The semantics of infinitival tense*

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Based on both experimental and crosslinguistic evidence, this paper argues for a novel empirical generalization: infinitives crosslinguistically and within the same language are deficient in tense; in other words, they cannot bear past or present tense. First, I provide novel experimental evidence showing that infinitival tense cannot be interpreted de re. Second, I present a survey of infinitival adjunct constructions in English, Catalan, Spanish, Japanese and Korean, all of which are tenseless in different ways despite their different properties. Based on these pieces of evidence, I argue that infinitives can be tenseless in one of three ways. They can have a dependent tense specification, of which there are two types: anaphoric, de se tense for propositional and future-irrealis infinitives, or tense sharing between the matrix and embedded predicate for aspectual and eventive infinitives. The third kind of tenselessness is true tenselessness, where the temporal interpretation is merely an implicature. Finally, to help support this generalization, I provide an analysis of infinitives with the aspectual marker *have* in terms of anaphoric tense.

Keywords: tense, infinitive, control, de re, de se

1 Introduction

A thorny issue in the literature, which has become even more vexing recently, is whether infinitives have tense. Owing to the lack of tense morphology, infinitives in English were classified as tenseless by traditional grammars. But appearances can be deceiving. Stowell (1982) argued that control infinitives have a temporal interpretation that follows the matrix tense. This can be seen in a sentence like (1) below, in which Caitlin's eating of a salad must take place after Caitlin's decision to do so. This is further evidenced by the possibility of the adverbial *tomorrow*:

(1) Caitlin decided [to eat a salad (tomorrow)].

On the other hand, the temporal interpretation of exceptional case-marking (ECM) with respect to the matrix tense can range from simultaneous (2a), futurate (2b) or past (2c), as seen in the set of sentences (2a)-(2c). Their temporal specification is determined by the embedding predicate:

(2) a. Caitlin considers [herself to be the most beautiful].
b. I expect [Madeline to eat the most food].
c. I remember [Periwinkle to be the fluffiest].

*Some of the examples in this paper that I have cited from the literature that have male proper names have been changed to female proper names. I am grateful to Susi Wurmbrand first and foremost for extensive comments. In addition, I am grateful to David Pesetsky and Toshiyuki Ogihara for comments at various stages of this project.

Wurmbrand (2014) provides convincing arguments that such infinitives are tenseless, at least in some sense. Some basic arguments in favor of her account are as follows. It is well known that English PRES is indexical and must include the utterance time. This excludes a before-present interpretation (3a) and triggers a *double access* reading (3b). The parallel infinitives in (3a) and (3b) show neither of these restrictions, which Wurmbrand (2014), following Ogihara (1995), takes as evidence for their lack of tense.

(3) a. Leo decided a week ago [that he will go to the party (*yesterday) / to go to the party yesterday].

b. 5 years ago, she claimed [#that she is pregnant / to be pregnant].

The goal of this paper is to defend the idea that infinitives are "tenseless." But before doing so, we need to clarify what it means for a clause to be tenseless. I will attempt to do so based on two primary sources of evidence. First, I provide novel experimental data that infinitival tense must be read de se, on a par with infinitival subjects like PRO. This was done via an experiment involving 600 native speakers of English recruited from Prolific. Second, I provide crosslinguistic data from infinitival complements in English, French and Dutch and infinitival adjuncts in Catalan, Spanish, Japanese and Korean. I thus extend Wurmbrand's conclusion that infinitival complements are tenseless to adjuncts. I conclude that while infinitives show different properties, they all share deficiency in temporal interpretation.

A clause can be *tenseless* in one of three ways. First, it can have anaphoric tense in the sense of Heim (1994) and Abusch and Rooth (1997) among others, where there is a deleted tense variable which is bound by a higher lambda abstractor. Second, it could involve tense sharing rather than bound tense, in which case infinitives lack an obligatory de se reading, for instance. Finally, certain infinitives in languages like Japanese and Korean can be completely tenseless, on a par with discourse in tenseless languages like Yucatec Maya. But I believe that all of these infinitives have something in common. To be precise, I argue for the following novel empirical and semantic generalization: **infinitives cannot bear a PAST or PRES tense.**. In other words, infinitives are necessarily deficient in tense, by their very nature.

This paper is structured as follows. Section 2 provides a background to the debate on whether infinitives are tensed or tenseless and recent developments, together with some novel evidence from Dutch and French which Wurmbrand's account predicts. Section 3 provides novel experiental evidence in favor of Wurmbrand's account that infinitives cannot have a de re interpretation. Section 4 provides a crosslinguistic survey of infinitival adjuncts in English, Catalan, Spanish, Japanese and Korean all of which exhibit different kinds of tenselessness. Section 5 provides an analysis of the different kinds of infinitival complements and adjuncts. Section 6 builds on this analysis, providing a tenseless account of *have*-EN infinitives. Section 7 concludes, while the appendix in section 8 discusses the details of the experiment.

2 Are infinitives tensed or tenseless?

Infinitival tense is a complex and controversial topic. It is therefore not surprising that in addition to disagreeing on whether infinitives are tensed or necessarily tenseless, linguists also disagree regarding the classification of tense within different kinds of infinitival complements. Table 1

below provides the reader with a summary of the classification of infinitival tense according to four approaches that have been proposed in the literature.

Table 1: A comparison of four different accounts of infinitival tense. Given that Null Case theories do not have an account of tense in propositional infinitives, it has been marked with a ?.

Type	**Null Case**	**Pesetsky**	**Landau**	**Wurmbrand**
Event (*begin)*	+tense	+tense	–tense	–tense
Forward expanded (*decide)*	+tense	+tense	+tense	–tense
Implicative (*manage)*	+tense	+tense	–tense	–tense
Factive (*hate)*	+tense	+tense	+tense	–tense
Propositional (*claim)*	+tense?	+tense	+tense	–tense

Thus, it would be essential to provide the reader with a discussion of the different theories. Section 2.1 presents the Null Case approaches to infinitival tense, while 2.2 discusses Wurmbrand's theory in which all classes of infinitives are tenseless. Section 2.3 presents Pesetsky's alternative approach which is almost empirically indistinguishable. Although this section is mostly a background, I provide novel evidence in favor of Wurmbrand's account from two languages which have indexical PRES tense like English: Dutch and French. Infinitives in these languages also allow a before-present interpretation and lack a double access reading, as expected.

2.1 Infinitives are tensed

Stowell (1982) was the first to refine the notion of tense in infinitives. He generalized that control infinitives like (1) were futurate with respect to matrix tense, while ECM infinitives in (2a)-(2c) were not restricted in the same way. Martin (1996) builds on Stowell's generalizations, presupposing Chomsky and Lasnik (1993)'s account of Null Case, which was an attempt to provide a principled explanation for the complementary distribution between PRO and overt elements such as pronouns and proper names. Martin notes two kinds of control infinitives, implicative (4a) and factive (4b), are not future-oriented, as seen below.

(4) a. Caitlin managed to get chocolate on her face.
b. Caitlin was surprised to get a present for Christmas.

Martin thus proposes that, rather than control infinitives necessarily being future-oriented, they just need to have some kind of modal element. This is similar to how the modal *will* can have non-future oriented meaning in certain contexts. Martin (2001) provides further evidence for Stowell's generalizations, based on the impossibility of eventive complements in ECM infinitives. (5a) below is a control infinitive with an eventive reading while (5b), an ECM infinitive, is unacceptable with such a reading. (5c), however, is acceptable because it contains the aspectual marker *be*. Martin adopts Enç (1991)'s account, in which eventive predicates are bound by a modal or temporal operator to explain the difference between control infinitives, which have such an operator, and ECM infinitives, which cannot.

(5) a. Ginny remembered to bring a beer.
b. * Ginny believed Rebecca to win the game.

c. Ginny believed Rebecca to be competing at the game.

Many linguists have noted a great deal of empirical problems for Null Case theories of infinitival tense, however. As we will see, the presence or absence of infinitival tense has been shown to not be predictable. Landau (1999) claims otherwise, however: according to Landau, partial control predicates take tensed complements whereas exhaustive control predicates do not, as seen in the contrast (6a)-(6c) below.

(6) a. Mary claimed to have met at 6. *propositional*
b. Mary wanted/decided/wished to meet at 6. *future-oriented irrealis*
c. * Mary tried/began/started/continued to meet at 6. *eventive*

This does not yet conclude our discussion of theories in which infinitives are tensed. After all, Pesetsky (2021) proposes such an account. For the time being, we move onto Wurmbrand (2014), who exposes multiple fatal issues for Stowell and Martin's approaches, leaving Pesetsky to 2.3.

2.2 Infinitives are tenseless

The theory of infinitival tense that will be assumed, and built upon, in this paper is Wurmbrand (2014)'s. For her, all kinds of infinitives–even the propositional infinitive with the aspectual marker *have*–are tenseless, at least in some sense.[1] I will now review several of her arguments.

Stowell and Martin claim that eventive control predicates like *try*, *begin* and impliccative ones like *manage* are future-oriented. Wurmbrand notes this makes an incorrect prediction: they cannot contain the adverbial *tomorrow*, while other predicates like *decide* can:

(7) a. Yesterday, Caitlin decided/wished/hoped to eat chocolate tomorrow.
b. Yesterday, Caitlin tried/began/managed to eat chocolate (*tomorrow).

Furthermore, Wurmbrand provides a counterexample for Martin (2001)'s generalization regarding ECM infinitives not allowing eventive complements: the predicate *claim*. We have seen in (6a) that *claim* is a partial control predicate. It does not allow eventive readings (8a), which I force with the adverbial *right then*. But it can have aspectual markers like *be* or *have* (8b) and be interpreted habitually (8c).

(8) a. * Caitlin claimed to eat chocolate right then.
b. Caitlin claimed to be eating chocolate/be happy.
c. Caitlin claimed to eat chocolate sometimes.

In addition, the Stowell-Martin view makes incorrect predictions regarding the presence of tense in English control infinitives more generally. To see why, it is important to get into the details of tense in English more generally. It is well-known, as noted by Enç (1987), Ogihara (1995) and Abusch (1997) among others that the English PRES is indexical.[2] This is illustrated by the

[1] Wurmbrand (2014) and Wurmbrand and Lohninger (2019) argue that infinitival complements should be split into three types based on their different temporal interpretations. I will discuss this in detail in section 5.

