; Dalrymple, 2001). A desirable improvement to the theory is to allow such linking possibilities and, at the same time, be able to express the marked nature of such a linking as *agent*-OBJ.

As for the mapping principles, two disjunctions are observed. The first one is in the mapping principles of subject roles: a disjunction exists between $\hat{\theta}_{[-o]}$ and $\theta_{[-r]}$, each a stipulation for linking to SUBJ. In a more general theory of UG, it would be desirable not to include such function-specific linking conditions. Notice also the specification that $\hat{\theta}_{[-o]}$ be the initial role in the a-structure. This principle thus must refer explicitly to the ordering in the a-structure[5]. The second disjunction is found between subject roles and non-subject roles. For the former, a qualified role is mapped to SUBJ (i.e., the most prominent GF). However, on the contrary, non-subject roles-must be linked to the least prominent compatible GF. A consistent principle for all roles would make a simpler and more general theory.

Finally, note that the Subject Condition in LFG states explicitly that every clause must have a subject. Similar constraints are also necessary in other syntactic frameworks; for example, the same is accomplished by the Extended Projection Principle (EPP) in Transformational Grammar and the Final-1 Law in Relational Grammar. However, as it often has been noted, such an inflexible stipulation may not be empirically accurate[6]. As cited in Ackerman and Moore (2001a), clauses may truly be without a subject (Babby, 1989; McCloskey, 2001). Bresnan (2001) thus hinted that this condition should perhaps be stipulated as a parameter. Again, ideally, a UG theory should be able to account for such subjectless clauses and their marked nature at the same time.

Assuming that the conventional LMT takes the same position advocated first in Alsina and Mchombo (1993) and does not allow morphological operations to add features, this version of LMT described previously also does not seem to account for locative inversion straightforwardly.

As shown in Figure 16, the argument-function linking of <*th*-OBJ *loc*-SUBJ> in the locative inversion construction cannot be obtained, even though the canonical linking of <*th*-SUBJ *loc*-OBL > is accounted for in Figure 16. Therefore, it would make sense empirically to allow morphological processes in the theory to alter syntactic

Figure 15.

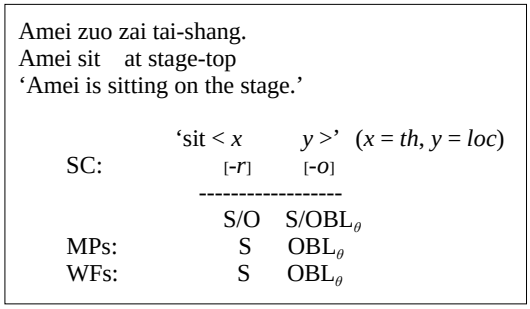
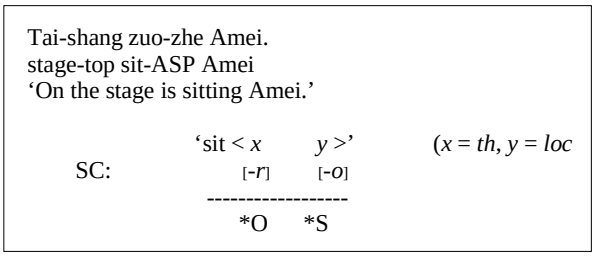


Figure 16.



assignments by adding features, as proposed in Zaenen (1987), Ackerman (1992), Markantonatou (1995), and Her (1998, 2003). The default locative classification employed by Bresnan and Kanerva (1989) and Bresnan (1989), which assigns $loc_{[-r]}$ when *th* is focused, likewise can be viewed as such a feature-adding morphological operation. In the fourth section, we also will discuss the advantages of feature-adding morphological operations from the standpoint of expressivity and formal power.

In the second section, we will propose an LMT in OT terms, thus an OT-LMT, that attempts to incorporate the desirable improvements suggested here.

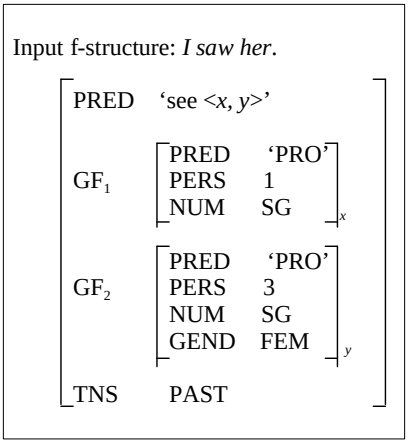
AN OPTIMALITY-THEORETIC LMT

Optimality Theory has exerted great influence over the field of phonology; however, its application in syntactic theory is still in its infancy. Recently, there have been some explorations within the OT-LFG framework (aka Optimal Syntax [Bresnan, 2000]). From the OT point of view, OT-LFG can be seen as OT with a universal LFG as GEN. From the point of view of LFG, a constraint-based grammatical framework, generalizations are interpreted in OT terms with (violable) constraints ranked in relation to one another (Sells, 2001). A number of studies have been carried out within this general framework (Mikkelsen, 2003; Sells, 2001). There also have been efforts to render argument-function linking in OT terms (Butt et al., 1997; Lødrup, 1999).

An OT-LFG Overview

Bresnan (2000) depicts the basic structure of OT-LFG, or Optimal Syntax, where LFG's correspondence theory of parallel structures serves as a model for GEN. The standard OT-LFG assumes in-

Figure 17.



put to be "a (possibly underspecified) feature structure representing some given morphosyntactic content independent of its form of expressions" (Bresnan, 2000). An example is given in Figure 17, which assumes *I saw her* as its optimal form of expression. Note that in the input structure, <*x, y*> is the a-structure of *see* and GF_1 and GF_2 are unspecified grammatical functions that argument roles with which *x* and *y* are associated.

