On the semantics of the Japanese infinitive/gerund-clause constructions: Polysemy and temporal constraints

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Abstract

The Japanese infinitive-clause construction (InfCx) and gerund-clause construction (GerCx) may convey a wide range of interclausal semantic relations, including 'temporal sequence', 'cause', and 'manner', largely due to pragmatic enrichment. This work addresses the question of what the core meaning(s) of the two constructions is (are), and demonstrates (i) that the InfCx and GerCx indicate either that the first-clause eventuality precedes or temporally subsumes the second-clause eventuality or that the two clauses stand in the rhetorical relation of *contrast*, and (ii) that the GerCx has a distinct sense that the InfCx lacks, which gives rise to the 'resulting state' interpretation.

1 Introduction

This paper examines the semantic properties of the Japanese infinitive/gerund-clause constructions (considered as coordination constructions by some), which are the most basic means of clause-linking in the language. Comparable to the English *and*-coordination construction (e.g., *John pressed the button and the engine started*) and free adjunct/absolute constructions (e.g., *John started the engine pressing the button*; *The nurses having arrived, the doctor started the surgery*), the Japanese infinitive-clause construction (InfCx) and gerund-clause construction (GerCx) may convey a wide range of interclausal semantic relations, including 'temporal sequence', 'cause', and 'manner', largely due to pragmatic enrichment.

This work addresses the question of what the core meaning(s) of the two constructions is (are), and demonstrates (i) that, contra authors such as Lee and Tonhauser (2010), the InfCx and GerCx pose a semantic constraint on the temporal order between the two described eventualities, and (ii) that the GerCx has a distinct sense that the InfCx lacks, which gives rise to the 'resulting state' interpretation.

2 Basic facts

2.1 Morphological and syntactic properties of the InfCx/GerCx

The InfCx refers to a kind of complex clause where a clause headed by a predicate in its infinitive form (also called *ren'yookei*) is subordinated to another clause (typically the matrix clause). The GerCx refers to a similar structure where the head of the subordinate clause is a gerund form (also called *te*-form). Gerund forms are formed by attaching the particle *te* to infinitive forms,[1] although they are

[†]I would like to thank Shin-ichiro Sano, Kimi Akita, Tsutomu Ohna, and the audience of HPSG 2012 for valuable comments. All remaining errors are my own.

[1]Some scholars consider *te* as an inflectional affix directly following the stem.

not always realized as the mere concatenation of the infinitive form and *te* due to morphophonological processes. (1) exemplifies the two constructions:[2]

(1) a. **Hiroshi-ga booru-o** {**nage/nagete**}, Akira-ga uketa.
H.-Nom ball-Acc throw.Inf/throw.Ger A.-Nom receive.Pst
'Hiroshi threw the ball and Akira caught it.'
b. **Hiroshi-ga** {**kogi/koide**}, Akira-ga kaji-o kitta.
H.-Nom row.Inf/row.Ger A.-Nom rudder-Acc handle.Pst
'Hiroshi rowed and Akira steered.'

Infinitive and gerund clauses are functionally similar and in many cases interchangeable. They stylistically differ, however, the former being more formal.

All Japanese verbs have infinitive and gerund forms. However, infinitive clauses headed by a verb whose stem is monosyllabic and ends with a vowel, including the imperfective auxiliary *-i*(*ru*), sound awkward, if not completely acceptable; hence the degraded acceptability of (2a):

(2) **Ame-ga** {a. ??**futtei** /b. **futteite** }, kaze-mo tsuyoi.
rain-Nom fall.Ipfv.Inf fall.Ipfv.Ger wind-also be.strong.Prs
'It is raining and the wind is strong too.'

To circumvent this distributional gap, speakers have to use the gerund-form (e.g., *futteite*) or a more formal variety of the imperfective auxiliary, *-or*(*u*) (e.g., *futte-ori*).[3]

Infinitive/gerund clauses are non-finite (untensed), and in this regard the InfCx and GerCx are more similar to English free adjunct/absolute constructions than to *and*-coordination constructions. Some scholars (e.g., Fukushima 1999:297–298; Hirata 2006:72–76; Lee and Tonhauser 2010:308) nevertheless regard the two constructions as coordination structures.[4] One piece of evidence against this view is the possibility of the 'dislocation' out of the second (right) clause; under the coordination analysis, (3a,b) would be wrongly predicted to be ill-formed due to the Coordinate Structure Constraint, a type of the strong island effect.

(3) a. [$_S$ Ensoku-ga chuushi-ni {nari/natte} GAP$_i$
excursion-Nom cancellation-Dat become.Inf/become.Ger
ichiban zannengatta] gakusei$_i$-wa Hiroshi$_i$-da.
most be.disappointed.Pst student-Top H.-Copula.Prs
'The student who was most disappointed when the excursion was canceled is Hiroshi.'

[2]The abbreviations used in glosses are: Acc = accusative, Dat = dative, Ger = gerund, Inf = infinitive, Ipfv = imperfective, Nom = nominative, Pass = passive, Prs = present, Pst = past, Top = topic.

