Enough, *too*, and causal dependence[1]

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Abstract. *Enough-/too*-constructions (E/T constructions) have an **implicative** reading: e.g., *Mary was clever enough to leave early yesterday* entails *Mary left early yesterday*. I argue that this implicative reading is not due to the lexical semantics proper of *enough*/*too*, but due to its **bi-clausal structure** (e.g., the above-mentioned example is analyzed as *Mary left early yesterday because she was clever enough*). I analyze *enough* and *too* simply as degree modifiers that involve a comparison: *enough* means reaching the lower bound of an interval, while *too* means exceeding the upper bound of an interval. Then inspired by Schulz (2011), Baglini and Francez (2015), and Nadathur (2016), I relate the semantics of E/T constructions to **causal dependence**: due to some sufficiency/excess, the infinitival complement clause in E/T constructions is episodically or generically (depending on its aspect being perfective or imperfective) true/false. I also argue that this infinitive has its tense and aspect marked on the main predicate of sentences, resulting in the seeming correlation between aspect and implication in languages that overtly make a distinction between perfective and imperfective aspects (e.g., French).

Keywords: *enough*, *too*, comparatives, causal dependence, necessary (but not necessarily sufficient) causes, sufficient (but not necessarily necessary) causes, infinitives, implicatives.

1. Introduction

This paper analyzes the semantics of *enough*, *too*, and ***enough-/too*-constructions** (E/T constructions). E/T constructions contain an infinitival complement,[2] and it has been noticed that they have **implicative** inferences and license so-called **actuality entailment** (or **realis reading**) for their infinitival complement (Karttunen 1971). For example, sentence (1a) entails that its complement clause *Mary left early* is true, while sentence (1b) entails that its complement clause *Bill stayed awake* is **false** (i.e., the **negation** of this complement clause is true).

(1) E/T constructions and their actuality entailment:
   a. Mary was clever **enough** to leave early. ⇝ Mary left early.
   b. Bill was **too** tired to stay awake. ⇝ Bill didn't stay awake.

The implicative reading of these sentences is reminiscent of real implicatives (e.g., *manage*, see Karttunen 1971), but the contrast between (2a) and (2b) seems to suggest defeasibility and calls for a pragmatic account for the cases involving *enough*/*too*.

(2) a. Sue **managed** to finish homework, # but eventually, she failed to finish homework.
   b. (i) John was tough **enough** to win tennis matches, but yesterday, he lost.
      (ii) John was **too** proud to apologize, but Tom made him apologize anyway.

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[2]However, I will show that **not all** *enough-/too*-sentences containing an infinitive are genuine E/T constructions.

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However, a further complication has been noted by Hacquard (2005, 2006): in French, this defeasibility correlates with the use of **perfective/imperfective** aspect, as shown in (3). When French ***assez***(*enough*)-/***trop***(*too*)-sentences are in perfective aspect (i.e., **passé composé**), their actuality entailment is not cancelable (see (3a)), which is in contrast with the case of those *assez*-/*trop*-sentences in imperfective aspect (i.e., **imparfait**) (see (3b)).

(3) French *assez*-sentences in **perfective** vs. **imperfective** aspect:

a. Jean a été **assez** rapide pour s'enfuir, # mais il ne s'est pas enfui.
John was-PFV enough quick to escape but he didn't-PFV escape
'John was quick enough to escape, # but he didn't escape.' perfective

b. Jean était **assez** rapide pour s'enfuir, mais il ne s'est pas enfui.
John was-IPFV enough quick to escape but he didn't-PFV escape
'John was quick enough to escape, but he didn't escape.' imperfective

Nevertheless, as noted by Hacquard (2006) and Nadathur (2017), French *assez* and *trop* are still questionable as real implicatives, since the implication of real implicatives (e.g., *réussir*) can never be cancelled, no matter whether they are in perfective or imperfective aspect (see (4)).

(4) a. Juno a **réussi** à gagner la course, # mais elle n'a pas gagné.
Juno succeed-PFV to win the race, but she didn't-PFV win
'Juno managed to win the race, # but she didn't win.' perfective

b. Juno **réussissait** à gagner la course, # mais elle n'a jamais gagné.
Juno succeed-IPFV to win the race, but she didn't-PFV never win
'Juno managed to win the race, # but she never won.' imperfective

Thus we need to explain (i) why sentences in (1) have an implicative reading and (ii) why there seems a correlation between aspect and implication in French.

Previously, this implicative reading has been attributed to a two-way entailment between sufficiency/excess and the event described by the infinitival complement of E/T constructions. In particular, Hacquard (2005, 2006) has proposed that *enough* and *too* are real implicatives and their semantics already contains hidden two-way entailment, and it is the use of a genericity operator (which is overtly reflected by the use of imperfective aspect in French) that is responsible for the non-implicative readings (see Bhatt 1999). However, according to Nadathur (2017), *enough* and *too* are themselves not real implicatives: they only contain hidden modals to express some capacity, which makes them a necessary condition, and an actuality entailment arises due to (i) the use of a sufficiency operator that turns them into a sufficient condition and (ii) 'actualistic' aspectual coercion under perfective aspect (see Homer 2011).

In Section 2, I use a set of data to show that **not all** *enough*-/*too*-sentences contain an infinitival complement, and thus, the lexical semantics of *enough*/*too* should be much simpler, involving neither hidden two-way entailment nor hidden modals. In Section 3, with an interval-based framework for gradable adjectives (see Zhang and Ling 2015, 2017a,b), I analyze *enough* and *too* as degree modifiers: *enough* means reaching the lower bound of an interval (i.e., *not less* (*than*)), while *too* means exceeding the upper bound of an interval (i.e., *more* (*than*)).

Section 4 shows that not all *enough*-/*too*-sentences containing an infinitive are **genuine E/T constructions**. Genuine E/T constructions are actually **bi-clausal**, and **causal dependence** is involved in their interpretation (see (5)): the meaning of **sufficiency** brought by ***enough*** provides a **necessary but not necessarily sufficient** (i.e., **necessary but potentially insufficient**) cause for its complement clause to be **true**, while the meaning of **excess** brought by ***too*** provides a **sufficient but not necessarily necessary** (i.e., **sufficient but potentially unnecessary**) cause for its complement clause to be **false**. Based on Wurmbrand (2014), Section 5 shows that due to the restructuring-like syntax of genuine E/T constructions, the semantic tense and aspect of their infinitival complement are marked on the main predicate, resulting in the seeming correlation between aspect (or rather episodicity) and implication in languages like French.

(5) The interpretation of genuine bi-clausal E/T constructions involves causal dependence:

a. [[(1a)]] = Mary left early **because** she was clever enough. $\rightsquigarrow$ Mary left early.
b. [[(1b)]] = Bill didn't stay awake **because** he was too tired. $\rightsquigarrow$ B. didn't stay awake.