The candidate set comprises pairs of f-structure and corresponding c-structure (and perhaps other corresponding planes of information) generated by the LFG grammar (Bresnan, 2000; Kuhn, 2001). For ease of presentation, I am simplifying the matter by taking the input to be an a-structure <*x y*>, and a set of <*x*-GF_1 *y*-GF_2> pairs as candidates in OT-LMT, which is a module within OT-LFG that constrains argument-function linking specifically. The candidates are evaluated by a universal set of lexical mapping constraints. The output is taken to be the most harmonic, or optimal, candidate pair; namely, the one with the least (serious) violations (Kuhn, 2001).

A Comprehensive OT-LMT

The OT-LMT proposed here modifies and expands the LMT component in Bresnan (2001) and is based specifically on the particular formulation of LMT in Her (1997), Huang and Her (1998), and Her (2003), where syntactic feature assignments are simplified, and the multiple mapping principles and well-formedness conditions in the conventional LMT are all unified into a single consistent mapping principle. Here, I will take this further and reinterpret the entire simplified LMT as a set of Optimality-Theoretic constraints and thus offer a comprehensive OT-LMT.

Crucial to the theory are two prominence scales discussed earlier: a universal thematic hierarchy and a markedness hierarchy of grammatical functions (GFs) (see Figures 18 and 19).

Mapping constraints are classified into three categories: well-formedness constraints on argument roles, well-formedness constraints on argument functions, and constraints on linking. Note that we are ignoring athematic arguments in this article[7]. "R" is thus a thematic role in a-structure, and "F" is a corresponding grammatical func-

Figure 18.

ag > *ben* > *go/exp* > *inst* > *pt/th* > *loc*

Figure 19.

SUBJ**[-*r* –*o*]** > OBJ**[-*r* +*o*]**/OBL$_{\theta}$**[+*r* –*o*]** > OBJ$_{\theta}$**[+*r* +*o*]**

Figure 20. Well-formedness constraints on argument roles

a. **UniqRol**(R_a, R_b): Given <..R_a-F_a..R_b-F_b..>, $R_a \neq R_b$
b. **DescendRol**(R_a, R_b): Given <.. R_a-F_a R_b-F_b..>, R_a > R_b in prominence

Figure 21. Well-formedness constraints on grammatical functions

a. **UniqFun**(F_a, F_b): Given <.. R_a-F_a..R_a-F_b..>, $F_a \neq F_b$
b. **DescendFun**(F_a, F_b): Given <.. R_a-F_a R-F_b..>, $F_a \geq F_b$ in prominence

tion. We first examine the well-formedness constraints on the representation of argument roles (see Figure 20).

UniqRol ensures the uniqueness of each and every role in the a-structure and thus rules out a-structures like <*ag ag th*> and <*th loc loc*>. DescendRol further formalizes the a-structure representation, where argument roles descend in prominence. For example, given the locative verb *sit* and its two roles, theme and locative, in a-structure, <*th loc*> is the only well-formed representation; <*loc th*> is ill-formed. Two corresponding constraints are proposed for argument functions (see Figure 21).

UniqFun ensures the uniqueness of each and every function in the a-to-f mapping; thus, both of the following are ill-formed: <θ_a-SUBJ θ_b-SUBJ>, and <θ_a-OBJ θ_b-OBJ>. DescendFun penalizes a candidate with a violation of the descending order in prominence. For example, because SUBJ outranks OBJ, <θ_a-SUBJ θ_b-OBJ> has 0 violation and is favored over the inverted <θ_a-OBJ θ_b-SUBJ>, which incurs one violation. Thus, given *n* GFs in a candidate form, there are at most $n - 1$ violations as there are $n - 1$ consecutive pairs (Kuhn, 2001). Inversion is still possible, given that all OT constraints are violable in order to satisfy higher-ranked constraints, including language-specific morphosyntactic operations. (We will discuss the possibility of a language-specific component in the next section.) Next, we move on to the general constraints on the linking between roles and functions.

The two constraints in Figure 22, LinkRol and LinkFun, ensure that each expressed role is linked to a GF and that each GF is linked to a role. A role that is not linked to an argument function causes incompleteness, while an argument function that is not linked to an argument role in a-structure causes incoherence. Notice that there is no need to specify a constraint just to ensure that a role is linked to a GF with compatible features. This is accomplished automatically by the universal constraints on the morphosyntactic properties of argument roles shown in Figure 23.

LinkPtTh reflects the unaccusative hypothesis that cross-linguistically the primary patient/theme is encoded as an unrestricted [-*r*] GF (i.e., SUBJ or OBJ)

Figure 22. General constraints on argument-function linking

a. **LinkRol**(R, F): Given <..R..>, R is linked to an F such that <..R-F..>.
b. **LinkFun**(F, R): Given <..F..>, F is linked to an R such that <..R-F..>.

Figure 23. Specific constraints on argument-function linking

a. **LinkPtTh**(R, F): Given <..R-F..>, where R = *pt/th*, F is [-*r*]
b. **LinkRolRes**(R, F): Given <..R-F..>, where R ≠ $\hat{\theta}$, F is [+*r*]
c. **LinkUnobj**(R, F): Given <..R-F..>, F is [-*o*]
d. **LinkUnres**(R, F): Given <..R-F..>, F is [-*r*]

Figure 24. OT ranking of lexical mapping constraints (Chinese)

UniqRol/DescendRol/UniqFun/LinkRol/LinkFun
»
LinkPtTh
»
LinkRolRes
»
DescendFun
»
LinkUnobj/LinkUnres

(Bresnan & Kanerva, 1989; Bresnan & Zaenen, 1990; Zaenen, 1993)[8]. LinkRolRes captures the generalization that a non-patient/theme internal argument prefers the syntactic assignment of a thematically restricted function. Finally, LinkUnobj and LinkUnres consistently favor the assignment of a role to the most unmarked function, SUBJ, [-*r* –*o*][9]. Each function thus may have zero to two violations. These two constraints together are more general and insightful than the previous Subject Condition, which simply stipulates that every clause should have a subject.

