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The Interactions among Syntax, Semantics, and Morphology — How Lexical Structures Affect Verbal Semantics and Syntax

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The Interactions among Syntax, Semantics, and Morphology

— How Lexical Structures Affect Verbal Semantics and Syntax

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1 Introduction

So far computational linguists have not been able to fully handle the conversion between deep semantic structure (in brain) and surface syntactic structure (as a language), so there is always a question about how to robotically retrieve precise semantic information from existing sentences or reversely, to express meanings with grammatical sentences. In order to clarify the semantic composition procedure and logicalness of human expressions, we decompose a lexicon into lexemes and morphemes; a grammar into lexical structures and sentence patterns to further review the detailed content of each part of the language. According to the earlier studies, most of linguists agreed lexical senses affect syntactic properties of lexemes [Levin 1993, Pustejovsky 1995, Baker & Fillmore 1998], and we believe that morphological constructions derive lexical senses and more; therefore, lexical structures must also affect syntactic properties of lexemes. There is a complex interaction among semantics, syntax and morphological constructions.

It is clear that grammatical behaviors in general are guided by principle of word ordering and syntactic patterns. However lexical structures play the role of bridging the gap of semantics and syntax. In detail, lexical structures affect lexical semantics by deriving lexical senses, and then lexical structures and senses affect grammatical behavior of lexemes. Moreover, there are also grammatical behaviors not caused by semantic reasons but affected by lexical structures [Huang & Chen 2013]. These complex relations among semantics, syntax and morphological constructions will be our focus of the paper.

Because our objective is to figure out how the harmony will be fulfilled among syntax and semantics with the help of morphological constructions, analysis of lexical structures of verbal lexemes become our first task. A verbal lexeme is not only a basic meaning unit of event; it also carries some other important semantic features and constraints, such as event type, argument structure, temporal structure, semantic focus etc. In fact, the selections of grammatical alternations are strongly influenced by verbal semantics. For instance, argument structures reveal the syntactic information of valency, theta grids and sub-categorization frames, so we are able to determine transitivity and argument type of verbs [Chomsky 1965, Hopper 1980, Levin 1993, Goldberg 1995].

In what follows, different morphological constructions and their word sense derivations will be studied and the detailed description of how word senses influence on syntactic properties will be addressed in Section 2. In Section 3, we discuss the interaction between lexical structures and syntactic properties of words; the sentence patterns determined by each lexical structure will be introduced in Section 3.1. The syntactic constraints which are not due to the reasons of semantics or lexical structures will be described in Section 3.2. Finally, in Section 4 we summarize our theory and make the conclusion.

2 Syntactic Properties Inferred from Word Senses

Most linguists agree that word senses have great impact on their syntactic properties due to logical compatibility of collocational constituents. In the following, we will demonstrate the major syntactic properties associated with semantic types and see how semantic functions are related to syntactic functions.

Sense Types

The major lexical semantic types include: entities which are objects, acts, states; and relations which are attributes/semantic roles, functions. They form the top-level semantic hierarchy of E-HowNet ontology as shown below:

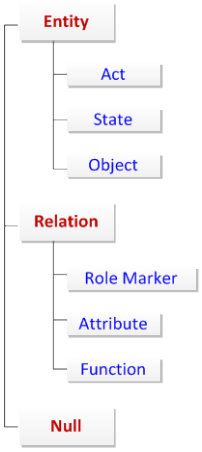

Figure 1: Major Lexical Semantic Types in E-HowNet Ontology

From the perspective of semantic functionality, each semantic type plays some specific functions of *host*, *attribute* and *value* which form the basic semantic expression of *attribute(host)={value}* as exemplified in (1). Words of entity type normally play the *host* role and also to be syntactic phrasal head. Functional words, such as prepositions, conjunctions, are *role markers* and *functions*. State type and object type words usually play *value* functions which are *arguments* or *modifiers*.

(1) Color({cup})={white} denotes "white cup"
Agent({buy})={Jack} denotes "Jack buys"
Location({eat})={Taipei} denotes "eat at Taipei"

From the perspective of syntactic property, words of same semantic type hold particular syntactic properties. For instance, Levin [2009] defined verb classes as "*sets of semantically-related verbs sharing a range of linguistic properties*". Here, linguistic properties basically denote syntactic properties like transitivity, argument, and diathesis alternations etc., by that Levin classified over 3000 verbs into different verb groups such as manner of motion verbs, directed motion verbs, sound verbs, change of state verbs, perception verbs, verbs of gestures and sign, weather verbs…etc. E-HowNet [Chen et al. 2005, Huang et al. 2014] took a different classified viewpoint from Levin, for example, verbs are partitioned into process and state first, which is a higher priority dichotomous classification criterion than the syntactic classification because we think semantic classification is more intuitive, and more in line with the general view of the real world. Nevertheless, we have the same observation with Levin, that is, words of same semantic class hold particular syntactic

properties and different semantic types have different syntactic properties. For example, processes and states are usually verbs, but only stative verbs are modified by degree adverbs. Words of playing value function are usually adjectives and majorly are stative verbs in Chinese. Words of attribute and object types are nouns, but attribute nouns in general do not play the role of modifiers of nouns [Liu 2008]. Semantic type not only determines the fundamental syntactic classes, as exemplified in FrameNet [Fillmore 1998], fine-grained event type also specifies the frame of an event (i.e. argument structure). In other words, it provides necessary participants of an event and their constraints, which allow us to attain basic grammatical information of synonyms, such as argument type and transitivity. We will discuss the interactions between verbal semantic types and their syntactic properties in detail and address the issue of how lexical structures affect verbal semantics in the following sections. However, synonyms only share the same event frame, i.e. participant roles and their constraints; lexical structure is the crucial factor to determine their surface forms. For instance, 殺生 *kill lives* and 撲殺 *kill* are synonyms with totally different surface form and we will discuss the issue in Section 3.

