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The semantics of *yuè V yuè A* in Mandarin Chinese: Coercion and the necessarily temporal reading

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1 Introduction

Yuè . . . *yuè* sentences in Mandarin are akin to comparative correlatives in English and other languages and have been the object of several recent studies (Lin 2007, Liu 2008, E 2014). Most attention in previous analyses has been paid to *yuè* . . . *yuè* sentences in which both the predicate which occurs after the first *yuè* (V1) and the predicate which occurs after the second *yuè* (V2) are gradable: either gradable adjectives or gradable verbs, illustrated in (1) and (2), respectively.

(1) *Píngguǒ* ***yuè*** *dà*, ***yuè*** *tián*.
apple YUE big YUE sweet
'The bigger an apple is, the sweeter it is.'

(2) *Zhāngsān* ***yuè*** *xǐhuān Lìsì*, *wǒ* ***yuè*** *tǎoyàn Lǐsì*.
Zh. YUE like L. I YUE resent L.
'The more Zhangsan likes Lisi, the more I resent Lisi.'

What has received far less attention are *yuè* . . . *yuè* sentences with non-gradable predicates. In this paper we focus on *yuè* . . . *yuè* sentences with a non-gradable V1 and a gradable V2, which we also refer to as *yuè V yuè A* sentences, as in (3). We show that this class of *yuè* . . . *yuè* sentences displays a distinctive necessarily temporal reading, develop a semantic account of this fact, and also argue that, in contrast to other *yuè* . . . *yuè* sentences which are always biclausal, *yuè* . . . *yuè* sentences with a non-gradable V1 may be monoclausal.

(3) *Zhāngsān* ***yuè*** *pǎo* ***yuè*** *kuài*.
Zh. YUE run YUE fast
'Zhangsan ran faster and faster.'

2 The Gradability of a Predicate

The gradability of a predicate in Mandarin can be determined on the basis of whether or not it can be modified by a degree modifier such as *hěn* (very). By this test, in (4) and (5), we can see that V1 in (1) and (2) are gradable, and in (6), that V1 in (3) is non-gradable.

(4) *zhè gè píngguǒ* ***hěn*** *dà*.
this Cl apple very big
'This apple is very big.'

(5) *Zhāngsān **hěn** xǐhuān chī píngguǒ.*
Zh. very like eat apple
'Zhangsan likes eating apples.'

(6) **Zhāngsān **hěn** pǎo.*
Zh. very run

3 The Necessarily Temporal Reading

Yuè ... yuè sentences with non-gradable V1 display a necessarily temporal reading not observed in *yuè ... yuè* sentences with a gradable V1. That is, the truth of a *yuè ... yuè* sentence with a non-gradable V1 requires the value of V2 to increase over time; for instance, the truth of (3) requires Zhangsan's running speed to increase over time. Thus, (3) is intuitively false in Scenario A in Table 1, where Zhangsan's running speed does not increase over time, but true in Scenario B in Table 2, where Zhangsan's running speed does increase over time.

Table 1: Scenario A

Day	Length	Speed
1	Zhangsan ran 5 miles	his running speed was 5.3 mph
2	Zhangsan ran 4 miles	his running speed was 5.2 mph
3	Zhangsan ran 3 miles	his running speed was 5.1 mph

Table 2: Scenario B

Day	Length	Speed
1	Zhangsan ran 3 miles	his running speed was 5.1 mph
2	Zhangsan ran 3 miles	his running speed was 5.2 mph
3	Zhangsan ran 3 miles	his running speed was 5.3 mph

In contrast, a *yuè ... yuè* sentence with a gradable V1 does not have a necessarily temporal reading, i.e. does not require the value of V2 to increase over time. Consider for instance the *yuè ... yuè* sentence in (7), which is similar to (3) except that V1 is gradable. Unlike (3), (7) does not require Zhangsan's running speed to increase over time. In particular, (7) is intuitively true in Scenario A in Table 1 above, where Zhangsan's running speed does not increase over time, unlike (3).[1]

(7) *Zhāngsān pǎo-de **yuè** duō, (jiù) **yuè** kuài.*
Zh. run-DE YUE much then YUE fast
'The more Zhangsan ran, the faster he went.'

Before turning to our own analysis of these facts, we review the semantics of *yuè ... yuè* sentences in Lin (2007) and show that it does not capture the facts discussed in this section.

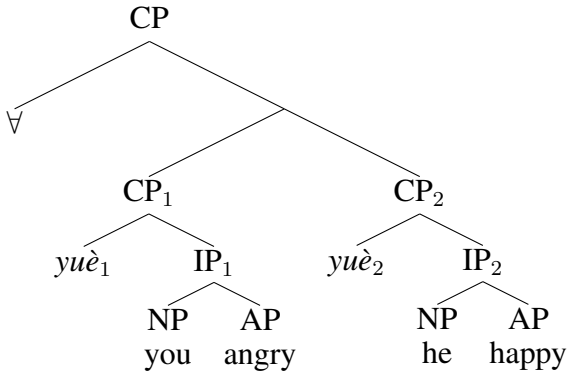
[1]The same contrast holds for the English translations offered in (7) and (3). That is, the former is true in Scenario A in Table 1, but the latter is false.

4 Previous analysis of *yuè ... yuè*: Lin (2007)

Lin (2007) analyzes *yuè ... yuè* sentences with gradable V1 and V2 as biclausal structures. For instance, Lin offers (9) as the syntactic analysis of the *yuè ... yuè* sentence in (8).

(8) *nǐ yuè shēngqì, tā (jiù) yuè gāoxìng.*
you YUE angry he then YUE happy
'The angrier you are, the happier he (then) is.'