Note that LinkRolRes does not apply to agent, the external argument. Being the highest-ranked role, it is linked to SUBJ due to LinkUnobj and LinkUnres. This thus accounts for the fact that, for the majority of the world's languages, agent cannot be realized as an object. However, given the violable nature of these constraints and their variable ranking, the possibility of *agent*-OBJ does exist as a marked morphosyntactic option. This reflects the insight of Falk (1989) cited in Lødrup (2000) that in Norwegian, "what has been called external theta roles are in fact structurally unspecified theta roles" (p. 173).

I will follow the standard view in OT and assume that these constraints are universal, but their ranking may be language-specific. For Chinese, I propose the ranking shown in Figure 24.

An Illustration of OT-LMT

We will now look at the lexical mapping of three different verbs in their canonical active construction as examples: "melt<*th*>," "laugh<*ag*>," and "sell<*ag th*>." To save time and space, the (many) candidates that violate any of the five highest-ranked well-formedness constraints will be excluded and we only will be concerned

Figure 25. Input a-structure: 'melt *<th>'*

	Candidate	LinkPtTh	LinkRolRes	DescendFun	LinkUnobj	LinkUnres
☞ *C1*	<*th*-SUBJ>					
C2	<*th*-OBJ>				*!	
C3	<*th*-OBL$_\theta$>	*!			*	*
C4	<*th*-OBJ$_\theta$>	*!			*	*

Figure 26. Input a-structure: 'laugh *<ag>'*

	Candidate	LinkPtTh	LinkRolRes	DescendFun	LinkUnobj	LinkUnres
☞ *C1*	<*ag*-SUBJ>					
C2	<*ag*-OBJ>				*!	
C3	<*ag*-OBL$_\theta$>					*!
C4	<*ag*-OBJ$_\theta$>				*!	*

with the lower five. Following standard OT notation, in Figure 25, a violation is marked with "*"; a "*fatal*" violation causing a candidate to lose in evaluation is highlighted with "!". The shaded area covers the constraints that are no longer relevant in the evaluation of a particular candidate, and finally, the ☞ sign indicates the optimal selection.

The candidate *C1*, <*th*-SUBJ>, with no violation, is clearly the optimal selection, where SUBJ is an unrestricted [-*r*] function allowed by LinkPtTh, and also the unmarked [-*r* –*o*] function preferred by LinkUnobj and LinkUnres.

Next, we turn to the a-structure of an unergative verb "laugh<*ag*>" (see Figure 26). Here, the only relevant constraints are LinkUnobj and LinkUnres, which again select SUBJ, the unmarked function.

Again, the candidate with no violation (*C1*) is the optimal selection.

The final example, *sell*, is a transitive verb with an agent role and a theme role. Again, Figure 27 excludes candidates that violate any of the five highest-ranked constraints.

Among the candidates, *C1*, <*ag*-SUBJ *th*-OBJ>, is the optimal selection, even though it does violate one of the two lowest-ranked constraints (i.e., LinkUnobj) due to the linking of theme to OBJ, a function with the marked feature [+*o*]. All other candidates, however, violate at least one higher-ranked constraint. Note that a candidate a-structure where both roles are linked to the unmarked function, thus <*ag*-SUBJ *th*-SUBJ>, violates the highest ranked UniqFun and, therefore, is not included in the figure.

AN OT-LMT ACCOUNT OF LOCATIVE INVERSION IN CHINESE

We first apply the OT-LMT to the canonical a-structure of the locative verb.

Figure 27. Input a-structure: 'sell *<ag th>*'

	Candidate	LinkPtTh	LinkRolRes	DescendFun	LinkUnobj	LinkUnres
☞ *C1*	<*ag*-SUBJ *th*-OBJ>				*	
C2	<*ag*-SUBJ *th*-OBL$_\theta$>	*!				*
C3	<*ag*-SUBJ *th*-OBJ$_\theta$>	*!			*	*
C4	<*ag*-OBJ *th*-SUBJ>			*!	*	
C5	<*ag*-OBJ *th*-OBL$_\theta$>	*!			* *	*
C6	<*ag*-OBJ *th*-OBJ$_\theta$>	*!			* *	*
C7	<*ag*-OBL$_\theta$ *th*-SUBJ>			*!		*
C8	<*ag*-OBL$_\theta$ *th*-OBJ>				*!	*
C9	<*ag*-OBL$_\theta$ *th*-OBJ$_\theta$>	*!				* *
C10	<*ag*-OBJ$_\theta$ *th*-SUBJ>			*!	*	*
C11	<*ag*-OBJ$_\theta$ *th*-OBJ>			*!	* *	*
C12	<*ag*-OBJ$_\theta$ *th*-OBL$_\theta$>	*!		*	*	* *

The theory correctly predicts the following optimal argument-function linking: <*th*-SUBJ *loc*-OBL$_\theta$>, shown in Figure 28.

With *C2*, <*th*-SUBJ *loc*-OBL$_\theta$>, as the optimal selection, this constraint ranking obviously does not account for locative inversion, which is represented by candidate *C4*, <*th*-OBJ *loc*-SUBJ>. An additional constraint is needed.