2.1 How Lexical Structures Affect Verbal Semantics

Lexical senses can be derived from senses of morphemes and the relation between them, if they are compositional. Since syntactic properties and semantic types are strongly related and lexical structures affect word senses and more, it results that lexical structures strongly affect syntactic properties of words.

Word sense derivations depend on morphological constructions, for example, coordinate structure derives two kind of lexical senses: First, when synonymous morphemes are combined together, it results a **hypernymous sense**, such as 研 *study* and 究 *probe* denotes 研究 *research*; Second, when stative antonymous morphemes are combined together, it usually results an **attribute sense**, such as 大小 neither denotes 大 *big* nor 小 *small*, but denotes *the size of an object*. Similarly other morphological constructions are also carrying specific relational senses between morphemes. For examples, passive structure forms aspectual state type senses which are derived from morphemes of process verbs, such as 遇害 *be*

murdered, 蒙羞 *be dishonored* etc. They have stative senses and accept sentence patterns like normal stative verbs but do not play adjectival roles.

2.2 Different Morphological Constructions and Word Sense Derivations

In general, there are five main classes of lexical structures for verbs and their fine-grained subclasses as shown in (2):

(2) The Types of Lexical Structure

- Verb+Object (VO) structure
  - Verb+ Direct Object
  - Verb+ Non-direct Object
- Verb+Result (VR) structure
  - Verb+Goal-affected Result
  - Verb+Agent-affected Result
  - Verb+Directional Suffix structure
  - ……
- Modifier+Verb (AV) structure
  - Passive structure
  - Instrument+Verb structure
  - ……
- CoordinateVerb (VV) structure
  - Synonymous coordinate structure
  - Stative antonymous coordinate structure
- Subject+Verb (SV) structure
  - Agent+Verb structure
  - Theme+Verb structure

Each type of lexical structure derives specific lexical senses in a principle way which is demonstrated by some specific semantic relations of morpheme1 and morpheme2, such that morpheme1, morpheme2, and their semantic relation must logically fit together. In detail, the Verb+Object structure denotes a relation between head verb and its goal. The fine-grained types of goal include content, possession, patient, cause, and theme etc. Similarly, the Verb+Result and Modifier+Verb structure denote a resultant and a modified relation respectively. The fine-grained

result relations are result of goal-affected, result of agent-affected, range, direction, aspect etc.; and the modifier roles are manner, condition, means, instrument, purpose, degree etc. Coordinate-Verb structure expresses two kinds of meaning constructions as we have mentioned in the previous section. Subject+Verb structure includes Agent+Verb and Theme+Verb structures, both of them indicate a state type sense. The different morphological constructions and their respective examples are listed below.

Lexical Structure	Semantic Focus	Fine-grained Relational Sense of morpheme1 and morpheme2	Examples
1. VO	The goal of verb	content, possession, patient, PatientProduct, cause, theme, target, duration, source, location, LocationFin, instrument	受苦 *suffer* (content) 訂貨 *order merchandises* (possession) 拍手 *clap one's hands* (patient) 作畫 *draw a picture* (PatientProduct) 怕事 *fear getting into trouble* (cause) 吸毒 *take drugs* (theme) 抗日 *resist against Japanese* (target) 度日 *subsist* (duration) 離群 *live in solitude* (source) 住院 *be in hospital* (location) 探底 *probe into* (LocationFin) 通信 *communicate by letter* (instrument)
2. VR	①The result of verb	① result, range, direction, aspect, degree, StateFin	驚退 *frighten off* (goal-affected result) 吃飽 *eat and be full* (agent-affected result) 買全 *buy all* (range) 步入 *walk into* (direction) 死光 *die out* (aspect) 嚇死 *frighten to death* (degree) 爬起來 *stand up* (StateFin)
	②the modality of verb	②modality	活不成 *be unlikely to survive* (modality)
3. AV	The modifier of verb	manner, condition, means, instrument, purpose, degree, quantity, negation, TimeFeature, duration, sequence, location, LocationThru, direction, modality	相悖 *conflict with each other* (manner) 寄生 *infest* (condition) 泣訴 *sob out sorrows* (means) 筆耕 *make living by writing* (instrument) 義診 *treat patients free* (purpose) 微恙 *having minor ailments* (degree) 群聚 *throng* (quantity) 未亡 *not dead* (negation)

				預定 *expect* (TimeFeature) 久病 *prolonged illness* (duration) 初診 *pay first visit to doctor* (sequence) 梵唱 *chant Buddhist scriptures* (location) 空運 *air transport* (LocationThru) 下滑 *decline* (direction) 必要 *have to* (modality)
4.	VV	①The hypernymous sense of verb ②the attribute of verb value	or	殺戮 *kill* (hypernym) 研究 *research* (hypernym) 是非 *correctness* (attribute) 大小 *size* (attribute)
5.	SV	①The theme of verb ②The agent of verb	①theme ②agent	山崩 *land slide* (theme) 蟲蝕 *worm-eaten* (agent)

Table 1: The Lexical Senses Denotes by Lexical Structure

It is obvious that morphological structures of words affect word senses which affect syntactic behaviors of words. In the next section, we will discuss how major syntactic properties related to verbal semantics and lexical structures.

2.3 Syntactic Properties Associated with Verbal Semantics and Lexical Structures

Many syntactic properties of words can be inferred from their senses. In this section, we are going to state most significant verbal syntactic properties which affected by word senses and adjusted according to their lexical structures.

