[REVIEW]

Advances in Generative Lexicon Theory

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TAKESHI USUKI

*Kyoto Sangyo University**

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1. Introduction

This volume, which is titled *Advances in Generative Lexicon Theory*, is a comprehensive collection of 19 studies pursuing further developments of the Generative Lexicon (GL) theory. As discussed in Pustejovsky et al.'s introductory chapter (Chapter 1), the GL theory was developed to provide theoretical explanations for a wide range of semantic variations of lexical items that emerge in linguistic contexts in the real world.

Since Pustejovsky's (1995) landmark study of GL, some authors have proposed that GL is a drastically different framework from the traditional static lexical semantic perspective in that GL theory assumes enriched semantic conceptual components of lexical items comprised of a lexical typing structure, an argument structure, an event structure, and a qualia structure (cf. Levin and Rappaport Hovav (1995)). In addition, GL's dynamic and compositional lexical operations include Selective binding, Type coercion, and Co-composition, which are mechanisms that have also been adopted in other lexical semantic frameworks (Jackendoff (1997)). According to Pustejovsky (1995), a lexical item is comprised of four qualia: (i) a CONSTITUTIVE role (depicting the relation between an object and its constituents, or proper part), (ii) a FORMAL role (that which distinguishes the

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object within a larger domain), (iii) a TELIC role (depicting purpose and function of the object), and (iv) an AGENTIVE role (factors involved in the origin or “bringing about” of an object), which are assumed to capture the rich semantic and compositional nature of lexical items. One achievement of the GL theory is that it provides a dynamic lexical mechanism to explain a much wider range of linguistic phenomena in collaboration with qualia and lexical compositional operations compared to the traditional lexical theories. Conventional examples of this point are depicted below.

- (1) a. John began the book.
- b. John baked the cake.

In the example (1a), the verb *began* selects an event as its complement but the nominal *book* is not an event noun. To avoid the type mismatch between the verbal head and the nominal complement, Type coercion applies to the nominal *book* on the basis of either its AGENTIVE [x write y] or TELIC [x read y] role. Then, the sentence is successfully interpreted as either ‘John began writing the book’ or ‘John began reading the book.’ Another typical case showing the nature of the compositional dynamicity of GL is a case of Co-composition depicted in (1b) above. Therein, a creation reading of ‘John made the cake’ is accomplished in the process of so-called Co-composition on the basis of the change-of-state meaning of *bake* and the AGENTIVE role of *cake* [x bake y].

In this volume, each study aims to explore a further specification of qualia and its elaboration with lexical compositional operations. This includes Type coercion and Co-composition that provide a principled explanation for various linguistic phenomena and their cross-linguistic applicability.

This review is organized as follows. Each study collected in this volume is written from a different perspective and can be divided into four parts. The following sections, Sections 2 through 5, briefly outline the chapters in each part. Section 6 evaluates the entire book in terms of the theoretical developments of GL, and addresses remaining issues for future research. Finally, Section 7 concludes this review.

2. Basic Theoretical Mechanisms of GL

This part of the volume presents current theoretical developments focusing mainly on the type shifting phenomena in the GL theory. The studies presented provide fine-grained semantic representations, including an introduction to Type theory, which is crucial in the argument selection and interpretation of predicates, and the following application of Co-composition and

Type coercion.

In Chapter 2, Pustejovsky proposes that problems related to argument selection phenomena can be justified with the collaboration of Type theory and compositional mechanisms assumed in GL theory. First, following his earlier paper, Pustejovsky (2001), he assumes three distinct types of lexical entities: (i) natural, (ii) artifactual, and (iii) complex. On this basis, he discusses how these types interact with three types of selection mechanisms in GL to satisfy these selection requirements and derive the proper interpretation that emerges in context: (i) Pure selection, (ii) Accommodation, and (iii) Type coercion (either Exploitation or Introduction) as formulated in (2).

