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Semantics and Syntax of Degree Construction in and Mandarin

1. INTRODUCTION

Gradability is an essential concept in the studies of adjectives, which classifies adjectives into two major classes, non-gradable adjectives, like *British*, etc. and gradable adjectives, like *tall*, *long*, etc. Gradable adjectives are important role to build degree comparative constructions in a language. In this section, this paper will go through a batch of examples of comparatives and categorize them by their different structures, and this classification will lead semantic and syntactic analysis in next sections.

From traditional view, ingredients of a comparative construction are, a comparee, a standard, a comparative marker and a gradable predicate (Guo, 2012). And from this this paper's perspective, in semantic, a comparative construction can be departed to a comparee, a standard, a gradable predicate, and a optional differential phrase; in syntactic, there are two more ingredients, comparative marker and comparative morpheme.

A simplest example in English is shown in (1), in this sentence, "*John*" is comparee, "*Mary*" is standard, word "*than*" is a comparative marker whose job is introduce strict partial relation meaning "greater than" ref here, and suffix "*-er*" is another comparative marker whose function is still controversial. Some researchers believe that "*-er*" is just a word in specifier position without crucial function (Bhatt & Pancheva, 2004; Heim, 1985; Rullmann, 1995; Von Stechow, 1984a), another kind of view treat this word as a head of degree phrase (DegP) (Bierwisch, 1989; Corver, 1990, 1993, 1997a; Grano, 2012; Kennedy, 1997). Different form English, Mandarin is considered as a single mark language in comparative expression (Bobaljik, 2012; Grano, 2012). In most of cases, this mark is morpheme "*bi*" such as example in (2), and there is no inflection of adjectives in Mandarin like "*-er*" in English (Guo, 2012).

(1) John is taller than Mary.

(2) John bi Mary gao.
John than Mary tall.
John is taller than Mary.

Differential phrase (DP) is an important part of comparative structure, whose job is giving the differential scale of context individuals. A comparative structure with differential phrase in English is shown in (3), and Mandarin version is shown in (4).

(3) John is 2 meters taller than Mary.

(4) John bi Mary gao 2 mi.
John than Mary tall 2 meters.
John is 2 meters taller than Mary.

The differential phrase in examples above are specific value differential phrase, which gives a accurately value of scale about gradable adjective. Another type of differential phrase gives vague value of scale. When this kind of differential phrase appears in comparative meaning, there is always a standard scale existed in context, and this vague value is either bigger than the standard value, or smaller than the standard value. Like example in (5a), morpheme "*hen duo*" is a big value vague differential phrase, which means, John is not only taller than Mary, but also, the difference of their height is lager than a standard value. This standard value is given in context, it is a consensus between speakers. Similarly, a small value vague differential phrase is shown in (5b). In Mandarin, vague differential phrase can be complex, many researchers (Li, 2015; Lin, 2014) do deeply investigation on it, (6a) and (6b) show such type of differential phrase which appears as "vague prefix + accurately value" or "accurately + vague suffix".

(5) (a) John bi Mary gao hen duo.
John than Mary tall much.
John is much taller than Mary.

(b) John bi Mary gao yi dian.
John than Mary tall a little.
John is a little taller than Mary.

(6) (a) John bi Mary gao liang mi duo.
John than Mary tall 2 meters more.
John is more than 2 meters taller than Mary.

(b) John bi Mary gao bu dao liang mi.
John than Mary tall less 2 meters.
John is less than 2 meters taller than Mary.

In comparative structure built by gradable adjectives, sometimes, the standard is not a specific individual. This paper propose that there are three categories of standard, which are "single individual standard", "individual set standard" and "specific value standard". All examples mentioned above is single individual comparison. (7a) gives a example of specific value comparison, in which standard is not a individual. (7b) shows a example of individual set comparison.

(7) (a) John bi 2 mi gao.
John than 2 meters tall.
John is taller than 2 meters.

(b) zai yi ban, John zui gao.
in one class, John most tall.
John is tallest in class one.

Then we propose a classification of degree structure into two types, assignable meaning and comparative meaning.

1. **Assignable meaning**: a degree structure is assignable meaning if and only if the function of gradable adjective is assignment. Under assignable meaning, there is no more subtypes, (8) shows a example, where gradable adjective assigns a accurately value "2 mi" to another individual's height. When a scale-related group of words appears in assignable meaning, this paper do not call it differential phrase, but measure phrase (MP). Many researchers do not separate this two concepts very clear. Under our discussion, differential phrase appears in assignable meaning, measure phrase appears in comparative meaning.