[2] There does not appear to be a survey of languages in the literature which have indexical PRES, which would be hugely useful. I have personally determined that Dutch has indexical PRES, and Demirdache and Lungu (2011) note that French does as well. It is not the case that all Germanic and Romance languages have indexical PRES, however. German does not have an indexical PRES (Susi Wurmbrand, p.c.) and neither does Italian, according to Giorgi and Pianesi (1997). I am not aware of any other languages with indexical PRES.

double-access reading of (9) below, in which the embedded time must be equivalent to the utterance time. (9) is unacceptable simply because pregnancy usually lasts nine months, and the finding-out time precedes the embedded time by five years:

(9) # Five years ago, Leo found out that Mary is pregnant.

In addition, in (10) the embedded time with *will* must take place after the utterance time:

(10) Leo found out that Mary will be pregnant.

This property of *will* follows if, we assume with Abusch (1984) among others that future is not a simple tense but composed of two parts: a modal *woll* contributing posteriority and a PRES or PAST tense.[3] Morphologically, PRES + *woll* is spelled out as *will*, while PAST + *woll* is spelled out as *would*. Now, notice that the finite embedded clause in (11) cannot have a before-present interpretation, due to the indexical PRES in English:

(11) Leo decided a week ago that he will go to the party (*yesterday).

At this point, Stowell-Martin approach and Wurmbrand's make distinct predictions. If infinitives are tensed, one would expect that double-access interpretations would be obtained with infinitives as well, while before-present interpretations are not allowed. Neither of these predictions are borne out: infinitives never have double-access interpretations in English, and they allow before-present interpretations:

(12) a. Leo decided a week ago to go to the party yesterday.
b. 5 years ago, she claimed to be pregnant.

Wurmbrand's approach makes a clear prediction in other languages which have indexical PRES and infinitives. I have verified that French and Dutch have double-access interpretations below:

(13) a. # Il-y-a cinq ans, Pierre a dit que Rose est enceinte.
ago five years, Pierre has said that Rose is pregnant
'Five years ago, Pierre said that Rose is pregnant.' French
b. # Vijf jaar geleden, zei Daniël dat Maria zwanger is.
five years ago said Daniel that Maria pregnant is
'Five years ago, Daniel said that Maria is pregnant.' Dutch

Like English, I have verified that they also lack double-access interpretations with infinitives:

(14) a. Il-y-a cinq ans, Rose a affirmé être enceinte.
ago five years, Rose has claimed be.INF pregnant
'Five years ago, Rose claimed to be pregnant.' French
b. Vijf jaar geleden, beweerde Mary zwanger te zijn.
five year ago, claimed Mary pregnant to be
'Five years ago, Mary claimed to be pregnant.' Dutch

And before-present interpretations are permitted only in infinitives in both Dutch and French.

(15) a. Rose a décidé il-y-a une semaine de faire de l'exercice hier.
Rose has decided ago one week to do of exercise yesterday
'Rose decided a week ago to exercise yesterday.' French

[3] A semantics for *woll* is presented in section 5.1.

b. Mary besloot een week geleden om gisteren te gaan sporten.
Mary decided a week ago at yesterday to go exercise
'Mary decided a week ago to start exercising yesterday.' Dutch

One more argument in favor of this account remains. The sequence of tense (SOT) phenomenon noted by Ogihara (1996) appears to reveal that future infinitives do not contain the modal *will*; that is, *woll* with PRES tense. Wurmbrand follows Ogihara in assuming that SOT effects arise from a rule that deletes tense at LF, just in case it is in the scope of another tense that has the same value.[4] This is how, under the most salient interpretation of the sentence, the embedded time in a sentence like *Leo found out that Mary was pregnant* overlaps with the finding-out time. In addition, both authors take SOT effects to take place with PRES as well, not just PAST.

Let us now consider a structure with three clauses. In both (16a) and (16b) below, both the matrix tense and the most deeply embedded tense have morphological PAST tense. In (16a), the first embedded clause has *will*, and this prevents the possibility of the time of Leo's telling to be at the same time as the meal time. By contrast, with the future-oriented infinitive which Wurmbrand takes to have *woll*, this is possible, because the infinitive lacks PRES.

(16) a. Leo promised me yesterday that he will tell his mother tomorrow that they were having their last meal together. ✗ *telling time = meal time*

b. Leo promised me yesterday to tell his mother tomorrow that they were having their last meal together. ✓ *telling time = meal time*

As expected, *would* also allows it, as seen in (17).

(17) Leo promised me yesterday that he would tell his mother tomorrow that they were having their last meal together. ✓ *telling time = meal time*

She notes one last fact with the SOT variation of *would*, which is *woll* with PAST tense.[5] *Would* is blocked in an embedded clause if the matrix tense is not PAST, but an infinitive is allowed:[6]

(18) a. * Leo will promise me tonight that he would tell his mother tomorrow...

b. Leo will promise me tonight to tell his mother tomorrow that they were having their last meal together.

Wurmbrand's account is thus at a significant empirical advantage compared to the Stowell-Martin approach. But this does not mean we need to completely give up the idea that infinitives are tensed. One could suppose that the infinitive has a different tense value in different contexts to account for all of Wurmbrand's data–which is precisely what Pesetsky (2021) proposes.

2.3 Revived from the dead: infinitives are tensed (?)

Another interpretation of Wurmbrand's findings is possible. Pesetsky (2021) argues that Wurmbrand only shows that the future-oriented infinitive does not behave uniformly like a clause with

[4]My goal here is to only focus on the empirical facts. The formal semantic details of sequence-of-tense readings will be presented in section 5.1.

[5]SOT *would* in embedded clauses is only allowed with matrix past tense. It is usually blocked in matrix clauses, except for a somewhat antiquated context: the consequent of a conditional missing its antecedent.

[6]Wurmbrand takes this to indicate that future-irrealis complements lack even anaphoric tense. I argue against this in section 5.1.

would or *will*, not that the infinitive is tenseless.[7] Let us reconsider the sentences in (16a)-(16b) and (18a)-(18b) above. Notice that replacing *will* with *would* allows the telling time to be equivalent to the meal time in (16a), and (18a) is acceptable if *will* is replaced with *would*:

(19) a. Leo promised me yesterday that he would tell his mother tomorrow that they were having their last meal together. ✓*telling time = meal time*

b. Leo will promise me tonight that he will tell his mother tomorrow...

Here is the basic idea. The future-oriented infinitive, which has the modal *woll*, has one of two temporal interpretations: sequence-of-tense (SOT) PAST, which is equivalent to *would*, or PRES, which is equivalent to *will*. Here is a more concrete example. Suppose that we are dealing with a predicate like *decide* which accepts both an infinitival complement and a finite one. If in a context only *would* is permissible with a finite embedded clause, in that same context if the infinitive were used instead, it would be interpreted as if it had a *would* (that is, with *woll* and SOT PAST). If in a context only *will* is permissible with a finite embedded clause, then the infinitive would be interpreted with *will*, or *woll* and PRES.

In this way, all of Wurmbrand's data is accounted for. Both of the infinitives in (12a)-(12b) above repeated in (20a)-(20b) below have SOT PAST, precluding the possibility of double access and allowing a before-present interpretation:

(20) a. Leo decided a week ago to go to the party yesterday.

b. 5 years ago, she claimed to be pregnant.

Pesetsky's idea is very difficult to distinguish from Wurmbrand's account, for two reasons. First, it is easy to verify that embedded PRES under matrix PRES is almost identical to SOT PRES anyway, whether or not it takes place. And as we will discuss in more detail in 5.1, SOT PAST is already the kind of tenselessness that I have in mind for future-irrealis oriented infinitives.

One apparent empirical advantage for Pesetsky's account might be the possibility of relative present tense, in bold (21), which Wurmbrand cannot straightforwardly derive. No PRES is present to derive the relative interpretation. Crucially, this pattern can only happen with future-oriented embedding verbs like *hope*, as Anand and Hacquard (2008) (A&H) point out.

(21) Last week, the weatherwoman hoped/*tried to announce **that it's snowing**.

Wurmbrand suggests that Pesetsky would be able to derive this by generating the infinitive with PRES. I do not believe this is right, however, given that it would predict the possibility of *will* instead of the infinitive in (21), which is contrary to fact. Only *would* is possible, indicating that the infinitive in (21) may only have SOT PAST:[8]

(22) * Last week, the weatherwoman hoped that she will announce that it's snowing.

(23) Last week, the weatherwoman hoped that she would announce that it's snowing.

[7] The reader is referred to Pesetsky (2021) for the syntactic framework in which he proposes his account, which he calls the Principle of Unambitious Reverse-Engineering (PURE).

[8] The contrast could be derived via the presence of *woll*, if, following Anand and Hacquard (2008), one supposes that PRES is an anti-PAST polarity item that needs to escape the scope of PAST. This derives the de re interpretation of double access readings–if de re readings involve movement. Movement will take place unless there is an intervener like *woll*. One could suppose that the relative present only arises in this context due to the presence of the *woll*. This explains the difference between *hope* and *try* in (21) as well, since *try* does not project *woll*. Both Wurmbrand and Pesetsky would be able to use this, but I will not pursue this solution in this paper.

Thus, Pesetsky and Wurmbrand's accounts remain very difficult to distinguish.

Although Pesetsky does not state directly how to determine whether the infinitive bears PAST or PRES, one can make an empirical generalization regarding the choice of tense in English infinitives. Notice that only *will* is allowed in the embedded clause if the matrix tense is also PRES:

(24) a. In a year, Caitlin will promise to become pregnant.
b. In a year, Caitlin will promise that she will/*would become pregnant.

The following generalizations can be made: if the matrix tense is PAST, then the embedded tense of an infinitive must be SOT PAST. If the matrix tense is PRES, then the embedded tense of an infinitive must be PRES. Crucially, I have not specified whether embedded infinitival PRES under this account would necessarily be SOT. For some speakers of English, I believe it need not be. This will now allow me to distinguish between Wurmbrand and Pesetsky's accounts.

3 The impossibility of temporal de re in English infinitives

We are currently at an impasse. But I believe that the PRES tense, or lack thereof, may be used to distinguish the accounts. Pesetsky's account predicts the possibility of de re readings of PRES tense in an infinitive, whereas Wurmbrand does not. As such, my goal in this section is to provide novel experimental evidence in favor of Wurmbrand's account, via an investigation of the possibility of temporal de re in English propositional infinitives. Prior to doing so, I must first provide the reader with an interaction to the semantics of de se, de re and how it relates to tense in 3.1. I then briefly discuss the experiment to distinguish between the two accounts in 3.2.