(9)



Following Beck (1997), Lin (2007) proposes the semantics for *yuè* in (10) and compositionally derives the semantics of *yuè ... yuè* sentences. For instance, (11) is the semantics that Lin assigns to the syntactic analysis of (8) in (9).

(10) $[\![\textit{yuè}]\!] = \lambda P_{<d<st>>}\lambda d_1 d_2 \lambda s_1 s_2 [P(d_1)(s_1) \wedge P(d_2)(s_2) \wedge d_1 < d_2]$

(11) $[\![(9)]\!] = \forall d_1 d_2 s_1 s_2 [\text{angry(you)}(d_1)(s_1) \wedge \text{angry(you)}(d_2)(s_2) \wedge d_1 < d_2] \rightarrow \exists d_3 d_4 s_3 s_4 [s_1 \leq s_3 \wedge s_2 \leq s_4 \wedge \text{happy(he)}(d_3)(s_3) \wedge \text{happy(he)}(d_4)(s_4) \wedge d_3 < d_4 \wedge R(<d_1, s_1>, <d_3, s_3>) \wedge R(<d_2, s_2>, <d_4, s_4>)]$

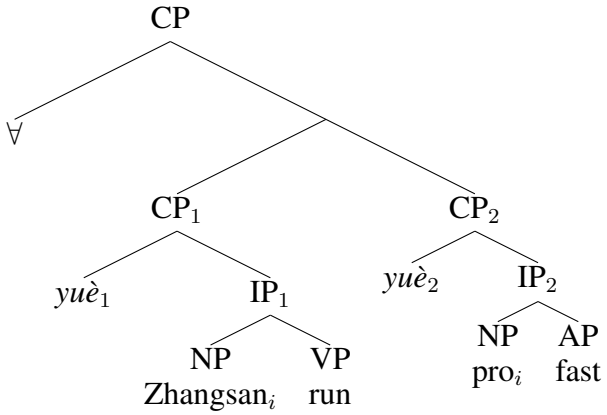
Intuitively, (11) states that for all pairs of situations of you being angry such that the degree to which you are angry is greater in the second than in the first, there correspond situations of him being happy such that the degree to which he is happy in the situation related to the second is greater than in that related to the first. This semantics adequately captures the truth-conditions of the *yuè ... yuè* sentence with gradable V1 and V2 in (8); namely, that (8) is true if and only if an increase in the value of V1 correlates with an increase in the value of V2.

However, the compositional semantics consequently assigned to *yuè ... yuè* sentences with non-gradable V1 on Lin's analysis are inadequate to account for their necessarily temporal reading. Following Doetjes (1997), Lin (2007:187) proposes that non-gradable predicates lexicalize a degree argument in a manner parallel to gradable adjectives. For instance, Lin (2007:187-8) proposes the semantics in (12a) for the non-gradable predicate *zǒu* (walk), parallel to the semantics assigned to the gradable adjective *gāoxìng* (happy) in (12b), and characterizes the contribution of the degree argument of walk in (12a) as measuring the amount of walking in s.

(12) a. $[\![\text{walk}]\!] = \lambda x_e \lambda d_d \lambda s_s \text{ walk}(x)(d)(s)$
b. $[\![\text{happy}]\!] = \lambda x_e \lambda d_d \lambda s_s \text{ happy}(x)(d)(s)$

In a manner parallel to (8) above and its syntactic analysis in (9) and compositionally derived semantics in (11), the syntactic analysis and compositional semantics that Lin predicts for (3) are given in (13) and (14), respectively. Intuitively, (14) states that for all pairs of situations of Zhangsan running such that Zhangsan does a greater amount of running in the second than the first, there correspond situations of Zhangsan running fast such that the speed of the situation related to the second is greater than that related to the first. Problematically, then, the semantics in (14) predicts that (3) should be true in Scenario A in Table 1, where Zhangsan's running speed increases as the quantity of Zhangsan's running increases, contrary to fact.

(13)



(14) $[\![(13)]\!]^{g[i\rightarrow Zhangsan]} = \forall d_1 d_2 s_1 s_2[run(Zh)(d_1)(s_1) \wedge run(Zh)(d_2)(s_2) \wedge d_1 < d_2] \rightarrow \exists d_3 d_4 s_3 s_4[s_1 \leq s_3 \wedge s_2 \leq s_4 \wedge fast(Zh)(d_3)(s_3) \wedge fast(Zh)(d_4)(s_4) \wedge d_3 < d_4 \wedge R(<d_1, s_1>, <d_3, s_3>) \wedge R(<d_2, s_2>, <d_4, s_4>)]$

Thus, Lin's semantics is empirically inadequate for *yuè* … *yuè* sentences with non-gradable V1. In the following, we will propose our own semantic analysis of this class of *yuè* … *yuè* sentences. First, however, we take a closer look at the syntax of this class of *yuè* … *yuè* sentences and argue that the biclausal analysis exemplified in (13) is not necessary.

5 Syntactic Analysis

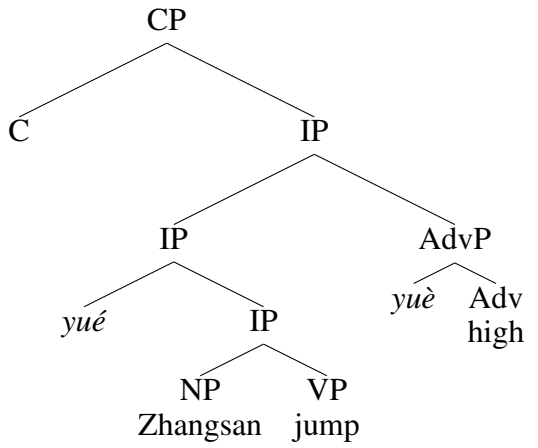
We claim that *yuè* … *yuè* sentences with a non-gradable V1 may allow either a monoclausal or a biclausal parse. For instance, we propose that (15) allows either a monoclausal or a biclausal parse.