2. Challenges to previous accounts

Focusing on the actuality entailment for the infinitive in E/T constructions, previous studies (including Meier 2003; Hacquard 2005, 2006; Nadathur 2017) have proposed that (i) this implicative reading is essentially due to a **two-way entailment** between sufficiency/excess and the event described by the infinitival complement, and that (ii) either the lexical semantics of *enough*/*too* contains already hidden two-way entailment (Hacquard 2005, 2006), or it contains hidden modals that partially contribute to the expression of two-way entailment (Meier 2003; Nadathur 2017). Here I use naturally occurring examples to show that infinitives are not necessarily present in *enough*/*too*-sentences. Therefore, those previous accounts all under-generate.

According to Hacquard (2005, 2006), sentence (6) **presupposes** that there is a unique degree of quickness which is a necessary and sufficient condition for John's escape and **asserts** that John meets this condition. Thus, Hacquard (2006) proposes (7a) and (7b) as the lexical entries of *enough* and *too*. Their presuppositional requirement is underlined: there is a unique degree d such that in all possible worlds w' accessible from the actual world w, sentence Q is true (for *enough*) or false (for *too*) iff x reaches the degree d on the scale P in world w'. The assertion is that x reaches this unique degree d on the scale P in the actual world w.

(6) Jean a été **assez** rapide pour s'enfuir.
John was-**PFV** enough quick to escape
'John was quick enough to escape.' (French *enough*-construction in **perfective** aspect)
a. Presupposition: there is a degree of quickness sufficient & necessary for his escape.
b. Assertion: John had the degree of quickness sufficient & necessary for his escape.

(7) a. $[\![\text{enough}]\!]^w \stackrel{\text{def}}{=} \lambda P_{\langle d,\langle e,st\rangle\rangle}.\lambda Q_{\langle st\rangle}.\lambda x_e.P(\underline{\iota d : \forall w' \in \text{Acc}(w).Q(w') \leftrightarrow P(d)(x)(w')})(x)(w)$
b. $[\![\text{too}]\!]^w \stackrel{\text{def}}{=} \lambda P_{\langle d,\langle e,st\rangle\rangle}.\lambda Q_{\langle st\rangle}.\lambda x_e.P(\underline{\iota d : \forall w' \in \text{Acc}(w).\neg Q(w') \leftrightarrow P(d)(x)(w')})(x)(w)$
(P: gradable adjective; Q: the infinitival complement clause; x: subject.)

Under this account, as far as the actual world w is accessible to itself, the two-way entailment in the lexical entries of *enough* and *too* makes them **real implicatives**.

To account for the non-implicative reading of *enough-*/*too-* sentences in imperfective, Hacquard (2006) adopts Bhatt (1999)'s **genericity operator** (see (8)), which was originally developed to explain the correlation between aspect and implication for French ability modal *pouvoir*.[3] The use of this genericity operator is overtly reflected by the use of imperfective aspect in languages like French. As shown in (9), with the use of GEN, the set of accessible worlds is further restricted (by an overt or contextually-provided p), and the consequence is that the actual world is no longer necessarily one of those highly idealized ones where reaching a unique degree of quickness guarantees John's escape.

(8) $[\![\text{GEN}]\!]^w \stackrel{\text{def}}{=} \lambda p_{\langle st\rangle}.\lambda q_{\langle st\rangle}.\forall w'[w' \in \text{Acc}(w) \wedge p(w') \rightarrow q(w')]$ (p restricts the set of w'.)

(9) Jean était **assez** rapide pour s'enfuir
John was-**IPFV** enough quick to escape
'J. was quick enough to escape.' (French *enough*-construction in **imperfective** aspect)
GEN(w)[$\lambda w.w$ was relevant][λw. John had the sufficient/necessary quickness to escape in w]
In all **relevant** worlds, John had the quickness to escape.

However, real implicatives like *réussir* are immune to the actuality-entailment-cancelling effects of the genericity operator (see (4)), because even in imperfective sentences, their implicative reading is not cancelable. This poses a challenge for Hacquard (2005, 2006).

Alternatively, Bierwisch (1987), Meier (2003), von Stechow et al. (2004), Schwarzschild (2008), Marques (2012), and Nadathur (2017) take the view that *enough* and *too* are **intrinsically non-implicative**, i.e., their lexical semantics does not contain hidden two-way entailment. Nevertheless, *enough* and *too* are analyzed in terms of a comparison involving a hidden modal.

As shown in (10) and (11) (see von Stechow et al. 2004 and Nadathur 2017), *enough*/*too* relates a predicate Q (typically provided by the infinitival complement), a gradable adjective P, and an individual x. E.g., *Jo was fast enough to escape* means that in **any world** w' where Jo escaped, her speed was not higher than her actual speed in world w; *Jo was too slow to escape* means that in **at least one world** w' where Jo escaped, her speed was higher than her actual speed.

[3] Bhatt (1999) has pointed out that there is also a correlation between aspect and implication for French ability modal *pouvoir*, as illustrated by the contrast in (i). Bhatt (1999) proposes to analyze *pouvoir* as a real implicative like English *manage*: French *pouvoir* **asserts** the realization of its complement clause and **conveys the conventional implicature** that some effort contributes to the realization of the complement clause. Then Bhatt (1999) uses a genericity operator to derive the non-implicative reading of *pouvoir*-sentences in imperfective.

(i) a. Jean a **pu** soulever cette table, # mais il ne l'a pas soulevée.
John could-**PFV** lift this table but he didn't-PFV lift
'John was able to lift this table, # but he didn't lift it.' *pouvoir* + **PFV** $\rightsquigarrow$ actuality entailment

b. Jean **pouvait** soulever cette table, mais il ne l'a pas soulevée.
John could-**IPFV** lift this table but he didn't-PFV lift
'John was able to lift this table, but he didn't lift it.' *pouvoir* + **IPFV** $\not\rightsquigarrow$ actuality entailment

(10) a. $[\![\text{enough}]\!]^w \stackrel{\text{def}}{=}$
$\lambda Q_{\langle e,\langle st\rangle\rangle}.\lambda P_{\langle d,\langle e,st\rangle\rangle}.\lambda x_e.\{d : \forall w' \in \text{Acc}(w)[Q(x)(w') \rightarrow P(d)(x)(w')]\} \subseteq \{d : P(d)(x)(w)\}$

b. $[\![\text{too}]\!]^w \stackrel{\text{def}}{=}$
$\lambda Q_{\langle e,\langle st\rangle\rangle}.\lambda P_{\langle d,\langle e,st\rangle\rangle}.\lambda x_e.\{d : \exists w' \in \text{Acc}(w)[Q(x)(w') \wedge P(d)(x)(w')]\} \subset \{d : P(d)(x)(w)\}$

(11) a. $[\![\text{fast}]\!]^w \stackrel{\text{def}}{=} \lambda d_d.\lambda x_e.\text{SPEED}(x)(w) \geq d$ $\{d : \text{fast}(d)(x)(w)\} = [0, x\text{'s max. speed}]$

b. $[\![\text{slow}]\!]^w \stackrel{\text{def}}{=} \lambda d_d.\lambda x_e.\text{SPEED}(x)(w) < d$ $\{d : \text{slow}(d)(x)(w)\} = (x\text{'s max. speed}, +\infty)$

Based on these lexical entries, Nadathur (2017) proposes an account within Nadathur (2016)'s framework of **causal dependence** (see also Schulz 2011, Baglini and Francez 2015). According to this framework, as shown in (12), actuality entailment X holds if (i) there is a necessary and sufficient causing factor A and (ii) A holds.

