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) Píngguˇo yuè YUE  dà, yuè YUE tián.
apple  YUE big  YUE sweet
‘The bigger an apple is, the sweeter it is.’

(2) Zh¯angs¯an yuè YUE xˇıhu¯an Lisi, wǒ yuè YUE tˇaoyàn Lˇısì.
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) Zh¯angs¯an yuè YUE pˇao  yuè YUE 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 hˇen (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 píngguˇo hˇen YUE dà.
this Cl apple  very big
‘This apple is very big.’
(5) Zhāngsān hěn xīhuān 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>
<thead>
<tr>
<th>Day</th>
<th>Length</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Zhangsan ran 5 miles</td>
<td>his running speed was 5.3 mph</td>
</tr>
<tr>
<td>2</td>
<td>Zhangsan ran 4 miles</td>
<td>his running speed was 5.2 mph</td>
</tr>
<tr>
<td>3</td>
<td>Zhangsan ran 3 miles</td>
<td>his running speed was 5.1 mph</td>
</tr>
</tbody>
</table>

Table 1: Scenario A

<table>
<thead>
<tr>
<th>Day</th>
<th>Length</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Zhangsan ran 3 miles</td>
<td>his running speed was 5.1 mph</td>
</tr>
<tr>
<td>2</td>
<td>Zhangsan ran 3 miles</td>
<td>his running speed was 5.2 mph</td>
</tr>
<tr>
<td>3</td>
<td>Zhangsan ran 3 miles</td>
<td>his running speed was 5.3 mph</td>
</tr>
</tbody>
</table>

Table 2: Scenario B

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) 你 yuè 生气 shēngqì, 他 (jiù) yuè 高兴 gāoxìng.
    you YUE angry he then YUE happy
    ‘The angrier you are, the happier he (then) is.’

(9) 
\[
\begin{array}{c}
\text{CP} \\
\forall \\
\text{CP}_1 \quad \text{CP}_2 \\
yuè_1 \quad \text{IP}_1 \quad yuè_2 \quad \text{IP}_2 \\
NP \quad AP \quad NP \quad AP
\end{array}
\]

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) 〚 yuè 〛 = λP_{<d_{<st>}>} λd_1d_2λs_1s_2[P(d_1)(s_1) ∧ P(d_2)(s_2) ∧ d_1 < d_2]

(11) 〚 (9) 〛 = ∀d_1d_2s_1s_2[angry(you)(d_1)(s_1) ∧ angry(you)(d_2)(s_2) ∧ d_1 < d_2] → ∃d_3d_4s_3s_4[s_1 ≤ s_3 ∧ s_2 ≤ s_4 ∧ happy(he)(d_3)(s_3) ∧ happy(he)(d_4)(s_4) ∧ d_3 < d_1 ∧ R(<d_1, s_1>, <d_3, s_3>) ∧ 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. 〚 walk 〛 = λx_0λd_0λs_0 walk(x)(d)(s)
    b. 〚 happy 〛 = λx_0λd_0λs_0 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.

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) Zhăngsan yuè tiào yuè găo.
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; 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 biclusal 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 biclusal 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.

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).

\(16\)
\[\text{CP} \quad \text{C} \quad \text{IP} \quad \text{AdvP} \quad \text{Yuè} \quad \text{high} \quad \text{VP} \quad \text{Zhangsan} \quad \text{jump}\]

\(17\)
\[\text{CP} \quad \text{CP} \quad \text{CP} \quad \text{np} \quad \text{AP} \quad \text{tall} \quad \text{VP} \quad \text{Zhangsan} \quad \text{jump} \]

2While 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.
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. 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) \( \lambda d_1 \lambda d_2. d_1 \cap d_2 = d_2 \land d_1 \neq d_2 \)

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

(26) \[ [\text{yuè}] = \lambda P_{<d_1 \leq d_2 \gg} \lambda x_1 \lambda x_2 \exists d_1 \exists d_2. P(d_1)(x_1) \land P(d_2)(x_2) \land d_1 \sqsubset d_2 \]

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) \[ yuè + VP_{\text{non-gradable}} \]

\[ [\text{yuè}] = \lambda P_{<v \gg} \lambda e_1 \lambda e_2. P(e_1) \land P(e_2) \land e_1 \sqsubset e_2 \]

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.