(15) *Zhāngsān yuè tiào yuè gāo.*
Zh. YUE jump YUE tall/high
(i) 'Zhangsan jumped higher and higher.',
(ii) 'The more Zhangsan jumped, the taller he became.'

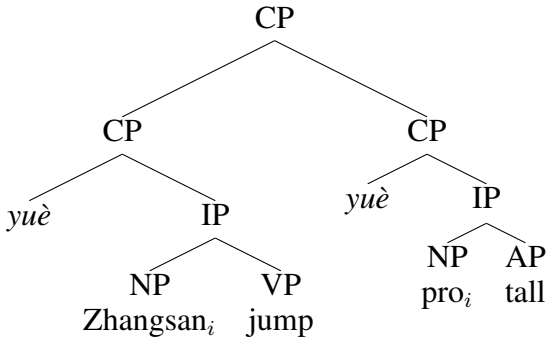
Note that (15) is associated with two readings. In the monoclausal parse we propose in (16), V1 is the matrix verb and the phrase containing *yuè* and V2 is

a postverbal adjunct modifying the matrix clause[2]; hence the monoclausal parse is associated with reading (i) in (15) on which *gāo* (tall/high) is predicated of the event of jumping. In the biclausal parse we propose in (17), the phrase containing *yuè* and V1 is a clausal adjunct and the phrase containing *yuè* and V2 is the matrix clause. The biclausal parse is associated with reading (ii) in (15) on which *gāo* (tall/high) is predicated of Zhangsan, via a null pronoun subject of the matrix clause which is coreferenced with the subject of the adjunct clause.

(16)



(17)



As evidence for this syntactic analysis, first note that in *yuè* … *yuè* sentences with a gradable V1, which are always biclausal, the Adverb *jiù* (then) may appear in the second clause but not in the first, as illustrated in (18). Similar remarks apply to the Modal *huì* (will), as illustrated in (19).

(18) a. *nǐ yuè shēngqì, tā **jiù** yuè gāoxìng.*
you YUE angry he then YUE happy
'The angrier you are, then the happier he is.'

b. **nǐ **jiù** yuè shēngqì, tā yuè gāoxìng.*
you then YUE angry he YUE happy

[2]While manner adverbials may follow a verb in Mandarin Chinese (Ernst 1995), the syntactic analysis we propose in (16) requires us to give up a principle to the effect that only these types of adjuncts may follow a verb in Mandarin Chinese; in particular, we must also allow for *yuè* adjuncts to do so. Clearly, there is more to be said about why *yuè* postverbal adjuncts are possible, but we forgo this discussion here.

(19) a. *nǐ yuè shēngqì, tā **huì** yuè gāoxìng.*
you YUE angry he will YUE happy
'The angrier you are, the happier he will be.'
b. **nǐ **huì** yuè shēngqì, tā yuè gāoxìng.*
you will YUE angry he YUE happy

In contrast, with a *yuè … yuè* sentence with a non-gradable V1 such as (15), *jiù* (then) and *huì* (will) may precede either the first or second *yuè*.

(20) a. *Zhāngsān yuè tiào **jiù** yuè gāo.*
Zh. YUE jump then YUE tall/high
'The more Zhangsan jumped, the taller he then became.'
b. *Zhāngsān **jiù** yuè tiào yuè gāo.*
Zh. then YUE jump YUE tall/high
'Zhangsan then jumped higher and higher.'

(21) a. *Zhāngsān yuè tiào **huì** yuè gāo.*
Zh. YUE jump will YUE tall/high
'The more Zhangsan jumps, the taller he will become.'
b. *Zhāngsān **huì** yuè tiào yuè gāo.*
Zh. will YUE jump YUE tall/high
'Zhangsan will jump higher and higher.'

Moreover, note that with each positioning, the sentence is now disambiguated. When *jiù* or *huì* precedes the second *yuè*, only reading (ii) in (15) where *gāo* (tall/high) is predicated of Zhangsan is available; whereas when *jiù* or *huì* precedes the first *yuè*, only reading (i) in (15) where *gāo* (tall/high) is predicated of the jumping event is available.

Our syntactic analysis can account for these facts. Suppose that the adjunct clause in the biclausal parse of a *yuè … yuè* sentence such as (17) is reduced and cannot host elements such as the higher Adverb *jiù* (then) or the Modal *huì* (will), but that a matrix clause can host these elements. It follows that in *yuè … yuè* sentences with gradable V1, which are biclausal, *jiù* (then) and *huì* (will) may only precede V2 and not V1; as is indeed the case, as observed in (18) – (19). It also correctly follows that the reading associated with the biclausal parse of (15) will only be available when *jiù* (then) or *huì* (will) precede V2 but not V1, as observed in (20) and (21). In the monoclausal structure, V1 is the matrix verb and hence *jiù* (then) and *huì* (will) can precede it but V2 is not in a clause, but rather just a small adjunct, and so cannot license *jiù* (then) or *huì* (will). It follows that the reading associated with the monoclausal parse will only be available when *jiù* (then) or *huì* (will) precede V1, as observed in (20) and (21).

As further evidence for our syntactic analysis, note that if an overt subject pronoun is added to (15) before the second *yuè*, the sentence again disambiguates and only reading (ii) of (15) where *gāo* (tall/high) is predicated of Zhangsan is possible.

