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A Nano Syntactic Analysis of the Mandarin Spatial Preposition *Zai*

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***Abstract*—This paper argues for a nano syntactic approach to the structure of Mandarin spatial preposition *zai*. It is assumed in this paper that the morpheme *zai* possesses a fine-grained internal structure with different semantic features on the terminal nodes. This complex syntactic structure provides insight into the omission of *zai* in Chinese which is in essence due to the feature movement.**

***Index Terms*—nano syntax, spatial prepositions, syntactic structures, semantic features, feature movement**

I. Introduction

Chinese locative preposition *zai* can be optionally omitted when following the verb that expresses the stative meaning (Yang 2019). The implications of the sentences are the same whether *zai* is present or not. In (1), *shui* 'sleep' is an intransitive verb implicating stative meaning. When the preposition *zai* is omitted, (1a) and (1b) indicate the same meaning that he is located in bed when he is sleeping.

(1) a. ta shui *zai* chuang shang.
he sleep in bed above
'He sleeps in bed.'
b. ta shui chuang shang.
He sleep bed above
'He sleeps in bed.'

The studies on the spatial preposition *zai* have collected wide popularity in linguistic field (Ma, 1997; Shen, 2003, 2004; Peng, 2011; Liu, 2019). However, most of the studies on Chinese spatial prepositions are carried out from the perspective of cognitive linguistic and typology, leaving little attention to the syntactic analysis. Moreover, the omission phenomenon fails to be captured from the syntactic perspective.

The structure of this paper is developed as follows: Section two provides general review of previous studies on preposition '*zai'*. Section three introduces the major arguments of nano syntax theory. Section four functions as the analysis of the structure of preposition *zai* and explains its omission phenomenon. The last section serves as a conclusion.

II. Related Studies

Recent years have witnessed rapid growth in the investigation of locative prepositions cross languages. In this section, both domestic and overseas studies on spatial prepositions are selected to be presented.

Dikken's (2003, 2010) foundational idea is to develop a complex structure for locative prepositions with different extended projections when embedded under V. There is only one structure for locative PP embedded under V but with full extended projections, which is schematized as V [CP C [Dxp DX [AspP Asp [PP P loc DP]]]]. Bare locative PP cannot serve as the complement of V, for they cannot incorporate with each other (Koopman, 2000). From this point of view, PP locative must be embedded in its own extended projections.

Base on Andrews (1985) and Cinque (1999), Svenonius (2004) postulates a series of functional heads for a refined structure of English locative phrases: p-Deg-Deix-Loc-AxPart-K-DP. What makes Svenonius's (2004) discussion much more particular is that vector space and axial part are taken into consideration. The K category is created to indicate a genitive marker and Axpart as a newly added category, presupposes the axial structure of the ground reference object. It is in Axpart that frame of reference is determined. Loc indicates vector space where DegP is postulated above to generate degree and measure phrases in order to identify the region. Deix is occupied by demonstratives referring to different degrees to a deictic center (Svenonius, 2008). P commonly expressed by prepositions is the locus of relational notions of containment and attachment.

Dikken (2003) and Svenonius (2004) propose that P as a lexical head is built up to be locative expressions with a sequence of functional projections; while Noonan (2006) suggests that the uniform category order for directional PPs is Vdir > Rpath > (Modpath)> Path > Ploc > Rplace > (Modplace) > Place, in which Ploc is a functional locative preposition and the abstract Vdir is a functional verb which needs to be licensed. Besides, Noonan (2006) ties the cross-linguistic variation to whether pronunciation or movement of components is achieved in the hierarchy.

Sentences in (2) receive directional reading when the contained locative PPs co-occur with motion verb.

(2) a. They ran under the bridge.
b. The snake slid in front of the door.

Noonan (2006) suggests that this is due to the movement of PlocP to the specifier of silent Vdir which is schematized as [VP [VdirP Vdir [PlocP]]]. In Noonan's (2006) explanation, the rigid order in Path>Ploc>DP indicates that Path moves together with Ploc to the specifier of abstract Vdir in order to denote directional reading.

Based on Jackendoff (1983, 1990) and Kayne (2004), Pantcheva (2011) semantically explains how each head can be postulated and generated. For locative expression, he adopts the orthodox assumption that the Place head encodes a spatial domain. According to Pantcheva (2011), PathP can be further cut into several smaller expressions including Scale, Bound, Route, Source, Goal and Place expressions respectively, all of which are ordered in hierarchic structure as [ScaleP/BoundP[RouteP[SourceP[GoalP[PlaceP]]]]]. On the basis of morphological containment, Scale and BoundP, the most complex ones, are built above the RouteP, meanwhile SourceP selected by RouteP contains GoalP in morphology itself. In turn, the Goal head takes the PlaceP as its complement.