Transitivity

Transitivity describes the number of objects which a verb can take or govern. Argument structure, as we have mentioned, provides the crucial information of general semantic type of participants, the number of object(s), the affectedness and individuation of object, and the volition of subject etc., which are necessary information to differentiate type and transitivity of verbs.

Lexical structure also affects transitivity. For example, Verb-Object structure results an intransitive or a pseudo-transitive verb, i.e. it cannot take a direct object because the object has been mentioned in the lexeme or the object position has been occupied. For example, 打針 *give an injection*, the verb-object structure verb is a typical pseudo-transitive verb which does not allow a direct object.

In general, syntactic properties of compound words will inherit from the syntactic properties of their composite morphemes/words. Transitivity is held for the same reason. However conflation of two event structures is complicated. As exemplified by VR structures, an intransitive verbal morpheme composed with an intransitive resultant morpheme, could be either a transitive verb, such as 跑破 *broken from running* or an intransitive verb, such as 跑累 *tired from running.* Chung et al. [2012] summed up heuristic rules to determine VR's transitivity and whether the affected argument is the logical subject or the logical object. Agent-Verb structure is another exceptive case in prediction of transitivity. According to semantic preservation principle, if a verbal morpheme in Agent-Verb structure is transitive; the verb should be transitive as well. However, almost all Agent-Verb structure verbs are stative-like verbs, such as 蟲蝕 *worm-eaten*, 他殺 *homicide*, 雷擊 *be struck by lightning* etc., i.e. they are intransitive verbs. According to the semantic logicalness, they are supposed to form an agent-verb-goal pattern. However, the only grammatical sentence pattern for them is Goal[NP]<被 *bei*<*. The reason could be interpreted as that since agent had occurred in the compound words, subject position can only be occupied by patient role. Therefore only the passive structure is allowed.

Argument Semantic Restriction

Arguments are the core participants of an event. They are classified into different semantic roles, such as agent, theme, experiencer, patient, target and content etc., and each of them has its own semantic restriction which also determined the syntactic property of a verb accepting NP, VP, or S as object/subject. For example, *agent* is a participant of a situation that carries out the action in this situation, so that it is usually a living being as a noun or noun phrase (NP) in syntactic classification. *Patient* is a participant of a situation upon whom an action is carried out. A *patient* as differentiated from a *theme* must undergo a change in state, so that it is usually a physically affected object, as a noun or a NP. *Content* is a participant of a situation which is manifested by the action, such as *teach*, *expect* and *reveal* etc. *Content* sometimes is very complicated so that it can be a noun, a noun phrase (NP), a verb phrase (VP), even a sentence (S). That is, the grammatical type, such as a noun phrase, a verb phrase, a prepositional phrase or a sentence can be attained through

the argument semantic restriction of an event. Take the head verb 協助 *assist* for an example, its arguments are agent, patient and content, whose semantic restrictions can be demonstrated as in (3).

(3) a. 納稅人(agent N)應協助(head V)好吃懶做的失業者(patient NP)維生(content V)嗎?

Should taxpayers (agent N) *assist* (head V) *lazy unemployed* (patient NP) *to make living* (content V)*?*

b. 感謝校友們(agent NP)積極協助(head V)母校的募款工作(content NP)

Thanks to alumni (agent NP) *who actively assist* (head V) *the fundraising work of alma mater* (content NP)

c.一千位來自各地的義工(agent NP)協助(head V)他們(patient N)搬動及展開被單(content VP)

One thousand volunteers from around the world (agent NP) *assist* (head V) *them* (patient N) *to move and expand sheets* (content VP)

For compound verbs, argument semantic restrictions should follow the head verb's. For instance, 熱愛 *love ardently,* the Modifier-Head structure word requires an animate agent (N or NP) and allows various types of targets (N, NP, VP, S) just like its head verb 愛 *love*. However, some lexical structures have imposed more restrictions on argument semantic types. For example, in addition to the head verb's argument type, we also need to take the result component's argument semantic restriction into account while determining a grammatical sentence for VR verbs as shown below:

(4) 房子看進去一目了然 *It is clear at a glance to look into the house.* vs.

*這幅畫看進去十分鮮明 **It is very clear to look into the painting.*

The target of the compound verb 看進去 *look into* is not only required to be a visual object but also need to be a three-dimensional object which can be look into to meet the semantic restriction of its result component 進去 *into.*

Adjunct Collocation

Collocations are partly or fully fixed expressions that become established through repeated context-dependent uses. A grammatical sentence will not be

logical or fluent if collocational preferences are violated. Although meanings of collocations may not be always semantic transparent, such as 打電話 *make a phone call*, we believe the majority of collocations are regulated by the logicalness of compositional semantics. The so-called semantic harmony is to describe the logical compatibility of different constituents in a sentence. For instances, adjunct of degree collocates with gradable states only. The temporal relation between temporal adverbs and aspectual markers: *le*, *guo*, and *zhe* must be in harmony. And many more collocational constraints are due to logical compatibility between constituents. We will only illustrate a few example cases here.

For instance, temporal adverb 曾經 *once*, denotes an action has ended before speaking time(End<ST).[1] On the other hand, the aspectual markers 了 *le*, 過 *guo* and 著 *zhe* impose the following constraints BP≦ST, End<ST, and ET=RT respectively. Since the condition End<ST is logically compatible with BP≦ST, End<ST and ET=RT, so 曾經 *once* is able to co-occur with *le*, *guo*, and *zhe* grammatically. Contrarily, 即將 *be about to* (ST<RT<Start) with *le*, *guo*, and *zhe* is ungrammatical since ST<RT<Start violates BP≦ST, End<ST, and ET=RT. Below (5) exemplifies some of the collocation constraints between temporal adverbs and verbs.