3.1 Background to temporal de re

It has been well-known since at least Castañeda (1966) that infinitival subjects–PRO–is obligatorily interpreted *de se*. Evidence for this is given in (25), in which we see a contrast between overt pronouns, which allows a de re construal, and PRO does not. The context provided brings out a de re interpretation, in which Leo is not aware that he himself is on fire, meaning that he does not bear a de se self-acquaintance relation to the man he believes to be on fire, in this case himself. Instead, he bears a different acquaintance relation; namely *the man Leo sees in the mirror*. The overt pronoun *he* in (25a) can be read de re, while PRO in (25b) cannot be:

(25) Leo is very drunk and on fire. He says the man in the mirror is on fire, not realizing that it is in fact himself.
a. Leo claimed he was on fire.
b. # Leo claimed to be on fire.

Following Chierchia (1990), we assume that the clausal complement contains a lambda abstraction operator, which binds a variable associated with the subject. This semantics makes it possible for one to bear an attitude de se towards a property just in case that property is self-ascribed. This rules out the possibility of de re interpretations.

(26) Leo claimed [λx [x to be on fire]]

We suggest that this operator necessarily binds tense in propositional infinitival clauses as well, following Heim (1994) and Abusch (1997), among others. As a result, tense also depends on the self-acquaintance relation. More specifically, SOT readings of embedded anaphoric tense, whether it is deleted or base-generated, also involves binding of the embedded tense variable by an abstraction operator. In other words, SOT tense, like PRO, is simply a variable that is abstracted over and then indirectly bound by the matrix tense. This leads to a de se interpretation with respect to the matrix attitude predicate.

(27) a. Mary claimed that she was pregnant.
b. Mary PAST_0 claimed λ1 [that she t_1-be pregnant]

I follow Heim (1994) in assuming res-movement for de re interpretations.[9] In fact, Heim originally applied res-movement to tense, and since then it has been extended to pronouns. In a de re interpretation of a pronoun, the res, *he* in (28) (=(25a)), moves out of the embedded clause to an argument position (the *res*) of the attitude verb.

(28) Leo [claimed he_1] [λ1 [t_1 was on fire]]

Most crucial for our purposes is that the double access interpretation has been treated as a special cases of de re (see Heim, 1994, Ogihara, 1995, Abusch, 1997, among others). Under such accounts, sentences such as (29a) are treated as involving a de re interpretation of the embedded PRES tense, rather than an indexical tense, yielding the same result; namely, that the utterance time must be included.

(29) a. Mary claimed that she is pregnant.
b. Mary [claimed PRES_1] λ1 [that she t_1-be pregnant]

Though it has long been noted in the literature that PRO needs to be read de se, this leaves open an important question. One wants to know whether infinitival tense needs to be read de se as well. If Abusch (1997) and Schlenker (2004) are right in extending the same de se restriction to tense in infinitives, then we would expect this to be the case. My goal now is to provide a foundation to experimentally test whether a de se interrpretation of tense is obligatory. This will help us to distinguish between Wurmbrand and Pesetsky's accounts.

3.2 PRES-under-*will* constructions

We are now ready to discuss the differing predictions the accounts make. Simply put, Pesetsky (2021) predicts that a temporal de re reading should in principle be available in infinitives, whereas Wurmbrand does not. But infinitives in which Pesetsky supposes that SOT PAST would be present are both theoretically and empirically indistinguishable from Wurmbrand's account. This is because, for Wurmbrand, SOT PAST is just anaphoric tense, and counts as a kind of tenselessness. What we therefore need to look is the present tense.

I believe that the two accounts can be distinguished in PRES-under-*will* constructions. Pesetsky is unclear regarding the nature of PRES in the infinitive. It is theoretically possible that it need not be SOT PRES–it could just be plain PRES. In principle, de re readings could arise with this. In

[9] An alternative to Heim's semantics for de re readings of tense is presented by Percus and Sauerland (2003) involving the notion of a concept generator. For our purposes, either approach could be used.

this section, I summarize the results of an experiment, showing that finite PRES-under-*will* constructions allow de re readings, as has been observed by Ogihara and Sharvit (2012) (O&S).

O&S note that some, but not all, speakers accept the interpretation of (30a) below, in which the embedded tense is read de re, as seen in the LF (30b):

(30) a. In 2 months, Mary will tell her mother that she is going to the Catskills tomorrow. Mary said to her mother: "I went to the Catskills about 2 months ago."

b. Mary PRES_1 woll [$\text{tell}^{\text{de re}}$-$\text{PRES}_3$] her mother λ3λ1 [she t_3-be-going to the Catskills]

If such a reading is allowed in a subset of speakers, then this means that this subset need not delete embedded PRES via the SOT operation. In other words, there is no SOT in the embedded clause, so PRES is interpreted de re. The possibility of de re readings in PRES-under-*will* constructions leads to the following prediction: such an interpretation should be allowed with the infinitive in (31), at least for the people noted to exist by O&S.

(31) Brian is preparing to buy a car tomorrow for his wife as a present, but he's keeping it a secret for her birthday next week, when he will tell his wife "I bought you a car last week!"

a. Next week, Brian will claim that he is buying a car for his wife. *finite*

b. Next week, Brian will claim to be buying a car for his wife. *infinitive*

Since the judgments are subtle and subject to idiolectal variation, as O&S point out, I conducted an experiment to determine whether a contrast exists among speakers who accept de re interpretations with embedded present. The details of the experiment are in the Appendix.

But, to summarize, it was a forced-choice experiment on Prolific with 600 native English speakers. The large sample size was necessary given how few accept (30a). The goal was to isolate speakers who accepted O&S's de re interpretation in (30a), then determine whether this group preferred the finite or the infinitival form in cases like (31). First, participants were asked if they found pairs like (30a) acceptable. If they answered yes, they were placed in Group A (n=76). If they answered no, they were placed in Group B (n=524). Although Group A is overall small and I found that speakers tend not to accept shifted readings in (30a), I believe that the number of speakers still confirms O&S's observation and is large enough to further test my prediction.

Tensed approaches to infinitives predict that Group A should not prefer the finite or infinitive form in temporal shifting contexts like (31). However, if tense in infinitives is read de se (and hence anaphoric tense), Group A should prefer the finite form over the infinitive. This prediction was borne out: Group A preferred the finite form (63.16%) over the infinitive (36.84%) at ($p<0.001$). Group B, who find (30a) unacceptable, did not make a contrast (48.03% vs. 51.97%). This is because Group B requires the use of SOT with embedded PRES.

The results of this experiment indicate that the de re interpretation of tense mirrors that of PRO, even in the subset of speakers who do accept the de re interpretation of embedded PRES with finite clauses. In other words, if native speakers have a preference for interpreting PRO de se, then this must also be the case for infinitival tense. I follow Heim (1994) in analyzing infinitival tense in propositional and irrealis complements as a deleted tense variable bound by a higher λ-operator. This indicates that tense in infinitives, at least in infinitival complements, is necessarily deficient, and Wurmbrand's approach is on the right track. I will spell out a semantics for this in section 5. But now, I would like to touch upon tense in infinitival adjuncts, rather than complements, which I believe provides novel evidence for the empirical generalization in this paper.

4 Tense in infinitival adjuncts

I have argued that infinitival tense is necessarily deficient, in that it cannot be PAST or PRES. But we have thus far seen the properties of tense in infinitival complements. If the empirical generalization in this paper is correct–or, at least, not purely limited in scope to complements–we would expect it to extend to infinitival adjuncts as well. I believe this to be the case, and I will present a survey of evidence from English, Catalan, Spanish, Japanese and Korean in favor of this claim.

Starting with English, given that there is no raising out of adjuncts, as they are syntactic islands, we can only look at control complements. Landau (2013) lists a variety of infinitival adjuncts with control in English (p. 221-222), of which the first is a gerund, not an infinitive: [10]

(32) a. *Temporal gerund*
Bill$_i$ called us [before/after/while/without PRO$_i$ visiting his aunt].

b. *Result clause*
Mary$_i$ grew up [PRO$_i$ to be a famous actress].

c. *Outcome/telic clause*
The ship$_i$ sank [only PRO$_i$ to be dredged up again].

d. *Goal clause*
Max$_i$ works hard [PRO$_i$ to stay out of jail].

e. *Stimulus clause*
Mary$_i$ smiled [PRO$_i$ to think what a fool she had been].

f. *Object purpose clause*
We bought Mary$_i$ the dog [PRO$_i$ to play with].

g. *Subject purpose clause*
She called a detective$_i$ [PRO$_i$ to investigate the affair].

h. *Rationale clause*
We$_i$ bought Mary$_j$ the dog [(in order) PRO$_{i/*j}$ to play with it].

Let's start from the top. As Landau points out, unlike the infinitives, it appears that the gerund can have its own tense specification in (32a), although only with the assistance of a preposition such as *before*, indicating that even the tense of a gerund is deficient in some sense. This can be seen further in free adjunct constructions such as in (33a)-(33b), in which a nonfinite predicative phrase functions as an adverbial subordinate clause.[11]

(33) a. Having taken out the trash, Mary decided to take a break.

b. Leaving her home in the morning, Kim reached her dorm at noon.

But our objects of investigation in this paper are not gerundival constructions, but infinitival ones. According to Landau, all the adjunct clauses in (32) are cases of obligatory control: for instance, the controller must be the subject (usually) or an object of a clause which immediately dominates

[10]The control status (whether PRO is obligatorily or non-obligatorily controlled) for rationale clauses is controversial, as Landau notes. The reader is referred to Landau (2013) for further discussion.

[11]See Stump (1985) for further details on the interpretation and analysis of these constructions. He notes that it is rare for infinitives to appear in the free adjunct construction, with only one example (p. 5):

(i) To tell you the truth, I have never really thought of them that way.

the adjunct; arbitrary and long-distance control readings are ruled out, and only sloppy readings emerge under ellipsis. But most importantly, relating it to the experiment I discussed in the section prior, PRO needs to be read de se in such cases. An example with a de re context is in (41a):

(34) Max is a sleepwalker. There is a thief on the streets who steals money from the rich and gives it to the poor. Max supports the criminal and tries to keep him out of jail by covering up his leftover evidence. He does not know, however, that he is in fact unconsciously the thief–the thief persona takes over when Max is asleep.

a. # Max works hard to stay out of jail.

The de se tendency of PRO ought to mirror the tense of these adjunct clauses. And it indeed appears that the temporal interpretation of the infinitives is much more constrained than those of gerunds. As Stowell (1982) notes, the temporal interpretation of subject purpose clauses is future-oriented, while for rationale clauses it is either simultaneous or future-oriented. Stowell's judgment can be extended to the other kinds of adjunct control in Landau's list, as well. For instance, the temporal interpretation of the result, telic and object purpose clauses must be future-oriented, whereas the goal and stimulus clauses must have simultaneous interpretations.