(22) *Zhāngsān yuè tiào* ***tā*** *yuè gāo*.
Zh. YUE jump he YUE tall/high
'The more Zhangsan jumped, the taller he became.'

The facts are the same if *jiù* precedes the second *yuè*.

(23) *Zhāngsān yuè tiào*, ***tā*** *jiù yuè gāo*.
Zh. YUE jump he then YUE tall/high
'The more Zhangsan jumps, the taller he then becomes.'

However, the sentence with an overt pronoun before the second *yuè* becomes unacceptable if *jiù* precedes the first *yuè*.

(24) ??*Zhāngsān jiù yuè tiào*, ***tā*** *yuè gāo*.
Zh. then YUE jump he YUE tall/high
'Zhangsan then jumped higher and higher.'

Again, these facts can be accounted for on our proposed syntactic analysis. The biclausal parse of (15) in (17) contains a subject position in the clause containing V2, the matrix clause. We have claimed that the reading associated with this parse, whereby *gāo* (tall/high) is predicated of Zhangsan, is mediated through a null subject pronoun in the matrix clause which is coreferential with the subject of the adjunct clause. On this analysis, this subject pronoun can certainly be made overt and retain the meaning, which is what is observed in (22). Moreover, taking the presence of *jiù* (then) before V2 to be a diagnostic of the biclausal parse, as argued directly above, it follows that an overt subject is also possible when *jiù* (then) precedes V2, as observed in (23). In contrast, the monoclausal structure in (16) does not license a subject position before the second *yuè*; this is just a small adjoined phrase and not a clause. Therefore, taking the presence of *jiù* (then) before V1 to be a diagnostic of a monoclausal parse, as argued directly above, it follows that *jiù* (then) preceding V1 will be incompatible with an overt subject preceding the second *yuè*, as indeed is observed in (24).

In this way, we have shown that our syntactic analysis whereby a *yuè* ... *yuè* sentence with a non-gradable V1 may admit of a monoclausal or a biclausal parse accounts for the facts reviewed in this section.

6 Semantic Analysis

We follow Kennedy (2001) in modeling degrees as intervals on a scale and in distinguishing two sorts of degrees, positive and negative degrees. Positive degrees are intervals that range from the lower end of a scale to some point, and negative degrees are intervals that range from some point to the upper end of the scale. The minimal element of the scale is called the zero point. Scales without a maximal element extend into infinity. For instance, for a given point n on a scale with a minimal but no maximal element, the interval from the zero point to n constitutes a positive degree and the interval from n to infinity, the upper end of the scale, constitutes a negative degree, as illustrated in Figure 1.

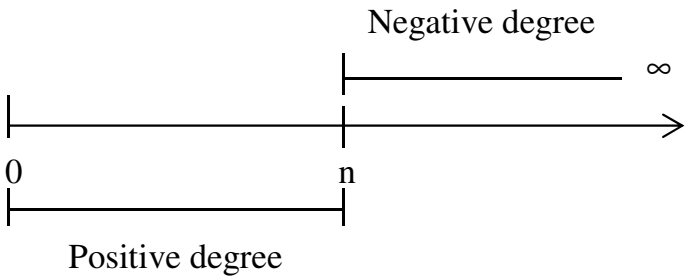


Figure 1: Positive and negative degrees on a scale with a minimal but no maximal element.

Kennedy (2001:53) posits functions POS and NEG such that, for a given scale S, POS(S) returns the set of positive degrees on S and NEG(S) returns the set of negative degrees on S.[3] Natural language expressions which denote degrees appear to be restricted to either positive or negative degrees. For instance, measure phrases, such as *21 pages*, denote positive degrees (Kennedy 2001:60) and gradable adjectives denote measure functions, i.e. functions from objects to degrees: positive adjectives denote functions from objects to positive degrees, and negative adjectives denote functions from objects to negative degrees (Kennedy 2001:52). Comparative morphemes denote ordering relations between degrees (Kennedy 2001:51). For instance, Kennedy (2001:54) suggests that English *more* denotes the ordering relation in (25), which basically tests whether its second argument is a proper subinterval of its first.

(25) $\lambda d_1 \lambda d_2.\ d_1 \cap d_2 = d_2 \wedge d_1 \neq d_2$

We follow Lin (2007) in assigning a comparative semantics to *yuè*.

(26) $[\![\ \textit{yuè}\ ]\!] = \lambda P_{<d<et>>} \lambda x_1 \lambda x_2 \exists d_1 \exists d_2.\ P(d_1)(x_1) \wedge P(d_2)(x_2) \wedge d_1 \sqsubset d_2$

We further propose that there is another *yuè* which is used when combining with a non-gradable VP. Note that it differs from the previous *yuè* only in the type of its property argument and corresponding changes in the further arguments it expects.

(27) *yuè* + $VP_{non-gradable}$
$[\![\ \textit{yuè}\ ]\!] = \lambda P_{<vt>} \lambda e_1 \lambda e_2.\ P(e_1) \wedge P(e_2) \wedge e_1 \sqsubset e_2$

To account for the ill-formedness of comparisons between positive and negative degree-denoting phrases as in (28), Kennedy (2001:58) proposes that comparative morphemes such as *more* presuppose that their degree arguments are of the same sort. If degrees are of different sorts, the ordering between the two is undefined and semantic anomaly results.

[3] It must be emphasized that this function POS is distinct from the operator pos which is invoked to derive the meaning of the positive form of an adjective such as *tall* (Cresswell 1976) and from the null Degree morpheme *pos* which is taken to denote this operator (Kennedy 2007).