The constraint shown in Figure 29 draws on the insight found in the default rule for focused theme posited by Bresnan and Kanverva (1989) and also faithfully reflects Bresnan's (1994) observation on the universals of locative inversion verbs. Given the fact that the complement of the predicator usually carries the discourse function of marking the less familiar information and that the subject is the default grammatical function for topic or more familiar information, the locative inversion operation forces the locative to map onto SUBJ such that the focused theme can surface as a complement of the locative verb. With this constraint in place, we now have an important decision to make; that is, whether to posit LinkLocInv as a language-specific constraint. Recall that locative inversion is found in many languages, and locative inversion verbs share an identical a-structure and function assignment. However, locative inversion certainly does not occur in all languages. In non-configurational languages with extensive case-marking for grammatical relations (e.g., Korean and Japanese), locative inversion may not be found (Huang & Her, 1998). Figure 30 depicts a Japanese example.

Notice that even though the locative phrase indeed may invert positions with the subject and thus affect the focus in Figure 30b, its grammatical functions remain the same. In other words, locative inversion does not affect argument-function linking. Recall the standard OT view that constraints are universal and that only their

Figure 28. Input a-structure: 'sit *<th loc>*'

	Candidate	LinkPtTh	LinkRolRes	DescendFun	LinkUnobj	LinkUnres
C1	<*th*-SUBJ *loc*-OBJ>		*!		*	
☞ *C2*	<*th*-SUBJ *loc*-OBL$_\theta$>					*
C3	<*th*-SUBJ *loc*-OBJ$_\theta$>				*!	*
C4	<*th*-OBJ *loc*-SUBJ>		*!	*	*	
C5	<*th*-OBJ *loc*-OBL$_\theta$>				*!	*
C6	<*th*-OBJ *loc*-OBJ$_\theta$>				*! *!	*
C7	<*th*-OBL$_\theta$ *loc*-SUBJ>	*!	*	*		*
C8	<*th*-OBL$_\theta$ *loc*-OBJ>	*!	*		*	*
C9	<*th*-OBL$_\theta$ *loc*-OBJ$_\theta$>	*!			*	* *
C10	<*th*-OBJ$_\theta$ *loc*-SUBJ>	*!	*	*	*	*
C11	<*th*-OBJ$_\theta$ *loc*-OBJ>	*!	*	*	* *	*
C12	<*th*-OBJ$_\theta$ *loc*-OBL$_\theta$>	*!		*	*	* *

Figure 29.

LinkLocInv(R, F): Given a-structure <R_a–F_a R_b–F_b>, where R_a = *th*[foc] and R_b = *loc*, F_b is [*-r -o*].

Figure 30.

a. Herikoputa ga yama no ue ni orimashita.
helicopter NOM mountain POSS top LOC land
'A helicopter landed on top of the mountain.'

b. Yama no ue ni herikoputa ga orimashita.
mountain POSS top LOC helicopter NOM land
'On top of the mountain landed a helicopter.

c.*Yama no ue ga herikoputa o orimashita.
mountain POSS top NOM helicopter ACC land
'On top of the mountain landed a helicopter.'

ranking is subject to variation. Therefore, if we follow the standard OT view and posit LinkLocInv as a universal constraint, languages such as Japanese also must be accounted for, but only with a different ranking of the same constraints. This is the path we will explore. Figures 31 and 32 show the revised ranking we propose for Chinese. Notice that LinkLocInv outranks LinkRolRes and is outranked by LinkPtTh. Again, we continue to ignore the five highest-ranked well-formedness constraints.

We also need to point out that LinkLocInv is irrelevant in the selection of

Figure 31. OT ranking of lexica mapping constraints (Chinese, revised)

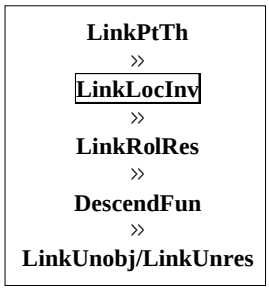


Figure 32. Input a-structure: 'sit <*th*[foc] *loc*>' *(Chinese)*

	Candidate	LinkPtTh	LinkLocInv	LinkRolRes	DescendFun	LinkUnobj	LinkUnres
C1	<*th*-SUBJ *loc*-OBJ>		*!	*		*	
C2	<*th*-SUBJ *loc*-OBL$_\theta$>		*!				*
C3	<*th*-SUBJ *loc*-OBJ$_\theta$>		*!*			*	*
☞ *C4*	<*th*-OBJ *loc*-SUBJ>			*	*	*	
C5	<*th*-OBJ *loc*-OBL$_\theta$>		*!			*	*
C6	<*th*-OBJ *loc*-OBJ$_\theta$>		*!*			* *	*
C7	<*th*-OBL$_\theta$ *loc*-SUBJ>	*!		*	*		*
C8	<*th*-OBL$_\theta$ *loc*-OBJ>	*!	*	*		*	*
C9	<*th*-OBL$_\theta$ *loc*-OBJ$_\theta$>	*!	**			*	* *
C10	<*th*-OBJ$_\theta$ *loc*-SUBJ>	*!		*	*	*	*
C11	<*th*-OBJ$_\theta$ *loc*-OBJ>	*!	*	*	*	* *	*
C12	<*th*-OBJ$_\theta$ *loc*-OBL$_\theta$>	*!	*		*	*	* *

the canonical in Figure 28, because there, the theme is not focused. Now, to account for the data from languages like Japanese, where the focused theme does not result in mismatches of the function assignment of argument roles, we posit the ranking in Figures 33 and 34. Notice here that LinkLocInv is outranked by all other constraints.