[3]The latter solution, of course, is available only when imperfective verb forms are involved.

[4]From the functional viewpoint, the InfCx/GerCx may correspond better to the English *and*-coordination than the free adjunct/absolute constructions, being the most unmarked means to link two clauses.

cf. *The student$_i$ who [[the excursion was canceled] and [GAP$_i$ was most disappointed]] is Hiroshi$_i$.

b. [S sensoo-ga {owari/owatte} GAP$_i$ kakki-o torimodoshita] machi$_i$
war-Nom end.Inf/end.Ger liveliness-Acc regain.Pst
city
'a city that regained its liveliness after the war ended'
cf. *a city$_i$ that [[the war ended] and [GAP$_i$ regained its liveliness]]

2.2 Semantic properties of the InfCx/GerCx

An infinitive/gerund clause may stand in a wide variety of semantic relations with the main clause. The reference work by Nihongo Kijutsu Bunpoo Kenkyuukai (NKBK; 2008) lists eight such relations: (i) simultaneity, (ii) sequence, (iii) cause, (iv) contrast, (v) accompanying circumstance, (vi) concession, (vii) preliminary remark, and (viii) condition (the last three of them are available only in rather limited configurations).

Note that comparably wide ranges of interpretations are available for similar constructions in other languages. Kortmann (1991:121ff) lists fifteen semantic relations that can be expressed by English free adjunct/absolute constructions. Also, it is well-known that conjunctive coordination structures may conversationally implicate such semantic relations as sequence, cause, and means-end (*conjunction buttressing*; Levinson 2000:117).

(4) Hans pressed the spring and the drawer opened.
+> 'Hans pressed the spring and then the drawer opened.'
+> 'Hans pressed the spring and thereby caused the drawer to open.'
+> 'Hans pressed the spring in order to make the drawer open.'

The most parsimonious account of the diverse interpretations of the InfCX and GerCx would be to assign to them a single simple meaning, say logical conjunction, and let the pragmatics do the rest of the job. Fukushima (1999) and Lee and Tonhauser (2010) take this position. Also, the following quote from NKBK (2008:280; my translation) points to the same idea:

> *Te*-forms [(gerund forms)] and infinitive forms have little semantic content, and their semantic interpretation depends on the states of affairs described in the first and second clauses as well as on the context. Because of this property, *te*-forms and infinitive forms have various uses.

In the following, however, I will point out (i) that the basic meaning shared by the InfCx and GerCx is not the mere logical conjunction but involves a constraint regarding the temporal order between the two described eventualities, and (ii) that the GerCx has a distinct meaning that the InfCx lacks.

3 Temporal constraints

As noted earlier, the first (left, subordinate) clause in an InfCx or GerCx lacks a tense. There has been some discussion in the literature as to how the temporal location of the first-clause eventuality is restricted. In the following, I will argue that, contrary to some previous claims, the InfCx and GerCx semantically entail that the second-clause eventuality (E_2) does *not* precede the first-clause eventuality (E_1).

For some examples (sentences or discourse segments) to be discussed below, I conducted a survey to investigate whether speakers accept or reject them on the intended interpretation. The survey was conducted in 2012 and involved 22 respondents, all of whom were graduate students of Nagoya University; 11 of them had background in linguistics. In the survey, the respondents were asked to evaluate 24 examples, which were presented to them in a randomized order, following (the Japanese version of) the instructions given below:

> Several Japanese passages will be presented. Each passage consists of one or two sentence. Please evaluate each passage, in terms of whether it explains the temporal order of events without contradiction, and choose one of the three options that comes the closest to your evaluation: (1) I feel like there is contradiction, (2) I cannot judge with certainty whether there is contradiction, (3) I feel like there is no contradiction. Evaluations should be based on your own linguistic intuition and be subjective/impressionistic.

The respondents were explicitly asked about temporal consistency (rather than, say, acceptability or naturalness) of the linguistic stimuli, in attempt to reduce the influence of secondary factors (e.g. stylistic awkwardness) on their evaluations.

In the rest of this paper, where applicable, the results of the survey will be reported in the following form: [$<a$, b, $c>$; S], where a, b, and c are respectively numbers of respondents who chose (1): contradictory, (2): uncertain, and (3): not contradictory, and S is the 'acceptability score' calculated by the formula: ($0.5b$ + c) / (a + b + c). Roughly, a higher score indicates a higher acceptability of the intended temporal interpretation. I will assume that an example within the score range of $0 \leq S \leq 0.33$ can be reasonably regarded as unacceptable (marked with '*'), and one within the score range of $0.67 \leq S \leq 1$ can be reasonably regarded as acceptable (no mark), although admittedly this assumption can be challenged. Where no score is provided, the judgment is my own or the cited author's.