(28) ?Alice is shorter than Carmen is tall. (Kennedy 2001:58)

In effect, then, on Kennedy's analysis, *more* carries a presupposition to the effect that its two degree arguments share the same start point (or end point). In a similar way, we propose that *yuè* carries a presupposition to the effect that the two elements it orders share a common starting point. If this requirement is not met, the semantics is undefined and the sentence is ill-formed.

Now, since degree-denoting natural language expressions appear to be restricted to denoting positive or negative degrees, the ordering relation denoted by a comparative morpheme only ever evaluates positive or negative degree arguments. However, in the case of an ordering relation on events, there is no such independent safeguard in place to guarantee that its two arguments will share a common starting point. As in *yuè* ... *yuè* sentences there is quantification over the two event arguments that *yuè* evaluates (see (11) above), the entire quantification will be undefined since many such pairs will not share a common starting point. As a result, all instances of *yuè* ... *yuè* sentences with a non-gradable V1 would be undefined and give rise to semantic anomaly. We propose that in order for *yuè* to felicitously combine with a VP denoting a set of events, the VP must first be modified by a coercion operator; see De Swart (1998) and Sawada & Grano (2011) on coercion operators in natural language. We propose the coercion operator in (29), which introduces a superevent which all events are subintervals of and share a common starting point with. Note that it is similar in its effect to the function POS in Kennedy (2001:53), which returns the set of positive degrees on a given scale; for instance, all degrees that begin at the zero point of the scale.

(29) $[\![C_E]\!] = \lambda P \lambda e.\ P(e) \wedge P(E) \wedge \text{MIN}(e) = \text{MIN}(E) \wedge e \sqsubset E$

We take non-gradable VPs to denote a set of events and that events admit a mereological ordering (Bach 1986, Kratzer 1989), as illustrated in Figure 2.

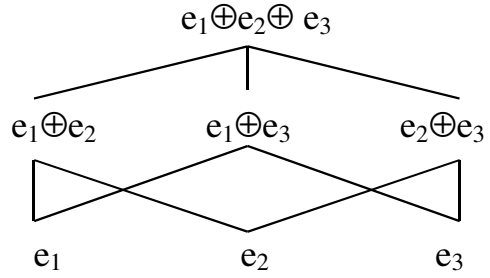


Figure 2: Mereological ordering on a set of events.

When modified by a coercion operator, a non-gradable VP denotes a set of events with a structure parallel to that of positive degrees, as illustrated in Figures 3 and 4. As a result, the denotation of the VP modified by the covert coercion operator does make for a suitable argument for *yuè*.

With these semantic preliminaries in place, we can now present our compositional semantics for the monoclausal parse of (3) in (30).

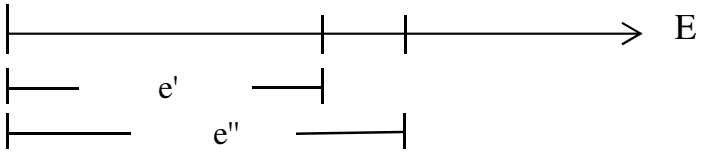


Figure 3: Event subintervals of an event E with the same starting point as E.

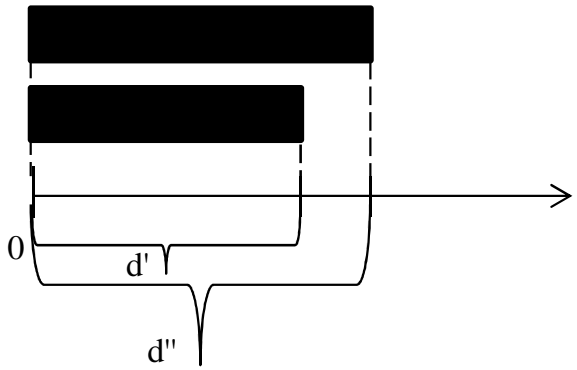
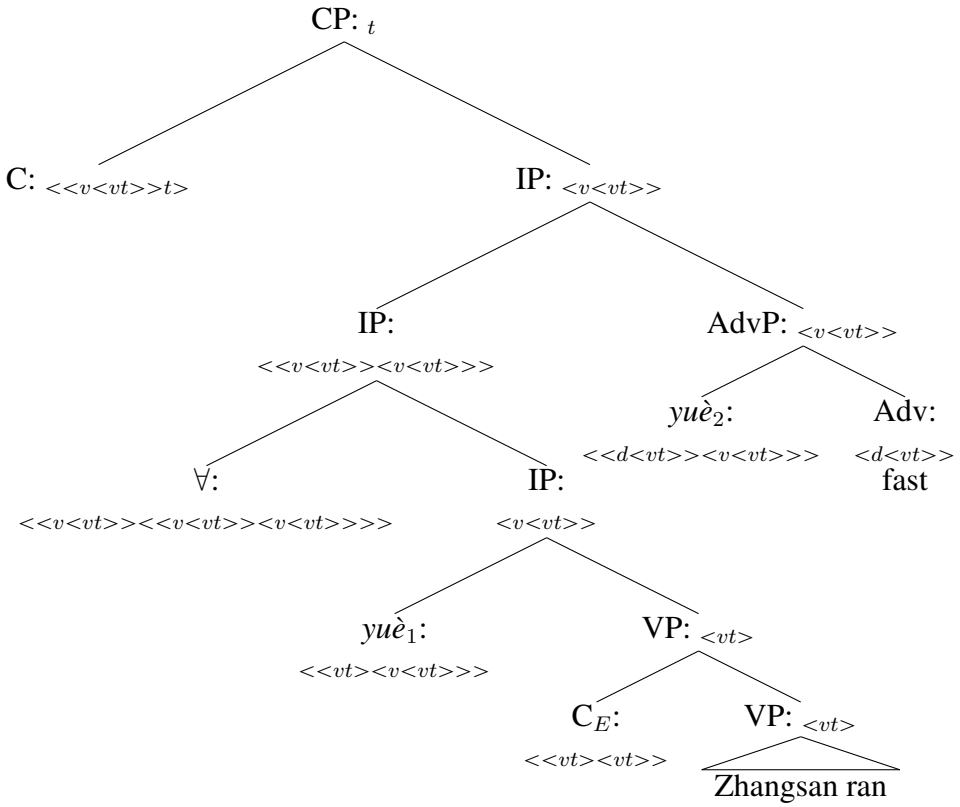