DISCUSSION

This section discusses three issues in further detail. The first issue relates to the nature and the scope of the OT-LMT proposed in the article. The second issue concerns the potential advantages that the OT-LMT may have over the conventional LMT. Finally, we explore some of the directions for further research concerning the OT-LMT.

Morphosyntactic vs. Morpholexical Processes

Given the often idiosyncratic nature of language-specific lexical information, it is not yet clear how the technical integra-

Figure 33. OT ranking of lexical mapping constraints (Japanese, Korean, etc.)

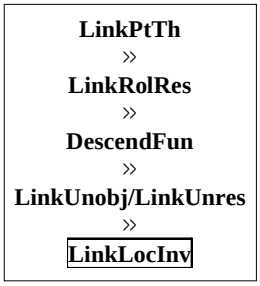


Figure 34. Input a-structure: 'land <*th*[foc] *loc*>' *(Japanese)*

	Candidate	LinkPtTh	LinkRolRes	DescendFun	LinkUnobj	LinkUnres	LinkLocInv
C1	<*th*-SUBJ *loc*-OBJ>		*!		*		*
☞ *C2*	<*th*-SUBJ *loc*-OBL$_\theta$>					*	*
C3	<*th*-SUBJ *loc*-OBJ$_\theta$>				*!	*	**
C4	<*th*-OBJ *loc*-SUBJ>		*!	*	*		
C5	<*th*-OBJ *loc*-OBL$_\theta$>				*!	*	*
C6	<*th*-OBJ *loc*-OBJ$_\theta$>				*! *!	*	**
C7	<*th*-OBL$_\theta$ *loc*-SUBJ>	*!	*	*		*	
C8	<*th*-OBL$_\theta$ *loc*-OBJ>	*!	*		*	*	*
C9	<*th*-OBL$_\theta$ *loc*-OBJ$_\theta$>	*!			*	* *	**
C10	<*th*-OBJ$_\theta$ *loc*-SUBJ>	*!	*	*	*	*	
C11	<*th*-OBJ$_\theta$ *loc*-OBJ>	*!	*	*	* *	*	*
C12	<*th*-OBJ$_\theta$ *loc*-OBL$_\theta$>	*!		*	*	* *	*

tion of the lexicon should be envisaged in OT syntax, in general (Kuhn, 2001). This article clearly does not address this larger issue. In order to have an insightful lexical mapping theory in OT syntax, we first must be explicit about its nature and scope. The OT-LMT envisioned here is part of a universal OT-LFG theory that constrains argument-function linking. In other words, it constrains the syntactic function assignment of argument roles required by a predicator. Thus, this OT-LMT, as it is currently formulated, has nothing to say about morpho*lexical* processes that alter the "lexical stock" in a-structure (Bresnan, 2001; Bresnan & Kanerva, 1989). Therefore, it is purely morpho*syntactic* in nature and scope. Crucially, Ackerman (1992) differentiates and characterizes morpholexical and morphosyntactic operations as follows:

Morpholexical (Operations), affect the lexical semantics of predicates by altering the semantic properties associated with predicates…Morphosyntactic (Operations), assign features supplemental

to those supplied by IC assignment[10]*: these operations can affect the final GF assignments to arguments but cannot affect the lexical semantics.* (p. 56)

Morpholexical operations thus are word-formation processes that produce predicates with an altered inventory of argument roles, or a-structures, which serve as input to OT-LMT. Morphosyntactic operations, however, are within the proper domain of LMT. Assuming that only morpholexical operations may be language-specific, the OT-LMT proposed thus universally governs how argument roles are mapped to GFs, with constraints that may vary from language to language only in terms of ranking. Thus, as Huang and Her (1998) have argued, given the nature of syntactic assignment of argument roles in the theory, it, in fact, makes the theory more coherent by allowing syntactic feature assignment in morphosyntcatic operations. This is precisely how we treated locative inversion. Similar proposals that allow morphological processes to affect syntactic assignments by adding features are found as early as Zaenen (1987) and Her (1990) and later in Ackerman (1992), Markantonatou (1995), Her (2003), among others.

Allowing feature-adding morphosyntactic operations, in fact, also offers a computational advantage. Morpholexical operations constitute a much more powerful formal device computationally in that they are not subject to the general monotonicity condition that information only can be added but cannot be deleted or changed (Bresnan, 1990; Falk, 2001)[11]. Monotonic morphosyntactic operations with the feature-adding capacity enable a formalism that is more consistent and also more expressive, without any increase in its formal power. Empirically, such operations also have been adopted to account for syntactic variations in several languages; for example, Greek (Markantonatou, 1995), Chinese (Huang, 1995; Her, 1999), and English (Zaenen, 1987).

We will now illustrate this view of the OT-LMT with two more constructions from Chinese that are related to locative verbs. The first one is a passivized locative construction. Three-place transitive predicates like *xie* "write," with the argument structure <*ag th loc*>, do not allow inversion in spite of the locative role it requires. However, there may be locative inversion if the agent role is suppressed. This is observed in Chinese (Huang & Her, 1998) and other languages (Bresnan, 1989; Bresnan & Kanerva, 1989). The examples in Figures 35 and 36 are from Chinese and English.

Recall that passivization, repeated in Figure 36, suppresses the logical subject. In effect, it gives rise to an argument structure <~~*ag*~~ *th loc*>, precisely that of a locative inversion verb. Locative inversion, therefore, is allowed, as in Figure 35c. Passivization thus falls outside of the realm of LMT and is regarded as a language-specific operation. One indication of its language-dependence is in the indirect expression of the suppressed agent role as an adjunct; for example, the English *by*-expression (Bresnan, 1994). Chinese, however, does not allow such indirect expressions[12].