3.1 Previous discussion

Fukushima (1999) proposes that the 'missing' tense in the first clause is recovered by the tense of the second clause, through a version of the ellipsis resolution process discussed in Dalrymple et al. (1991). Sentence (5a), for example, is assigned

the logical form (5b) where P is an underspecified functor. Then, (5b) is resolved into (5c).

(5) a. Taro-ga utai odotta.
T.-Nom sing.Inf dance.Pst
'Taro sang and danced.'
b. P(**sing**(**Taro**)) ∧ PAST(**dance**(**Taro**))
c. PAST(**sing**(**Taro**)) ∧ PAST(**dance**(**Taro**))

He also notes that when a temporal adverbial occurs in the first clause as in (6), the functor P is recovered from the adverbial, rather than the tense of the second clause (pp.308–309).

(6) Taro-ga kinoo-wa utai, kyoo-wa odoru.
T.-Nom yesterday-Top sing.Inf today-Top dance.Prs
'Taro sang yesterday and will dance today.'

Lee and Tonhauser (2010) maintain that in the InfCx and GerCx, the temporal order between the two described eventualities is not semantically fixed but is resolved by the joint effects of (i) temporal adverbials (if any occurs), (ii) the contextual information, and (iii) the independently motivated discourse principle that, by default, event descriptions (dynamic predicates) update the reference time (topic time; the interval serving as the temporal setting for the discourse segment) by putting it forward while state descriptions (stative predicates) leave it unaffected (e.g., Dowty 1986). More specifically, they assume that the following TID principle determines the default (defeasible) temporal interpretation of clauses constituting a coherent discourse:

(7) **Temporal interpretation in discourse (TID) principle**:
Sentences S_1, ..., S_n are temporally interpreted in narrative discourse as follows:
a. The reference time of a sentence S_i (for $1 \leq i \leq n$) is either (i) a time consistent with the temporal adverb(s) of S_i or (ii) if no temporal adverb occurs in S_i, the reference time provided by the preceding sentence $S_{i\text{-}1}$.
b. Event descriptions update the reference time to a new reference time shortly after the original reference time; state descriptions do not update the reference time.

To demonstrate that the first-clause eventuality in the InfCx/GerCx may temporally follow the second-clause eventuality, Lee and Tonhauser provide three examples, presented below with some modifications[5] (pp.318–319).

[5]The original version of (8b) is:

(i) Context: How is Chelswu doing in the hospital?

(8) a. Kyoo-wa hareteite, kinoo-wa ame-ga futta.
today-Top clear.up.Ipfv.Ger yesterday-Top rain-Nom fall.Pst
'It is sunny today, and it rained yesterday.'

b. Hiroshi-wa shikkari rihabiri-o shiteite,
H.-Top hard rehabilitation-Acc do.Ipfv.Ger
shujutsu-wa senshuu uketa.
surgical.operation-Top last.week receive.Pst
'Hiroshi is in a tough rehabilitation program and had the operation last week.'

c. Imiron gakkai-ga atte, ima-wa happyoo-no
semantics conference-Nom occur.Ger now-Top presentation-Gen
junbi-o shiteiru.
preparation-Acc do.Ipfv.Prs
'There will be a conference on semantics and I am preparing for my presentation now.'

(8a,b) were included in my survey,[6] and respectively rated as [<7, 5, 10>; 0.57] and [<7, 8, 7>; 0.50]. (8c) was not included, but a similar sentence, (9), was included and received a high score (S = 0.86).

(9) Raishuu shinrigaku-no gakkai-ga atte, ima
next.week psychology-Gen conference-Nom occur.Ger now
happyoo-no junbi-o shiteiru.
presentation-Gen preparation-Acc do.Ipfv.Prs
'There will be a conference on psychology next week, and I am preparing for my presentation now.' [<2, 2, 18>; 0.86]

Also, (10), which is similar to (8a) but consists of two clauses headed by a perfective verb, received a relatively high score (S = 0.77).

(10) Kinoo-wa yuki-ga futte, ototoi-wa
yesterday-Top snow-Nom fall.Ger the.day.before.yesterday-Top
ame-ga futta.
rain-Nom fall.Pst
'It snowed yesterday, and it rained the day before yesterday.'
[<4, 2, 16>; 0.77]

Rihabiri-o shikkari shiteite, shujutsu-wa senshuu uketa.
rehabilitation-Acc hard do.Ipfv.Ger surgical.operation-Top last.week receive.Pst
'He is in a tough rehabilitation program and had the operation last week.'

(8a,c) are the same as the original, except for some differences in glosses.

[6]The stimulus (8b) was accompanied by the note: '"Rihabili" refers to the rehabilitation after the operation'.

3.2 An alternative proposal

As an alternative to these authors' claims, I propose that the InfCx and GerCx require that the first-clause eventuality either precedes or temporally subsumes the second-clause eventuality ($E_1 < E_2$ or $E_1 \supseteq E_2$).[7] This roughly amounts to saying that the two constructions require that the second-clause eventuality do *not* precede the first-clause eventuality. While sentences like (9) and (10) appear to evidence that the order of '$E_1 > E_2$' is possible, it can be shown that they are exceptional cases that call for a separate treatment.