Figure 4: Positive degrees on a scale with a zero point.

(30)



(31) a. $[\![$ Zhangsan ran $]\!] = \lambda e.$ run(Zh, e)

b. $[\![C_E]\!] = \lambda P_{<vt>} \lambda e_v.$ P(e) $\wedge$ P(E) $\wedge$ MIN(e) = MIN(E) $\wedge$ e $\sqsubset$ E

c. $[\![C_E$ Zhangsan ran $]\!] = \lambda e_v.$ run(Zh, e) $\wedge$ run(Zh, E) $\wedge$ MIN(e) = MIN(E) $\wedge$ e $\sqsubset$ E

d. $[\![$ *yuè*$_1$ $]\!] = \lambda P_{<vt>} \lambda e_1 \lambda e_2.$ P(e_1) $\wedge$ P(e_2) $\wedge$ $e_1 \sqsubset e_2$

e. $[\![$ *yuè*$_1$ C_E Zhangsan ran $]\!] = \lambda e_1 \lambda e_2.$ run(Zh, e_1) $\wedge$ run(Zh, e_2) $\wedge$ run(Zh, E) $\wedge$ MIN(e_1) = MIN(E) $\wedge$ MIN(e_2) = MIN(E) $\wedge$ $e_1 \sqsubset$ E $\wedge$ $e_2 \sqsubset$ E $\wedge$ $e_1 \sqsubset e_2$

f. $[\![$ fast $]\!] = \lambda d_d \lambda e_v.$ fast(d)(e)

g. $[\![$ *yuè*$_2$ $]\!] = \lambda P_{<d<vt>>} \lambda e_1 \lambda e_2 \exists d_1 \exists d_2.$ P(d_1)(e_1) $\wedge$ P(d_2)(e_2) $\wedge$ $d_1 \sqsubset d_2$

h. $[\![$ *yuè*$_2$ fast $]\!] = \lambda e_1 \lambda e_2 \exists d_1 \exists d_2.$ fast(d_1)(e_1) $\wedge$ fast(d_2)(e_2) $\wedge$ $d_1 \sqsubset d_2$

i. $[\![\forall]\!] = \lambda P_{<v<vt>>} \lambda Q_{<v<vt>>} \forall e_1 e_2.$ P(e_1)(e_2) $\rightarrow$ Q(e_1)(e_2)

j. $[\![\forall$ *yuè*$_1$ C_E Zhangsan ran $]\!] = \lambda Q_{<v<vt>>} \forall e_1 e_2.$ run(Zh, e_1) $\wedge$ run(Zh, e_2) $\wedge$ run(Zh, E) $\wedge$ MIN(e_1) = MIN(E) $\wedge$ MIN(e_2) = MIN(E) $\wedge$ $e_1 \sqsubset$ E $\wedge$ $e_2 \sqsubset$ E $\wedge$ $e_1 \sqsubset e_2 \rightarrow$ Q(e_1)(e_2)

k. $[\![\forall$ *yuè*$_1$ C_E Zhangsan ran *yuè* fast $]\!] = \forall e_1 e_2.$ run(Zh, e_1) $\wedge$ run(Zh, e_2) $\wedge$ run(Zh, E) $\wedge$ MIN(e_1) = MIN(E) $\wedge$ MIN(e_2) = MIN(E) $\wedge$ $e_1 \sqsubset$ E $\wedge$ $e_2 \sqsubset$ E $\wedge$ $e_1 \sqsubset e_2 \rightarrow \exists d_1 \exists d_2.$ fast(d_1)(e_1) $\wedge$ fast(d_2)(e_2) $\wedge$ $d_1 \sqsubset d_2$

l. $[\![C]\!] = \lambda P \exists v_1 ... v_n.$ P (where $v_1 ... v_n$ are free in P)

m. $[\![C \forall$ *yuè*$_1$ C_E Zhangsan ran *yuè* fast $]\!] = \exists E \forall e_1 e_2.$ run(Zh, e_1) $\wedge$ run(Zh, e_2) $\wedge$ run(Zh, E) $\wedge$ MIN(e_1) = MIN(E) $\wedge$ MIN(e_2) = MIN(E) $\wedge$ $e_1 \sqsubset$ E $\wedge$ $e_2 \sqsubset$ E $\wedge$ $e_1 \sqsubset e_2 \rightarrow \exists d_1 \exists d_2.$ fast(d_1)(e_1) $\wedge$ fast(d_2)(e_2) $\wedge$ $d_1 \sqsubset d_2$

Intuitively, (31m) means that there is an event of Zhangsan running all of whose subintervals which have the same starting point as this event are such that if one is a superinterval of the other, then its associated speed, which we take to be its final speed, is greater than that of the other. In other words, there is an event of Zhangsan running such that for all subevents which have the same starting point as the main event, the longer a subevent lasts, the greater its associated speed. Or, paraphrasing roughly, we may also say that this semantics expresses that Zhangsan ran faster and faster, as desired.