- (2) a. PURE SELECTION: The type a function requires of its argument, A , is directly satisfied by that argument's typing:
 $[A_\alpha]_\alpha F$
- b. ACCOMMODATION: The type a function requires is inherited through the type of the argument:
 $[A_\beta]_\alpha F, \alpha \sqcap \beta \neq \perp$
- c. COERCION: The type a function requires is imposed on the argument type. This is accomplished by either (where $\odot$ represents the disjunction of the two constructors, $\otimes$ and $\bullet$):
- i. *Exploitation*: selecting part of the argument's type structure to satisfy the function's typing:
 $[A_{\alpha \odot \tau}]_\beta F, \alpha \sqsubseteq \beta$
 - ii. *Introduction*: wrapping the argument with the type the function requires:
 $[A_\alpha]_{\beta \odot \sigma} F, \alpha \sqsubseteq \beta$ (Pustejovsky (Chapter 2: 33))

One of the outstanding achievements of this chapter is the introduction of two types of coercion exemplified in (3), which leads to a deeper understanding of coercion along with Type theory.

- (3) a. The book fell.
 b. The water spoiled.

In example (3a), the proper semantics [*phys*] from the dot object *book* [*phys* • *info*] are exploited by the verb *fell* that selects a physical object depicted as “fell ($\lambda x: e_N$ [*fall*(x)])” in (4a).

- (4) a. [_S [_{NP} the book (*phys* • *info*)] [_{VP} fell ($\lambda x: e_N$ [*fall*(x)])]]
 b. [_S [_{NP} the water (*liquid*)] [_{VP} spoiled ($\lambda x: \sigma \otimes_{\tau} \tau$ [*spoil* (x)])]]

On the other hand, under the selectional restrictions of the verb *spoil* represented in (4b) as “spoiled ($\lambda x: \sigma \otimes_{\tau} \tau$ [*spoil* (x)])”, the natural type *water* [*liquid*] in example (3b) is wrapped by the introduction mechanism to provide a proper functional interpretation ‘This water was going to be used for

something.'

Similar to Chapter 2, Asher and Pustejovsky's contribution to this volume (Chapter 3) investigates discourse-related linguistic phenomena, which includes type-mismatches, incorporating the compositional lexical mechanisms in GL. In their discussion, they first argue that the GL approach is superior for distinguishing between lexical and world knowledge, which is more advantageous and relevant compared to the standard Segmented Discourse Representation Theory (SDRT).

Secondly, they develop Type theory which is partially integrated with SDRT, including lambda calculus and type composition logic for compositionally deriving the complex types. In example (5), they demonstrate a verb *read* can coerce a dot object status to its complement by what they call a dot-introduction (the example (5) is taken from Asher and Pustejovsky (Chapter 3: 63)).

(5) Mary read the subway wall.

The nominal object *the subway wall* is a physical object [*phys*], but the [*info*] is introduced (or coerced) by *read* and the object is type-shifted to a complex dot type [*phys* • *info*], which successfully explains the interpretation of the sentence. Finally, they ensure that operations assumed in GL theory are linguistically relevant mechanisms.

As the final contribution to this part, Van Valin's research (Chapter 4) tackles a persistent conflict between the projectionist view of lexicon represented by the Role and Reference Grammar (RRG) (Van Valin (1993)) and the constructionist perspective of lexicon represented by the GL (Pustejovsky (1995)). The former view assumes that lexical properties are projected from a verb, whereas the latter view assumes that lexical properties are determined in particular constructions. After discussing how these two approaches to the syntax-semantics interface deal with the same argument structure alternations, Van Valin proposes that each view is best captured as a difference between the speaker's and the hearer's perspectives for the linking algorithm in a syntax-semantics interface, and eventually these approaches do not conflict. According to his proposal, the constructionist perspective can be linked to the hearer's processing of the utterance. On the other hand, the projectionist perspective assumes that a speaker builds a sentence from a verb that he or she wants to deliver. Finally, the integration of the Co-composition mechanism into RRG is proposed to provide an explanation for pragmatic-related phenomena in the framework of RRG.