English is not the only reported language in which adjunct infinitives are deficient in tense; Rigau (1995) has reported the same in Catalan and Spanish. She discusses temporal adjuncts constituted by an infinitive verb that follows a preposition: *before*, *after* or *in*. She argues that the adjuncts, in bold, in (35)-(36) are PPs.

(35) Todo el mundo aplaudió **al acabar el concierto**.
everybody applauded in-the to-finish the concert
'Everybody applauded when the concert was finished.' Spanish

(36) Tothom va aplaudir **en acabar el concert**.
everybody applauded in to-finish the concert
'Everybody applauded when the concert was finished.' Catalan

She argues that the preposition must specify the temporal interpretation of the adjunct as a whole by acting as a temporal operator–in the same manner as other operators such as *yesterday* or *tomorrow*. It is easier to see how *before* or *after* can behave as a temporal operator; *before* requires that speaking follows the choking in (37b) below, while the opposite is the case for *after*. In the case of (37a), Rigau claims that the preposition expresses simultaneity: John's choking must take place at the same time as John's speaking.

(37) a. Juan se atragantó al tomar la palabra.
John himself choked in-the to-take the word
'John choked when he began to speak.'

b. Juan se atragantó antes de tomar la palabra.
'John choked before beginning to speak.

c. Juan se atragantó después de tomar la palabra.
'John choked after beginning to speak. Spanish

Rigau claims that the infinitival tense itself is too deficient to support a temporal interpretation on its own. Thus, a temporal operator such as a preposition is necessary. It thus appears that tense in Spanish and Catalan adjuncts is similar to that of tense in English temporal gerunds, as previously shown in (32a) above, as they also need to be supported by another temporal operator.

Crucially, however, both tenses are deficient. But as we will now see by looking at Japanese and Korean, there are different kinds of tense deficiencies.

Infinitival constructions are rarer in Japanese and Korean; in these languages, control predicates often take subjunctive clauses as complements instead. However, there is a set of constructions which have often been called coordination structures in the literature, in which the non-final "conjunct" must be untensed. I believe that the non-final "conjunct" in such constructions is in fact an infinitive or a gerund akin to a free adjunct in English. In fact, following Lee and Tonhauser (2010) (L&T), they lack tense entirely: their temporal interpretation is merely implicated.

Examples of such constructions are illustrated in Japanese and Korean in (38a)-(38b).[12] Although one has the temptation to assume that E.T.'s riding of the bike takes place prior to E.T.'s flying, in the movie, E.T. flies while riding a bike. And both (38a)-(38b) can be paired felicitously with this context, crucially without the need for any adverbs.

(38) Context: After watching the ending scene of the movie *E.T.*, Yenghi says:

a. E.T.-ka cacenke-lul tha-ko, pihayng-ul ha-ess-ta.
E.T.-NOM bike-ACC ride-and flight-ACC do-PAST-DECL
'E.T. rode a bike. And he flew.' Korean, Lee and Tonhauser (2010)

b. E.T.-wa jitensha-ni not-te ton-da.
E.T.-TOP bike-at ride-and fly-PAST
'E.T. rode a bike and flew.' Japanese, Lee and Tonhauser (2010)

I believe that such constructions are not in fact coordination constructions, and as such L&T's glossing in (38a)-(38b) is not correct. As Oshima (2012) points out, in grammars the verb of the non-final "conjunct" is called a gerund with the suffix, and an infinitive without. In fact, the suffix is fully optional, which L&T do not note, making it much less likely it is a genuine coordination suffix. But Oshima (2012) notes one piece of conclusive evidence that the non-final "conjunct" is not really a conjunct. This involves the Coordinate Structure Constraint (CSC), which is a type of the strong island effect. This can be seen in English below:

(39) * which professor did you divide the cake between [Caitlin and t]?

Oshima notes the following examples (40a)-(40b) in Japanese which involve movement out of the "conjunct." I have verified that this is also the case in Korean.

(40) a. [Ensoku-ga chuushi-ni nari/natte t_i ichiban
excursion-NOM cancellation-DAT become.INF/become.GER most
zannengat-ta] gakusei$_i$-wa Hiroshi$_i$-da.
be.disappointed-PST student-Top Hiroshi-COP.PRES
'The student who was most disappointed when the excursion was canceled is H.'

b. [sensoo-ga owari/owatte t_i kakki-o torimodoshi-ta] machi$_i$
war-NOM end.INF/end.GER liveliness-ACC regain-PST city
'a city that regained its liveliness after the war ended.' Japanese

As such, I believe that these constructions are in fact free adjunct constructions, like we saw in English above. Now, the free adjunct is usually interpreted as taking place at the same time or prior to that of the main event, as in the examples from L&T below:

[12] In Korean, the verb in the non-final "conjunct" can optionally have tense, whereas in Japanese it cannot. In my Korean examples, the verb always lacks tense marking.

(41) a. Ku-nun swuswul-ul pat-(ko) cikum-un cal cinay-n-ta.
he-TOP surgery-ACC receive-(GER) now-TOP well do-NPST-DECL
'He had a surgery and now he is doing well.' Korean

b. Kare-wa shujutsu-o uke-(te) ima-wa daijoobu-da.
he-TOP surgery-ACC take-(GER) now-TOP fine-COP.NPST
'He had a surgery and now is fine.' Japanese

But there are contexts in which the event described in the free adjunct can in fact come after the main event. In (42a)-(42b) from L&T below, this can be done without the temporal adverbs:

(42) a. Uimilon hakhoi-ey ka-ko cikum-un palphyo cwunpi-lul
semantics conference-at go-GER now-TOP presentation preparation-ACC
ha-n-ta.
do-NPST-DECL
'I will go to a conference and I am preparing for the presentation now.' Korean

b. Imiron gakkai-ga at-te ima-wa happyoo-no junbi-o
semantics conference-NOM exist-GER now-TOP presentation-GEN preparation-ACC
siteiru.
do-PROG-NPST
'I will go to a conference and I am preparing for the presentation now.' Japanese

It can also be interpreted as being at the same time, as we saw in (38a)-(38b). All temporal possibilities seem to be instantiated with the free infinitival adjunct in these languages.

For L&T, the temporal interpretation of the nonfinal conjunct in such constructions is fully determined by Aktionsart and the discourse context, mirroring the interpretation of tense in truly tenseless languages such as Yucatec Maya and Kalaallisut. It is not part of the truth-conditional meaning in narrative discourse but is merely implicated.[13] Thus, even though two events in narrative discourse usually receive a sequential interpretation, such an implicature can be canceled by the right context. For instance, it is possible to cancel the contextually implied reading in (41a)-(41b) (because people usually aren't doing well before surgery) by adding that the surgery is in fact tomorrow although he is doing fine prior to the surgery.[14]

L&T argue against different proposals which assume that the free adjunct has some tense, none of which can cover the full range of facts. These analyses split into a few different classes, all of which assume some kind of a tense-like restriction. For instance, Yoon (1993, 1994, 1997), Kang (1988) and Hirata (2006) all assume that the tense of the main clause introduces a restriction on the temporal interpretation of the free adjunct, but this is challenged by the examples seen in this section. Kuno (1973), Arikawa (1992) and Ogihara (1998) all assume that gerund marker in Japanese is temporal, meaning "and then" and requires the free adjunct to precede the main event. This is challenged by examples (42a)-(42b). Finally, Fukushima (1999) proposes an answer similar to Pesetsky (2021)'s PURE: the temporal interpretation of the free adjunct is recovered via a version of the ellipsis resolution mechanism in Dalrymple (2005).[15]

[13]The reader is referred to Lee and Tonhauser (2010) for the formal details on their analysis.

[14]This is evidence against the possibility pointed out to me by David Pesetsky (p.c.) that the temporal ordering may be due to the presence of a null adverb in the free adjunct. Adverbial meaning is part of the asserted content, and so cannot be canceled.

[15]Although in these cases Fukushima proposes that the presence of adverbs can supersede the ellipsis resolution

I conclude with L&T that free adjuncts in Japanese and Korean are fully tenseless. The empirical scope of this paper can therefore be extended to all infinitives, and not merely complements. But this leads to a great deal of confusion as to what we mean when we call an infinitive "tenseless," which now needs to be clarified at an even greater level of urgency. In addition to infinitival complements, an analysis for the different kinds of temporal adjuncts that we have just seen will now be provided in the next section.

5 Analysis

Clarifying the notion of tenselessness in an infinitive can only be done via a formal semantic analysis. The goal of this section is to provide a semantics for the three different types of infinitival complements discussed by Wurmbrand and Lohninger (2019) (henceforth W&L) which syntactically are represented by different sizes: propositional (CP), future-irrealis (TP) and eventive complements (vP). These complements are distinguished by their different temporal properties.

I will discuss the empirical differences and theoretical similarities between propositional and future-irrealis infinitival complements in 5.1. Crucially, I claim that their temporal interpretation is anaphoric. I then propose the separation of the complement of *try* into a fourth class of infinitive in 5.3, and then propose an account of vP eventive complements in 5.4. The temporal interpretation in these cases is not anaphoric, I argue, but rather involves tense sharing between the matrix and embedded predicates. I synthesize these theoretical and empirical generalizations in 5.5 into the key empirical claim of this paper: no matter the type of infinitive, they are necessarily deficient in tense, unable to bear PAST or PRES.

5.1 Propositional and future-irrealis infinitival complements

The split between propositional and future-irrealis complements is a common one in syntax, starting with Stowell (1982) on the distinction between control infinitives and ECM-infinitives. As mentioned in section 2, for Stowell, all control infinitives have a future-irrealis meaning whereas ECM-infinitives are propositional. But as Wurmbrand notes, the existence of the control predicate *claim* is challenging for this generalization:

(43) * Yesterday, Mary claimed to be happy tomorrow.

(44) Yesterday, Mary decided/hoped/wished/wanted to be happy tomorrow.

Unsurprisingly, even if a finite complement is possible with a future-irrealis predicate, it must still have a future meaning and cannot have a past interpretation:

(45) a. Clara decided that she would fly/will fly to Paris next week.

b. * Clara decided that she flew to Paris last year.