In sentences (11a–b), the temporal interpretation of '$E_1 > E_2$' is impossible. Throughout the paper, the survey results shown under a pair of an InfCx and GerCx, such as (11a) and (11c), are for the GerCx version (the survey did not include InfCx's).

(11) a. *Hiroshi-wa chichioya-ni man'nenhitsu-o purezento-shi(te), sono
H.-Top father-Dat fountain.pen-Acc present.Inf(Ger) that
man'nenhitsu-o Ginza-no depaato-de katta.
fountain.pen-Acc G.-Gen department.store-Loc buy.Pst
(Hiroshi {gave/will give} his father a fountain pen, and he bought it at a department store in Ginza.) [<15, 2, 5>; 0.27]

b. *Hiroshi-wa ima chooshoku-o tabeteite, shichi-ji-ni
H.-Top now breakfast-Acc eat.Ipfv.Ger 7-o'clock-Dat
okita.
wake.up.Pst
(Hiroshi is eating his breakfast now, and woke up at 7 o'clock.) [<13, 4, 5>; 0.32]

c. *Raishuu shinrigaku-no gakkai-ga kaisai-sare(te),
next.week psychology-Gen conference-Nom hold.Pass.Inf(Ger)
ima happyoo-no junbi-o shiteiru.
now presentation-Gen preparation-Acc do.Ipfv.Prs
(A conference on psychology will be held next week, and I am preparing for my presentation now.) [<13, 4, 5>; 0.32]

(cf.) a. Hiroshi-wa man'nenhitsu-o Ginza-no depaato-de
H.-Top fountain.pen-Acc G.-Gen department.store-Loc
kai/katte, sono man'nenhitsu-o chichioya-ni
buy.Inf/buy.Ger that fountain.pen-Acc father-Dat

[7] Examples of InfCx/GerCx which describe a situation where E_1 temporally subsumes E_2 ($E_1 \supseteq E_2$) are provided below.

(i) a. Netsu-ga {ari/atte}, nyuujoo-o kyohi-sareta.
fever-Nom be.present.Inf/be.present.Ger entrance-Acc refuse.Pass.Pst
'I had fever, and was refused entrance.'

b. Hiroshi-wa yotteite kaidan-kara korogeochita.
H.-Top get.drunk.Ipfv.Ger staircase-from fall.down.Pst
'Hiroshi was drunk and fell down from the staircase.'

purezento-shita.
present.Pst
'Hiroshi bought a fountain pen at a department store in Ginza, and gave it to his father.' [<0, 0, 22>; 1.00]

b. Hiroshi-wa shichiji-ni oki(te), ima chooshoku-o
H.-Top 7-o'clock-Dat wake.up.Inf(Ger) now breakfast-Acc
tabeteiru.
eat.Ipfv.Prs
'Hiroshi woke up at 7 o'clock, and is eating his breakfast now.'
[<0, 0, 22>; 1.00]

The unacceptability of (11a–c) contradicts Fukushima's analysis, as well as Lee and Tonhauser's. The acceptability of (9) and (10), on the other hand, is at odds with my claim, suggesting that the proposed temporal constraint is not always present.

One may hypothesize that the low acceptability of (11a–c) is due to clash between the stated meaning and conversational implicature attributable to the TID principle (see (7) above) or the like, the latter of which is exemplified in (12).

(12) a. John looked out of the window. The train started to move slowly.
+> 'John looked out of the window before the train started to move.'

b. The train started to move slowly. John looked out of the window.
+> 'The train started to move before John looked out of the window.'

Such implicature, however, should be defeasible and thus disappear when it conflicts with the literal meaning and/or our world knowledge (Levinson 2000:123–125; Lee and Tonhauser 2010:314). Indeed, discourse segments (13a–c), where two clauses are paratactically arranged, were considered 'not contradictory' by most respondents, contrasting with (11a–c).[8] This contrast is unexpected if InfCx's and GerCx's do not convey temporal information as part of their conventional (literal) meaning.

(13) a. Hiroshi-wa chichioya-ni man'nenhitsu-o purezento-shita.
H.-Top father-Dat fountain.pen-Acc present.Pst
Kare-wa sono man'nenhitsu-o Ginza-no depaato-de
he-Top that fountain.pen-Acc G.-Gen department.store-Loc
katta.
buy.Pst
'Hiroshi gave his father a fountain pen. He bought it at a department store in Ginza.' [<2, 4, 16>; 0.82]

b. Hiroshi-wa ima chooshoku-o tabeteiru. Kare-wa shichi-ji-ni
H.-Top now breakfast-Acc eat.Ipfv.Prs he-Top 7-o'clock-Dat

[8]The contrast between (13a) and (11a), that between (13b) and (11b), and that between (13c) and (11c), were all determined to be significant at the 0.01 level by the Wilcoxon signed ranks test (Z = -3.203, p = 0.001; Z = -2.863, p = 0.004; Z = -3.827, $p < 0.001$, respectively).