In effect, this semantics captures the necessarily temporal reading of *yuè* ... *yuè* sentences with non-gradable V1. It correctly predicts that (3) is true in a scenario in which Zhangsan's running speed increases over time, but false in one in which Zhangsan's running speed does not increase over time.

For instance, consider again Scenario A in Table 1, where Zhangsan's running speed decreases over time. Our proposed semantics correctly predicts that (3) is false in Scenario A. The salient subevents of Zhangsan's running over three days which share the same starting point as the whole event are the event consisting of the running on Day 1, e_1, the event consisting of the running on Days 1 and 2, e_2, and the event consisting of the running on Days 1, 2, and 3, e_3. The event e_1 is a proper subinterval of e_2 and e_3, and e_2 is a proper subinterval of e_3. Associating with each event Zhangsan's final running speed, i.e. the speed of Zhangsan's running on the last day that the event encompasses, it can be seen in Figure 5 that the associated speed of e_2 is not greater than that of e_1, the associated speed of e_3 is not greater than

that of e_1, and the associated speed of e_3 is not greater than that of e_2. Clearly, then, it is not the case that if a subevent is a superinterval of another, its associated speed is also greater, as the truth-conditions for the monoclausal parse of (3) requires. Hence our proposed semantics correctly predicts that (3) is false in Scenario A, where Zhangsan's running speed does not increase over time.

In contrast, consider Scenario B in Table 2, where Zhangsan's running speed increases over time. Our proposed semantics correctly predicts that (3) is true in Scenario B. Again the salient subevents of Zhangsan's running over three days which share the same starting point as the whole event are the event consisting of the running on Day 1, e_1, the event consisting of the running on Days 1 and 2, e_2, and the event consisting of the running on Days 1, 2, and 3, e_3. The event e_1 is a proper subinterval of e_2 and e_3, and e_2 is a proper subinterval of e_3. Again associating with each event Zhangsan's final running speed, i.e. the speed of Zhangsan's running on the last day that the event encompasses, it can be seen in Figure 5 that the associated speed of e_2 is greater than that of e_1, the associated speed of e_3 is greater than that of e_1, and the associated speed of e_3 is greater than that of e_2. It follows that for all subevents, if one is a superinterval of another, its associated speed is also greater, as required by the truth-conditions for the monoclausal parse of (3). Hence our proposed semantics correctly predicts that (3) is true in Scenario B, where Zhangsan's running speed increases over time.

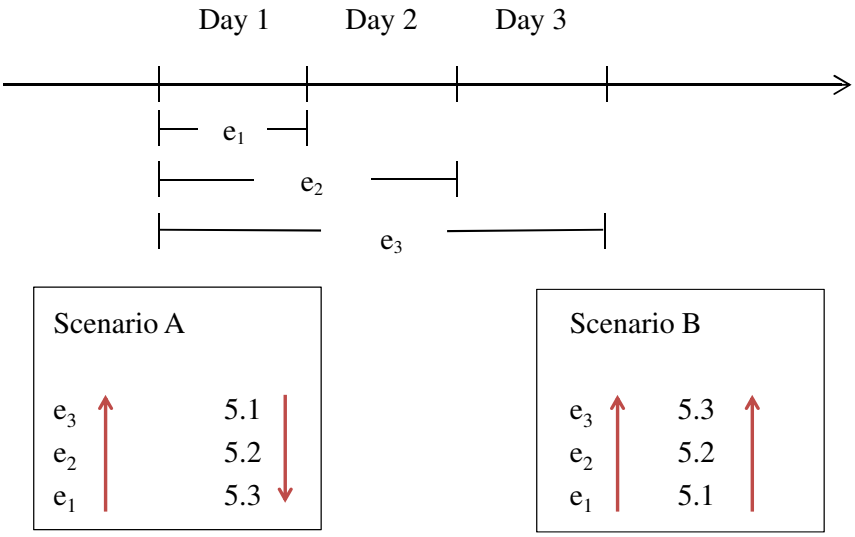


Figure 5: Relevant subevents for semantic evaluation and their associated speeds. Speed increases over time in Scenario B but not in Scenario A.

7 Two welcome results

Our analysis brings two welcome results. First, Liu (2008) observes that in *yuè* ... *yuè* sentences with a non-gradable V1, V1 must be atelic. That is, V1 cannot be an accomplishment or achievement VP. Liu (2008) dubs this phenomenon the

'unbounded condition'.

(32) a. **yuè* + Achievement

tā yuè* ***dàodá shān-dǐng*, *yuè gāoxìng*.
he YUE arrive mountain-top YUE happy

b. **yuè* + Accomplishment

tā yuè* ***chī yí-gè-píngguǒ*, *yuè gāoxìng*.
he YUE eat one-cl-apple YUE happy

Our analysis actually derives this 'unbounded condition'. Recall that we have assumed that when *yuè* combines with a non-gradable VP, a covert coercion operator intervenes. The denotation of the non-gradable VP modified with this covert coercion operator is made up of events, all of which are subintervals of the main event and share a common starting point, much like the set of positive degrees on a given scale, all of which further satisfy the same property P denoted by the VP. That is, this set of events satisfies the subinterval property, which states that if a predicate is true at some interval i, it is also true at every subinterval of i (Bennett & Partee 1972). Atelic predicates satisfy the subinterval property, but telic predicates do not. Hence if a coercion operator is applied to an achievement or accomplishment VP, there will be no proper subevents which satisfy the property denoted by the VP. Consequently, the denotation of the VP modified by the coercion operator will only consist in the single event E introduced by the coercion operator. Since there is thus not a plurality of events, the condition that *yuè* contributes that all subevents such that one is a proper subinterval of another must satisfy some further condition will be satisfied vacuously, since there are no subevents of E such that one is a proper subinterval of another. If there is a ban on vacuous quantification in natural language, these structures will be ruled out on the grounds of semantic anomaly. In this way, we capture the data in (32) and explain Liu's observation.