(12) Given an **implicative** I and a complement proposition X, then $I(X)$
a. **presupposes** the existence of a **causing factor/event** A so that:
(i) A **is causally necessary for** X,
(ii) A **is causally sufficient for** X;
b. **asserts** that A holds in the world of evaluation. (i.e., the actualization of A.)

Thus, as illustrated in (13), under Nadathur (2017)'s account, the actualization of Jo's escape depends on (i) her speed in the actual world w (here written as 'Jo's maximum speed in w') being a **sufficient and necessary** factor for Jo's escape and (ii) Jo's actually being that fast.

Essentially, the lexical semantics of *enough* makes Jo's speed in the actual world a **necessary** factor, while the use of **a causal sufficiency operator** $\triangleright_{\text{CAUS}}$ further makes it a **sufficient** factor. Notice that the use of this causal sufficiency operator $\triangleright_{\text{CAUS}}$ requires that (i) the **flavor** of the modal involved in the lexical semantics of *enough* be **circumstantial** and that (ii) the gradable adjective represent **an exercisable capacity**. Finally, the use of **perfective** aspect (which is overtly marked in French) guarantees Jo's actually being that fast (see Homer 2011). Therefore, we get the actuality entailment that *Jo escaped*.

(13) Jo was fast enough to escape.
a. Jo's maximum speed is a **necessary** condition for her escape:
(i) Presupposition: $\exists d_{\text{nec}} : \forall w' \in \text{Acc}(w)[\text{Jo's speed in } w' < d_{\text{nec}} \rightarrow \neg\text{escape(Jo)}(w')]$
(ii) Assertion: Jo's max. speed in $w \geq d_{\text{nec}}$

b. Jo's maximum speed is a **sufficient** condition for her escape:
With (i) a **circumstantial modal** and (ii) a gradable adjective representing **an exercisable capacity**, the sentence backgrounds:
$\forall w' \in \text{Acc}(w)[\text{fast}(d_{\text{nec}})(\text{Jo})(w') \triangleright_{\text{CAUS}} \text{escape(Jo)}(w')]$

Nadathur (2017)'s account is similar to the account of Hacquard (2005, 2006) in that the implicative reading results from a two-way entailment. However, here this two-way entailment is not entirely due to the lexical semantics of *enough/too*, but partially due to the use of the operator $\triangleright_{\text{CAUS}}$. This brings some conceptual problems.

First, according to the framework (12), it has to be the same factor (here *A*) that serves both a necessary and a sufficient condition for *X*. However, for sentence (13), Jo's being d_{nec}-fast is by itself a necessary condition for Jo's escape, while it is the use of a sufficiency operator that turns this into a sufficient condition. Thus, it is questionable whether the necessary and the sufficient conditions are exactly the same here.[4]

Moreover, in the framework (12), implicative *I* is distinct from causing factor *A*. However, under Nadathur (2017)'s account, it remains unclear which element in E/T constructions contributes to the expression of implicative *I*. If it is the semantics of *enough*/*too*, then how can *enough*/*too* be involved in the expression of both the implicative and the causing factor? What would be the consequences in terms of compositionality? Further explanation is needed here.[5]

In fact, actuality entailment does not necessarily involve causally necessary and sufficient factors, or even causal dependence at all (i.e, actuality entailment might not even involve (i) causally necessary but insufficient or (ii) causally sufficient but unnecessary factors). For example, sentence (14) means that *John made a boat with oak* and entails that *John made a boat*, but no causal dependence is involved here. Thus, any account for the actuality entailment of E/T constructions needs to explain the exact source and the exact nature of their actuality entailment. The framework of (12), which only addresses causally necessary and sufficient factors, might turn out to be irrelevant.

(14) John used oak to make a boat. ⇝ John made a boat.

Empirically, by including hidden two-way entailment or modals in the lexical semantics of *enough*/*too*, the accounts of both Hacquard (2005, 2006) and Nadathur (2017) rely on the presence of infinitival complements for these degree adverbs and thus suffer from under-generation. Naturally occurring examples from *the Corpus of Contemporary American English* (*COCA*, Davies 2008) show that infinitival complements are not necessary in the use of *enough* and *too*.

(15) a. The double-bedded room seemed luxury **enough** compared to the farm house. (*Fantasy & Science Fiction*, 1995)
b. The rest of us do count for something, but not **enough** compared with him, since Walter's absence makes us all invisible in our parents' eyes and in our own. (*The Hudson Review*, 2009)
c. He was young **enough** and strong **enough** compared to H. (*CBS: 48 Hours*, 2011)
d. Erdogan and his party won a mere 258 seats, not **enough** even for a parliamentary majority. (*National Review*, 2015)
e. She uses a 2013 Dell laptop: new by government standards, but clunky **enough** compared with the cutting-edge devices of her former life. (*New York Times*, 2015)

[4]Notice also that the use of this sufficiency operator also brings additional stipulations (i.e., its requirements for modal flavor and adjective type), which makes this operator rather *ad hoc*. However, without these *ad hoc* stipulations, presumably, this operator would turn any necessary condition into a necessary and sufficient one.
[5]It seems that real implicatives like *manage* do not play this kind of dual role. According to the analysis of *manage* by Baglini and Francez (2015), *manage* invokes the existence of some necessary but insufficient factors, but does not express this kind of factors itself.

(16) a. The costs of this technology were at that time **too** high compared to diskettes for such applications. (*IBM Journal of Research and Development*, 1998)
b. (...) The U.S. petroleum industry found itself shutting in an extraordinary portion of its domestic production capacity, which was **too** high-priced compared to foreign-sourced oil. (*Journal of International Affairs*, 1999)
c. Perhaps it was **too** expensive compared to similar items. (*Reference & User Services Quarterly*, 2012/2013)
d. They appeared much **too** small compared with the actual Sun (...). (*space.com*, 2015)
e. Property taxes (...) are way **too** high compared with neighboring states. (*Omaha World-Herald*, 2017)

Obviously, the use of *enough*/*too* does not require the existence of infinitival complements. To have a unified account for both E/T constructions as well as the data in (15) and (16), we need much simpler lexical entries for *enough* and *too*. The mechanisms underlying the implicative reading of E/T constructions should not be part of the lexical semantics proper of *enough*/*too*.