The second construction we will examine is the transitivized locative verb. It has been noted that, in Chinese, a two-place locative verb with an argument structure <*th loc*> in fact allows its locative phrase to be a PP or an NP. The locative phrase thus may be alternatively mapped onto OBL or OBJ (Huang & Her, 1998). This, however, is not allowed in English, as shown in Figures 37 and 38.

Figure 35.

a. Amei xie le yi ge zi zai qiang-shang.
Amei write ASP a CL character at wall-top
'Amei wrote a Chinese character on the wall.'

b*Qiang-shang xie le yi ge zi Amei.
wall-top write ASP a CL character Amei
*'On the wall was written a Chinese character (by) Amei.'

c. Qiang-shang xie le yi ge zi.
wall-top write ASP a CL character
'On the wall was written a Chinese character.'

Figure 36. Passivization

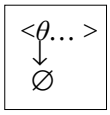


Figure 37.

a. Amei zuo zai yizi-shang.
Amei sit at chair-top
'Amei sits on the chair.'

b. Amei shui zai diban-shang.
Amei sleep at floor-top
'Amei sleeps on the floor.'

Figure 38.

a. Amei zuo yizi-shang.
Amei sit chair-top
'Amei sits *(on) the chair.'

b. Amei shui diban-shang.
Amei sleep floor-top
'Amei sleeps *(on) the floor.'

Huang and Her (1998) treat this function change as a morphosyntactic variation of the same argument structure; thus, <*th*-SUBJ *loc*-OBL > in Figure 37 and <*th*-SUBJ *loc*-OBJ> in Figure 38. However, further evidence indicates that this view may be incorrect and that locative transitivization involves a morpholexical change, instead. In other words, without the preposition *zai*, the argument structure is, in fact, no longer <*th loc*>. Note that the presence of the locative preposition *zai* requires a place noun as its complement in Figure 39. In Chinese, certain nouns are place nouns inherently, such as *xuexiao* "school," *zheli* "here," and *gongyuan* "park," and thus can be the complement of preposition *zai* directly. Non-place nouns,

Figure 39.

a. Amei zuo zai yizi-*(shang).
Amei sit at chair-top
'Amei sits on the chair.'

b. Amei shui diban-*(shang).
Amei sleep floor-top
'Amei sleeps on the floor.'

Figure 40.

a. Amei zuo yizi.
Amei sit chair
'Amei sits *(on) the chair.'

b. Amei shui diban.
Amei sleep floor
'Amei sleeps *(on) the floor.'

Figure 41. Locative transtivization

<*th loc*> → <*ag th*>

however, must form a constituent with a locative affix such as *–shang* and *-xia*, or a locative noun such as *shangmian* and *xiamian*; or there must be a place noun as the complement of locative preposition *zai*. Notice in Figure 40 that the object required by the transitivized verb *zuo* "sit" and *shui* "sleep" is free of this restriction.

Therefore, it is clear that the objects in Figure 40 do not denote the location where the theme that undergoes the movement ends up; rather, they are the entities that receive the action denoted by the verbs. To account for this construction, I propose a morpho*lexical* operation (see Figure 41).

Two more syntactic tests, shown in Figures 42 and 43, confirm that this argument structure is now <*ag th*>: passivization and resultative compounding.

In the passive construction, the suppression of the agent results in the theme role's "promotion" to SUBJ, as seen in Figure 42. In Figure 43, the single composite role, formed by the binding of the theme role of the action verb and the theme of the result state verb, maps to SUBJ (Her, 2004)[13]. Based on the prevailing evidence, locative transitivization should be treated as a morpholexical operation that alters the lexical stock of an argument structure, and, as such, it is again outside of the realm of the OT-LMT proposed here.

According to the previous discussion, it is now possible to indicate exactly how the OT-LMT system is envisaged as the module in LFG that links the lexical semantic structure and the syntactic structure of a predicator (Bresnan & Kanerva, 1989; Bresnan & Zaenen, 1990). The particular conceptualization of the a-structure assumed here, as shown in Figure 44, is based on Bresnan (1996, 2001), which, in turn, follows Baker (1983).

The a-structure is a lexical syntactic representation with the minimally necessary information on the syntactic arguments

Figure 42.

a. Yizi bei zuo le.
Chair BEI sit ASP
'The chair has been sat *(on).'

b. Diban bei shui le.
Floor BEI sleep ASP
'The floor has been slept *(on).'

Figure 43.

a. Yizi zuo-lan le.
Chair sit-threadbare ASP
'The chair is threadbare from (over)sitting.'

b. Diban shui-kua le.
Floor sleep-collapse ASP
'The floor was slept on and collapsed.'

Figure 44.

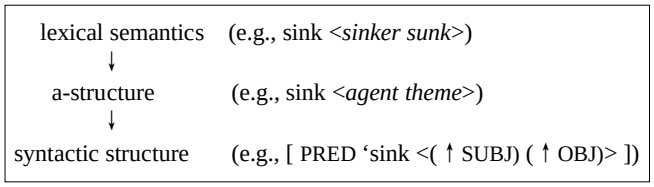
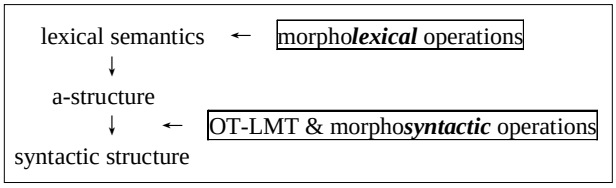


Figure 45.



of a predicator, such as the number of arguments, their thematic and syntactic types, and their hierarchical organization. As shown in Figure 44, the a-structure "sink <*ag pt*>" states that the verb *sink* requires two arguments, one of the type *agent* and the other *theme*, and also that *agent* is thematically more prominent than *theme*. The a-structure thus contains information necessary for the final syntactic manifestation or more precisely, the mapping of *agent* and *theme* to SUBJ and OBJ, respectively.