(5) a. *我明天曾經介紹過 **I have introduced it tomorrow.*

b. *他曾經早日離去 **He had left soon.*

c. *我即將已買到它了 **I am about to have bought it.*

d. *我們即將討論過 ** We are about to have discussed.*

In (5) a and b, the temporal adverb 明天 *tomorrow* and 早日 *soon* both have semantic restrictions: ST<Start, which violates the semantic restriction of 曾經 *once*, i.e. End<ST, making them ungrammatical sentences. Similarly, in (5) c and d 即將 *be about to* cannot co-occur grammatically with 已 *already* and 過 *guo* because its semantic restriction ST<RT<Start conflicts with the semantic restriction of 已

[1] The abbreviations and formulas in the following discussion represent the below meaning: *Start* means the start point of an event; *END* means the end point of an event; *ST* denotes the speaking time; *RT* denotes a reference time; and *ET* denotes an event time. Consequently, *BP≦ST* indicates that the prominent boundary point of the referred event precedes the speaking time; *End<ST* indicates that the end point of the referred event precedes the speaking time; and *ET=RT* indicates that the referred event time overlaps with the speaking time.

already and 過 *guo*, i.e. End<ST. Li et al. [2005] provided more detailed discussion on this topic.

Take degree adverb and state verb as another example. States can be either gradable or non-gradable; they collocated with different type of degree adverbs according to the semantic harmony as well. For example, *expensive* and *cheap* are gradable states which represent a point on a scale of "how much something costs". We can only use *very* and *a bit* but not *absolutely* and *nearly* to make the gradable states stronger or weaker, because the sense of latter is only harmonized with states that denote the limits of a scale and there is no middle ground senses, that is, **absolutely expensive* or **nearly cheap* are not proper phrases. On the other hand, we can use *absolutely* and *nearly* but not *very* and *a bit* to intensify or weaken the non-gradable states like *fail*, *disappear* and *win* etc., thus, **very fail* and **a bit disappear* are improper phrases. The adjunct collocation illustrates the influence of semantics towards grammatical logicality.

3 Construction Meaning in Harmony with Verbal Semantics and Lexical Structures

Construction patterns contribute the senses of syntactic arguments by specifying their semantic roles and provide additional meaning [Goldberg 1995]. Lexical constructions (i.e. morphological structures) of verbs had been introduced in the section 2.2. A morphological construction specifies verbal morphemes and their related semantic roles, as shown in Table 1, they naturally bear different constructional meanings. For example, Verb-Result structure usually denotes a resultant sense of patient, which makes ergative usage while the event focus is on the result, like 襪子穿破了 *socks worn out*. As we have mentioned, VR structure marks a precise result as an end point of an event, which also makes it easier to apply *Ba*-construction and *Bei*-construction, such as 把襪子穿破 *worn out the socks* or 襪子被穿破 *socks are worn out*. For another example, passive structure forms aspectual state type verbs; it describes an aspectual view of a process and the patient became the subject of the sentence, such as 市長昨日遇害 *The mayor was killed yesterday*.

Similarly sentential patterns (syntactic alternations) are also constructions and different alternations may associate with additional meaning which is not lexically generable. For example, 把 *Ba*-construction imposes a disposal event and 被 *Bei*-construction imposes a malicious sense [Li & Thompson 1989]. And both impose a semantic constraint of an end point or a result on the construction events. Any verb violating the respective constraints cannot logically fit into either *Ba* or *Bei*-constructions.

3.1 Construction Meaning of Lexical Structures and Alternations

Construction patterns contribute the sense of syntactic arguments by specifying their semantic roles and provide additional meaning. Near-synonyms with same core senses but different lexical structures may accept different sentential patterns. For instance, 殺生 *kill lives* and 撲殺 *kill* denote the concept of *killing* with different lexical structures, i.e. Verb-Object structure and Modifier-Verb structure respectively, which make them compose different surface forms and are unlikely to share sentence patterns with each other. For example, in Mandarin, 人類常無端地殺生 *Humans often kill lives for no reason* is grammatical sentence while *人類常無端地撲殺 **Humans often kill for no reason* is not; 政府全面撲殺豬隻 *The Government kills pigs all around* is acceptable but *政府全面殺生豬隻 **The Government kills lives pigs all around* is not. The reason is that words of Verb-Object structure like 殺生 *kill lives* do not allow a second object; and words of Modifier-Verb structure like 撲殺 *kill* require an indispensable object.

Near-synonym verbs of different lexical structures may accept different syntactic alternations, such as *Ba*-construction and *Bei*-construction. Events with an end point or a precise result is a crucial criterion to justify the uses of *Ba*-construction and *Bei*-construction. Since Verb-Result structure verbs contain resultant sense, they are able to apply *Ba*-construction and *Bei*-construction more freely than verbs of other types of lexical structure as shown by the previous example of 穿破 *worn out*. On the contrary, 快樂 *happy* and 笑 *laugh* are not applied *Ba*-construction and *Bei*-construction. However 把他樂壞 *to please him to the utmost* and 快被他笑死 *almost laugh to death by him* are common daily expressions for both sentences express an end point or a precise result.