3. Proposal: the semantics of *enough* and *too*

Here I propose that *enough* and *too* are simply **degree modifiers** that involve a **comparison** with a certain **interval** on a scale. Essentially, *enough* means **reaching** the **lower bound** of an interval, while *too* means **exceeding** the **upper bound** of an interval (see Figure 1).

To formally implement this proposal, I adopt Zhang and Ling (2015, 2017a,b)'s interval-arithmetic-based framework for the semantics of gradable adjectives and comparatives. This framework is motivated to allow for a **generalized comparison** on a scale and based on two assumptions. First, a comparative (e.g., *5:00 is 1 hour earlier than 6:00*) means a relation among three degree-related items: two positions on a scale — **comparative subject** and **comparative standard** (e.g., the positions marking *5:00* and *6:00* on the temporal scale) — and the distance between them — **differential** (e.g., here *1 hour*). Second, we adopt a generalized view for positions on a scale and represent them as intervals. An **interval** is a range of degrees so that it marks a position in a not-so-precise way. Thus it is a **convex** set of degrees: e.g., $\{x|a \leq x \leq b\}$, which means a position ranging from a to b and can also be written as $[a,b]$.[6] Operations on two intervals result in **the largest possible range** (Moore 1979). As shown in (17), a generalized comparison can be characterized in terms of **interval subtraction**: subtracting the interval representing the **comparative standard** from the interval representing the **comparative subject** results in a third interval — the **differential**.

(17) Interval subtraction:

$$\overbrace{[y_1,y_2]}^{\text{comparative subject}} - \overbrace{[x_1,x_2]}^{\text{comparative standard}} = \overbrace{[y_1-x_2, y_2-x_1]}^{\text{differential}} \quad \text{(Moore 1979)}$$

E.g., $[7,8]-[2,3]=[4,6]$

4 and 6 are the min. and max. **distances** between the **positions** $[7,8]$ and $[2,3]$ respectively.

[6] A convex totally ordered set is a totally ordered set P such that for any elements a and b in the set, if $a \leq b$, then any element x such that $a \leq x \leq b$ is also in the set. Evidently, sets such as $\{x|x \leq 5 \vee x > 8\}$ are not convex.

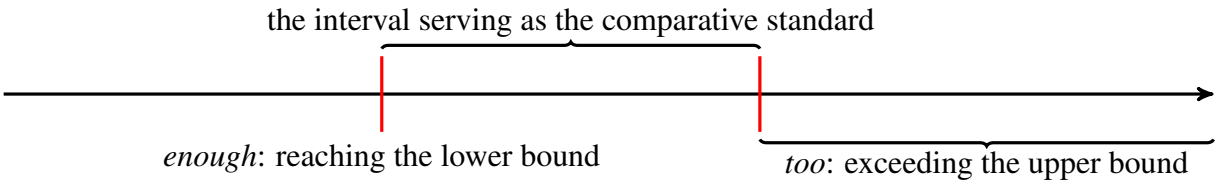

Figure 1: The lexical semantics of *enough* and *too*.
Enough means reaching the lower bound of an interval,
while *too* means exceeding the upper bound of an interval.

As shown in (18), the semantics of gradable adjectives is analyzed as relations between intervals (of type $\langle dt \rangle$) and entities (of type e). For the absolute use of gradable adjectives, the interval argument is a context-dependent interval I^C (see (18a)), which means 'the context-dependent interval such that it is from the lower to the upper bound of being tall for a relevant comparison class'. Then in (18b), $6'$ can be interpreted either (i) as a singleton set (for the 'exactly $6'$' reading) or (ii) as an interval with $6'$ as its lower bound (for the 'at least $6'$' reading).

(18) $[\![\text{tall}]\!]_{\langle dt,et \rangle} \overset{\text{def}}{=} \lambda I_{\langle dt \rangle}.\lambda x_e.\textsc{height}(x) \subseteq I$

a. $[\![\text{John is tall}]\!] \Leftrightarrow \textsc{height}(\text{John}) \subseteq I^C$ absolute use of gradable adjectives

b. (i) $[\![\text{John is } 6' \text{ tall}]\!] \Leftrightarrow \textsc{height}(\text{John}) \subseteq [6', 6']$ 'exactly $6'$' reading

(ii) $[\![\text{John is } 6' \text{ tall}]\!] \Leftrightarrow \textsc{height}(\text{John}) \subseteq [6', +\infty)$ 'at least $6'$' reading

More/-er is analyzed as the default differential in comparative sentences – $(0, +\infty)$: it refers to the largest possible range of positive degrees (see (19a)). Then, *little* changes the polarity of an interval (see (19b)). Based on the semantics of *more* and *little*, *less* means the default differential in *less-than* comparatives: it refers to the largest possible range of negative degrees (see (19c)). Finally, *(th)-an* encodes an interval subtraction (see (17) and (19d)).

(19) a. $[\![\text{more/-er}]\!]_{\langle dt \rangle} \overset{\text{def}}{=} (0, +\infty)$ (i.e., the default range of **positive** degrees)

b. $[\![\text{little}]\!]_{\langle dt,dt \rangle} \overset{\text{def}}{=} \lambda I_{\langle dt \rangle}.[0,0] - I$ (see Zhang and Ling 2017b)

c. $[\![\text{less}]\!]_{\langle dt \rangle} \overset{\text{def}}{=} [\![\text{little}]\!][\![\text{more/-er}]\!] = (-\infty, 0)$ (i.e., the default range of **negative** degrees)

d. $[\![\text{(th)-an}]\!]_{\langle dt,\langle dt,dt \rangle \rangle} \overset{\text{def}}{=} \lambda I_{\text{stdd}}.\lambda I_{\text{diff}}.\iota I[I - I_{\text{stdd}} = I_{\text{diff}}]$

(20) illustrates how to derive the meaning of a comparative sentence. Here the comparative standard denotes a range of values, and the interval-arithmetic-based framework precisely characterizes the sentence meaning and the semantic contribution of the comparative standard.