okita.
wake.up.Pst
'Hiroshi is eating his breakfast now. He woke up at 7 o'clock.'
[<5, 4, 13>; 0.68]

c. Raishuu shinrigaku-no gakkai-ga kaisai-sareru. Ima
next.week psychology-Gen conference-Nom hold.Pass.Prs now
happyoo-no junbi-o shiteiru.
presentation-Gen preparation-Acc do.Ipfv.Prs
'A conference on psychology will be held next week. I am preparing for my presentation now.' [<0, 1, 21>; 0.98]

Note also that the English *and*-coordination constructions provided in (11) to illustrate the intended interpretations are compatible with the 'reversed' temporal order.

3.3 Contrast as a factor licensing the InfCx/GerCx

I propose that the crucial factor for the acceptability of sentence (10), and the marginal acceptability of (8a,b), is the rhetorical relation (see Asher and Lascarides 2003; Zeevat 2011 and references therein) of *contrast*. In (8a)/(10), the weather of a day is explicitly contrasted with that of another. In (8b), *wa*-topicalization of the direct object of the second clause induces contrast, and the whole sentence naturally translates as 'Hiroshi is in a tough rehabilitation program, and as for the operation, he had it last week'.[9] Without topicalization of the object of the second clause, the acceptability significantly degrades.[10]

(14) *Hiroshi-wa shikkari rihabiri-o shiteite,
H.-Top hard rehabilitation-Acc do.Ipfv.Ger
shujutsu-o senshuu uketa.
surgical.operation-Acc last.week receive.Pst
(Hiroshi is in a tough rehabilitation program and had the operation last week.) [<17, 2, 3>; 0.18]

Interestingly, even if the two clauses are in the relation of contrast, the InfCx/GerCx cannot describe a situation where E_1 takes place in the future and E_2 takes place in the past.

(15) a. Hiroshi-wa ototoi toochaku-shi(te), Akira-wa
H.-Top the.day.before.yesterday arrive.Inf(Ger) A.-Top
kinoo toochaku-shita.
yesterday arrive.Pst

[9] As discussed in Oshima (2010), *wa*-marking on a direct object has a similar information-structural effect as English *as for*-topicalization, while *wa*-marking on a subject does not.

[10] Like (8b), the stimulus (14) was accompanied by the note: '"Rihabili" refers to the rehabilitation after the operation'.

'Hiroshi arrived the day before yesterday and Akira arrived yesterday.' [<2, 1, 19>; 0.89]

b. Akira-wa kinoo toochaku-shi(te), Hiroshi-wa
A.-Top yesterday arrive.Inf(Ger) H.-Top
ototoi toochaku-shita.
the.day.before.yesterday arrive.Pst
'Akira arrived yesterday and Hiroshi arrived the day before yesterday.' [<2, 3, 17>; 0.84]

c. Hiroshi-wa kinoo toochaku-shi(te), Akira-wa ashita
H.-Top yesterday arrive.Inf(Ger) A.-Top tomorrow
toochaku-suru.
arrive.Prs
'Hiroshi arrived yesterday and Akira will arrive tomorrow.' [<1, 2, 19>; 0.91]

d. *Akira-wa ashita toochaku-shi(te), Hiroshi-wa kinoo
A.-Top tomorrow arrive.Inf(Ger) H.-Top yesterday
toochaku-shita.
arrive.Pst
(Akira will arrive tomorrow and Hiroshi arrived yesterday.) [<18, 2, 2>; 0.14]

Note that (15d) is predicted to be acceptable under Fukushima's and Lee and Tonhauser's analyses.

3.4 The temporal extent of *aru*

Sentence (9) (repeated below), where there is no clear contrast between the two clauses, requires a different explanation.

(9) Raishuu shinrigaku-no gakkai-ga atte, ima
next.week psychology-Gen conference-Nom occur.Ger now
happyoo-no junbi-o shiteiru.
presentation-Gen preparation-Acc do.Ipfv.Prs
'There will be a conference on psychology next week, and I am preparing for my presentation now.' [<2, 2, 18>; 0.86]

I suggest that the eventuality referred to by the existential predicate *atte* (*aru*), here used in the sense of 'occur, take place',[11] has a temporal extent that is not limited to the time when the conference takes place, but includes the preceding temporal stretch overlapping with the second-clause eventuality (preparing for the presentation). There is independent evidence that *aru* predicated of an expression denoting an event (a conference, a party, etc.) could have such a temporally extended denotation. Compare (16a–d):

[11] *Aru* could also mean 'exist, be present', predicated of an expression denoting an object (rather than an event).