A large number of domestic analyses on Chinese spatial prepositions in syntactic way have been carried out, most of which are studied from aspects of cognitive linguistic, typology and syntactic structure under the framework of conventional generative grammar. Grammaticalization is the phenomenon which is essential in the development of language (Chomsky, 1995). It is believed that most Chinese prepositions to some extent derive from verbs and during the development process they are influenced by the grammatical factors, thus keeping close connection with verbs. Present domestic studies on the most widely used spatial prepositions in Chinese are illustrated in following part.

Locative preposition has been explored in many works. Traditional studies on prepositions *zai* are mainly conducted in traditional grammar such as Wang (1943), Zhu (1982), Wang (2008), Wang (2009), Zhao (2016), Yan (2019) and Zhou (2019).

Wang (1943) proposes two constructions to present locative meaning, *zai*-place noun and *zai*-common noun-zhe /na. Zhu (1982) proposes three positions for *zai*-place noun construction (ZP) in sentence. Different position of ZP in sentence leads to diverse sentence structure syntactically and semantically.

(3) a. ZP+NP+VP
b. NP+ZP+VP
c. NP+VP+ZP

In (3a), ZP indicates where things occur and disallows the merge of auxiliary as well as to be modified by adverb. Sharing the same semantic function with ZP in (3a), ZP in (3b) includes the stative meaning and allows the occurrence of adverb, adjective and auxiliary. ZP in (3c) presents the stative meaning of the action, thus being closer to VP and disallowing the insertion of other elements between VP and ZP.

Wang (2008) concludes that locative *zai* following an intransitive verb represents the stative meaning of the action and when selected by a transitive verb, *zai* construction can present the location of action. Wang (2009) holds the view that when indicating locative meaning, *zai*-place noun construction is followed by verb, adjective and subject, while it only appears after a verb to present the place where the events happen. What's more, *zai* construction needs to merge before the verb that is modified by adjunct (Zhao, 2016).

In conclusion, the related studies on the locative *zai* are rarely conducted from the syntactic perspective and the omission issue of *zai* has been neglected.

III. Theoretical Framework

Nano syntax is a new model of grammar that connects syntax and morphology. Different from the conventional generative grammar, it is assumed that a morpheme like a sentence possesses a fine-grained syntactic structure whose terminal nodes are features instead of lexical items.

In conventional generative grammar theory, one lexical item occupies each terminal node so the lexical item is the smallest component in syntactic tree and cannot be decomposed further. In nano syntax however, lexical item turns to be decomposed into a complicated substructure with atomic syntactic features in the terminal nodes. A series of features can be spelled out by a lexical item. A morpheme can be presented as the combination of phonological representation, syntactic structure and conceptual content (Caha, 2009, 2010; Starke, 2009; Pantcheva, 2011).

A. Phrasal Spell-Out Principle

One of the main principles in nano syntax is phrasal spell-out which is an essential syntactic principle in this paper. Phrasal spell out can be defined as a replacement of a piece of the syntactic tree by a lexical item from lexicon, thus supplying the syntactic structure with phonological and conceptual content of the entry (Pantcheva, 2011). There is a sequence of features underlying lexical item, which means different lexical item possesses different sizes of syntactic structures. Based on Starke's (2009) and Pantcheva's (2010) proposal, the lexicalization process is in a bottom-up, right-to-left and cyclic order. In this way, the whole structure is spelled out as a lexical item, which means the lexical item can also be inserted to a phrasal node. The core idea of phrasal spell out can be captured as [XP X [YP Y Z]]. The terminal nodes X, Y and Z are occupied with semantic features. The projections XP and YP can be inserted by a lexical item. The lexical entries in the biggest projection XP require the compatibility of features between the syntactic structure and the inserted lexical item. The lexical insertion in YP is supposed to possess the feature of Y and Z; this is

also true of element in XP satisfying the features of X, Y, Z. As a result, the insertion in none-terminal nodes is known as phrasal spell out.

The phrasal spell-out principle is applied in overseas linguistic studies. Ramchand (2008) proposes that a complete event structure is composed of three subevents causing event, process event and result event. The tree diagram is presented as [InitP [ProP[ResP]]].

Three subevents correspond to three different projections initiation phrase, process phrase and result phrase respectively. In her system, a single verb indicating an event can be decomposed into more than one subevent, for example, the verb *break* occupies the phrasal node ProcP indicating two subevents: ProcP and ResP, while the verb *enter* can be inserted in InitP covering all three subevents InitP, ProcP and ResP.