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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 VI 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) \[ \left[ C_E \right] = \lambda P \lambda e. \ P(e) \land P(E) \land \text{MIN}(e) = \text{MIN}(E) \land e \sqsubseteq E \]

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.

```
   e1⊕e2⊕e3
   / \ / \ / \\
e1⊕e2 e1⊕e3 e2⊕e3
  / \ / \\
e1 e2 e3
```

**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. \[ \text{Zhangsan ran} = \lambda e. \text{run(Zh, e)} \]
b. \[ \text{C}_E = \lambda P_{<v,t>} \lambda v. \text{P(e) \land P(E) \land MIN(e) = MIN(E) \land e \sqsubset E} \]
c. \[ \text{C}_E \text{ Zhangsan ran} = \lambda e_v. \text{run(Zh, e) \land run(Zh, E) \land MIN(e) = MIN(E) \land e \sqsubset E} \]
d. \[ \text{yuè}_1 = \lambda P_{<v,t>} \lambda e_1 \lambda e_2. \text{P(e_1) \land P(e_2) \land e_1 \sqsubset e_2} \]
e. \[ \text{yuè}_1 \text{ C}_E \text{ Zhangsan ran} = \lambda e_1 \lambda e_2. \text{run(Zh, e_1) \land run(Zh, e_2) \land run(Zh, E) \land MIN(e_1) = MIN(E) \land MIN(e_2) = MIN(E) \land e_1 \sqsubset E \land e_2 \sqsubset E} \]
f. \[ \text{fast} = \lambda d_e \lambda e_v. \text{fast(d)(e)} \]
g. \[ \text{yuè}_2 = \lambda P_{<d,v,t>} \lambda e_1 \lambda e_2 \exists d_1 \exists d_2. \text{P(d_1)(e_1) \land P(d_2)(e_2) \land d_1 \sqsubset d_2} \]
h. \[ \text{yuè}_2 \text{ fast} = \lambda e_1 \lambda e_2 \exists d_1 \exists d_2. \text{fast(d_1)(e_1) \land fast(d_2)(e_2) \land d_1 \sqsubset d_2} \]
i. \[ \forall \text{yuè}_1 \text{ C}_E \text{ Zhangsan ran} = \lambda Q_{<v,t,t,t>} \forall v e_1 e_2. \text{run(Zh, e_1) \land run(Zh, e_2) \land run(Zh, E) \land MIN(e_1) = MIN(E) \land MIN(e_2) = MIN(E) \land e_1 \sqsubset E \land e_2 \sqsubset E \land e_1 \sqsubset e_2 \rightarrow Q(e_1)(e_2)} \]
j. \[ \forall \text{yuè}_1 \text{ C}_E \text{ Zhangsan ran yuè fast} = \exists e_1 e_2. \text{run(Zh, e_1) \land run(Zh, e_2) \land run(Zh, E) \land MIN(e_1) = MIN(E) \land MIN(e_2) = MIN(E) \land e_1 \sqsubset E \land e_2 \sqsubset E \land e_1 \sqsubset e_2 \rightarrow \exists d_1 \exists d_2. \text{fast(d_1)(e_1) \land fast(d_2)(e_2) \land d_1 \sqsubset d_2} \]
k. \[ \forall C \forall \text{yuè}_1 \text{ C}_E \text{ Zhangsan ran yuè fast} = \exists E \exists e_1 e_2. \text{run(Zh, e_1) \land run(Zh, e_2) \land run(Zh, E) \land MIN(e_1) = MIN(E) \land MIN(e_2) = MIN(E) \land e_1 \sqsubset E \land e_2 \sqsubset E \land e_1 \sqsubset e_2 \rightarrow \exists d_1 \exists d_2. \text{fast(d_1)(e_1) \land fast(d_2)(e_2) \land d_1 \sqsubset d_2} \]
l. \[ C = \lambda P \exists v_1 \ldots v_n. P \text{ (where } v_1 \ldots v_n \text{ are free in } P) \]
m. \[ C \forall \text{yuè}_1 \text{ C}_E \text{ Zhangsan ran yuè fast} = \exists E \exists e_1 e_2. \text{run(Zh, e_1) \land run(Zh, e_2) \land run(Zh, E) \land MIN(e_1) = MIN(E) \land MIN(e_2) = MIN(E) \land e_1 \sqsubset E \land e_2 \sqsubset E \land e_1 \sqsubset e_2 \rightarrow \exists d_1 \exists d_2. \text{fast(d_1)(e_1) \land fast(d_2)(e_2) \land d_1 \sqsubset d_2} \]