   (8) John gao 2 mi.
   John tall 2 meters.
   John is 2 meters tall.

2. **Comparative meaning**: a degree structure is assignable meaning if and only if the function of gradable adjective is comparison. Under comparative meaning, there are three subtypes, positivity, superiority and equality.

   i. **Positivity**: a comparative meaning degree structure is positivity if and only if the standard is implicit. (9) gives a example of positivity, this utterance tells a truth that, the value of John's height is greater than a standard which exists under the context between speakers.

      (9) John hen gao.
      John very tall.
      John is very tall.

   ii. **Superiority**: a comparative meaning degree structure is superiority if and only if the standard is explicit and the difference between comparee and standard is strictly greater than zero. (2) is a example of superiority, which is basic type of degree structure. what should be noticed is example in (7b), which is also belong to comparative meaning type and superiority subtype. This degree structure belongs to comparative meaning because the gradable adjective here is still bear comparison job, which compare height between

John and an individual set. And the example is superiority this superlative expression gives a truth that the the value of John's heigh is strictly greater than any of individual set.

iii. **Equality**: a comparative meaning degree structure is superiority if and only if the standard is explicit and the difference between comparee and standard is equal zero. (10) shows a example of equality, which gives a expression that the value of John's height is same with the value of Mary's height. Here may have some controversies, someone may think that, (10) actually assigns the value of Mary's height to John's height, which will lead the function of gradable adjective turn to assignment (Guo, 2012). This paper argues that, the height is kind of inner property of an individual, so we can not assign one's height to another. On the opposite, the essence of equality is to express a truth that, the difference between tow individuals height is zero, thus the function of gradable adjective in equative form is comparison rather than assignment.

(10) John he Mary yi yang gao.
John and Mary same tall.
John is as tall as Mary.

Next phenomena should be noticed is the visibility of the standard. See example in (9), in traditional research ref here, this example is classified in assignable meaning, but by this paper's approach, this example is comparative meaning because the gradable adjective bears the comparison function, rather than the assignment function. So the problem raises up which is, there is no standard to comparison. Actually, here do exist a compare target under this context. The morpheme "*very tall*", means that there is a standard height between speakers, and the value of John's height is greater than that standard. So this "specific value standard" is actually a implicit standard.

Up to now, it is time to summarize all kinds classification mentioned above. First of all, a simple degree structure built by gradable adjectives can be classified into two categories, comparative meaning and assignable meaning. If gradable adjectives bear value assignment function, sentence can be seen as assignable meaning, and when gradable adjectives bear value comparison function, the degree structure can be seen as comparative meaning. And in comparative meaning, sentence can be built to positivity, superiority and equative. In superiority, there are three different angles to classified degree structure.

1. The differential phrase is explicit or implicit.
2. The standard is specific value or single individual or individual set.
3. The standard is explicit or implicit.

For now, we give a clear classification to degree structures, and in next sections, we are going to make a deep discussion about the syntactic and semantic properties of those degree structures. In section

2, this paper will enumerate some former researchers' work about degree semantics, especially the lexical entry of gradable adjectives, the DegP structure and the DegP-shell structure. In section 3, this paper will based on former's achievement and the classification given above, illustrate a new syntactic and semantic analysis in Mandarin degree structure.

2. FORMER DEGREE SEMANTICS RESEARCH

2.1 *Some history*

First founder of analysis on gradable adjectives is Cresswell (Cresswell, 1976), who creates a third primitive semantic type d besides the two primitive semantic types e and t in classical semantics Degree semanticists also identify three major parts of gradable adjectives:

1. A measure function G, mapping the target x onto the abstract dimension for measurement characteristic of the gradable adjective (Bartsch & Vennemann, 1974).

2. The total ordering relation $\geq$, which makes the set of scales corresponding to the abstract dimension ordered in pairs of a same direction.

3. The degree variable, indicating the value of $G(x)$. A gradable adjective of predictive use is analysed as a two-place predicate with the individual and the degree as its arguments.