Unlike future-irrealis infinitives, propositional ones are interpreted as occurring simultaneously with the matrix predicate as in (46a)-(46b) or shifted into the past as in (46c)-(46d). We will discuss the nature of *have*-EN infinitives in section 6 in further detail. Furthermore, propositional

mechanism, L&T point out that the adverbs are fully optional, and the temporal interpretation of the free adjunct can be recovered from the context alone.

infinitives behave like finite clauses in that when referring to a non-generic episodic event simultaneous with the matrix time, they cannot occur in a non-progressive form, as in (46a)-(46b).

(46) a. Clara believes/claims that she is eating salad/*eats salad right now.
b. Clara believes Danny to be eating/*to eat salad right now.
Clara claims to be eating/*to eat salad right now.
c. Clara believes/claims that Danny ate salad.
d. Clara believes Danny to have eaten salad.
Clara claims to have eaten Salad.

Following Grano (2015) and contra Wurmbrand (2014), I believe that both kinds of infinitives project tense, but crucially such a tense can only be anaphoric, interpreted in the NOW of the attitude holder. In other words, they cannot bear PAST or PRES. For Wurmbrand, only propositional complements project anaphoric tense; one reason is that the nonfinite and finite complement of *claim* appear truth-conditionally equivalent, at least when both the tense and the overt pronoun of the embedded finite clause are read de se.

(47) a. Caitlin claimed to be pregnant.
b. Caitlin claimed that she was pregnant. (under SOT reading, de se *she*)

In addition, the complement of *claim* must be stative and cannot be interpreted episodically. Such a contrast can be captured if eventive complements do not project tense at all and involve tense sharing, as I will propose in 5.3-5.4:

(48) a. * Caitlin claimed to leave right then.
b. Caitlin managed to leave right then.

By contrast, irrealis complements do allow episodic interpretations. Wurmbrand (2014) takes this to indicate that irrealis complements do not have anaphoric tense, and just involve tense sharing between the matrix and embedded predicates:

(49) Caitlin wanted/hoped/decided to go tomorrow.

Grano (2015) points out that this possibility arises due to the presence of the modal *woll*, however. Grano shows that anaphoric tense disallows perfective episodic eventive predicates more generally, accounting for (48a). This is because sentences like (50b) disallow SOT interpretations when an eventive predicate is involved:

(50) a. Mary said that Caitlin was happy.
Non-SOT reading: Caitlin's happiness overlaps with Mary's saying.
SOT reading: Caitlin's happiness precedes Mary's saying.
b. Mary said that Caitlin left.
Non-SOT reading: Caitlin's leaving precedes Mary's saying.
#SOT reading: Caitlin's leaving overlaps with Mary's saying.

But the presence of *woll* enables (in fact, requires) SOT, and hence anaphoric tense, readings:

(51) a. Mary said that Caitlin would leave.
SOT reading: Caitlin's leaving follows Mary's saying.

In addition to this, I believe that there is a very simple reason why we need to assume anaphoric tense for *want*-class predicates as well. Although the experiment demonstrated that tense needs to be read de se just for propositional complements, I would like to point out that tense can be read de se in the complement of a verb like *wish*, as well. For instance, the sentence in (52a) can still be true even if Caitlin is not aware that daylight savings has taken place and the time which she identifies as 10 am is in fact 9 am. This information is not welcome for an eventive predicate like *manage*, however, in such a context, and pushes (52b) into unacceptability:

(52) a. Caitlin wishes to eat chocolate at 10 am.
b. # Caitlin managed to eat chocolate at 10 am.

Although both propositional and future-irrealis of complements require an animate subject, this is not sufficient to determine whether such complements are in fact attitudinal. One test that can be used to determine whether they are attitudinal is Quine (1956)'s double vision test, which doesn't allow the substitution of a proper name which an attitude holder has a different relation to. Lois Lane in the Superman stories may be in love with Superman, because he is strong and handsome, but she may not like Clark Kent because he is nerdy and wears glasses. This means that she does not know that Superman is Clark Kent. And this has the consequence seen below:

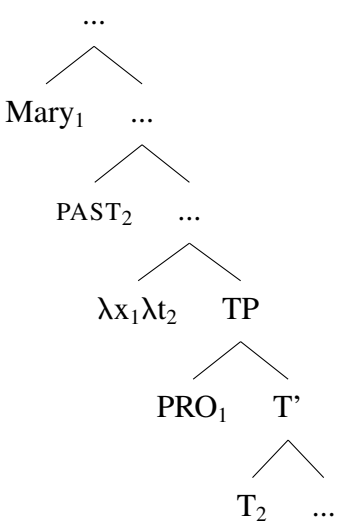
(53) Context: Superman is Clark Kent.
a. Lois Lane decided/claimed to kiss Superman.
b. Lois Lane decided/claimed to not kiss Clark Kent. (can be true at the same time)

Both of these complements allow partial control readings of the embedded subject. This is expected if, following Landau (2015), partial control predicates are those which are attitudinal, which the double vision test we have just seen established:

(54) a. Caitlin claimed to be meeting at 6.
b. Caitlin decided to meet at 6.

Let us now see how all this is captured in our semantics. I capture the obligatory de se reading of PRO (and of tense, as argued for via the experiment) via an abstraction operator in the left periphery of the embedded clause. PRO and tense are bound indirectly by their respective controllers:

(55)



The reading of simultaneous embedded tense is finite clauses is also captured in terms of an abstraction operator as well, following Heim (1994) and Abusch (1997). The only semantic difference between (56a) and (56b) below is that the infinitive must have anaphoric tense whereas the embedded finite clause need not.

(56) a. Caitlin claimed to be pregnant.
b. Caitlin claimed that she was pregnant.

Abstraction operators bind coindexed variables just in case they are of the same type. A sample semantics of the sentence *Caitlin claimed to be beautiful* is given in (57) in which the tense, in addition to PRO, is abstracted over.[16]

(57) a. $[\![\text{claim}]\!]^{w,t,g} = \lambda P_{<e,<st>>}\lambda x_e \lambda w_s.\forall <w',y> \in \textbf{claim}_{x,w}$: P(y)(w') where $\textbf{claim}_{x,w}$ = {<w',y>: what x claims in w is true w' and x identifies herself as y in w'}
b. $[\![\text{to be beautiful}]\!]^{w,t,g} = \lambda x \lambda t \lambda w$. x is beautiful in w at t
c. $[\![\text{Caitlin claimed to be beautiful}]\!]^{w,t,g} = \lambda t \lambda w$. $\forall <w',y, t'> \in \textbf{claim}_{\text{Caitlin},w,t}$: y is beautiful in w' at t'

This semantics is based on Hintikka (1969)'s semantics for attitude reports where the content of an attitude is not a set of worlds. Chierchia's semantics makes it possible for one to bear an attitude de se towards a property just in case that property is self-ascribed. The attitude predicate does not quantify merely over worlds; it quantifies over sets of *claim*-alternatives <w',y,t'> such that it is compatible with the attitude holder in w at t saying she is y in w' at t'.

This semantics will ensure that a sentence with a non de se scenario–or a sentence in which the attitude holder does not know she is referring to herself–will turn out false. This is because in the definition such as that given in (57), the attitude holder would be able to self-identify the person in the *claim*-alternative worlds as herself, and this is not possible in a de re scenario.

A key difference between propositional and future-irrealis infinitives is that truth values can be assigned to the embedded complement in the former but not the latter:

(58) a. Caitlin claimed to be eating chocolate, which is true.
b. Caitlin wanted to eat chocolate, #which is true.

I believe that this difference can be captured in terms of the accessibility relations that is built into the semantics of each kind of predicate.[17] Hintikka (1962) builds a semantics for *want* in which it consists of a bouletic accessibility relation, which holds between two worlds w and w' for some individual A in w iff all of A's desires in w are satisfied in w'. A truth value cannot be attributed to such complements. By contrast, a semantics for *believe* consists of a doxastic accessibility relation, which holds between two worlds w and w' for some individual A in w iff A in w identifies herself as A in w', which a truth value can be attributed to.

Before concluding, I would like to provide a semantics for the future-oriented irrealis complements. Following Abusch (2004), Wurmbrand (2014) and Grano (2015) among many others, I posit the presence of a covert future modal *woll* with the semantics in (59a). A sentence such as *Caitlin decided to eat chocolate* has the LF in (59b), in which matrix tense is not represented:

[16] I am not representing the matrix tense here for simplicity In addition, I have added tense into the equation, following Abusch (1997) and Schlenker (2004); I have provided empirical evidence for this via the experiment.

[17] One need not stipulate that future-irrealis complements belong to an entirely different class of *situations* rather than propositions, as WL do following Ramchand and Svenonius (2014).

(59) a. $[\![\text{woll}]\!]^{w,t,g} = \lambda P_{it}.\lambda t.\ \exists t'.\ t' > t\ \&\ P(t')$

b. $[\![\text{Caitlin decided to eat chocolate}]\!]^{w,t,g} = \lambda t \lambda w.\ \forall \langle y,w',t' \rangle \in \textbf{decide}_{\text{Caitlin, w, t}}$: $\exists t''.\ t'' > t'$ and y eats chocolate w' at t''

In both propositional and future-irrealis complements, then, the NOW of the attitude holder, in Abusch (1997)'s terms, is imposed as the reference time of the infinitive. The NOW is a very short time interval, getting the simultaneous interpretation in propositional infinitives. The presence of *woll* simply pushes this tense value into the future. Such a semantics does not work for all infinitival complements with an irrealis interpretation, however, as we will now witness.

5.2 Aspectual infinitival complements

I would like to discuss another potential class of infinitival complements in Wurmbrand and Lohninger (2019)'s hierarchy. This contains at the very least the complement of the predicate *try*, which appears to have irrealis-eventive properties.[18] Here, I propose an analysis based on Sharvit (2003) and Grano (2011)'s treatment of *try* as an aspectual morpheme, which will allow us to capture its borderline properties. *Try* patterns with the eventive infinitive rather than the propositional one in that it can have an eventive interpretation:

(60) Mary tried to use the restroom right then.

(61) * Mary claimed to use the restroom right then.

It is not future-oriented:

(62) a. Mary wanted to take out the trash tomorrow.

b. # Mary tried to take out the trash tomorrow.

Following Wurmbrand (2014) and Grano (2015), I believe that these three pieces of evidence indicate strongly that a different understanding of tense is needed: anaphoric tense is not sufficient. In addition, they do not allow partial control interpretations of the embedded subject:

(63) a. Mary wanted to meet at 6.

b. * Mary tried to meet at 6.

But as Wurmbrand and Lohninger (2019) note, *try* involves an irrealis component in that the embedded event is not yet completed in a situation involving *trying*. Indeed, *try* appears to be a borderline attitudinal predicate at the same time. It does not pass the double vision test:

(64) Context: Superman is Clark Kent. The following two sentences cannot both be true.

a. Lois Lane tried to kiss Superman.

b. Lois Lane tried to not kiss Clark Kent.