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, e1, the event consisting of the running on Days 1 and 2, e2, and the event consisting of the running on Days 1, 2, and 3, e3. The event e1 is a proper subinterval of e2, and e2 is a proper subinterval of e3. 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 e2 is not greater than that of e1, the associated speed of e3 is not greater than
that of e₁, and the associated speed of e₃ is not greater than that of e₂. 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, e₁, the event consisting of the running on Days 1 and 2, e₂, and the event consisting of the running on Days 1, 2, and 3, e₃. The event e₁ is a proper subinterval of e₂ and e₃, and e₂ is a proper subinterval of e₃. 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 e₂ is greater than that of e₁, the associated speed of e₃ is greater than that of e₁, and the associated speed of e₃ is greater than that of e₂. 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.

\[\text{Day 1} \quad \text{Day 2} \quad \text{Day 3}\]

\[\text{e₁} \quad \text{e₂} \quad \text{e₃}\]

\begin{tabular}{|c|c|}
\hline
Scenario A & Scenario B \\
\hline
\text{e₃} & \text{e₃} \\
\text{e₂} & \text{e₂} \\
\text{e₁} & \text{e₁} \\
\hline
5.1 & 5.3 \\
5.2 & 5.2 \\
5.3 & 5.1 \\
\hline
\end{tabular}

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

\section{7 Two welcome results}

Our analysis brings two welcome results. First, Liu (2008) observes that in \textit{yuè} \ldots \textit{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
Our analysis actually derives this ‘unbounded condition’. Recall that we have assumed that when yùè 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 yùè 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 yùè . . . yùè sentences. Lin (2007) and Liu (2008) note that in yùè . . . yùè sentences with gradable V1 and V2, an overt adverbial quantifier such as tóngcháng (usually) overwrites the default universal quantificational force of these sentences, as can be observed in the contrast between (33) and (34).

(33) píngguǒ yùè dà, yùè tián.
apple YUE big YUE sweet  
‘The bigger an apple is, the sweeter it is.’  
\[ \forall x_1 x_2, \text{apple}(x_1) \land \text{apple}(x_2) \land x_1 \text{ is bigger than } x_2 \rightarrow x_1 \text{ is sweeter than } x_2 \]

(34) píngguǒ tóngcháng yùè dà, yùè tián.
apple usually YUE big YUE sweet  
‘The bigger an apple is, the sweeter it usually is.’  
MOST \[ x_1 x_2 [ \text{apple}(x_1) \land \text{apple}(x_2) \land x_1 \text{ is bigger than } x_2 ] [ x_1 \text{ is sweeter than } x_2 ] \]
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 pāo 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>
<thead>
<tr>
<th>Minute</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Zhangsan’s running speed was 5 mph</td>
</tr>
<tr>
<td>10</td>
<td>Zhangsan’s running speed was 6 mph</td>
</tr>
<tr>
<td>15</td>
<td>Zhangsan’s running speed was 7 mph</td>
</tr>
<tr>
<td>20</td>
<td>Zhangsan’s running speed was 7 mph</td>
</tr>
<tr>
<td>25</td>
<td>Zhangsan’s running speed was 8 mph</td>
</tr>
</tbody>
</table>

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

(36) a. \( \text{MOST} \left[ \text{run}(Zh, E) \right] \left[ \forall e_1 e_2. \text{run}(Zh, e_1) \land \text{run}(Zh, e_2) \land \text{MIN}(e_1) = \text{MIN}(E) \land \text{MIN}(e_2) = \text{MIN}(E) \land e_1 \sqsubseteq E \land e_2 \sqsubseteq E \land e_1 \sqsubseteq e_2 \rightarrow \exists d_1 \exists d_2. \right. \\
 fast(d_1)(e_1) \land fast(d_2)(e_2) \land d_1 \sqsubseteq d_2 \right] \\
 b. \exists E \left[ \text{MOST} e_1 e_2. \left[ \text{run}(Zh, e_1) \land \text{run}(Zh, e_2) \land \text{run}(Zh, E) \land \text{MIN}(e_1) = \text{MIN}(E) \land \text{MIN}(e_2) = \text{MIN}(E) \land e_1 \sqsubseteq E \land e_2 \sqsubseteq E \land e_1 \sqsubseteq e_2 \right] \left[ \exists d_1 \exists d_2. \right. \\
 fast(d_1)(e_1) \land fast(d_2)(e_2) \land d_1 \sqsubseteq d_2 \right] \\

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.

References