Morpholexical operations interact specifically with lexical semantics and, as such, are outside the proper domain of the LMT, while morphosyntactic operations are part of the LMT, which constrain the syntactic assignment of a-structure roles. All OT-LMT constraints thus are conceived to be morphosyntactic and universal in nature, while morpholexical operations may be language-specific.

Figure 46.

	Candidate	LinkPtTh	LinkLocInv	LinkRolRes	DescendFun	LinkUnobj	LinkUnres
☞ C2	<*th*-SUBJ *loc*-OBL$_\theta$>						*

	Candidate	LinkPtTh	LinkLocInv	LinkRolRes	DescendFun	LinkUnobj	LinkUnres
☞ C4	<*th*-OBJ *loc*-SUBJ>			*	*	*	

Potential Advantages of OT-LMT

The OT-LMT proposed here targets specifically at the universal constraints on argument-function linking. We leave the OT formulation of morpholexical operations to further research. In this section, we discuss some of the advantages that the OT-LMT may afford.

We start from the fact that all OT constraints are declarative. In the conventional LMT, the two subject conditions must apply sequentially, not simultaneously, to prevent θ[-*r*] from mapping to SUBJ, when $\hat{\theta}$[-*o*] is present. Likewise, only after the mapping of the subject role can other roles be mapped. In contrast, all constraints in OT-LMT apply declaratively and, thus, simultaneously. Furthermore, in the conventional LMT, all roles are uniformly assigned exactly one feature for function assignment, while the OT-LMT allows a more expressive system with only the patient/theme role pre-assigned to unrestricted functions. This OT-LMT thus allows the possibility of *agent*-OBJ as a marked morphosyntactic selection, which is ruled out in the conventional LMT.

Recall also that two disjunctions are observed in the conventional LMT: the disjunction between the two principles of subject role mapping and the disjunction between subject roles and non-subject roles. The OT-LMT, however, consistently favors the unmarked values for all roles. This characteristic ultimately may lead to the replacement of the stipulation in the Subject Condition while preserving its insight. Thus, in general, this revised LMT formulated in OT formalism offers a potentially more consistent and simpler computational system[14].

As noted earlier, the LinkLocInv constraint proposed in the OT-LMT account essentially reflects the insight of Bresnan and Kanerva's (1989) locative default, which assigns *loc*[-*r*] when *th* is focused. Thus, both accounts are descriptively equivalent in explicating locative inversion in the various languages observed, Chinese included. However, Bresnan and Kanerva's (1989) account would need to state that languages like Japanese and Korean lack the mechanism of linking *loc* to [-*r*]. The OT account, on the other hand, has the advantage of a more general solution in attributing the presence or absence of locative inversion in a language to the relative ranking of LinkLocInv, which, like all OT constraints, is universal[15].

Finally, we will indicate exactly how the OT-LMT better reflects the intuition that the locative inversion construction of <*th*-OBJ *loc*-SUBJ> is marked in comparison to the canonical locative construction of <*th*-SUBJ *loc*-OBL >. In Figure 46, we examine the constraints that each of the two violates.

Notice that the canonical form constitutes only one violation of one of the two

Figure 47.

Il est arrivé beaucoup de gens à la plage
it is arrived many of people at the beach
'There were many people arriving at the beach.'

Figure 48.

Il travaille deux mille ouvriers dans cette usine
it works two thousand workers in this factory
'There are two thousand workers working in the factory.'

lowest-ranked constraints. The inverted form, on the other hand, violates two of the higher-ranked constraints, LinkRolRes and DescendFun, in addition to one of the two lowest-ranked constraints. Nonetheless, even with such violations, the inverted form still outranks all other candidates. It is, therefore, still the optimal choice, in spite of its markedness. The OT-LMT is, therefore, more expressive and flexible, accounts for a wider range of data, and reveals the (un)markedness of different linking relations. It is, in short, a simpler, more consistent, and more general theory.

Directions of Further Research

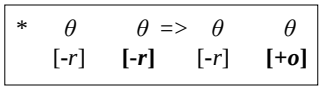
Considering its limited number of principles, LMT is a relatively small theory but with ambitious goals. In the previous sections, an OT version of the theory has been laid out and tested against cross-linguistic data of locative inversion, as generalized by Bresnan (1994). However, there are locative constructions closely related to locative inversion that have not been covered. For instance, locative inversion might bear some relation to sentences with an expletive subject and a locative argument (Bresnan, 1994). Figure 47 is an example from French[16].

The expletive subject is an athematic argument, and, as such, it must receive an intrinsic [-*r*] classification by the very nature of thematic restrictedness [*r*], (Bresnan, 2001). Given its initial position, it invariably links to SUBJ[17]. Similar to the locative inversion discussed earlier, this construction also indicates that the object function of the theme role renders it more focal than the oblique locative role. An athematic argument in the a-structure is indicated by an underscore outside of the angled brackets, while thematic arguments are within the angled brackets. Thus, the a-structure of Figure 47 is "arrive _<*th*[foc] *loc*>." An expletive subject also may be associated with the linking of agentive objects. Figure 48 is an example from French.