(16) a. Kinoo-no enkai-de-wa, kuruma-de
yesterday-Ger banquet-Loc-Top car-by
{kaeru/*kaetta}-node non'arukooru biiru-o nonda.
go.home.Prs/go.home.Pst-because non.alcoholic beer-Acc drink.Pst
'At the banquet yesterday, I drank non-alcoholic beer because I was going to drive home.'

b. Kinoo-wa hisashiburi-ni kazoku minna-ga yoru
yesterday-Top after.a.long.time family everyone-Nom evening
uchi-ni {iru/*ita}-node, hirusugi
home-Dat be.present.Prs/be.present.Pst-because early.afternoon
jootoo-na niku-o kai-ni-itta.
quality meat-Acc buy-go.Pst
'Yesterday, I went to buy some quality meat in the early afternoon because all members of my family were going to be home in the evening for the first time in a long time.'

c. Kinoo-wa ame-ga {?futteiru/futteita}-node
yesterday-Top rain-Nom fall.Ipfv.Prs/fall.Ipfv.Pst-because
kuruma-de itta.
car-by go.Pst
'Yesterday, I went there by car because it was raining.'

d. Kinoo-wa yoru boonenkai-ga
yesterday-Top evening year.end.party-Nom
{aru/atta}-node hiru-wa karuku sumaseta.
occur.Prs/occur.Pst-because lunch-Top lightly finish.Pst
'Yesterday, I had a light lunch because there was a year-end party in the evening.'

When an adjunct reason-clause with *node* is subordinated to a past-tensed clause, it must be present-tensed if the subordinate eventuality temporally follows the main-clause eventuality (as in (16a,b)), and is preferred to be past-tensed if the subordinate eventuality temporally subsumes the main-clause eventuality (as in (16c)). In (16d), the embedded tense can be past, and this implies that the eventuality denoted by *atta* (*aru*) could have a temporal extent that subsumes some period preceding the actual year-end party and the time of the lunch – perhaps the period in which the party *is planned* to take place. As such, sentence (9) is expected to have a reading on which E_1 does not actually follow but temporally subsumes E_2.

3.5 Section summary

In summary, (i) the InfCx and GerCx as a rule entail that the temporal relation of 'precedence or inclusion' ($E_1 < E_2 \vee E_1 \supseteq E_2$) holds between the two described eventualities, but (ii) the reverse order interpretation ($E_1 > E_2$) becomes available when the rhetorical relation of contrast holds between the two clauses, but (iii) it is never possible for the first clause to refer to a future eventuality with the second

clause referring to a past eventuality.

A possible way to account for these facts is to postulate that there are two varieties (each) of the InfCx/GerCx, or perhaps two distinct senses (each) of these constructions: one variety poses a temporal restriction, and the other poses a rhetorical-structural restriction. In Section 5, I provide a formal analysis of the two kinds of InfCx and GerCx.

4 The 'resulting state' interpretation of the GerCx

As mentioned above, infinitive and gerund clauses are functionally similar and in many cases interchangeable. There are, however, cases where the choice between the two constructions leads to an interpretative difference. Specifically, the GerCx, but not the InfCx, allows the interpretation that the *resulting state* of the event described in the first clause, rather than the event itself, temporally subsumes the eventuality described in the second clause, when the first-clause predicate is one of certain telic verbs including *tatsu* 'stand up', *kiru* 'put on (clothes)', and *motsu* 'grab, take in one's hand' (cf. NKBK 2008:286–287). Consider the following pair of sentences:

(17) a. Hiroshi-wa booshi-o **kaburi** e-o kaita.
H.-Top hat-Acc put.on.Inf picture-Acc paint.Pst
'Hiroshi put on a hat and painted a picture.'

b. Hiroshi-wa booshi-o **kabutte** e-o kaita.
H.-Top hat-Acc put.on.Ger picture-Acc paint.Pst
'Hiroshi put on a hat and painted a picture.'
OR: 'Hiroshi painted a picture wearing a hat.'

(17a) is compatible with the state of affairs described in (18a) but not with the one described in (18b). (17b), on the other hand, allows a second interpretation on which it is compatible with (18b) as well as (18a).

(18) a. Hiroshi came to a beach to paint a picture. The sun was strong. He put on his hat before starting painting.

b. Hiroshi always wears his hat, except when he is in bath or bed. This afternoon, he painted a picture in his art class, wearing his hat as usual.

On the second interpretation, (17b) does not imply that Hiroshi's putting on a hat occurs within the topic time (the interval serving as the temporal setting for the discourse segment; Klein 1994) but rather that the resulting state of his putting on hat – i.e., his wearing a hat – holds then. The following pair of sentences illustrates the same point.

(19) a. Hiroshi-wa **tachi** shashin-o totta.
H.-Top stand.up.Inf photo-Acc take.Pst

'Hiroshi stood up and took a photo.'

b. Hiroshi-wa **tatte** shashin-o totta.
H.-Top stand.up.Ger photo-Acc take.Pst
'Hiroshi stood up and took a photo.'
OR: 'Hiroshi took a photo standing on his feet.'