(20) $[\![\text{Lucinda is taller than every boy is}]\!] = [\![\text{tall}[\text{[-er] -an th-[every boy is (tall)]}][\text{Lucinda}]]\!]$

$\Leftrightarrow \textsc{hight}(\text{Lucinda}) \subseteq \iota I[I - [\![\text{the}]\!][\![\text{every boy is (tall)}]\!] = (0, +\infty)]$ (see (18): $[\![\text{tall}]\!]$)

$\Leftrightarrow \textsc{hight}(\text{Lu}) \subseteq \iota I[I - [\![\text{the}]\!][\lambda I'.[\forall x[\text{boy}(x) \rightarrow \textsc{hight}(x) \subseteq I']]] = (0, +\infty)]$

$\Leftrightarrow \textsc{hight}(\text{Lucinda}) \subseteq (I^{\text{the-interval-including-every-boy's-height}}_{\text{upper-bound}}, +\infty)$ (see (17): interval subtraction)

Based on these, I analyze *enough* as 'not less (than)', and *too* as 'more (than)' (see (21) and (23)): *enough* means reaching the lower bound of an interval I, while *too* means exceeding the upper bound. Similar to numbers (see (18b-i)), *enough* also has an 'exactly' reading (see (22)).

(21) [[John was strong **enough** compared to his classmates]] (see (15c))
= [[strong [**not** [**less -an th**-[his classmates (are strong)]]] [John]]]
$\Leftrightarrow$ STRENGTH(John) $\subseteq U \backslash \iota I[I - [[\text{the}]][[\text{his classmates (are strong)}]] = (-\infty, 0)]$
$\Leftrightarrow$ STRENGTH(John) $\subseteq U \backslash (-\infty, I^{\text{the-interval-including-his-classmates'-strength}}_{\text{lower-bound}})$ $U = (-\infty, +\infty)$
$\Leftrightarrow$ STRENGTH(John) $\subseteq [I^{\text{the-interval-including-his-classmates'-strength}}_{\text{lower-bound}}, +\infty)$
$\therefore [[\text{enough}]]_{\langle\langle dt,et\rangle,\langle dt,et\rangle\rangle} \stackrel{\text{def}}{=} \lambda G_{\langle dt,et\rangle}.\lambda I_{\langle dt\rangle}.\lambda x_e.G\text{-DIMENSION}_{\langle e,dt\rangle}(x) \subseteq [I_{\text{lower-bound}}, +\infty)$
(i.e., *enough* means reaching the lower bound of an interval, the lower bound included.)

(22) The 'exactly' reading of *enough*: reaching the singleton set of the lower bound
$[[\text{enough}]]_{\langle\langle dt,et\rangle,\langle dt,et\rangle\rangle} \stackrel{\text{def}}{=} \lambda G_{\langle dt,et\rangle}.\lambda I_{\langle dt\rangle}.\lambda x_e.G\text{-DIMENSION}_{\langle e,dt\rangle}(x) = [I_{\text{LOWER-BOUND}}, I_{\text{lower-bound}}]$
E.g., The city hides 3,000 eggs in an annual Easter egg hunt (...), which is **more than enough** for the 200 children who usually show up. (*COCA*, *The Detroit News*, 2017)

(23) [[This laptop was **too** expensive compared to similar items]] (see (16c))
= [[expensive [**more -an th**-[similar items (are expensive)]] [this laptop]]]
$\Leftrightarrow$ PRICE(this laptop) $\subseteq \iota I[I - [[\text{the}]][[\text{similar items (are expensive)}]] = (0, +\infty)]$
$\Leftrightarrow$ PRICE(this laptop) $\subseteq (I^{\text{the-interval-including-similar-items'-price}}_{\text{upper-bound}}, +\infty)$
$\therefore [[\text{too}]]_{\langle\langle dt,et\rangle,\langle dt,et\rangle\rangle} \stackrel{\text{def}}{=} \lambda G_{\langle dt,et\rangle}.\lambda I_{\langle dt\rangle}.\lambda x_e.G\text{-DIMENSION}_{\langle e,dt\rangle}(x) \subseteq (I_{\text{upper-bound}}, +\infty)$
(i.e., *too* means exceeding the upper bound of an interval, the upper bound excluded.)

As illustrated in (24), comparatives (in particular those containing modals in their *than*-clause) and *enough*/*too*-sentences are interchangeable in terms of truth conditions. The current account reflects exactly this interchangeability: *enough* and *too* are analyzed as variations of comparative morphemes *more*/*less*. Intriguingly, this interchangeability also shows that modals are not part of the meaning of *enough*/*too*. Instead, when modals are involved, they are part of the overtly expressed or contextually suggested comparative standard.

(24) CONTEXT: Cal wants to be a fighter pilot. Air Force regulations require all pilots to be between 5′4″ and 6′5″ tall.
a. If Cal is 6′6″,
Cal is **taller than** required = Cal is **too tall** (to be a pilot).
b. If Cal is 5′4″,
Cal is **not less tall than** required = Cal is **tall enough** (to be a pilot).

In sum, empirical evidence shows that *enough*/*too* does not always take an infinitival complement. Thus, by reducing *enough*/*too* to degree modifiers, I have excluded hidden modals or two-way entailment from their lexical semantics. In the *enough*/*too*-sentences in (24), it is the optional infinitival phrase *to be a pilot* that involves a modal element and contributes to the expression of comparative standard. In the next section, I show that in terms of syntax and semantics, the infinitival complement of **genuine E/T constructions** (see (1)) is totally different from the phrase *to be a pilot* in (24). Then I further explain the source and the nature of the implicative reading of genuine E/T constructions.

4. Causal dependence in the interpretation of E/T constructions

Having shown that not all *enough*-/*too*-sentences contain an infinitive, now I show that not all *enough*-/*too*-sentences containing an infinitive are **genuine E/T constructions** that have an implicative reading. Essentially, I argue that genuine E/T constructions with an implicative reading have a **bi-clausal** structure, while non-genuine E/T constructions have a **mono-clausal** structure. Section 4.1 presents the diagnostics of these two types of sentences. Then, Section 4.2 shows that the interpretation of bi-clausal E/T constructions involves causal dependence.

4.1. E/T constructions: bi-clausal vs. mono-clausal

At first sight, it seems that sentences (25a) and (25b) (hereafter called the *chess*-sentence and the *party*-sentence respectively) have the same syntactic structure, both containing an infinitive, but intuitively, we feel that only the *party*-sentence has an implicative reading. I will use four diagnostics to show that these two sentences actually have different syntactic structures.

(25) a. CONTEXT: Jerry was a talented kid. He wanted to learn to play chess. This club only admitted kids with an IQ of 120 from low-income families. (*chess*-sentence)
Jerry was clever **enough** to join this chess club. $\not\rightsquigarrow$ Jerry joined this chess club.

b. CONTEXT: Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold. (*party*-sentence)
Mary was clever **enough** to leave the party early. $\rightsquigarrow$ Mary left the party early.