Below we will take transitive verb as an example, by demonstrating major syntactic alternations and their constraints, to show how lexical structures affect the acceptance of major syntactic alternations for process and stative verbs, as listed in the follows where "@" denotes head verbs and "*" denotes unacceptable examples:

a. subject[NP]<@< object[NP]

The prototypical alternation for verbs with regular transitive meaning, and it is suitable for all lexical structures except for VO structure which does not allowed a direct object, e.g. *弒父 *patricide* *殺生 *kill lives.*

b. subject[NP]< object[PP{把、將}]<@

The use of 把 *Ba*-construction is to describe the disposed result of an affected goal. It results the following three constraints for *Ba*-construction: the first and well-known constraint is verbs having the sense of disposal, e.g. 洗淨 *wash away*, or in some cases, relaxed to the verbs of mentally controllable sense, e.g. 抹黑 *discredit*; Second, action upon the object which makes the goal affected, e.g.重擊 *whack*; Third, it requires verbs or VPs with a definite endpoint (result), e.g.殺死 *kill*. Generally speaking, verbs satisfy more of the above constraints may better apply *Ba*-construction. Verbs of VR structure are most likely to satisfy those constraints and suitable for this alternation, e.g. 焚燬 *burn down*, 穿破 *worn out*. However *張三把李四打贏 *Zhang San defeats and wins Li Si* is not a good example, since 打贏 *beat and defeat* is not a goal-affected verb. Lu [1999] had mentioned an unsolved problem of the reason why *Ba*-construction can accept VP with aspect 了 *le* or 著 *zhe* but not 過 *guo*, as exemplified in (6).

(6) a. 他把新衣服穿破了 *He worn new clothes out.*

b. 他把新衣服穿著上街 *He wears new clothes to go shopping.*

c. *他把新衣服穿過了 **He has already worn the new clothes.*

Both sentences (6) a and b satisfy the constraints of describing the disposed result of an affected goal, but (6) c violates this constraint, since 過 *guo* focuses on the past experience of the subject instead of the disposed result of goal.

For AV and VV structure verbs with the disposal sense and argument "patient" are also often apply *Ba*-construction but usually need to form a VP structure with a definite endpoint, e.g. 把它重整一番 *to restructure it once more*, 把它拓展到全世界 *to extend it to the whole world*. It is also worth of mentioning that most of none-disposal AV structure verbs with the argument "target" cannot apply *Ba*-construction is not only because they are not disposal nor goal-affected, e.g. 遙想 *fancy*, but also because the adverbial morpheme A is a manner to modify agent which causes crossing dependent relations exemplified in (7).

(7) *老師把學生親授 **teacher on student pass skill personally*.

*子女把先人哭悼 **children to the deceased mourn.*

c. subject [NP]< object[PP{對、向}] <@

In general, 對 *Dui*-construction is suited for non-disposal verbs, which normally take an unaffected target as their object. In most of cases, *Dui*-construction is applied to intransitive verbs and pseudo transitive verbs with VO structure, e.g. 道謝 *thank*, 生厭 *dreary.*

d. subject [NP]< object[PP{替、為、幫、給}] <@

替 *Ti*-construction is suited for verbs with beneficial sense, e.g. 祝福 *wish happiness to*, 洗淨 *wash away*. Although lexical structure does not restrict the use of *Ti*-construction, in most of cases, it is applied to intransitive verbs and pseudo transitive verbs with VO structure, e.g. 慶生 *celebrate someone's birthday*, 助興 *liven things up,* 接風 *give reception for visitors*.

e. object[NP]< subject[PP{被、遭、為、受}]<@

The 被 *Bei*-construction describes an event in which an entity or person is dealt with, handles, or manipulated in some way, thus imposed the goal-affected constraint, e.g. 火化 *cremate*; and it generally (but not necessary) requires verbs or VPs with a definite end point, such as 被看上 *was chosen by* and 被跪拜了千年之久 *was worshipped for thousand years*, but not the cases of *被看 *was look* and *被跪拜 *was worshipped*. Traditionally, researchers suggest that the *Bei* passive is used essentially to express an adverse situation, in which something unfortunate has

happened, e.g. 貶職 *demote*. [Li &Thompson 1989] However, the non-adversity usage of the *Bei*-construction is increasing due to the influence of translating foreign passive verbs (e.g. been written, being called) or *by*, which makes malicious sense not a necessary constraint, e.g. 被器重 *was regarded highly*.

f. object[NP]<@<了

The goal-affected constraint is a very important constraint for alternations which focus on describing the affected results of goals, such as *Ba*-construction and ergative construction except that the *Ba*-construction requires additional constraint of disposal sense for VP. The ergative construction requires the VP has the sense of change-state of object (Note: without confusing with subject-state-change.), i.e. goal-affected, so process verbs that describe how object was processed or with 了 *le* to denote aspectual state-change can accept this alternation, for examples, VR structure verbs with a stative result, such as 撫平 *soothe*; but not the agent-affected verb like *告知 *notify*. Nevertheless, prototypical goal must not satisfy the semantic restriction of prototypical agent to avoid semantic confusing. For example, *張三教壞了 **Zhang San was taught badly* is not a good ergative construction since the goal 張三 *Zhang San* satisfies the semantic restriction agent, but 數學教壞了 *math was taught badly* is perfectly acceptable because the goal 數學 *math* is not possible to satisfy the semantic restriction agent. In addition, for AV structure while A is a manner to modify agent, ergative construction is disallowed because the manner should modify agent but it is omitted, e.g. 這首歌唱(*歡唱)了 *this song has been sung* (**caroled*).

g. subject[NP] < V < object[NP,+whole] 的< object[+part]

The verb-object insertion construction is only suited for VO structure verbs and it requires that the morpheme O must be the part of the true object, such as body part, possession or attribute, e.g. 頭 *head* in 砍頭 *decapitate*; 色 *color* in 染色 *dye*.