Since Cresswell, the semantic type of gradable adjectives is largely debated. Von Stechow proposes a comprehensive constructive analysis of comparisons (Von Stechow, 1984a), which becomes the so-called standard analysis later (Bale, 2011). From his view, the meaning of gradable adjectives are interpreted as a measure function and an ordering relation. The measure function maps the individual to the dimension denoted by gradable adjectives and the ordering relation ensures that the scale of the individual exceeds the degree to compare. In generative grammar, a gradable adjective is the head of adjective phrase. It functions as a two-place predicate, with an individual typed e and a degree typed d as its two arguments. What deserves a note is it is von Stechow who in first seriously regards degrees denoted by symbol d as one of the primitive semantic types and it is degree d that captures the difference between gradable adjectives and non-gradable adjectives. Here the semantic type of gradable adjectives is manifested as $< d, < e, t >>$. Still giving "*tall*" as an instance, the lexical entry of a gradable adjective is shown in (8), in which height denotes the measure function encoded by *tall* and $\geq$ denotes the ordering relation between the individual and the degree:

(8) $[\![tall]\!] = \lambda d \lambda x.[height(x) \geq d]$

The analysis of DegP headed by a degree morpheme is much more complicated. The semantic type of DegP is $< d, < e, t >>$. Based on the approach in generative grammar, DegP lands at an adjunct

position of AP in the deep structure and then undergoes quantifier raising in the logical form to a node above the original IP inside which DegP is initially located, with the trace left denoting a d type argument. The motivation for this movement is that, according to von Stechow' s analysis DegP can be regarded as isomorphic to a generalised quantifier phrase, an account under large debate afterwards.

The head of DegP, giving the comparative morpheme "*-er*" as the typical one, takes a "than phrase" (thanP) as its complement and a differential phrase as its specifier. Depending on various categories of complement in thanP as well as the overt appearance, such as "*2 meters*", or covert appearance of differential phrase. "*-er*" has kinds of semantic variants:

1. thanP can take three types of complement:

   i. A direct degree expression, such as than "*2 meters*", which denotes a degree argument typed d.

   ii. A comparative clause, such as "*than Mary is tall*", which denotes a property of degree argument, typed $< d, t >$ because according to the view of Chomsky, the comparative clause *than Mary is tall* owns a deep structure looking like "*than how*$_i$ *Mary is* t_i *tall*" which undergoes *wh*-movement, leaving the trace t_i denoting a degree variable bound by λ-operator (Chomsky et al., 1977).

   iii. A bare NP, such as "*than Mary*", regarded as a deletion from the full comparative clause "*than Mary is tall*", also denotes a property of degree argument typed $< d, t >$.

2. DiffP with overt appearance denotes a degree argument, typed d.

Here some examples of possible semantic variants of "*er*" are illustrated:

(9) (a) John is taller than 6 feet.

(b) John is taller than Mary.

(c) John is taller than Mary is.

(d) John is 6 inches taller than Mary is.

The thanP takes a direct degree expression as complement in (9a), a bare NP in (9b), a comparative clause in (9c) and (9d). Optional differential phrase only owns overt appearance in (9d). Based on the analysis above, sematic type of "*er*" in (9a) is $< d, << d, t >, t >>$, in (9b) as well as (9c) is $<< d, t >, << d, t >, t >>$, in (9d) is $<< d, t >, < d, << d, t >, t >>>$.

According to type-driven computation in formal semantics, the gradable adjective typed $< d, < e, t >>$ first combines the trace of the semantic type d which is left by DegP in the process of QR, then combines the subject in the matrix clause of the semantic type e, outputting a t type proposition with a free degree variable. λ-abstraction turns this t type open proposition into a

property of degree typed $< d, t >$ which saturates DegP typed $<< d, t >, t >$. Finally, a t type proposition is made out. Here we have successfully recapitulated the procedure in von Stechow' s analysis of how to derive a comparative construction.

The research of Kennedy investigates what the so-called gradable adjectives refer to as well as in what kind of constructions they appear, which is referred to as degree constructions in his paper (Kennedy, 1997). In this research, Kennedy combines semantics and syntax to reveal the essence of this largely discussed topic.

As to the semantic interpretation of gradable adjectives, there are two major schools:

1. Scalar analyses, in which the set of scales corresponding to a gradable adjective is compatible with the partial ordering relation(Bierwisch, 1989; Cresswell, 1976).

2. Vague predicate analyses, in which the extensions of gradable adjectives need to be determined according to the context(Ginet, 1973; Kamp, 2013; Klein, 1980).

Kennedy' s analysis falls into the general family of scalar analyses. However, Kennedy also makes some revolution to the classical scalar analysis, particularly as to the semantic type of gradable adjectives, as well as the interpretation of degrees.