First, under the given context, the infinitive in the *chess*-sentence can be omitted (since we can accommodate the comparative standard) or replaced by similar expressions that contribute to the expression of comparative standard (e.g., *for joining this chess club*, etc.), with no difference in meaning. As evidence, all the four sentences in (26a) are natural continuations here. In contrast, for the infinitive in the *party*-sentence, its omission or replacement by expressions like *for leaving the party early* would lead to differences in meaning. As evidence, among the three sentences in (26b), only (26b-i) sounds a natural continuation.

(26) **Diagnostic (I)**: whether the infinitive is omittable or replaceable

a. Jerry was a talented kid. He wanted to learn to play chess. This chess club only admitted kids with an IQ of 120 from low-income families ...
   (i) Jerry was clever enough to join this chess club.
   (ii) Jerry was clever enough. = (26a-i)
   (iii) Jerry was clever enough for joining this chess club. = (26a-i)
   (iv) Jerry was clever enough with regard to the threshold of IQ. = (26a-i)

b. Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold ...
   (i) Mary was clever enough to leave the party early. a natural continuation
   (ii) ?Mary was clever enough. ≠ (26b-i)
   (iii) #Mary was clever enough for leaving the party early. ≠ (26b-i)
   (This sounds like there's a qualification for leaving early.)

Second, (27a) shows that the *chess*-sentence can be nominalized without a change in meaning: for both the original and the nominalized versions, it is Jerry's cleverness that pleased his mother. In contrast, (27b) shows that the *party*-sentence cannot be nominalized without a change in meaning: for the original *party*-sentence, it is Mary's early leaving from the party that pleased her mother, but for the nominalized one, it seems that it is rather Mary's cleverness that pleased her mother.[7] Intriguingly, the semantic contrast shown in (27b) suggests that semantically speaking, the main information of the original *party*-sentence is not Mary's cleverness, but rather her early leaving from the party.

(27) **Diagnostic (II)**: whether the sentence can be paraphrased with nominalization
   a. CONTEXT: Jerry was a talented kid. He wanted to learn to play chess. This chess club only admitted kids with an IQ of 120 from low-income families.
      (i) Jerry was clever enough to join the club, so his mother was happy. =
      (ii) Jerry's sufficient cleverness to join the club makes his mother happy.
   b. CONTEXT: Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold.
      (i) Mary was clever enough to leave the party early, so her mother was happy. ≠
      (ii) Mary's sufficient cleverness to leave early makes her mother happy.

Third, (28a) shows that the *chess*-sentence cannot be turned into a '*be* adj. *enough so that*' version without a change in meaning. The semantic difference between (28a-i) and (28a-ii) can be shown by adding *but his family was too rich*. Due to its entailment that *Jerry joined this chess club*, sentence (28a-ii) sounds contradictory, but sentence (28a-i) does not have this entailment and does not sound contradictory. In contrast, (28b) shows that the *party*-sentence can be paraphrased with a '*be*-adj.-*enough-so-that*' sentence without a change in meaning: (28b-i) and (28b-ii) have the same meaning.

(28) **Diagnostic (III)**: whether the 'adj.-*enough-to*'-sentence can be paraphrased with a '*be*-adj.-*enough-so-that*' sentence
   a. CONTEXT: Jerry was a talented kid. He wanted to learn to play chess. This chess club only admitted kids with an IQ of 120 from low-income families.
      (i) Jerry was clever enough to join this chess club, but his family was too rich. **– no contradiction**
      (ii) Jerry was clever enough so that he joined this chess club, but his family was too rich. **– contradiction**
   b. CONTEXT: Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold.
      (i) Mary was clever enough to leave the party early.
      (ii) Mary was clever enough so that she left the party early.

[7] The nominalized version in (27b), i.e., (27b-ii), might not even be grammatical. According to Pesetsky (1991) and Pesetsky and Torrego (2001, 2004, 2006) (see Wurmbrand 2014), English infinitives can combine with nominalized irrealis predicates, but not with nominalized propositional, implicative, or factive predicates. Though it is unclear whether most native speakers of English would judge sentence (27b-ii) grammatical or not, it is certain that even if it is grammatical, the semantic contrast shown in (27) holds.

	genuine E/T constructions	non-genuine E/T constructions
example	(25b): Mary was clever enough to leave the party early.	(25a): Jerry was clever enough to join this chess club.
analysis of sentence structure	**bi**-clausal: (i) **comparative**: expressing a **cause** (ii) **infinitive**: expressing a **consequence** Main information of the sentence: the infinitive	**mono**-clausal: a **comparative** (Overt or covert *than*-clauses are not considered independent here.)
infinitive	not part of the comparative; not comparative-standard-related; not modal-related	part of the comparative; expressing **comparative standard**; containing **modal** elements
implicative reading	available	unavailable

Table 1: *Enough-*/*too*-sentences containing an infinitive can be divided into two categories.

Fourth, modal elements can be inferred from context (29a), and thus, both (29a-i) and (29a-ii) mean that Jerry's cleverness reaches the required value. However, given the context (29b), interlocutors cannot accommodate any requirement, and thus different from the felicitous sentence (29b-i), sentence (29b-ii) is infelicitous. Thus, sentence (29a-i) is interchangeable with a comparative containing a deontic modal in its *than*-clause, but sentence (29b-i) is not. This contrast suggests that while the infinitive of the *chess*-sentence conveys a certain modality, the infinitive of the *party*-sentence is actually irrelevant to the expression of any modality.

(29) **Diagnostic (IV)**: whether the sentence can be interchangeable with a comparative containing a deontic modal in its *than*-clause

a. Context: Jerry was a talented kid. He wanted to learn to play chess. This chess club only admitted kids with an IQ of 120 from low-income families.
   (i) Jerry was clever enough to join this chess club.
   (ii) Jerry was not less clever than he was **required** to be. = (29a-i)

b. Context: Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold.
   (i) Mary was clever enough to leave the party early.
   (ii) #Mary was not less clever than she was **required** to be. ≠ (29b-i)

In sum, these diagnostics suggest that the *party*-sentence (25b) is **bi-clausal**, including a **comparative** and an **infinitive**. Semantically, it is actually this infinitive that carries the main information (see Diagnostic (II)). Thus, this infinitive cannot be optional, and the whole sentence cannot be nominalized or reduced to a comparative. Crucially, this infinitive is not part of a comparative: it is not related to comparative standard, and it does not contribute any modal elements. Therefore, as shown in Table 1, there are two categories for *enough-*/*too*-sentences involving an infinitive. Only the interpretation of bi-clausal E/T constructions is implicative and involves causal dependence between its two clauses: the comparative part serves as a cause, and the infinitive serves as a consequence.