For more acceptable and unacceptable examples of each alternation, please refer to Appendix.

3.2 Syntactic Constraints Which Are Not Due to the Reasons of Semantics or Lexical Structures

Although most of verb alternations are determined by lexical structure and its derivative semantic information, some grammatical constraints cannot be interpreted by the reasons of semantics or lexical structures, i.e. syntactic constraints have no semantic reason behind, for instances, word ordering, idiomatic patterns, word collocations and more. The syntactic constraints listed below are considered having no logical consequences from semantic structures.

Word Order

SVO structure: Subject-verb-object ordering for Chinese language is different from other SOV or free word order languages and there is no semantic reason for word ordering selection.

Phrasal and Idiomatic Patterns

Many construction patterns are not compositional and idiomatic.

所- NP construction	e.g. 所著的書 *the book written by*
的- NP construction	e.g. 美麗的花 *beautiful flowers*
Comparative construction	e.g. 我比他大三歲 *I am three years older than him*
Idiomatic Patterns	e.g. 一. . . 就. . . 一看就喜歡 Once you see it, you will like it.

Word Collocation without Semantic Reason

Some of the word collocations cannot find strong semantic reasons behind.

Measure word-noun collocations	e.g.一匹馬 *a horse*, *一個馬
Common expressions	e.g. 生日快樂 *happy birthday*,*生日高興, *生日幸福

Syntactic Type Constraint on Arguments or Adjuncts

It seems that 一瞬間 *a moment* cannot be the post-verbal duration for its syntactic type not for any semantic reason. Huang (2013) showed that duration of certain syntactic structures do not function as post-verbal durations, for instances 一轉眼 *in a wink*, 不一會兒 *a moment*.

一瞬間 *a moment* +preverbal duration vs. 一下子 *a moment* +preverbal or post verbal duration

e.g.一瞬間就不見了 *disappear in a moment*
一下子就不見了 *disappear in a moment*
*哭了一瞬間 *crying a moment
哭了一下子 crying for a while

4 Conclusion

Most grammatical constraints are due to logical composition of constituents. In this paper, we try to point out some major syntactic constraints of a language which are caused by semantic reasons. Since it is a very complicate and have a very broad range of interactions among syntax and semantics, we hope more research will be carry out in the future to provide a more clear picture on semantic composition and grammaticality. On the other hand, pure syntactic constraints are very limited as described in the section 3.2.

In order to clarify the composing procedure and semantic logicalness of human expression, we need to fully handle the conversion between deep semantic structure and surface syntactic structure. In this paper, we demonstrate the functionality of morphological constructions to figure out how the harmony fulfills among syntax and semantics, and we attain the following conclusions.

a. Lexical structures determine sense of compounds by composing morpheme's sense under the relation frames derived from each lexical structure. For example, under the fine-grained relation frame of Modifier-Head structure, we know 微 *minor* as a degree modifies its head 恙 *having ailments* and compose the sense of 微恙 *having minor ailments.*

b. Lexical structures provide constructional sense. For instance, passive structure and Agent-Verb structure are always stative-like verbs, such as 遇害 *be murdered* and 蟲蝕 *worm-eaten*; VV construction results a hypernymous sense or an attribute depending on the synonymous or antonymous relations on morphemes, such as 研 *study* and 究 *probe* composing a hypernymous compound word 研究 *research*, and 大 *big* and 小 *small* composing a compound of attribute type 大小 *size* respectively.

c. Lexical structures determine lexical senses and syntactic properties of compounds, for example, VR structure tends to allow ergative usage and it is more flexible in respect of collocating with *Ba*-construction and *Bei*-construction, such as 把他樂壞 *to please him to the utmost* and 被他笑死 *laugh to death by him*; Agent+V structure is only suited for the sentence pattern of Goal<被 *bei*<*, such as 牆壁被蟲蝕 *the wall is eaten by worm*; Theme+V structure on the other hand is only suited for the sentence pattern of experiencer<* or theme<* according to it denotes a metal state or a physical state, such as 她心碎 *she breaks her heart* and 門牙牙痛 *have an ache in front tooth*.

d. Lexical structures derive lexical sense and lexical sense affect syntactic properties of lexemes, thus lexical structures affect transitivity and argument semantic restriction of verbs. For example, VO structure defines an intransitive or a pseudo-transitive usage of events, and in general the second object co-occurred is not allowed, which makes *抗日和其他聯軍 *resists Japanese and other coalition* in Mandarin a confusing and ungrammatical phrase.

e. Lexical structures preserve syntactic properties, but under certain conditions or in some exceptive cases morphological constructions may adjust or change the original syntactic construction. For example, the patient collocates with VR structure has to fit in with the argument semantic restriction of verb component and the semantic restriction of result component in the meanwhile, such as 盒子看進去 *look into the*

box is acceptable but *理念看進去 **look into the idea* is not.

In all, a grammatical sentence should fulfill the syntactic constraints of (a)construction patterns, (b)word ordering, (c)word collocations, as well as semantic constraints of (a)host-attribute-value relations being logical, (b)construction meaning and lexical senses being coherent. In the future, more fine-grained semantic features and their logical compatibilities which cause various syntactic constraints will be further studied. Construction patterns and their additional meanings should also be thoroughly investigated.

References

Chen Keh-Jiann, Shu-Ling Huang, Yueh-Yin Shih, Yi-Jun Chen, 2005, *Extended-HowNet- A Representational Framework for Concepts*, OntoLex 2005 - Ontologies and Lexical Resources IJCNLP-05 Workshop, Jeju Island, South Korea

Chomsky N., 1965, *Aspects of the theory of syntax*. Cambridge, MA: MIT Press.