Firstly, classical scalar analyses characterize the core meaning of gradable adjectives as an ordering relation between the target and the degree. Most scholars employing scalar approaches also believes the free variable degree to be bound by a quantificational expression(Hellan, 1981; Hoeksema, 1983; Von Stechow, 1984a). In contrast, Kennedy assumes that gradable adjectives denote measure function, giving rise to his non-quantificational analysis of degree constructions.

Kennedy identifies three semantic constituents in degree constructions (Russell, 1905):

1. A reference value $G(x)$, expressing the projection from the target x to the scale associated with the gradable adjective G.

2. A standard value s, which is indicated via measure phrase or the comparative clause landing at the complement position of the preposition "*than*".

3. Degree relation R, a partial ordering relation encoded by degree morphemes, elements of {*er/more, less, as, too, enough, so, how, ...*}, which compares the reference value and the standard value.

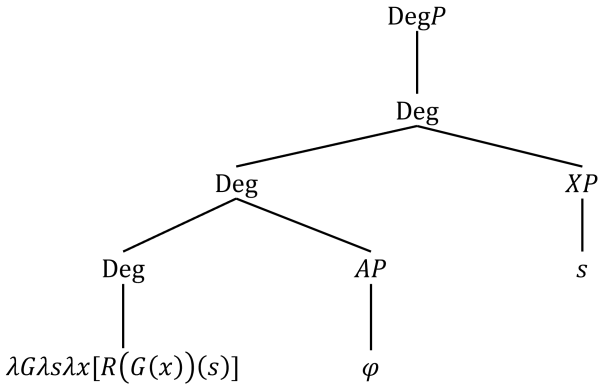
The formalization of degree constructions is shown in (10).

(10) $\lambda x.[R(G(x))(s)]$

In terms of the syntactic structure of degree constructions, Kennedy projects the degree phrase headed by a degree morpheme as a functional phrase above the adjective phrase headed by a gradable morpheme, an account which is developed from approaches where adjectives are projected

to an extended functional structure (Abney, 1987; Corver, 1990, 1997b; J, 1991). The syntactic tree structure of degree constructions is shown in (11):

(11)



Typically, scholars think that the meaning of gradable adjectives is composed of two major parts: a measure function and an ordering relation (Carston, 2013; Horn, 1992).

In contrast, Kennedy' s analysis excludes the relational component from the meaning of gradable adjectives, rather assigning this semantic part to the degree morphology. This division of labour between the gradable adjective and the degree morphology is also reflected by the AP/DegP extended projection. Therefore, Kennedy' s analysis revises the semantic type of gradable adjectives from the traditional version $< d, < e, t >>$ to the simplified version $< e, t >$, making the complexity transmitted to the degree morphology.

Secondly, Kennedy makes refinement to the interpretation of degrees. He argues that degrees should be formalized as extents(Bierwisch, 1989; Löbner, 2010; Seuren, 1978; Von Stechow, 1984b) rather than as points on a scale, which is different from classical scalar analyses. Based on this extent-scalar view, Kennedy assumes that gradable adjectives characteristic of adjectival polarity can be divided into positive adjectives, such as "*tall*", and negative ones, such as "*short*". According to this distinction, the anomaly of comparisons made between antonymous adjectives as shown in (12) can be explained by the undefined ordering relation for extents of opposite polarity:

(12) *Carmen is taller than Mike is short.

2.2 *Lexical entry of gradable adjective*

In order to take a deep investigation about phenomena mentioned in last section, we shall go back to the really beginning: the lexical entry of gradable adjectives.

After a series of debates, form the modern view, there are two typical hypotheses of what this lexical entry should look like, which are shown in (13). The definition of lexical entry of gradable adjectives is literally important, because different definitions of adjectives' lexical entry always lead totally different results in semantics and syntax just like butterfly effect.

(13) (a) $[\![tall]\!] = \lambda d \lambda x.[Height(x) \geq d]$

(b) $[\![tall]\!] = Height(x) = d$

(13a) is a traditional lexical entry of gradable adjectives, and many researchers believe in it (refhere). Under this definition, gradable adjective "*tall*" is considered as a relation of "greater equal", which is true when an individual x as input and x's height is at least as great as d. A simple application of this kind of lexical entry definition to (14) is shown in (15).

(14) 2 meters tall.