Possible logical translations of (i) (17a,b) on the 'precedence or subsumption' reading and (ii) (17b) on the 'resulting state' reading are provided in (20), where τ = the trace function that maps an eventuality to the time in which it occurs/holds (Krifka 1998), TT = the topic time, and **RS** = the relation of 'is a resulting state of':

(20) (i) $\exists e_2[\exists e_1[$**put.on.hat**$(e_1,$ **hiroshi**$) \wedge \tau(e_1) \subseteq \text{TT} \wedge [\tau(e_1) < \tau(e_2) \vee \tau(e_1) \supseteq \tau(e_2)] \wedge$ **draw.picture**$(e_2,$ **hiroshi**$) \wedge \tau(e_2) \subseteq \text{TT} \wedge \tau(e_2) <$ now]]

(ii) $\exists e_2[\exists e_1[\exists e_3[$**put.on.hat**$(e_1,$ **hiroshi**$) \wedge$ **RS**$(e_3, e_1) \wedge \tau(e_3) \supseteq \text{TT} \wedge \tau(e_3) \supseteq \tau(e_2) \wedge$ **draw.picture**$(e_2,$ **hiroshi**$) \wedge \tau(e_2) \subseteq \text{TT} \wedge \tau(e_2) <$ now]]]

5 A Sign-Based Construction Grammar analysis

This section provides a formal analysis of the InfCx and GerCx in a version of Sign-Based Construction Grammar (SBCG; Sag 2010, forthcoming) coupled with Montague-style semantics.

5.1 The InfCx/GerCx with a temporal constraint

(21) shows a construction (in the SBCG sense) that licenses the versions of the InfCx and GerCx with the 'precedence or subsumption' sense. The type *suspensive* is the immediate supertype of *infinitive* and *gerund*, and the definition of **R** is provided in (22). The attribute LF, which stands for 'logical form', has a logical expression as its value. The up and down arrows with a subscript are metavariables over logical expressions; $\uparrow_n$ in (the LF of) a daughter sign should match $\downarrow_n$ in (the LF of) the mother sign.

(21)
$$\begin{bmatrix} \textit{temporal-suspensive-clause-cxt} & \\ \text{MTR}|\text{SEM}|\text{LF} & \left(\begin{array}{l}\lambda P_{\langle v,t\rangle}[\lambda Q_{\langle v,t\rangle}[\lambda e_2[\exists e_1[P(\text{e}_1) \wedge \mathbf{R}(P, \tau(e_1), \text{TT}) \wedge \\ [\tau(e_1) < \tau(e_2) \vee \tau(e_1) \supseteq \tau(e_2)] \wedge Q(e_2)]]]](\downarrow_1)(\downarrow_2)\end{array}\right) \\ \text{DTRS} & \left\langle \text{S}:\begin{bmatrix}\text{SYN}|\text{CAT}|\text{FORM} & \textit{suspensive} \\ \text{SEM}|\text{LF} & \uparrow_1\end{bmatrix}, \boxed{1} \right\rangle \\ \text{HD-DTR} & \boxed{1}\ \text{S}:\begin{bmatrix}\text{SEM}|\text{LF} & \uparrow_2\end{bmatrix} \end{bmatrix}$$

(22) $\mathbf{R}(P, i_1, i_2) = \begin{cases} i_1 \supseteq i_2 \text{ if } P \text{ is stative} \\ i_1 \subseteq i_2 \text{ if } P \text{ is dynamic} \end{cases}$

It is assumed here (i) that an infinitive/gerund clause modifies the main clause (rather than the main predicate), (ii) that linear word order does not necessarily reflect constituent structure, and variation in relative order between an adjunct clause and complements of the main clause is to be dealt with a Reape-style linearization mechanism, and (iii) a matrix sentence denotes a property of eventualities and its truth/falsehood is determined by the Truth Definition presented in (23) (cf. Ogihara 1996).

(23) **Truth Definition**: The logical expression $\phi_{\langle v,t\rangle}$ serving as a translation of a natural language matrix sentence is true with respect to context c, world w, and assignment g iff $[\![\exists e_0[\phi(e_0)]]\!]^{c,w,g} = 1$

In the case of (17a), the slots of $\uparrow_1$ / $\downarrow_1$ are filled by 'λe_4[**put.on.hat**(e_4, **hiroshi**)]', and the slots of $\uparrow_2$ / $\downarrow_2$ are filled by 'λe_5[**paint.picture**(e_5, **hiroshi**) $\wedge$ $\tau(e_5) \subseteq$ TT $\wedge$ $\tau(e_5) <$ now]'; by existentially binding the lambda-bound event variable in the resulting expression (Truth Definition), (20i) is obtained.

A key feature of the presented analysis is that it regards the temporal meaning of the InfCx/GerCx as contribution by the clause-linking construction, rather than by the infinitive/gerund form. This move is motivated by the fact that infinitive and gerund forms occurring in other environments do not necessarily convey temporal information. For example, in (24b), the gerund form of *kuru* 'come' occurring as part of a complex predicate with the benefactive auxiliary *kureru* does not convey any temporal information.