Chung You-shan and Keh-Jiann Chen, 2012, Transitivity of a Chinese Verb-Result Compound and Affected Argument of the Result Verb, *Computational Linguistics and Chinese Language Processing*, Vol. 17, No. 2, pp. 1-20

Fillmore Charles J., John B. Lowe, 1998, *The Berkeley FrameNet Project*. COLING-ACL: 86-90

Goldberg, A., 1995, *A Construction Grammar approach to argument structure*, Chicago: University of Chicago Press.

Hopper, Paul J., Sandra A. Thompson, 1980, Transitivity in Grammar and Discourse, *Language* 56 (2): 251–299.

Huang, Shu-Ling and Keh-Jiann Chen, 2013, *Semantic Analysis and Contextual Harmony of Durations*, Journal of Chinese Linguistics vol. 41, #1, pp 118-144.

Shu-Ling Huang, Yu-Ming Hsieh, Su-Chu Lin, and Keh-Jiann Chen, 2014, *Resolving the Representational Problems of Polarity and Interaction between Process and State Verbs*, Journal of Computational Linguistics and Chinese Language Processing vol.

19, to appear.

Levin Beth, 1993, *English Verb Classes and Alternations: A Preliminary Investigation*, Chicago: The University of Chicago.

Levin Beth, 2009, Where Do Verb Classes Come From?, *Verb Typologies Revisited: A Cross-linguistic Reflection on Verbs and Verb Classes*, Ghent University, Ghent, Belgium

Li & Thompson, 1989, *Mandarin Chinese--a functional reference grammar*, University of California Press

Li Shih-Min, Su-Chu Lin and Keh-Jiann Chen, 2005, Feature Representations and Logical Compatibility between Temporal Adverbs and Aspects, *Computational Linguistics and Chinese Language Processing*, Vol. 10, No. 4, pp. 445-458

Liu C. H., 2008, *Xiandai Hanyu Shuxing Fanchou Yianjiu* (現代漢語屬性範疇研究). Chengdu: Bashu Books.

Lu, J., and Z. Ma (陸儉明&馬真) , 1999, ”把”字句補議, *現代漢語虛詞散論*, pp.98-127.

Pustejovsky James, 1995, *The Generative Lexicon*, Cambridge, MA: MIT Press.

Appendix

The Main Constraints for Each Alternation of Transitive Verbs and Examples

Alternation Type	Main Constraints
a. prototype	1. Exclude VO structure.
b. *Ba*-construction	1. Disposable (including mentally controllable). 2. Goal affected. 3. Have an end point. 4. A' cannot be a manner to modify agent in AV structure.
c. *Dui*-construction	1. Be pseudo transitive verbs 2. Not disposable
d. *Ti*-construction	1. Have benefit sense. 2. Not disposable
e. *Bei*-construction	1. Goal affected 2. Have an end point. 3. Have malicious sense.
f. ergative	1. Goal affected. 2. Have a stative result. 3. Proto-goal must not satisfy the proto-agent. 4. A' cannot be a manner to modify agent in AV structure.
g. insertion	1. Only suited for VO structure

Below ✓denotes acceptable alternation; ***** denotes unacceptable alternation; Δ denotes partially acceptable cases.

The unacceptable reason according to above table is given and represented by an abbreviation, in which **PA=PG** denotes *proto-goal satisfies the proto-agent*; **N-Disp** denotes *not disposal*; **N-SR** denotes *not stative result*; **GA** denotes *goal affected*; **N-GA** denotes *not goal affected*; **AMa** denotes *A modify agent*; **DO** denotes *direct object*; **N-Pt** denotes *not pseudo transitive*; **N-MS** denotes *without malicious sense*.

Lexical Structure	**Argument Structure**	**example**	**Syntactic Alternation**						
			a prototype	b Goal[把]	c Goal[對]	d Goal[為]	e Agent[被]	f ergative	g insertion

Lexical Structure	Argument Structure	example	Syntactic Alternation						
			a prototype	b Goal[把]	c Goal[對]	d Goal[為]	e Agent[被]	f ergative	g insertion
VR	**agent, patient**	擊斃	✓	✓			✓	✓	
		焚燬	✓	✓			✓	✓	
		抹黑	✓	✓			✓	*PA=PG	
		改良	✓	✓			✓	✓	
		徵到	✓	✓			✓	✓	
		改小	✓	✓			✓	✓	
		穿壞	✓	✓			✓	✓	
		洗淨	✓	✓		✓benefit	✓	✓	
		壓低	✓	✓			✓	✓	
		拓寬	✓	✓			✓	✓	
		打爛	✓	✓			✓	✓	
		擴張	✓	✓			✓	✓	
	agent , target	討好	✓	* N-Disp			✓	* PA=PG	
		嚇跑	✓	✓			✓	✓	
		教壞	✓	✓			✓	Δ	
		告知	✓	✓			✓	*N-SR	
		騙出	✓	✓			✓	*N-SR	
		打動	✓	✓			✓	*N-SR	
		撫平	✓	✓		✓benefit	✓	✓	
	experiencer, target	看上	✓	*N-Disp			✓	*N-GA	
		看重	✓	*N-Disp			✓	*N-GA	
		聽厭	✓	*N-Disp			✓	✓	
		恨死	✓	✓			✓	*N-GA	
		看輕	✓	✓			✓	*N-GA	
		記錯	✓	✓			*N-GA	✓	
AV	**Agent, patient**	撲殺	✓	✓			✓	✓	
		火化	✓	✓			✓	✓	
		讒害	✓	✓			✓	* AMa	
		重整	✓	✓			✓	✓	
		竄改	✓	✓			✓	✓	
		試穿	✓	✓			✓	✓	
		刷洗	✓	✓		✓benefit	✓	✓	
		重擊	✓	✓			✓	* AMa	
	Agent, target	力捧	✓	* N-Disp			✓	* N-Disp	
		威嚇	✓	* AMa			✓	* AMa	