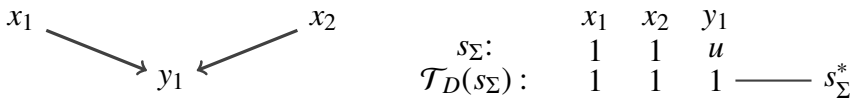

Figure 2: A dynamics D: $B = \{x_1, x_2\}$. $I = \{y_1\}$. $F(y_1) = \langle Z_{y_1} = \{x_1, x_2\}, f_{y_1} = (y_1 \Leftrightarrow x_1 \wedge x_2)\rangle$. E.g., let Σ be $\{x_1, x_2\}$, and s_Σ be the situation making all formulas in Σ true.

4.2. The semantics of E/T constructions: necessary vs. sufficient causes

Having shown that the implicative reading of genuine E/T constructions is due to its bi-clausal structure, here I further characterize the nature of this implicative reading. Inspired by Schulz (2011), Baglini and Francez (2015), and Nadathur (2016), I propose that **causal dependence** is involved in the interpretation of genuine E/T constructions. As illustrated in (30), bi-clausal E/T constructions can be paraphrased with the use of *because*: their infinitival complement represents a **consequence**, which **causally depends on** the factor expressed by the comparative.[8]

(30) a. [[M. was clever enough to leave early]] = [[M. left early **because** she was clever enough]]
b. [[Bill was too tired to stay awake]] = [[Bill didn't stay awake **because** he was too tired]]

The intuition here is that under a given context (e.g., (25b)), (30a) means that among many other factors (e.g., her willingness to sacrifice fun for health), Mary's cleverness (in decision-making) in this situation was a **necessary** (but not necessarily **sufficient**) one for her early leaving from the party, while (30b) means that among many other factors (e.g., his lack of effort to stay awake), Bill's excessive fatigue was a **sufficient** (but not necessarily **necessary**) one for his not staying awake.

I adopt the framework of Schulz (2011) to formally describe the causal dependence between the two clauses of E/T constructions:

(31) a. A **dynamics** D represents causal relationships over a set of propositions $\mathcal{P}$.
b. D includes
(i) a set of **background variables** B which are causally independent,
(ii) a set of **inner variables** $I = \mathcal{P} - B$,
(iii) the function F that associates every inner variable X with
(I) a set of propositions Z_X that X directly causally depends on,
and **(II)** a two-valued truth function f_X ($f_X : \{0,1\}^n \rightarrow \{0,1\}$) that describes how to calculate the truth value of X from the values of the members of Z_X.
c. A **situation** s is an incomplete valuation of the propositions in $\mathcal{P}$, mapping $\mathcal{P}$ to $\{0, 1, u\}$, where u means **undetermined**.
d. **Operator** $\mathcal{T}_D$ maps situations s to new situations $\mathcal{T}_D(s)$, calculating the direct

[8] In fact, this kind of bi-clausal causal-dependence-related constructions are not limited to E/T constructions, as illustrated by (i). (i) means that grass is green, which is a factor contributing to the promotion of photosynthesis.
(i) Grass is green to promote photosynthesis. (Williams 1974)

causal effects of the settings in s. After a finite number of applications of $\mathcal{T}_D$, the **least fixed point** s^*_Σ is reached. (see Figure 2 for an example.)

Based on these definitions, Baglini and Francez (2015) defines the notions of **causal sufficiency** (see (32a)) and **causal necessity** (see (32b)). Evidently, when s_Σ is **causally sufficient** for ϕ, then s_Σ **causally entails** ϕ, i.e., $s_\Sigma \vDash_D \phi$. s_Σ is **causally necessary** for ϕ when there is no s' (where ϕ is still undetermined) different from s_Σ that causally entails ϕ, i.e., $s' \vDash_D \neg\phi$.

(32) a. Let Σ be a set of literals and D a dynamics. Then $s_\Sigma \vDash_D \phi$ iff$_{\text{def}}$ $[\![\phi]\!]^{D,s^*_\Sigma} = 1$
(i.e., s_Σ **causally entails** ϕ given D iff ϕ is true on the least fixed point s^*_Σ.)

b. $\phi \lhd_D s_\Sigma$ iff$_{\text{def}}$ $\neg\exists s'$: $\underbrace{s' \neq s_\Sigma}_{\text{in the values of determined variables relevant for } \phi}$ $\wedge \underbrace{s'(\phi) \neq 1}_{\phi=u \text{ in } s'} \wedge$ $\underbrace{s' \vDash_D \phi}_{s' \text{ causally entail } \phi}$

For E/T constructions, the causal dependence between the comparative (C) and the infinitive (X) is formally described in (33). Obviously, as noted by Baglini and Francez (2015), the choice of dynamics (in particular what background and inner variables are under consideration) plays a crucial role in analyzing causal dependence. Thus, following Baglini and Francez (2015), I choose particular contexts to construct dynamics and provide empirical evidence for (33).

(33) The causal dependence between C and X in E/T constructions:

a. *enough*-sentences: $\underbrace{\neg C \vDash_D \neg X}_{C \text{ is causally } \textbf{necessary} \text{ for } X}$ It is not necessary that C is causally sufficient for X.

b. *too*-sentences: $\underbrace{C \vDash_D \neg X}_{C \text{ is causally } \textbf{sufficient} \text{ for } \neg X}$ It is not necessary that C is causally necessary for $\neg X$.

In *enough*-sentences, C is causally necessary for X. (34) shows that *enough*-sentences are infelicitous under contexts where $C = 0 \wedge X = 1$. Thus, C has to be causally necessary for X.

(34) Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold. **Mary was drunk, but Jo took her back early.**
– *What happened to Mary?*
a. #– *Mary was clever enough to leave the party early.*
(C = Mary was clever enough. X = Mary left early.)

In *enough*-sentences, C can be causally insufficient for X. For (35), $F(X) = \langle Z_X = \{C, K\}, f_X = (X \Leftrightarrow K \wedge C)\rangle$. The felicitous answer (35a) shows that C can be an insufficient factor for X.

(35) Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold. **Mary made a wise decision, and since she stayed sober, she drove back early herself.** – *What happened to Mary?*
a. ✓– *Mary was clever enough to leave the party early.*
(X = *Mary left early*, C = *Mary was clever enough*, K = *Mary stayed sober.*)

In *too*-sentences, C is causally sufficient for $\neg X$. (36) shows that *too*-sentences are infelicitous under contexts where $\neg X \Leftrightarrow C$. Thus C alone has to be sufficient for $\neg X$. Note that under (36), the answer *Bill was too busy to come last night* sounds misleading, and those who know the whole context have very good reason to claim that this answer misses the crucial point.