The second welcome result of our analysis involves overt Adverbs of quantification modifying *yuè* ... *yuè* sentences. Lin (2007) and Liu (2008) note that in *yuè* ... *yuè* sentences with gradable V1 and V2, an overt adverbial quantifier such as *tōngcháng* (usually) overwrites the default universal quantificational force of these sentences, as can be observed in the contrast between (33) and (34).

(33) *píngguǒ yuè dà*, *yuè tián*.
apple YUE big YUE sweet
'The bigger an apple is, the sweeter it is.'
$\forall x_1 x_2$. apple(x_1) $\wedge$ apple(x_2) $\wedge$ x_1 is bigger than x_2 $\rightarrow$ x_1 is sweeter than x_2

(34) *píngguǒ* ***tōngcháng*** *yuè dà*, *yuè tián*.
apple usually YUE big YUE sweet
'The bigger an apple is, the sweeter it usually is.'
MOST$x_1 x_2$ [apple(x_1) $\wedge$ apple(x_2) $\wedge$ x_1 is bigger than x_2] [x_1 is sweeter than x_2]

In a *yuè* … *yuè* sentence with a non-gradable V1, whose semantics involves two quantifications, one over the superevent and another over its subevents, *tōngcháng* (usually) overwrites the default existential quantificational force of the superevent.

(35) *Zhāngsān* ***tōngcháng*** *yuè pǎo yuè kuài.*
Zh. usually YUE run YUE fast
'Zhangsan usually ran faster and faster.'

This can be seen by observing that in Scenario C in Table 3, in which Zhangsan's running speed increases over most subinterval pairs but not all. In particular, Zhangsan's running speed increases from the 5th minute to the 10th, 20th, and 25th minutes, and also increases from the 10th minute to the 20th and 25th minutes, and from the 15th minute to the 20th and 25th minute, and from the 20th to the 25th minute, but does not increase from the 10th to the 15th minute, nor from the 5th to the 15th minute. This scenario thus satisfies (36b) but is one in which (35) is intuitively false.

Table 3: Scenario C

Minute	Speed
5	Zhangsan's running speed was 5 mph
10	Zhangsan's running speed was 6 mph
15	*Zhangsan's running speed was 5 mph*
20	Zhangsan's running speed was 7 mph
25	Zhangsan's running speed was 8 mph

Thus, the correct semantic representation of (35) is (36a), and not (36b).

(36) a. $\text{MOST}E\ [\text{run}(Zh, E)]\ [\forall e_1 e_2.\ \text{run}(Zh, e_1) \wedge \text{run}(Zh, e_2) \wedge \text{MIN}(e_1) = \text{MIN}(E) \wedge \text{MIN}(e_2) = \text{MIN}(E) \wedge e_1 \sqsubset E \wedge e_2 \sqsubset E \wedge e_1 \sqsubset e_2 \rightarrow \exists d_1 \exists d_2.\ \text{fast}(d_1)(e_1) \wedge \text{fast}(d_2)(e_2) \wedge d_1 \sqsubset d_2]$

b. $\exists E\ [\text{MOST}e_1 e_2\ [\text{run}(Zh, e_1) \wedge \text{run}(Zh, e_2) \wedge \text{run}(Zh, E) \wedge \text{MIN}(e_1) = \text{MIN}(E) \wedge \text{MIN}(e_2) = \text{MIN}(E) \wedge e_1 \sqsubset E \wedge e_2 \sqsubset E \wedge e_1 \sqsubset e_2]\ [\exists d_1 \exists d_2.\ \text{fast}(d_1)(e_1) \wedge \text{fast}(d_2)(e_2) \wedge d_1 \sqsubset d_2]]$

If we adopt the principle that an overt Adverb of quantification overwrites the quantifier with the widest scope, we can account for all the readings of *yuè* … *yuè* sentences with overt Adverbs of quantification, such as (34) and (35).

8 Conclusions

In this paper, we have shown that *yuè* … *yuè* sentences with non-gradable V1 display a necessarily temporal reading which other *yuè* … *yuè* sentences do not. We have given a semantic analysis of *yuè* … *yuè* sentences with non-gradable V1 which accounts for their necessarily temporal reading. In addition, we have argued that some *yuè* … *yuè* sentences with non-gradable V1 are monoclausal, in contrast to other types of *yuè* … *yuè* sentences which are all biclausal.

Our semantic analysis has accounted for the occurrence and interpretation of non-gradable predicates in a comparative structure such as the *yuè* … *yuè* construction without introducing a degree argument for non-gradable verbs as in Lin

(2007). Thus, our account allows for the view that non-gradable predicates do not lexicalize a degree argument to be maintained in the light of potentially problematic data.

Our semantic analysis has appealed to degree intervals and to a symmetry between these and events, insofar as a coercion operator may apply to the denotation of a non-gradable VP and returns a set of events which admits an ordering parallel to that of positive degrees. Our account thus supports the claim of Kennedy (2001) that a natural language semantics which models degrees as intervals on a scale is superior to one which models degrees as points and, more generally, supports the view that comparison in natural language evaluates intervals, of whatever type, which share a common start or end point.

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