And yet, Sharvit (2003) notes that *try* behaves like *want* in that a non-existential reading is available for indefinite NPs in their scope. *Try* behaves the same way in just this case below:

(65) a. Mary wanted to find a syntax book, but there were no syntax books around.

[18] I believe that another *try*-class predicate is *pretend*. It requires an animate, volitional agent, and it also does not allow a future-oriented reading. Intuitively for me, a key difference between these two predicates is that a mental action for *pretend* is not sufficient: it must be externalized.

b. Mary tried to find a syntax book, but there were no syntax books around.

But this does not consistently obtain in all cases. *Want* consistently allows indefinite NPs in its scope to have non-existential readings, but *try* does not:

(66) a. Caitlin wanted to cut a tomato, but there were no tomatoes to cut.
b. Caitlin tried to cut a tomato, ##but there were no tomatoes to cut.

a. Mary wanted to push a cart, but there were no carts to push.
b. Mary tried to push a cart, ##but there were no carts to push.

a. Esther wanted to start a car, but there was no car to start.
b. Esther tried to start a car, ##but there was no car to start.

For Sharvit, *try* doesn't simply express an attitude of an individual towards a proposition unlike *want* or *believe*, but it also expresses an extensional action which has to have taken place in the actual world. She believes that this is akin to the progressive aspect. This allows one to capture its borderline attitudinal properties above.

Grano (2011) and Grano (2017) propose some improvements to her analysis, and I adopt his approach here. He notes that *try*-sentences need not entail an externally observable action or even a likelihood of success in completing such an action, with this acceptable sentence below. This indicates that for *trying*, a mental action is sufficient and the action need not be physical.

(67) Mary was unknowingly paralyzed and tried to raise her arm.

Grano maintains Sharvit's key intuition that *try* has an aspectual element and combines this with the idea that a mental action is sufficient for *try*. I propose a sample semantics from Grano (2017) below. $\subset_{\text{init}}$ is a relation relating an event to its mental action stage:

(68) Mary tried to open the door.
LF: $\exists$e[Agent(e, m) & $\forall$w' $\in$ $\text{INT}_{\text{m,w}}$: $\exists$e'[e $\subset_{\text{init}}$ e' & open(e') & Agent(e', m) & Theme(e', d) in w']
There is some event e whose agent is Mary and all worlds compatible with Mary's intentions in w are worlds in which e is an initial stage of some event e' which is an opening event whose agent is Mary and whose theme is the door.

We are now armed with the knowledge needed to explain why future-oriented readings of *try* are ruled out. Notice the contrast below in which the presence of the sentence-initial adverb does not make an improvement in acceptability for the *try*-sentence.

(69) a. (Today/Yesterday,) Caitlin decided to eat chocolate tomorrow.
b. # (Today/Yesterday,) Caitlin tried to eat chocolate tomorrow.

Here, I provide Grano (2017)'s solution. The contrast arises due to the presence of tense sharing, rather than anaphoric tense, in *try*-complements. Given that the time of *trying* and *eating chocolate* is identical, it is not possible for it to be both *today* and *tomorrow*. (69b) is unacceptable precisely for the same reason that a sentence such as *Today, Caitlin ate chocolate tomorrow* is unacceptable. Grano's solution based on the same semantics as in (68) is given below:

(70) # Today, Caitlin tried to eat chocolate tomorrow.
LF: $\exists$e[T(e) $\subseteq$ day-of(t*) & Agent(e, c) & $\forall$w $\in$ $INT_{c,w}$: $\exists$e[e $\subset_{init}$ e & open(e) & Ag(e, c) & Th(e, d) & T (e) $\subseteq$ day-after(t*) in w]]
There is an event e whose runtime is included in the day of the utterance time and whose agent is Caitlin and all worlds compatible with Caitlin's intentions in w are worlds in which e is an initial stage of an opening event whose agent is Caitlin and whose theme is the door and whose runtime is included in the day after the utterance time.

A final comment I would like to make is that it has been claimed that eventive predicates such as *begin* and *continue* are in fact control predicates if the matrix subject is animate and volitional, for instance in a sentence such as *Mary began to take out the trash*. Grano (2017) suggests that the control use of *begin* differs from *try* in that *try* requires only the initial stage of a mental action whereas *begin* does require an action to be externalized, as Sharvit suggested for *try*. Grano (2017) provides evidence for this below:

(71) Mary is paralyzed from the neck down.
a. Mary tried to raise her arm.
b. # Mary began to raise her arm.

One could therefore analyze the control use of *begin* as having an aspectual element as well, with the following semantics, where, following Grano's suggestion, $\subset_{ext}$ relates an event to some portion of its externalized onset.[19] I propose a simplified semantics of this in (72) below.

(72) Mary began to open the door.
LF: $\exists$e[Agent(e, m) & $\forall$w' $\in$ $INT_{m,w}$: $\exists$e'[e $\subset_{ext}$ e' & open(e') & Agent(e', m) & Theme(e', d) in w']
There is some event e whose agent is Mary and all worlds compatible with Mary's intentions in w are worlds in which e is an initial stage of some **externalized** event e' which is an opening event whose agent is Mary and whose theme is the door.

But it would not be possible to extend this analysis to sentences such as *It began to rain* for obvious reasons. Such raising complements are what we will now look at.

5.3 Eventive infinitival complements

Many of the differences between eventive and other kinds of complements have already been noted, but I will gather these tests below.

(73) *Allows episodic interpretations*
a. * Mary claimed to use the restroom right then.
b. Mary managed/began/started to use the restroom right then.

(74) *Exhaustive control only*
a. Mary wanted to meet at 6.

[19] Grano (2011) proposes that *try* may in fact be a raising predicate which imposes a restriction on its subject, following Cinque (2006). I am not opposed to this possibility here.

b. * Mary began/managed/started/continued to meet at 6.

(75) *No future-oriented interpretation*

a. Mary wanted to take out the trash tomorrow.

b. # Mary began/managed/started/continued to take out the trash tomorrow.

(76) *Fails double vision test*
Context: Superman is Clark Kent. The following two sentences cannot both be true:

a. Lois Lane managed/began/continued to kiss Superman.

b. Lois Lane managed/began/continued to not kiss Clark Kent.

As with the aspectual infinitival complements, eventive complements are best analyzed in terms of tense sharing rather than anaphoric tense for the same reasons. However, there is a crucial difference, in that eventive predicates may have inanimate subjects, or even expletive subjects:

(77) a. The key managed/began/continued to unlock the door.

b. It began to rain.

Thus, extending Grano's analysis to this will not be possible here, because his analysis includes the intention worlds of the subject. One would hope that inanimate objects like keys do not have intentions. As such, I will provide a sketch of Piñón (1997)'s alternate semantics for such infinitives, which I refer the reader to for further details. As far as I am aware of, it is the only semantics in the literature for inanimate or expletive uses of predicates like *begin*.

Piñón (1997) divides eventualities into two basic sorts: *happenings* and their *boundaries*. Take for instance the happening of Caitlin eating chocolate. The beginning of that happening is the *left boundary*, whereas the ending of that happening is its *right boundary*. This notion allows for a semantics of *begin*, as defined in (78) below by Piñón (1997).

(78) $[\![\text{begin}]\!]^g = \lambda e \lambda e' \lambda P.$ Boundary(e) & Left(e, e') & P(e') & $\neg\exists e''$(e'' < e' & P(e'' + e')))
Begin is a function from two happenings, e and e', and a predicate P from happenings to truth-values such that e is a boundary, and e is the left boundary of e', e' is an happening of type P and there is no happening e'' immediately preceding it such that the sum of the two eventualities is of type P.

When we add in tense and worlds, we obtain the following semantics for *It began to rain*, where as desired the tense and world values of the matrix predicate are merely shared:

(79) It began to rain.

a. $[\![\text{rain}]\!]^g = \lambda w \lambda t \lambda e.$ rain(e) in w at t

b. $[\![\text{It began to rain}]\!]^{g,t,w} = \lambda w \lambda t \exists e \exists e'$(Boundary(e) & Left(e, e') & rain(e') in w at t & $\neg\exists e''$(e'' < e' & rain(e'' + e') in w at t))

To recap, propositional and future-irrealis complements both have in common an anaphoric tense value, whereas aspectual and eventive complements can be shown to even not have anaphoric tense. Instead, they involve tense sharing. But what is in common between each of these cases, in my view, is that tense is deficient: it cannot be simple PAST or PRES.

5.4 Three types of tenselessness

I have argued, following Wurmbrand (2014) and Grano (2015), that infinitival complements may have two different tense specifications, at least in English. But crucially, what is in common between these two types of tense specification is that they are both deficient in some sense: infinitives are never attested bearing genuine PAST or PRES. In addition, infinitival tense cannot be interpreted de re, as I believe the experimental data has shown.

Tense sharing, on the other hand, is not even de se tense: such infinitival complements lack a tense node entirely, and no tense variable. They are thus even more deficient in tense. We have also discussed the temporal interpretation of adjuncts in detail, which can only be simultaneous or future-oriented in English, or mediated via prepositions in Spanish and Catalan, indicating further that this deficiency of tense in infinitives extends to adjuncts in addition to complements.[20]

A third type of temporal deficiency was seen in Japanese and Korean free adjuncts, which we saw clearly lacked tense sharing. Its temporal interpretation was determined not by tense per se however, but by Aktionsart and the discourse context, making it an implicature. Though all of these attested possibilities may seem disparate and do have very different empirical properties, they can be unified under one empirical generalization: **infinitives cannot bear PAST or PRES**. In other words, infinitives are necessarily deficient in tense. This novel observation, in my view, is revealing but unsurprising under theories of infinitives in which they are truncated or deformed.[21] But one apparent counterexample remains. Let us determine how to get rid of it.

6 *Have*-EN infinitives

There is one kind of infinitival construction that appears to be a flat-out contradiction of the empirical generalization that I have proposed in this paper. It appears that propositional infinitives with the auxiliary verb *have* and a past participle can express a shifted past reading, as seen below. It is easy to verify that the embedded time takes place prior to the matrix time, regardless of whether or not the matrix predicate is in the past or present:

(80) a. They believed/believes Mary to have gotten pregnant a month ago.
b. Mary claimed/claims to have gotten pregnant a month ago.