Similar phenomena also are observed in Bantu languages (Demuth, 1990; Demuth & Mmusi, 1997; Harford, 1990; Machobane, 1995). All these issues are important and interesting but cannot be adequately addressed in the current article. Further research is needed on how the a-structure "arrive _<*th*[foc] *loc*>" and "work _<*ag*[foc]>" come about, whether they are morpholexically or morphosyntactically related to "arrive <*th loc*>" and "work _<*ag*[foc]>," respectively, and how best to incorporate such relations within the OT-LMT proposed here.

Further development of this OT-LMT also will need to address the issue of sec-

Figure 49. Asymmetrical object parameter (AOP)



ondary patient-like roles as a parameter of variation in double object constructions, known as the Asymmetrical Object Parameter (AOP) (Alsina & Mchombo, 1993; Bresnan, 2001). In a non-AOP language, all patient-like roles are linked to an unrestricted function, while AOP languages must link the secondary patient/theme to an object function. An additional constraint may be necessary, and constraint ranking then may reflect this variation. This asymmetrical object parameter is stated in Figure 49.

Finally, the OT-LMT developed here needs to be applied to a much wider range of data cross-linguistically; for example, complex predicates in various languages (Abaitua, 1988; Ackerman, 1992; Alisina, Bresnan & Sells, 1997; Her, to appear; Ishikawa, 1985), the valence-changing morphemes and inversion constructions in Georgian (Blevins, 2005; Harris, 1981; Holisky, 1981), among others. A solid analysis of some of these facts would be a significant test of the linking theory proposed here.

CONCLUSION

In this article, we set out to accomplish two goals. The more ambitious one is to come up with a simpler and more general lexical mapping theory in OT terms, or OT-LMT. The second one is to test this theory and account for locative inversion in Chinese, English, and Chichewa on the one hand and Japanese and Korean on the other hand. Following the standard view in Optimality Theory, the mapping constraints we proposed are all universal, and language variation in locative inversion is accounted for by different constraint rankings. The OT-LMT we proposed is the UG component that constrains the argument-function linking, or morphosyntactic processes. It thus does not govern language-specific morpholexical processes, such as passivization, locative transitivization, and resultative compounding. Locative inversion, on the other hand, involves only morphosyntactic operations and, therefore, is accounted for within the OT-LMT.

In summary, the OT-LMT we proposed not only covers a wider range of empirical data, but it also affords a simpler, more consistent, and more general theory.

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ENDNOTES

1 See Bresnan (2001, chapter 14) for a brief exposition of other formulations.

2 Falk (2001) also presents a concise introduction to LMT and a more precisely defined theory of argument roles. Dalrymple (2001) offers more examples in her introduction to the theory.

3 The concept of thematic hierarchy is well-established (Grimshaw, 1990; Li 1995). The hierarchy in "The Subject Condition" also might be derived from the proto-role properties proposed by Dowty (1991) (Ackerman & Moore, 2001b; Bresnan, 2001).

4 Note that following Zaenen and Engdahl (1994), the two propositional argument functions COMP and XCOMP are treated as instances of OBL .

5 Note that $\hat{\theta}$ refers to the most prominent role in the a-structure. The fact that it is also the left-most role within the angled brackets is inconsequential. $\hat{\theta}$ is usually also the initial role, unless there is an initial athematic argument.

6 Alsina (1996) also argues that the function-argument bi-uniqueness condition, which is fully integrated in the OT-LMT proposed later, is too strong.

7 A constraint for athematic roles must restrict such roles to [-*r*]. Alternatively, a constraint may be proposed to outrank LinkFun in Figure 22b and thus allow a GF in a-structure to be unmatched.

8 An additional constraint is needed for the secondary patient/theme, which restricts the secondary *pt/th* to [+*o*]. Again, we will ignore this issue in this article.

9 DescendFun and DescendRol effect a parallel alignment between the thematic hierarchy and the markedness hierarchy. This parallel alignment is similar to a

harmonic alignment, but with an important difference. In a harmonic alignment, according to Prince and Smolensky (2004), the correspondence between a more prominent element on one scale and a less prominent element on the other is worse than the correspondence between two elements that are equal in prominence (Aissen, 1999; Asudeh, 2001; Lee, 2001; Sharma, 2001). Thus, it is better for agent, the most prominent role, to link to SUBJ, the most prominent function, and likewise for locative, the least prominent role, to link to OBJ. However, in our scheme here, due to LinkUnobj and LinkUnres, a more prominent GF is favored, regardless of the prominence of the role.

[10] IC refers to the intrinsic classification of argument roles. See Figure 7.

[11] Therefore, as I have proposed elsewhere (Her, 2003), morpholexical operations likewise can add features and, thus, alter syntactic assignments of argument roles, besides changing the lexical semantics of a predicator.

[12] See Her (1989) and Ting (1998), among others, for compelling arguments against viewing the *bei*-NP phrase as a PP *by*-phrase.

[13] In fact, the same concept of suppression in passives is used here, as well. See Her (2004) for details of mapping the composite role, formed by two roles, to a single GF.

[14] Note that I am only referring to computational efficiency in formulation and formalism, not in practical terms of an actual computational implementation. See Kuhn (2003) for extensive discussions on the computational aspects of OT. However, there is little practical evidence for the computational efficiency of a large-scale OT implementation of a grammar, as there seems to be no such practical systems yet. For the computational efficiency of LFG in general, see Maxwell and Kaplan (1996, 1993, 1991); for LFG in practice, refer to Kaplan, et al. (2004). I thank the anonymous reviewer who made this point and provided the references.

[15] I thank another anonymous reviewer for pointing this out to me.

[16] I thank the anonymous reviewer who suggested this direction of further research and provided this French example and its discourse analysis.

[17] Refer to Bresnan (2001, section 14.1) for a more in-depth discussion on athematic arguments in raising constructions.

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