(36) If we don't invite Bill, Bill comes only if he is not overly busy. But if we invite Bill, he comes no matter whether he is busy or not. **Last night, we didn't invite Bill, and Bill was overly busy, so he didn't come.** – *What happened to Bill?*
a. ?– *Bill was too busy to come last night.*
(X = *Bill came*, C = *Bill was overly busy*, K = *Bill wasn't invited.*)

In *too*-sentences, C can be causally unnecessary for $\neg X$. For (37), $F(X) = \langle Z_X = \{C, K\}, f_X = (\neg X \Leftrightarrow K \vee C)\rangle$. For those who know the whole context, the answer (37a) is still acceptable and truthful, suggesting that C can be an unnecessary factor for X.

(37) Bill does not come if he is overly busy or sick. **Last night, he was both overly busy and sick, so he didn't come.** – *What happened to Bill?*
a. ✓– *Bill was too busy to come last night.*
(X = *Bill came*, C = *Bill was overly busy*, K = *Bill was sick.*)

A further prediction of the current account is that since **positive *enough***-sentences contain a **necessary** (but not necessarily **sufficient**) cause for their infinitival complement to be **true**, **negative *enough***-sentences should contain a **sufficient** (but not necessarily necessary) cause for their infinitival complement to be **false**; while since **positive *too***-sentences contain a **sufficient** (but not necessarily necessary) cause for their infinitival complement to be **false**, **negative *too***-sentences should contain a **necessary** (but not necessarily **sufficient**) cause for their infinitival complement to be **true**. (38) and (39) show that this prediction is perfectly borne out.

(38) a. Mary was clever enough to leave early. ⇝ Mary left early.
b. Mary was not clever enough to leave early. ⇝ Mary didn't leave early.

(39) a. Bill was too busy to come last night. ⇝ Bill didn't came last night.
b. Bill was not too busy to come last night. ⇝ Bill came last night.

This kind of pattern for the implicative reading of positive and negative E/T constructions is actually due to the lexical semantics of *enough*/*too* and their interplay with negation in creating dual relations, as sketched out in (40). Overall, the current account characterizes the nature of the implicative reading of positive and negative E/T constructions in a precise way.

(40) a. [[clever **enough**]] = [[not **too** stupid]] ⇝ a **necessary** (but not necessarily sufficient) cause for the infinitival complement to be realized
b. [[not clever **enough**]] = [[**too** stupid]] ⇝ a **sufficient** (but not necessarily necessary) cause for the **negation** of the infinitival complement to be realized

infinitive type	examples	syntax	episodic interpretation	temporal composition of infinitive
irrealis future	*decide*, *expect* *expect*	control ECM	possible	*woll*
propositional	*claim* *believe*, *expect*	control ECM	impossible	reference time is attitude holder's NOW
non-propositional; no attitude holder	***manage*** *begin*, *seem*	**control** ECM	**dependent on matrix tense**	**reference time is matrix reference time**

Table 2: Wurmbrand (2014)'s framework on tense properties of English infinitives

5. The tense and aspect of the infinitival complement of E/T constructions

According to Wurmbrand (2014), infinitives are not semantically tenseless. As shown in Table 2, her framework for tense properties of English infinitives includes three classes: **(i)** future irrealis infinitives, **(ii)** those expressing propositional attitude reports, and **(iii)** those involving no attitude holder.

Here I argue that the infinitives of bi-clausal E/T constructions fall into the third class. There are at least two reasons for this. First, similar to *manage*-sentences, E/T constructions involve no attitude holders. Second, Faraci (1974) has shown that the infinitives in E/T constructions (even including *for*-phrases, e.g., *Mary runs too fast* ***for me to keep up with her***) are reduced sentential objects (i.e., smaller than CP or even TP), which makes them similar to the infinitival complement of core **restructuring** predicates like *manage* (see Wurmbrand 2001, 2004). Thus, as a consequence, E/T constructions constitute a single temporal domain, and the tense and aspect (or rather **episodicity** in the framework of Wurmbrand 2014) of their infinitival complement are reflected on the syntactically main predicate of the sentence.

Though Wurmbrand (2014)'s framework focuses on English infinitives, it seems generalizable to cross-linguistic data. For example, Marques (2012) notes that for Portuguese implicative E/T constructions, temporal overlap between the main predicate and the infinitive is required. This is a natural consequence if Wurmbrand (2014)'s analysis also works for Portuguese infinitives.

As mentioned earlier, for French E/T constructions, there seems a correlation between aspect and implication. An explanation is easily available if Wurmbrand (2014)'s analysis can be extended to French. In French, imperfective and perfective aspects are used to characterize generic and episodic events respectively. Thus, since the implicative reading of an E/T construction typically describes an episodic event (e.g., *Mary was nice enough* ***to come last night***), its semantic aspect is perfective, leading to a perfective marker on the main predicate in French. In other words, it is the episodicity of the entailed event that dictates the requirement for the aspect of the main predicate, not the other way round. This explains why the aspect of the main predicate is not a perfect indicator for the implicative reading (see the discussion of Hacquard 2006 and Nadathur 2017): a non-genuine E/T construction is a comparative and thus usually in imperfective, but sometimes it can also be in perfective.

6. Summary and outlook

This paper addresses the semantics of *enough*/*too* and E/T constructions. It includes three components: (i) an interval-based account for the lexical semantics of *enough*/*too*; (ii) a causality-based account for the semantics of E/T constructions; and (iii) a brief analysis of the semantic tense and aspect of the infinitival complement in E/T constructions. The conclusion is that ***enough* and *too* are essentially variations of comparatives** (i.e., *enough* means *not less* (*than*) and *too* means *more* (*than*)), but **bi-clausal E/T constructions are real implicatives**. To some extent, I agree with Nadathur (2017) that *enough* and *too* are not implicatives, but I also agree with Hacquard (2005, 2006) that (bi-clausal) E/T constructions are real implicatives. Crucially, by showing that genuine E/T constructions are bi-clausal, I attribute the source of implicative readings to this bi-clausal structure, not to the lexical semantics proper of *enough*/*too*. Moreover, by showing that implicative readings do not necessarily rely on the existence of two-way entailment or a sufficient and necessary condition, the current analysis more precisely characterizes the interpretation pattern of E/T constructions. As mentioned in Section 4, the pattern of causal dependence in the interpretation of positive and negative E/T constructions is related to the lexical semantics of *enough*/*too*, then is there a unified underlying mechanism for the interpretation pattern of the whole inventory of implicatives (see (41))? Syntactically, do implicatives all involve restructuring (cross-linguistically)? These are left for future research.

(41) Implicatives
   a. Involving a **necessary** cause for the infinitival complement to be realized: **French *pouvoir*** (e.g., *Jean a pu aller* means *John went because he could*, see Bhatt 1999), ***enough to***, ***not too to***, ***manage to*** (see Baglini and Francez 2015), ...
   b. Involving a **sufficient** cause for the **negation** of the infinitival complement to be realized: ***too to***, ***not enough to***, ***fail to*** ...

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