(15) (a) $[\![tall]\!] = \lambda d \lambda x.[Height(x) \geq d]$

(b) $[\![2\ meters\ tall]\!] = \lambda x.[Height(x) \geq 2\ meters]$

Actually, lexical entry definition like (13a) remains a problem with corresponding examples shown in (16). In English, sometimes measure phrase can not directly combine with negative-pole adjectives. We can say someone is "*2 meters tall*", but can not say someone is "*2 meters short*". But situation changes when suffix "*er*" shows up in (16c), "*2 meters shorter*" is a correct usage in English. Besides, this phenomenon is also a language-specific problem, in Japanese, we can not combine measure phrase even with "*segatakai*(*tall*)". Traditional lexical entry of gradable adjectives has no ability to explain this phenomenon.

(16) (a) 2 meters tall. 10 years old.

(b) *2 meters short. *10 years young.

(c) 2 meters shorter. 10 years younger.

Based on the problem mentioned above, there is another group of researchers propose that the gradable adjectives' lexical entry should not encode the partial ordering relation, instead, the gradable adjectives should reveal the original property of an individual, which means "*tall*" should simply illustrate the height of an individual. Thus the lexical entry of gradable adjectives should looks like (13b), in which there is just a measure function.

Under this assumption, the partial ordering relation still needs a place to be introduced, if not, there will be a lexical entry type mismatch. The type of measure function "*tall*" is $< e, d >$, but measure phrase is type d, so gradable adjectives are no way to composite with measure phrase on account of type-theoretic. To resolve this problem, Svenonius(Svenonius & Kennedy, 2006) claims that there is a null operator whose semantic function is linking the lexical entry of gradable adjectives and the lexical entry of measure phrase, and syntactic function is to introduce a degree argument and bear the mission of introducing the "greater equal" meaning. The denotation of this null operator is spelled out in (17), and the (17c) shows the composition of null operator and gradable adjective, which is same with (13a). The lexical entry of (17c) is $< d, < e, t >>$, which can combine with measure phrase with out any type conflict.

(17) (a) $[\![nop]\!] = \lambda G_{<e,d>} \lambda d \lambda x.[G(x) \geq d]$

(b) $[\![tall]\!] = Height(x)$

(c) $[\![nop\ \ tall]\!] = [\![nop]\!]([\![tall]\!])$

$= \lambda d \lambda x.[Height(x) \geq d]$

Although the lexical result of null operator and adjectives in (17c) looks exactly same with traditional lexical entry of gradable adjectives in (13a), which makes this null operator seems redundant. But this "null operator + gradable adjective" structure resolve the problem mentioned in (16). Actually, this design separates the "individual property function" from "greater equal meaning", the former's owner is gradable function, and latter's owner is null operator. It is null operator who does not select for "*short*" when measure phrase is "*2 meters*". And, this idiosyncratic property of null operator is language-specific. The advantage of this kind of structure is leaving language-specific problem to null operator and keeping gradable adjectives away form any idiosyncratic language-specific properties.

Next questions are, whether this null operator has a specific phonetic expression in any language and where its position is in syntactic structure.

For the first question, Svenonius does a deep investigation about Icelandic and Norwegian, which shows that a phonetic word of this null operator does not exist in Norwegian but does exist in Icelandic. In Icelandic, (18) gives three different ways to express the same meaning. In (18a), the word "*Hversu*" is mapping to two English words "*how.much*", but actually "*Hversu*" only used as a degree operator, and it does not bear the function of manner adverbial. In (18b), speaker can omit word "*Hversu*" and front predicate to express the same meaning. Also, in (18c), a word "*Hvað*" can be placed at the beginning of the sentence, and keep all other morphemes in their original position. What should be noticed is that the Icelandic word "*Hvað*" does not have real meaning, it is just a phonologically placeholder, which exactly is an evidence of the existence of null operator. For the latter question, Svenonius gives syntactic structures of (18) respectively as shown in (19). From Svenonius' perspective, null operator and the word "*Hvað*" show the same locality conditions which is same with famous *wh*-movement.

(18) (a) Hversu gammall ertu?

how.much old are.you

how old are you?

(b) er du gammel?

are you old

how old are you?

(c) Hvað ertu gammall?

null are you old

how old are you?