I have argued in this paper that, by their very nature, infinitives are deficient in tense. One would expect this to carry onto infinitives in different languages and to different constructions within a given language. The apparent possibility of shifted tense in (80a)-(80b) is a counterexample to this idea. The existence of such constructions might push us to admit that at least a small subset of infinitives can have PAST tense, and this is indeed what some authors have proposed.

I discuss such accounts in 6.1, and argue that it is in fact empirically advantageous to maintain the idea that such infinitives are still tenseless in 6.2. 6.3 presents my analysis.

[20] At this stage, though it does not change my generalization, I do not have enough evidence to determine whether simultaneous interpretations of tense infinitival adjuncts involve tense sharing or anaphoric tense without *woll*. I leave this open for future research.

[21] See, for instance, Müller (2020), Pesetsky (2021) and Satık (2022) for theories in which finiteness is a matter of clause size.

6.1 The apparently special infinitival *have*

Normally, Pesetsky (2021) treats infinitives embedded under matrix past tense as having anaphoric, SOT PAST tense. He makes a special exception in the case of *have*-EN infinitives. Following Landau (1999) and Grano (2015), he proposes that simple past can be expressed via the auxiliary *have*-EN, but only in an infinitive. A stipulation is required to rule out the possibility of simple past being expressed in a sentence like *They have seen David*, which cannot mean *They saw David*. Finite T must be specified for PAST or PRES, whereas an infinitive need not.

Landau (1999) and Grano (2015) originally proposed a treatment of the infinitival *have*-EN as special, in that it is ambiguous between a perfect and a true past reading. They note that on the perfect interpretation it is available even in exhaustive control structures, such as the complement of *manage*. Although it is important to point out that such a sentence is only natural with modifiers such as *before it got too cold* and very marginal otherwise:

(81) Earlier today, Mary managed to have closed the window before it got too cold.

In order to force a true past reading, they insert a time adverbial that conflicts with the matrix tense, which is possible only with the partial control predicate *claim* and not with the exhaustive control predicate *manage*:

(82) a. * Earlier today, Mary managed to have closed the window yesterday.
b. Earlier today, Mary claimed to have closed the window yesterday.

To strengthen this appeal to an exceptional use of *have*-EN, Grano (2015) provides, in his view, several additional pieces of evidence that *have*-EN in infinitives behaves similarly to the finite simple past rather than the present perfect.[22] He notes that, for example, the present perfect comes with the presupposition that a recurrence of the event it describes is possible, as seen in (83a). This presupposition is carried onto the embedded clause in (83b), and remains awkward. Both (83a) and (83b) are ruled out because being born is something that can only happen once. By contrast, (83c) is acceptable, showing that no such restriction is present in the infinitive:

(83) a. # Mary has been born in Paris.
b. # Mary claims that she has been born in Paris.
c. Mary claims to have been born in Paris.

Grano notes that the present perfect cannot occur with certain time adverbials as demonstrated in (84a)-(84b), carrying onto the embedded clause in (84c). But the infinitive can, as in (84d):

(84) a. # The convict has escaped at 3.
b. The convict had escaped at 3.
c. # The convict claims that he has escaped at 3.
d. The convict claims to have escaped at 3.

Grano is right that there are differences between the embedded present perfect and the infinitival *have*-EN. But I believe these differences are all on the wrong track: they could arise simply from the possibility of PRES in the embedded present perfect, which is never present in the *have*-EN infinitive. In other words, these comparisons do not involve minimal pairs and are thus ill-formed:

[22] I cannot provide a full and complete discussion of the evidence that he provides here. The reader is referred to Grano (2015), p. 130-132 for further details.

the infinitival *have*-EN does not have PRES, whereas the present perfect does. The presence of PRES leads to many differences that could be independent explanations for all of Grano's contrasts. For instance, embedded present perfect induces a lifetime effect while *have*-EN does not. (85a) is always fine, but (85b) could only have been uttered when Einstein was alive.

(85) a. Historians believe Einstein to have lived in Princeton.
b. # Historians believe that Einstein has lived in Princeton.

Instead, I believe that one needs to compare embedded simple past with infinitival *have*-EN.

6.2 Towards treating *have*-EN infinitives as tenseless

The analysis that I propose here treats infinitival tense in propositional complements as an anaphoric tense, even ones with *have*-EN. There is no need, contra Grano, Landau and Pesetsky, to resort to a special infinitival *have*-EN. Not only will this end up being empirically optimal and superior over past analyses, but it will also allow us to maintain our empirical generalization, without needing to posit a special exception.

The first argument in favor of this possibility is a very simple one, noted to me by David Pesetsky (p.c.). Notice the following contrast between (86a) which is completely unacceptable if the embedded infinitive with *have*-EN contains a mathematical truth, which is necessarily true at all times and worlds. On the other hand, (86b) has the simple past and is completely felicitous.

(86) a. # I believed 2+2 to have been 4.
b. I believed that 2+2 was 4.

The infelicitousness of (86a) is not expected by accounts where infinitival *have*-EN is treated as a simple past. The contrast seems to arise because of the properties of the perfect, which implies that the embedded eventuality in question is over. Notice the complete infelicitousness of (87):

(87) # I believed that 2+2 has been 4.

This is one clear difference between the infinitival perfect and the simple past.

There is another empirical argument which strongly indicates that the infinitival *have*-EN is one and the same as the perfect *have*-EN. As Kiparsky (2001) notes, in matrix clauses the past perfect allows two distinct readings with point-denoting time adverbials whereas the present perfect is not acceptable at all. The two readings are represented below:

(88) a. # The convict has escaped at 3.
b. The convict had escaped at 3.
Reading 1: At 3, the convict had just finished escaping (the actual time of the escape may have been slightly earlier).
Reading 2: The convict had escaped, and the escape took place at 3.

The second reading may be easier to conceive of with the presence of the adverb *already*, such as *The convict had already escaped at 3*. The simple past only admits the second reading. This can be verified with the usage of the adverb *already* which is awkward: putting a *had* fixes it.

(89) The convict (??already) escaped at 3.
Reading: The convict had escaped, and the escape took place at 3.

This is not unique to the matrix past perfect. In fact, as Kiparsky notes, the embedded past perfect–which can undergo sequence of tense deletion and therefore has anaphoric tense–also has two interpretations. This is therefore a property of the perfect *have*-EN itself:

(90) The convict claimed that the convict had escaped at 3.
Reading 1: The convict claimed the following: at 3, she had just finished escaping (the actual time of the escape may have been slightly earlier).
Reading 2: The convict claimed: she had escaped, and the escape took place at 3.

The infinitival *have*-EN has the same ambiguity in readings, which is completely unexpected if it were just a simple past. In addition, the presence of the adverb *already* is completely acceptable, much like the past perfect in (88b) above and unlike the simple past:

(91) The convict claimed to have (already) escaped at 3.
Reading 1: The convict claimed the following: at 3, she had just finished escaping (the actual time of the escape may have been slightly earlier).
Reading 2: The convict claimed: she had escaped, and the escape took place at 3.

An account of this difference is made possible by Thompson (1994)'s structure of tense and syntax of temporal adverbs. Under her account, temporal adverbs cannot directly attach to TP, given the fact that *Mary left at 4 pm* cannot be felicitously uttered at 4 pm, in a context where Mary left some time ago and it's 4 pm now. The utterance time is located in TP. But that sentence is possible if Mary's leaving is at 4 pm. So where are temporal adjuncts located?

The Reichenbachian framework for tense leaves us reference time and event time, which Thompson proposes are encoded in AspP and VP respectively, in the syntactic hierarchy TP > AspP > VP. For Thompson, in the simple past case, the reference time and event time are contemporaneous, so it doesn't matter if the temporal adverb is located in AspP or VP. But the perfect allows us to tease this apart. Thompson captures the ambiguity in (90) above by proposing that reading 1 involves modification of the event time (VP) whereas reading 2 involves modification of the reference time (AspP). This also appears to be the case in (91), given the presence of two different readings just as in (90). This cannot be captured under an account in which infinitival *have*-EN is the simple past.

6.3 The Analysis

I believe that the apparent similarities between the simple past and the perfect arise due to their very similar semantics. The semantic contribution of both is to introduce an episode which is earlier in time than the time associated with the higher predicate. I provide definitions for both below, in which I treat tense as a generalized quantifier rather than a pronoun, although nothing hinges on this. The aspect is a function from times to truth-values to times to truth-values:[23]

(92) a. $[\![\text{PAST}_i]\!]^{w,t,g} = \lambda P_{it}$: $\exists t'.\ t' < t\ \&\ t' \in g(i)\ \&\ P(t') = T$
Tenses come with an index and are mapped to a set interval of times

b. $[\![\text{have}]\!]^{w,t,g} = \lambda P_{it}.\lambda t$: $\exists t'.\ t' < t\ \&\ P(t') = T$

[23] I abstract away from more complicated analyses of the perfect such as Nishiyama (2006)'s in which the perfect introduces an eventuality and a state. This would not affect the analysis here.

Thus, the following two sentences end up having an identical LF, if the embedded tense becomes anaphoric under SOT, to mirror the anaphoric tense in the infinitive.

(93) a. Caitlin claimed that she had been pregnant.
b. Caitlin claimed to have been pregnant.
c. LF: λwλt∃t': t' < t & t' ∈ g(i) & ∀<y,w',t"> ∈ claim(Caitlin, w, t'): ∃t"'. t"' < t" and y is pregnant in w' at t"'

This, together, with my analysis of tenselessness in eventive complements such as those of *manage* in terms of tense sharing allows for a straightforward solution of the puzzle noted by Grano and Landau, repeated in (94a)-(94b).

(94) a. * Earlier today, Mary managed to have closed the window yesterday.
b. Earlier today, Mary claimed to have closed the window yesterday.

Here, I believe that the difference arises from the intensional nature of the complement of *claim* but not of *manage*. We have already discussed Grano's own explanation for why future-oriented readings of *try* are unacceptable in (70) above. As such, I believe that (94a) is unacceptable for the same reason that a sentence such as *Earlier today, Mary closed the window yesterday* is self-contradictory. Intuitively, due to the semantics of *manage*, it is apparent that in (94a) the time of Mary's managing to do X and Mary's closing the window are identical. Thus, the adverb *earlier today* and *yesterday* modify precisely the same time, and leading to a clear contradiction.

By contrast, the possibility of anaphoric tense in (94b) does allow such disparate adverbials. The infinitive does have its own tense value, but it is indirectly bound by an operator and within an intensional context. This is ultimately similar to how a contradiction is obtained in a sentence such as (95a) but not in (95b). (95a) is completely unacceptable if Caitlin's pregnancy hasn't ended, whereas (95b) is perfect. This is due to the intensional nature of the embedded complement of *claim* but not of *manage*. I believe the same thing is going on with tense.