3. Analysis of Linguistic Phenomena within GL

Part 2 of this volume explores the applicability of GL theory to cross-linguistic and language specific phenomena. The studies presented in this section clearly address the possibility of extending GL analysis to a broad range of linguistic phenomena across languages.

Bassac and Bouillon's chapter (Chapter 5) presents a study on French and Turkish compounds (e.g. *verre de vin* 'glass of wine' vs. *verre à vin* 'wine glass'). The authors propose that the properties of these words can be accounted for by assuming a complex TELIC role, where FORMAL and AGENTIVE roles are embedded. The TELIC role of *verre* (glass), for example, consists of [FM = contain (E2, x, y: liq)] and [AG = use (e0, z, x) $\wedge$ pour-into_act (e1, z, y, x)]. Given the complex TELIC role for compounds, the authors explain how to derive different interpretations between *verre de vin* 'glass of wine,' where it is assumed *de* is an indication of the TELIC role and is interpreted as the content of the glass (wine), and *verre à vin* 'wine glass,' where *à* indicates the FORMAL role and is interpreted as a container (glass). This interpretation also explains various syntactic properties of the compounds, including anaphoric reference, coercion, and lexicalization patterns in French and Turkish.

In Chapter 6, Bergler presents cases wherein both logical metonymical and metaphorical senses emerge in a particular context. Bergler discusses how a generative approach, such as GL theory, can (or cannot) treat both senses by employing an enriched semantic structure.

In the next chapter (Chapter 7), Castaño proposes a unified account of the Spanish clitic *se*, which has been conventionally classified both as an argument clitic *se* and a non-argument clitic *se* (or ethical dative). According to the analysis presented in this chapter, unifying the two types of Spanish clitics *se* can be accomplished by introducing an underspecified telic relation, which is similar to a telic proto-role. Castaño demonstrates that the proper interpretations are derived under elaboration with Opposition Structure (Pustejovsky (2000)). Given the underspecified Case feature of Spanish clitic *se*, one of the achievements of this study is that it shows a possible interaction between GL theory and the Case theory.

Dražković et al.'s study (Chapter 8) reports two experiments on the cognitive processing of three different adjective-noun combinations; intersective (e.g. *yellow car*), subjective compatible (e.g. *interesting car*) and subjective incompatible (e.g. *fast car*). The experimental results support the view from a lexical conceptual classification that intersective combinations are

conceptually simpler than subsecutive combinations. The expected difference of cognitive processing between subsecutive compatible and incompatible combinations, however, is unclear from these results.

In Chapter 9, Im and Lee investigate the combination of an entity type noun and the light verb *ha-* ‘do’ in Korean. They propose that the eventive interpretation of the entity nouns is coerced on the basis of either the noun’s AGENTIVE (e.g. *sakwa-rul ha-n-ta* ‘grow apples’) or TELIC (e.g. *scarf-rul ha-ess-ta* ‘wears a scarf’) role. They also present some constraints on the type coercion in Korean *ha-* ‘do’ constructions. First, the noun must be a functional type, and a natural type without proper agentive and telic quale cannot exhibit Type coercion (e.g. *??John-un kang-ul ha-n-ta* ‘John does a river’). Furthermore, following their proposal of a fine-grained telic quale (direct telic, indirect telic and engagement telic), they argue that entity type nouns without a direct telic cannot shift the types by Type coercion (e.g. *??John-un seythakki-rul ha-ess-ta* ‘(lit.) John did a washer.’). Therefore, their exploration of *ha-* ‘do’ constructions in Korean may lead to a cross-linguistic justification for restrictions on Type coercion.