(19) (a) $[_{CP}Nop_1\ er_2[_{IP}du_3\ t_2[_{VP}t_2[_{AP}t_3\ t_1\ gammel]]]]$

(b) $[_{CP}Hva\eth_1\ er_2[_{IP}\ -tu_3\ t_2[_{VP}t_2[_{AP}t_3\ t_1\ gammel]]]]$

The $< e, d >$ type gradable adjectives seems a perfect definition. But I have to point out that, both lexical entries in (13) may cause a mismatch between the meaning given by lexical calculation and meaning given by language common sense.

Since there are serval kinds of constructions of degree structure, positive form, comparative form, equative form and superlative form, a lexical meaning should have ability to give a interpretation of all these constructions. (20) gives a positive form example, and it's lexical entry calculation is shown in (21), who uses traditional gradable adjectives lexical type in (13a). To resolve λ reduction, the lexical entry of "*tall*" needs a measure phrase with lexical entry d and an individual x , which are respectively "*2 meters*" and "*John*". "*2 meters*" changes the semantic type of "*tall*" from $< d, < e, t >>$ to $< e, t >$, and "*John*" is input as type e which makes final result to type t. The result of lexical entry calculation tells a truth that John's height is not only equal to 2 meters precisely, but also has a possibility to greater than 2 meters. But actually we do know that sentence in (20) means John's height is 2 meters accurately, which is mismatch with the result of semantic calculation. The reason why this mistake is made is that the partial ordering relation of degree is encoded in gradable adjectives, and there is no way to resolve this "greater equal" . (13b) will also lead this problem, since the lexical entry of the combination of null operator and gradable adjective is same with the lexical entry shown in (13a).

(20) Jhon is 2 meters tall.

(21) (a) $[\![tall]\!] = \lambda d \lambda x.[Height(x) \geq d]$

(b) $[\![2\ meters\ tall]\!] = [\![tall]\!](2m)$

$= \lambda x.[Height(x) \geq 2m]$

(c) $[\![John\ is\ 2\ meters\ tall]\!] = [\![tall\ 2m]\!](John)$

$= Height(John) \geq 2m$

To fix this problem, this paper propose that the lexical entries of gradable adjective in superiority meaning and assignable meaning should be different. The detail will be discussed in next section.

2.3 *DegP hypotheses and DegP-Shell*

Before Abney, most researchers believe degree phrase is a specifier of adjective phrase, but Abney argues that degree phrase is a functional projection which is above the adjective phrase (Abney, 1987). This theory is called DegP hypotheses by later scholars. In DegP hypotheses, the general structure is described as followed. The XP in (22) is different in different situation, it may quantifier phrase, or differential phrase, or measure phrase. Three examples and their syntactic structures shown in (23).

(22) $[_{DegP} XP[_{Deg'} Deg^0[_{AP} ...]]]$

(23) (a) much too tall.

$[_{DegP}[_{QP} much]][_{Deg'} Deg^0\ \ too[_{AP} tall]]$

(b) two meters as tall.

$[_{DegP}[_{MP} two\ \ meters]][_{Deg'} Deg^0\ \ as[_{AP} tall]]$

(c) two meters taller.

$[_{DegP}[_{DiffP} two\ \ meters]][_{Deg'} Deg^0\ \ er[_{AP} tall]]$

After basic DegP hypotheses, there are serval modified versions raised up by later researchers. The most important modification of DegP hypotheses is the Larson's DegP-shell structure (Larson, 1991). In Larson's research, he propose a DegP-shell based on VP-shell structure, which is shown in (24). Compare to single layer DegP hypotheses, shelled structure has the ability to described a whole comparative form, such as example in (25).

(24) $[_{DegP}[_{Deg'} Deg^0[_{DegP} AP[_{Deg'} Deg^0[_{PP} ...]]]]]$

(25) John is taller than Mary. $[_{DegP} John[_{Deg'} Deg^0[_{DegP} AP[_{Deg'} Deg^0[_{PP} ...]]]]]$

3. MANDARIN DEGREE SEMANTIC ANALYSIS

In this section, this paper will do serval works to give a semantic and syntactic analyses of simple degree structure in Mandarin. At the first, based on former researchers' work, this paper will give lexical entry of gradable adjectives. After that, based on classification given in introduction, this paper will give a whole analyses respectively.

From this paper's view, different meaning of degree constructions should have different lexical entries of gradable adjectives. Because the function of gradable adjectives is totally different in superiority meaning and assignable meaning. As discussed in introduction, a degree structure is superiority meaning when gradable adjective bears comparison function, so this paper adopt the partial ordering definition of lexical entry, which is re-wrote in (26a); and on the opposite, a degree structure is assignable meaning when gradable adjective bears assignment function, thus the lexical entry of gradable adjective should have a equal sign, which is shown in (26b).