Lexical Structure	Argument Structure	example	Syntactic Alternation						
			a prototype	b Goal[把]	c Goal[對]	d Goal[為]	e Agent[被]	f ergative	g insertion
		盛讚	✓	* AMa			✓	* AMa	
		親授	✓	* AMa			✓	*AMa	
		預祝	✓	*N-GA			*N-GA	*N-GA	
		面謝	✓	* AMa			* N-GA	* AMa	
		跪拜	✓	* N-GA			* N-GA	* N-GA	
		遙祭	✓	* N-GA			* N-GA	* N-GA	
		哭悼	✓	* AMa			* N-GA	* AMa	
		虧待	✓	* AMa			✓	* AMa	
		禮遇	✓	* AMa			✓	* AMa	
		溫慰	✓	* N-GA			* N-GA	* N-GA	
	experiencer, target	熱愛	✓	* AMa			✓	* AMa	
		渴望	✓	* N-GA			* N-GA	* N-GA	
		遙想	✓	* N-GA			* N-GA	* N-GA	
		錯怪	✓	* AMa			✓	* AMa	
		痛恨	✓	* AMa			✓	* AMa	
		漠視	✓	* AMa			✓	* AMa	
		迷信	✓	* N-GA			* N-GA	* N-GA	
		死記	✓	* N-GA			* N-GA	* N-GA	
VV	**Agent, patient**	殺害	✓	✓			✓	✓	
		焚燒	✓	✓			✓	✓	
		污蔑	✓	✓			✓	*PA=PG	
		整頓	✓	✓			✓	✓	
		更改	✓	✓			✓	✓	
		穿戴	✓	✓		✓	✓	✓	
		洗滌	✓	✓			✓	✓	
		熨燙	✓	✓			✓	✓	
		打擊	✓	✓			✓	✓	
		拓展	✓	✓			✓	✓	
	Agent, target	諂媚	✓	* N-Disp			✓	*PA=PG	
		嚇唬	✓	✓			✓	*PA=PG	
		讚許	✓	* N-Disp	✓		✓	*PA=PG	
		抬舉	✓	* N-Disp			✓	*PA=PG	
		教導	✓	✓			✓	*PA=PG	
		告訴	✓	✓DO			* N-GA	*PA=PG	
		欺騙	✓	✓			✓	*PA=PG	

Lexical Structure	Argument Structure	example	Syntactic Alternation						
			a prototype	b Goal[把]	c Goal[對]	d Goal[為]	e Agent[被]	f ergative	g insertion
		祝福	✓	* N-GA		✓	✓	*PA=PG	
		祀奉	✓	* N-GA			✓	✓GA	
		弔祭	✓	* N-GA			* N-GA	✓GA	
		壓榨	✓	✓			✓	* PA=PG	
		款待	✓	✓			✓	✓ GA	
		撫慰	✓	✓			✓	✓ GA	
	Experiencer, target	喜歡	✓	* N-Disp			✓		
		器重	✓	* N-Disp			✓		
		期待	✓	* N-Disp			✓		
		想念	✓	* N-Disp			✓		
		憎恨	✓	* N-Disp			✓		
		懷疑	✓	* N-Disp			✓		
VO	**Agent,**	洗碗							✓
V+Patient	**patient**	敲門							✓
	Agent,	報喜			✓				
	target	說謊			✓				
		慶生				✓			
		教書							✓
		冒名							✓
V+Target		做手腳			✓				✓
	Experiencer, target	貪玩							
		厭食							
		思鄉							
		瀆職							
V+Non-Patient	**Agent, patient**	砍頭		✓			✓		✓
		焚身		* N-Pt			✓		
		扣帽子		* N-Pt			✓		✓
		護航		* N-Pt		✓	* N-MS		✓
		洗頭		* N-Pt		✓	* N-MS		✓
		貶職		✓			✓		✓
		隆鼻		* N-Pt		✓	* N-MS		✓
		掌嘴		* N-Pt			✓		✓
		摃背		* N-Pt		✓	* N-MS		✓
V+Non-Target	**Agent, target**	撒嬌			✓		*		
		灌迷湯		✓GA	✓		✓		

Lexical Structure	Argument Structure	example	Syntactic Alternation						
			a prototype	b Goal[把]	c Goal[對]	d Goal[為]	e Agent[被]	f ergative	g insertion
		稱善			✓		✓		
		洗腦		✓ GA	✓		✓		
		賀喜			✓		*		
		道謝			✓		*		
		叩頭			✓		*		✓
		行禮			✓		*		
		動心			✓		*		✓
		失敬			✓		*		
		奉茶			✓		*		
		助興				✓	*		
		背黑鍋				✓	*		
		喝采				✓	✓		
		送終				✓	*		
		接風				✓	*		
		壓驚				✓	*		
	Experiencer, target	注意	✓				✓		
		遷怒	✓				✓		
		懷恨	✓				*		
		著迷	Note these		✓		*		
		垂青	are exceptions		✓		✓		
		注意	of V0		✓		✓		
		著想				✓	*		
		垂涎			✓		✓		
		生厭			✓		*		
		懷恨			✓		*		
		失察			✓		*		
		起疑			✓		*		