In Kim and Lee’s chapter (Chapter 10), they divide Korean inchoative verbs into three classes—gradable (e.g. *noph-a-ci-ta* ‘to become higher’), semi-gradable (e.g. *nuc-e-ci-ta* ‘to become delayed’) and ungradable inchoatives (e.g. *eps-e-ci-ta* ‘to become non-existent, to disappear’)—whose natures are represented in a GL framework. Furthermore, they show that the difference of aspectual interpretations and argument selections among each class of inchoative verbs can be represented in qualia, and that type coercion is the only available option for the gradable and the semi-gradable inchoatives, which might open another possibility to constrain the application of Type coercion.

In the next chapter (Chapter 11), McNally and Kennedy focus on the *well* modification, which has degree and manner readings (e.g. *a well loaded packing box* (degree or manner reading) vs. *well loaded hay* (manner reading only)). The problem in the conventional analysis of *well* modification has been positing an ambiguous *well* in lexicon, and this leads to an ad hoc classification. They propose that a combination of Selective Binding theory with a well-motivated representation of past participles in GL theory presents a unified analysis of *well*’s degree and manner interpretations in the presented modification environment.

In the following Chapter 12, Nakatani presents an analysis of *V-te V* predicates in Japanese (e.g. *Taro-ga ofisu-ni syasin-o mot-te kii-ta*. ‘Taro brought the photo to the office.’). In his proposal, the compositional

mechanisms of qualia in GL are extended to provide a compositional lexical derivation for the complex verbal predicates, which are COLLAPSE, VARIABLE SHIFT, and THEME EVENTIFICATION. The operation of COLLAPSE is proposed to create a well-formed qualia for V-*te*-V constructions. According to Nakatani's analysis, example (6b) shows a case where the qualia structures of two verbs are concatenated (or collapsed) into one single qualia structure (examples in (6) are taken from Nakatani (Chapter 12: 271–272)).

- (6) a. kare-wa e-o mi-te ofisu-ni kita.
 he-Top picture-Acc see-TE office-Dat come-Past
 ‘He saw the picture and then came to the office.’
 b. kare-wa e-o mi-te kita.
 he-Top picture-Acc see-TE come-Past
 ‘He saw the picture and came here.’

He proposes that the qualia structure of V_1 (*mi-te* ‘see-TE’) is eventually represented as a FORMAL role and that of V_2 (*kita* ‘came’) is denoted as a AGENTIVE role of the unified (collapsed) qualia structure for the V-*te*-V verbal complex in the process of collapsing adjunction structure $[[V_1-te] V_2]$ in (6a) into a concatenated $[V_1-te-V_2]$ structure in (6b). Assuming these operations, he successfully captures the nature of verbal compounds in Japanese.

In Chapter 13, Lee observes the parallelism between change of location and change of state events in Korean. On the basis of observation of *spray*-type verbs in Korean, a GL theoretical explanation is proposed to account for the polysemous semantic nature of the verbal predicates.

In Ono's contribution to this volume (Chapter 14), he presents an analysis of indirect passives in Japanese that exploits event structure in the compositional framework of GL (e.g. *Taroo-ga kodomo-ni nak-are-ta*. ‘Taro was adversely affected by the child's crying.’). Ono's proposal for the indirect passives in Japanese can provide an account for the adversative interpretation, the obligatory nature of adjunct in indirect passives, and the nature of selection restrictions for indirect passives by the elaboration of an event structure and a qualia role.

4. Interfacing with a GL Lexicon

Studies in this section focus on the prospective integration of other theoretical frameworks with GL's enriched lexical compositions and governing generative mechanisms.

In the first chapter (Chapter 15), Badia and Sauri's study proposes an integration of GL's enriched semantic compositions and generative mechanisms with a standard Head-driven Phrase Structure Grammar (HPSG) framework to provide explanatory adequacy for issues of argument structures in Catalan. This includes optional arguments in verbal predicates and the interpretation of modification structures, which have not been accounted for in the previously assumed HPSG framework. According to their HPSG analysis, two GL mechanisms—Type coercion and Selective binding—can be unified as Selective Binding. Another GL mechanism, Co-composition, can be integrated with HPSG as a general process of lexical composition, which leads to simplifying the lexical compositional strategies originally assumed in GL.