Further, concerning different sizes of structures underlying the lexical items, language variation is explained within the operation of phrasal spell out. For example, English verb *kill* and *sha* the counterpart in Chinese differ in their compatibility when co-occurring with the word death in English and *si* in Chinese, as presented in (4). Chinese verb *sha* is allowed to appear with *si*, whereas English one does not.

(4) a. ta sha si le laohu.
he kill dead PRF tiger
'He killed the tiger.
b.*He killed the tiger to death.

Conventional generative grammar cannot provide a satisfying account for this kind of phenomenon, but there will be an enchanting sight if phrasal spell out is applied. According to phrasal spell out, English verb *kill* and Chinese verb *sha* encode different underlying structures. Different sizes of syntactic structures stand for those different verbs. In other words, those two verbs span different terminal nodes. In term of English verb *kill*, the whole event structure is fleshed out as [InitP [ProP[ResP]]]. However, this is not the case in Chinese. The feature [res] is not the component of Chinese verb *sha*, thus only spelling out a substructure [InitP [ProP]]. If the feature [res] represents the result death, then the word *death* cannot co-occur with *kill* in English, for death is one of the features in the structure, in other words, the structure of *kill* includes the meaning of death already and the sentence is ungrammatical in (4b). However, in the syntactic structure of Chinese *sha*, death representing result feature is not included. Therefore, *sha* can co-occur with *si* as in (4a).

Generally speaking, language parameters can be explained by the assumption that lexical items are represented in different shapes. Phrasal spell out provides a formal mechanism for the account of unsolved controversies in framework of conventional generative grammar.

B. Spell-Out Driven Movement

Another crucial syntactic operation in nano syntax is spell-out driven movement. Movement operations in nano syntax and conventional generative grammar like head movement, wh-movement and NP movement are crucial syntactic derivation processes. Although sharing the same term, some diversities are highlighted with the former happening only for spell-out while the latter commonly occurring for such reasons as case-driven, locality and association with inflectional morphology. Movement in nano syntax is specifically termed as spell-out driven movement by Starke (2009) on the idea that this type of movement is triggered by creating the appropriate configuration for insertion of a lexical item. As explained by Starke (2009), three aspects about movement operation need to be noted. Firstly, the movement operation as the last resort movement driven by the spell-out requirement takes place only when a constituent is blocking in the right configuration for spell out; secondly, the blocking lexical item raises above the highest position to a new node, thus creating an adjunct structure. Thirdly, unlike the trace of moved element in conventional generative grammar serving as an empty category, encoding the base position of the moved constituent and not being ignored, the trace of the evacuated lexical item in nano syntax must be ignored in matching procedure (Caha, 2009). Structure [AP[BP[CP[DP]]]] is generated in syntax with four features [A], [B], [C] and [D] as the head and the underlying structure of the lexical item *student* is [CP[DP]] with two features [C] and [D], and the structure [AP[BP]] stands for the morpheme '-s' with two features [A] and [B].

To spell out the entire syntactic structure [AP[BP[CP[DP]]]], no less than two lexical items should be inserted into the structure, because a single lexical item that can cover all features is unavailable in lexicon.

According to the bottom-up and right-to-left lexicalization order mentioned previously, lexical item *student* at the first stage, is inserted into the sub-part [CP[DP]] of syntactic stored structure [AP[BP[CP[DP]]]] with its encoding structure [C [D]] exactly matching with the sub-tree features.

After the insertion of *student*, features [A] and [B] in the newly generated structure are still waiting for the spell-out and the lexical item '-s' remains unused with features [A] and [B] in the underlying structure at the same time. Noted that the generated structure [AP [BP [student]]] after insertion of *student* appears to be incompatible with the underlying structure of the morpheme '-s', so the morpheme '-s' cannot be inserted into the structure, in other words, features [A] and [B] cannot be spelled out at the moment.

To make the way out, the idea of movement operation is proposed by Starke (2009) in nano syntax framework. Following this derivation, the obstructing element *student* is evacuated to a new node to get a right configuration [AP [BP]] and the trace can be ignored so as to exactly match the syntactic structure of '-s'. In this way, the right structure [AP [BP]] is derived after the item *student* moves out with its trace ignored, which will meet the requirement for the

insertion of '-s', hence yielding 'student-s'. If there is a trace represented by *t* left after the evacuation of spell out *student* to the highest node, then the left constituents fail to match with the syntactic structure of '-s', hence failing to derive 'student-s'.