Another reason which supports the separation of lexical entries is the mistake mentioned in last section. If a positive form has "greater than" meaning in gradable adjective, a wrong result will be calculated which makes "*John is 2 meters tall*" expresses "John is more than 2 meters tall".

(26) (a) $[\![tall]\!] = \lambda d \lambda x.[Height(x) \geq d]$

(b) $[\![tall]\!] = \lambda d \lambda x.[Height(x) = d]$

Next, follow the classification given in the introduction, the syntactic structure and semantic calculation will be given respectively in follow parts.

3.1 *Comparative meaning*

At the beginning, this paper proposes that there are two types syntactic structures in comparative meaning. For convenient, we give the two layers structure a name "DegP-AP" structure, and three layers structure a name "DegP-DegP-AP".

In the "DegP-DegP-AP" structure, the head of the higher DegP functions to introduce the standard, and the head of the lower DegP functions to introduce the difference between the comparee and the standard which is denoted by a differential phrase. The gradable adjective is the head of the adjective phrase. For the semantic part, given the DegP hypotheses illustrated above, the higher DegP is obligatory in that, the extra argument d should be bound by a functional projection which ultimately shifts the semantic type of gradable adjectives form $< d, < e, t >>$ to $< e, t >$, in order to absorb the comparee typed e successfully. The differential phrase is not required by the lexical entry of gradable adjectives, which can also support its optional appearance. From our intuition, the non-appearance of a standard (explicit or implicit) leads to the failure of expressing the comparative meaning, in contrast, the difference between the comparee and the standard should in no way be expressed consistently. In addition, the occurrence of the difference between two objects naturally requires the the occurrence of the two objects to be compared as a prerequisite. Here we assume that the lower DegP is projected if and only if there is an explicit differential phrase and the differential phrase is strictly greater than zero. The explanations of this assumption will be elaborated immediately on the below. In addition, the non-appearance of a projection when it is not needed in completing the meaning of an utterance also satisfies the economical principal of language.

We further classifies the comparative meaning into three distinct subtypes, which are positivity, superiority and equality. We will unfold the syntactic structures and the semantic interpretations of these three subtypes below.

3.1.1 *Positivity*

3.1.2 *Superiority*

$[\![\xi_{1,1}]\!] = \lambda G \lambda d \lambda x.[G(x, d)] \qquad << d, < e, t >>, < d, < e, t >>$

$[\![\xi_{1,2}]\!] = \lambda G \lambda x.[G(x, d_{stnd})] \qquad << d, < e, t >>, < e, t >>$

$[\![\xi_{2,1}]\!] = \lambda G \lambda y \lambda x. \exists d_1[G(x, d_1) \wedge d_1 = Max\ \ d_2(G(y, d_2))] \qquad << d, < e, t >>, < e, < e, t >>>$

$[\![\xi_{2,2}]\!] = \lambda G \lambda x. \exists d_1[G(x, d_1) \wedge d_1 = Max\ \ d_2(G(y_{stnd}, d_2))] \qquad << d, < e, t >>, < e, t >>$

$[\![\xi_{3,1}]\!] = \lambda G \lambda C \lambda x. \exists d_1[G(x, d_1) \wedge d_1 = Max\ \ d_2(G(C, d_2))] \qquad << d, < e, t >>, < e, < e, t >>>$

$[\![\xi_{3,2}]\!] = \lambda G \lambda x. \exists d_1[G(x, d_1) \wedge d_1 = Max\ \ d_2(G(C_{stnd}, d_2))] \qquad << d, < e, t >>, < e, t >>$

$[\![\mu]\!] = \lambda G \lambda d' \lambda d \lambda x. \exists d_1[G(x, d_1) \wedge |Max\ \ d_1 G(x, d_1) - d| = d'] \qquad << d, < e, t >>, < d, < d, < e, t >>>>$

(27) (a) John bi 2 mi gao.

(b) John bi Mary gao.

(c) zai yi ban, John zui gao.

3.1.3 *Equality*

(28) (a) John he Mary yi yang gao.

3.2 *Assignable meaning*

(29) (a) John gao 2 mi.

(b) John you 2 mi gao.

4. CONCLUSION

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