Fellbaum's study (Chapter 16) explores the possibility of integrating GL with WordNet classification. In particular, this chapter introduces the distinction between MANNER verbs (e.g. *jog*, *swim*, *bike*, etc.) and PURPOSE verbs (e.g. *exercise*, *control*, *help*, etc.). This is parallel to the distinction between TYPE nouns (e.g. *Dachshund* and *Chihuahua* are TYPES of *dog*) and ROLE nouns (e.g. *pet* and *guard dog* are ROLES of *dog*) in a GL framework (Pustejovsky (1995)). This provides various syntactic motivations for classification, including causative alternations, middle constructions, and resultative constructions.

In the final chapter of this section (Chapter 17), Namer and Jacquy present a unified compositional mechanism for Noun-to-Verb (N-to-V) (e.g. *drain*_N 'drain' to *drain*(*er*)_V 'drain') and Verb-to-Noun (V-to-N) (e.g. *march*(*er*)_V 'walk' to *march*_N 'walker') conversions in French with the Morphological Structure Composition Schema (MS-CS) employing the decomposition model of GL. Assuming the Abstract Lexical Unit (ALU) for V-to-N ($[X_V]_N$ ALU) and N-to-V ($[X_N]_V$ ALU) conversions, their analysis successfully captures the inheritance of a certain semantic content (FORMAL, TELIC, or AGENTIVE roles depending on the classification of the input nominal or verb) of the input element to the output (or derived) lexical category.

5. Building GL-Related Resources

The final section is comprised of a collection of studies dealing with building or developing lexical resources in other study domains based on GL lexical semantic representations and mechanisms.

In Chapter 18, Calzolari et al. show that the interoperability of lexical semantic resources in a multilingual environment are crucial issues in the pro-

cess of developing a Semantic Web (or language resources) to enhance the performance of Natural Language Processing (NLP) tools. They conclude that GL's rich semantic descriptions together with the benefit of the conventional Semantic Web can help build expressive and informative language resources for effective content processing.

In the following chapter by Claveau and Sébillot (Chapter 19), the authors discuss the effectiveness and importance of GL's rich semantic compositional description, especially qualia, for building effective language resource for NLP. They introduce a new learning tool called ASARES, which can infer morpho-syntactic and semantic patterns of qualia relations and show whether the lexical items are linked. From this, the extraction of N-V pairs from corpus-based data is examined. The results are then compared to other strategies the results of which demonstrate the relevance and usefulness of GL-based lexical resources.

Finally, in Chapter 20, Copestake presents several examples that demonstrate the semi-productivity of lexical and phrasal compositional interpretations, which leads her to argue that GL's interpretational mechanisms should partly employ a frequency-based mechanism.

6. On Coercion, Limits on Qualia, and Cross-linguistic Perspective

This section evaluates this volume by emphasizing what the authors do and do not achieve regarding contributions to the GL theory. I also point out which parts or chapters of this volume are recommended to readers with interests in various fields of study.

First, the studies presented, particularly in part 1, successfully contribute to further elaborating on the GL theory, which results in added explanatory adequacy. The constraints on Type coercion operations (Chapter 2 and Chapter 3 divide this into two types: Introduction and Exploitation), for example, have been vague since GL theory was formulated (Pustejovsky (1995)). Conventional GL theory might have shortcomings in providing a straightforward explanation for why we cannot interpret the sentence **John began water* as 'John began watering flowers or John began pouring water.' Fodor and Lepore (2001) make a strong case pointing out this failure of Pustejovsky's (1995) Type coercion mechanism. Assuming that lexical items are atomic, they argue that Pustejovsky's Type coercion strategy seems to include inadequate pragmatic information for atomic lexical items. In this volume (Chapter 2 and Chapter 3), GL theory explains the constraints on Type coercion in a principled fashion through the collabora-

tion with Type theory, and possible combinations are depicted in (7).