(24) a. Ashita chichi-ga kuru.
tomorrow father-Nom come.Prs
'My father will come tomorrow.'
b. Ashita chichi-ga **kite**-kureru.
tomorrow father-Nom come.Ger-Benefactive.Prs
'My father will come tomorrow for my sake.'

Likewise, in (25b), the infinitive form of *miru* 'see, watch' combined with an exemplificational particle *tari* does not convey any temporal information.

(25) a. Ato-de terebi-o miru.
later TV-Acc see.Prs
'I will watch TV later.'
b. Ato-de terebi-o **mi**-tari suru.
later TV-Acc see.Inf-for.example do.Prs
'I will do such things as watch TV later.'

5.2 The InfCx/GerCx with a rhetorical structural constraint

The versions of the InfCx/GerCx which indicate contrast between the two combined clauses can be formulated as in (26). The attribute RS, which stands for 'rhetorical structure', has a list of rhetorical relational specifications as its value. I suggest that the RS value of the mother is a list that (i) has all elements in the RS values of the daughters, and (ii) may further be augmented by rhetorical relational specifications introduced by the construction. By this principle, rhetorical relational specifications introduced within a sentence are all percolated up to the root level, and serve to update the rhetorical structural component of the discourse representation.

(26)
$$\left[\begin{array}{ll} \textit{contrast-suspensive-clause-cxt} & \\ \text{MTR}|\text{SEM} & \left[\begin{array}{ll} \text{LF} & \left(\begin{array}{l}\lambda P_{\langle v,t\rangle}[\lambda Q_{\langle v,t\rangle}[\lambda e_2[\exists e_1[P(\mathrm{e}_1) \wedge \\ \mathbf{R}(P, \tau(e_1), \mathrm{TT}) \wedge Q(e_2)]]]](\downarrow_1)(\downarrow_2)\end{array}\right) \\ \text{RS} & \left\langle \textit{contrast}(^\wedge\exists e_3[\downarrow_1](e_3), {}^\wedge\exists e_4[\downarrow_2](e_4))\right\rangle \oplus \boxed{\text{a}} \oplus \boxed{\text{b}} \end{array}\right] \\ \text{DTRS} & \left\langle \text{S}:\left[\begin{array}{ll} \text{SYN}|\text{CAT}|\text{FORM} & \textit{suspensive} \\ \text{SEM} & \left[\begin{array}{ll}\text{LF} & \uparrow_1 \\ \text{RS} & \boxed{\text{a}}\end{array}\right]\end{array}\right], \boxed{1}\right\rangle \\ \text{HD-DTR} & \boxed{1}\ \text{S}:\left[\text{SEM} \left[\begin{array}{ll}\text{LF} & \uparrow_2 \\ \text{RS} & \boxed{\text{b}}\end{array}\right]\right] \end{array}\right]$$

5.3 The GerCx on the resulting state interpretation

(27) illustrates a construction that licenses the version of the GerCx with the 'resulting state' sense. It specifies that the first daughter (the first clause) has to be headed by a gerund form, rather than an infinitive form.

(27)
$$\left[\begin{array}{ll} \textit{result-gerund-clause-cxt} & \\ \text{MTR}|\text{SEM}|\text{LF} & \left(\begin{array}{l}\lambda P_{\langle v,t\rangle}[\lambda Q_{\langle v,t\rangle}[\lambda e_2[\exists e_1[\exists e_3[P(e_1) \wedge \mathbf{RS}(e_3, e_1) \wedge \\ \tau(e_3) \supseteq \mathrm{TT} \wedge \tau(e_3) \supseteq \tau(e_2) \wedge Q(e_2)]]]]](\downarrow_1)(\downarrow_2)\end{array}\right) \\ \text{DTRS} & \left\langle \text{S}:\left[\begin{array}{ll} \text{SYN}|\text{CAT}|\text{FORM} & \textit{gerund} \\ \text{SEM}|\text{LF} & \uparrow_1 \end{array}\right], \boxed{1}\right\rangle \\ \text{HD-DTR} & \boxed{1}\ \text{S}:\left[\text{SEM}|\text{LF} \quad \uparrow_2\right] \end{array}\right]$$

6 Summary

It was argued that the Japanese infinitive/gerund-clause constructions have more complex meanings than previously claimed in the literature. They do not merely convey that the two described eventualities both hold, but indicate either that (i) the first-clause eventuality precedes or temporally subsumes the second-clause eventuality, or (ii) that (the propositions denoted by) the two clauses stand in the rhetorical relation of *contrast*. It was shown, with survey data, that the use of an infinitive/gerund-clause construction is infelicitous when neither of these conditions is satisfied. It was also pointed out that the gerund-clause construction has a distinct sense that the infinitive-clause construction lacks, which conveys that the resulting state of the first-clause eventuality, rather than the first-clause eventuality itself, temporally subsumes the second-clause eventuality. A formal analysis, couched in the Sign-Based Construction Grammar framework, of the two constructions and their three senses was presented.

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