In conclusion, the spell-out driven movement operation in nano syntax is triggered only for the lexicalization. In addition, no trace is left at the base site of the moved-out lexical item. Moreover, a new node in syntactic structure is created to which the moved-out material adjoins.

C. Superset Principle

The superset principle is one of several principles formulated as the conditions on matching so as to restrict the circumstance when a structure can be spelled out by a lexical item. In other words, the superset principle will make a difference on the insertion operation of the lexical item. According to the superset principle, the inserted lexical item must possess features no less than ones in the syntactic configuration and a lexically stored tree matches a syntactic node if and only if the lexically stored tree contains the syntactic node (Starke, 2009).

Matching does not mean one to one correspondence between inner structure and generated structure (Yan, 2019). Instead, matching requires that the lexically stored tree should be identical or bigger than the generated syntactic tree. The insertion of a lexical item to the node can be achieved only if the lexically stored structure is the superset of the node. Namely, when inner structure of lexical item is exactly the same as the structure of that node, it is the most ideal mapping. Besides, it is also accepted that if the syntactic structure of lexical item also contains other features which are not in the syntactic tree encoded in the node.

IV. Our Analysis

Under the guideline of nano syntax framework and based on Pantcheva's (2010) proposal of the internal structure of locative preposition, we assume that the locative preposition *zai* possesses a complex internal structure which is diagrammed as [PlaceP Place [AxpartP Axpart]]. Axpart presupposes the axial structure of the ground reference object. It is in Axpart that frame of reference is determined (Johan & Wyngaerd, 2007).

The constructions formed by the spatial preposition *zai* are generally classified into two categories: [zai/dao/cong-Place noun] and [zai/dao/cong-Place Noun-Localizers] and the derivation processes of these constructions vary in the shape of configuration. Various substructures of diverse prepositions, based on the spell-out governing principles, are used to account for both grammatical and ungrammatical lexicalizations of spatial expression constructions. In addition, nano syntax theory together with the uniformity between properties of verbs and features of spatial element provides a satisfying explanation for optional omission of prepositions in oral Chinese (Zhou, 2019).

Based on the basic syntactic structure of preposition *zai*, the language facts previous mentioned in (1) repeated here in (5) can be well explained. As demonstrated in (6a), place noun *chuang shang* 'on the bed' can follow preposition *zai* to form locational expression which denote stative meaning and give information about physical relationship between figure the people and ground the bed as well as the location where things happen. Bare place noun *chuang shang* 'on the bed' only refers to the identity of place; however, when attached to preposition *zai* to form *zai*-place noun construction, it will give more information about physical configuration and the location. The sentences below implicate that the semantic meaning remains the same no matter whether the locative preposition *zai* is present or not.

(5) a. ta shui *zai* chuang shang.
he sleep in bed above
'He sleeps in bed.'
b. ta shui chuangshang.
He sleep bed above
'He sleeps in bed.'

The stative verb *shui* 'sleep' encodes an internal structure including two terminal nodes: verb node and place node. Therefore, the syntactic structure of stative verb *shui* 'sleep' is [VP [PlaceP [AxpartP]]]. The underlying structure of preposition *zai* is [PlaceP [AxpartP]], so the preposition *zai* is the ideal entry for Place projection, leading to the legit sentence in (5a). The stative verb *shui* 'sleep' and preposition *zai* can be inserted into the corresponding head position. The final structure is [VP Vstative [PlaceP Place Axpart [AxpartP t Axpart [DP]]]].

When the structure of complex head in which the preposition *zai* is inserted moves up to the head of VP, it is reasonable to get a more complex head. The movement is legal because the stative feature is in the verb head position, thus denoting a stative meaning. The semantic meaning of the preposition *zai* is also the same with that of the stative verb. In other words, the semantic meanings of preposition *zai* and stative verb are compatible with each other. The derivation process of the omission of preposition *zai* is shown as [VP Vstative Place Axpart [PlaceP t Place [AxpartP t Axpart [DP]]]].

V. Conclusion

This paper serves to analyze Chinese spatial preposition *zai* in a nano syntactic approach. It follows the trend towards finer-grained internal syntactic structures encoded in the spatial preposition *zai*. The syntactic tree underlying location

element *zai* corresponds to [Place [Axpart]] which indicates different type of terminal node denotes corresponding feature constituent. The semantic meanings of spatial preposition get explained by the features in the syntactic structure encoded in the individual spatial preposition.

All in all, as an advanced method of studying Chinese spatial prepositions, current analysis proposed here will open a whole new field on the further study of spatial prepositions in other languages for example, in Japanese Locative marker -ni which denotes specific interpretation. If so, nanosyntax theory would be greatly enhanced from theoretical and practical point of view.

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