(7)

		Type Selected	
Argument Type		Artifactual	Complex
Natural	Sel / Acc	Intro	Intro
Artifactual	Exploit	Sel / Acc	Intro
Complex	Exploit	Exploit	Sel / Acc

(Pustejovsky (Chapter 2: 33))

A second theoretical advancement is presented in Chapter 11 concerning Selective Binding theory in relation to qualia structure, which ensures the possibility for GL theory to capture core semantic issues.

Thirdly, this volume achieves a cross-linguistic justification of GL theory, which contributes to modifications or extensions of GL theoretical mechanisms from various cross-linguistic perspectives. In particular, part 2 is a collection of studies targeting a wide range of language-specific constructions. For example, Nakatani's study on the *V-te V* verbal complex in Japanese opens a possibility to explore the derivation of verbal compounds in the GL framework. Therefore, these studies in GL theory are worth exploring for readers who are working on language-specific constructions. Finally, parts 3 and 4 are recommended for researchers working in different linguistic frameworks and seeking the possibility of integration with GL theory.

However, there remain crucial theoretical issues for the GL theory in this volume, which are primarily related to the proposed qualia and lexical composition rules presented in part 2. The most critical problem of GL theory as presented in this volume is how much room GL theory can provide for various language-specific conditions or additional (fine-grained) qualia roles (language specific rules and qualia are introduced to observed linguistic phenomena in Chapters 5, 9 and 12). This problem has been central since the dawn of GL theory (Pustejovsky (1995)), but consensus among researchers has not yet been reached as studies presented in this volume clearly demonstrate. Fodor and Lepore (2001) present an argument against Pustejovsky (1995) along this line. They argue that lexical items should be atomic in the lexicon and point out that GL theory in Pustejovsky's (1995) version subsumes non-lexical knowledge (world knowledge) that should be excluded in lexical atoms. Counter to this, Asher and Pustejovsky's chapter sheds light on this issue, and states that there should be clear distinction between lexical knowledge and world knowledge. Currently, there is no rigid linguistic test to distinguish these points, and this problem highlights the arbi-

trary aspects of qualia information and related operations. These must be theoretically justified in the near future in order to advance research related to the GL theory.

Finally, this volume contains no exploration attempting to integrate GL insights with the current Minimalist Program (henceforth, MP) (Chomsky (2008)). This is somewhat expected because GL theory assumes that enriched lexicon and lexical mechanisms will create a wide variety of meanings. In this sense, the GL approach can be considered a Maximalist Program relating to the syntax-semantics interface. While pursuing the simplest grammar in the minimalist approach, it is necessary to clearly distinguish between core syntactic phenomena that should be explained in syntax and peripheral phenomena that can be ignored. As discussed by the authors in this volume, GL theory can provide principled explanations for the latter cases. Therefore, it can be assumed that GL and MP may be complementary in a global picture of theoretical linguistics. Clearly, this is a critical topic of linguistic theory in need of further investigation.

7. Concluding Remarks

The title of this volume, *Advances in Generative Lexical Theory*, indicates that this book addresses current elaborations of generative theoretic mechanisms. It addresses not only the explanatory adequacy of GL theory but also offers a preliminary cross-linguistic empirical justification of the theory even though the current version of GL theory might have theoretical issues as of yet unsolved. This volume represents a starting point for the study of GL theory over the coming decades. Therefore, this book is recommended to researchers and graduate students interested in lexical semantics, and its interaction with interface conditions in the field of theoretical linguistics and other related fields of study.

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Institute of General Education
Kyoto Sangyo University
Motoyama, Kamigamo, Kita-ku,
Kyoto-shi, Kyoto 603-8555
e-mail: usuki@cc.kyoto-su.ac.jp