(95) a. * Caitlin managed to get pregnant today, but she isn't pregnant now.
b. Caitlin claimed to be pregnant today, but she isn't pregnant.

Now, I am not the first to suggest that perfect infinitives are tenseless. Ogihara (1996) claims the same, although without details. He provides the following example, in which he states that the infinitive has a null-tense like meaning which the perfect pushes into the past:

(96) John promised to visit Mary on December 15th.
He also promised to have finished the assigned task by then.

Ogihara notes one piece of data that one might take to be problematic for the idea that perfect infinitives are tenseless. He notes the following examples: in (97a), the time of Mary's being innocent can be interpreted to be at the same time as Mary's claim. The same is seen in the participial clause in (97b) which is also apparently tenseless, and the main clause has present tense. It seems that *have*-EN alone can serve as a trigger for SOT phenomena, then, and this prima facie seems easier to explain if infinitival *have* truly is simple past, following Grano, Landau and Pesetsky.

(97) a. Caitlin believes Mary to have claimed that she was innocent.
b. Having realized that she was in the wrong, Mary is now trying to change.

Ogihara takes this to be evidence that in addition to PAST, the perfect alone can also trigger SOT. As noted previously, they have a very similar semantic contribution, so this isn't implausible. To provide independent evidence for this conclusion, Ogihara notes that preterit expressions in general can trigger SOT, and not just PAST. For instance, he notes that SOT phenomena can be observed in preterit noun complements without tense marking (98a)-(98c), in which the past tense morphemes refer to a simultaneous episode as that of the noun complement (in bold):

(98) a. **Mary's earlier (claim)** that she was innocent is well-known.
b. I still recall **Mary's public announcement** that he had cancer.
c. This contradicts **Mary's (earlier) claim** that Caitlin would win the prize.

For instance, in (98b), the simultaneous regarding between the time of the announcement and the time of having cancer cannot be guaranteed just by assuming that the noun complement is in the past tense. If Mary's announcement precedes the speech time, the time of Mary's having cancer must precede the announcement time, or be simultaneous with it. This is precisely like the generic cases of SOT with verbal complements. Ogihara therefore notes that the data in (98a)-(98c) cannot be explained away simply by assuming that a past tense morpheme is interpreted as if it were unembedded.

Thus, preterit expressions more generally trigger SOT phenomena, and not just PAST.[24] I can maintain that my empirical generalization that all infinitives are tenseless in some sense, in a way that is empirically superior over accounts which stipulate a special nature for the infinitival *have*.

7 Conclusion

This paper has provided a formal semantic framework for the different types of infinitives that appear to be attested empirically. The framework itself was built on the novel crosslinguistic generalization that infinitives cannot bear PAST or PRES–in other words, they are necessarily deficient in tense. Although many authors such as Ogihara (1996) and Wurmbrand (2014) have implied something similar, such a generalization has not yet been clearly stated in the literature, nor has it been defended from an experimental or a crosslinguistic perspective. In addition, I have extended their observations to infinitival adjuncts in addition to complements. At the very least, I hope to have shed a bit of light on a notoriously vexing problem, and helped alleviate some of the controversy regarding the temporal interpretation of infinitives.

[24]The reader is referred to Ogihara (1996) (p. 134) for a definition of such an SOT rule. He assumes that preterit expressions have a [+past] feature which triggers SOT. [+pres] can also trigger SOT, but [+fut] cannot. This is evidenced by the fact that the future reading of a noun complement cannot trigger SOT, as seen below. This is likely to do with the nature of future tense, which Abusch (1984) has decomposed.

(i) a. ? Caitlin expected Mary's claim that she is drunk.
b. Caitlin expected that Mary will claim that she is drunk.

8 Appendix: Details of the Experiment

I conducted a forced-choice experiment with 600 native speakers of English. The survey was conducted on Qualtrics and participants were recruited from Prolific; a custom prescreening for native English speakers was applied to ensure that someone who is not a native speaker of English could not take the survey. The experiment consisted of 4 baseline context-sentence pairs and 4 novel pairs at a ratio of 1 to 1. This does not count the preliminary questions that were asked to separate the survey takers into groups.

8.1 Instructions

The survey takers were given instructions at the start of the survey. They were asked to pick the most natural sounding sentences from two options, and given the following examples:

(99) I asked my wife what time it is.

a. Natural option: What time is it?

b. Unnatural option: What time it is?

(100) John and Mary are school kids. John complains to a school teacher that Mary teased him.

a. Natural option: John said that Mary teased him.

b. Unnatural option: John said that Mary teased himself.

They were then asked to not think too deeply about the questions.

8.2 Preliminary Questions

After the survey taker read the instructions, they needed to be split into the right group: whether they accepted Ogihara and Sharvit (2012)'s de re interpretation of PRES-under-PRES, or not. This was done by asking them to answer "yes" or "no" for one of the following questions. Each survey taker only saw one of these questions.

(101) John is preparing to go on a trip to Hawaii tomorrow, but he is keeping it a secret until the trip is completed. So, in two months, he is going to tell everyone that he had gone on a trip to Hawaii.
Question: Do you believe that this sentence is an acceptable way of describing this context?

a. In two months from now, John will claim that he is going to Hawaii tomorrow.

(102) Mary is preparing to give birth in the next few days, but she is keeping it a secret for a year because of her country's one child policy–she already has one child. Next year, once her country relaxes its restrictions, she is going to tell her family and friends that she had given birth.
Question: Do you believe that this sentence is an acceptable way of describing this context?

a. Next year, Mary will tell her family and friends that she is giving birth soon.

The survey taker was then taken to the next page of the survey, in which they were given 4 context-sentence pairs, consisting of 2 baseline and 2 novel questions. The template for the next page of the experiment was as follows (the questions were randomly ordered):

(103) a. 1 question regarding whether PRO needs to be read de se
b. 1 question regarding whether the infinitive has a double access reading
c. 1 question with the de re interpretation of PRES-under-*will* with simple present
d. 1 question with the de re interpretation of PRES-under-*will* with a futurate

8.3 Baseline: Does PRO need to be read obligatorily de se?

The survey taker was given one of the following questions. This is one of the baseline questions in order to ensure that PRO needs to be read de se after all and the claim that has been made in the literature is correct.

(104) Mary is an elderly woman with dementia. She watches a video of a high school student solving a very difficult math problem in front of all of her classmates, and the teacher congratulates that student. Mary says "that girl is very clever!" But that student is actually Mary herself, though Mary doesn't know it.
Question: Out of these two sentences, please pick the one which you think fits with this context more naturally.

a. Mary claimed that she was clever.
b. Mary claimed to be clever.

(105) At a party, John gets so drunk that he can't even feel pain. He accidentally lights himself on fire while trying to light a cigarette. He sees a man who he thinks is someone else in the mirror and says "that guy is on fire!" but he doesn't realize that it is himself.
Question: Out of these two sentences, please pick the one which you think fits with this context more naturally.

a. John claimed that he was on fire.
b. John claimed to be on fire.

8.4 Baseline: Does the infinitive have a double access reading?

The survey taker was given one of the following questions. This is one of the baseline questions in order to ensure that the double access reading is not present with infinitives, and present with finite clauses.

(106) Back in 2016, Julia informed all her family and friends of her pregnancy. She gave birth the next year. It is currently 2021.
Question: Out of these two sentences, please pick the one which you think fits with this context more naturally.

a. Five years ago, Julia claimed that she is pregnant.

b. Five years ago, Julia claimed to be pregnant.

(107) A week ago, Dick caught the flu. He told his workplace that he was sick and couldn't make it to work. He is no longer ill.
Question: Out of these two sentences, please pick the one which you think fits with this context more naturally.

a. A week ago, Dick claimed that he is sick
b. A week ago, Dick claimed to be sick.

8.5 Novel: PRES-under-*will* with simple present

We now move onto the questions that were the object of investigation in the survey. The survey taker was presented with one of the two following context-sentence pairs:

(108) It is currently 2021, and Emily is pregnant. She will give birth in December of 2021. She refuses to inform anyone of her pregnancy until the start of 2022, but she will definitely tell everyone "I was pregnant in 2021!" once 2021 is over.
Question: Out of these two sentences, please pick the one which you think fits with this context more naturally.

a. Next year, Emily will claim that she is pregnant.
b. Next year, Emily will claim to be pregnant.

(109) Caitlin hasn't eaten all day because she has an essay due, so she's very hungry. But in an hour, she will finally get to eat with her friends. Right after she is done eating, going to say "Wow, I was starving!"
Question: Out of these two sentences, please pick the one which you think fits with this context more naturally.

a. In an hour, Caitlin will claim that she is starving.
b. In an hour, Caitlin will claim to be starving.

8.6 Novel: PRES-under-*will* with futurates

The survey taker was presented with one of the two following context-sentence pairs:

(110) Brian is preparing to buy a car tomorrow for his wife as a present, but he's keeping it a secret for her birthday next week. In a week, he will tell his wife "I bought you a car last week!"
Question: Out of these two sentences, please pick the one which you think fits with this context more naturally.

a. Next week, Brian will claim that he is buying a car for his wife.
b. Next week, Brian will claim to be buying a car for his wife.

(111) Grace is preparing to go on a trip to Hawaii tomorrow, but she is keeping it a secret until the trip is completed. So, in two months, she will tell her friends "I went to Hawaii two months ago!" once she returns.
Question: Out of these two sentences, please pick the one which you think fits with this context more naturally.

a. In two months from now, Grace will claim that she is going to Hawaii.

b. In two months from now, Grace will claim to be going to Hawaii.

8.7 Results

The following results were obtained, in which the baseline expected results were confirmed: PRO is strongly preferred to be read de se and the infinitive lacks a double access interpretation. This leads me to conclude (bolded in Table 1) that among people who have a de re interpretation of embedded PRES under *will*, the finite form is significantly preferred over the infinitive.

Table 1: Group A's results.

Type	Finite	Infinitive	Sample size	p<0.001?
Lack of double access	31.58%	68.42%	76	Yes
De re reading of pronoun possible?	69.74%	30.26%	76	Yes
De re reading of PRES-under-*will*	**63.16%**	**36.84%**	**152**	**Yes**

Table 2: Group B's results.

Type	Finite	Infinitive	Sample size	p<0.001?
Lack of double access	21.05%	78.95%	524	Yes
De re reading of pronoun possible?	73.68%	26.32%	524	Yes
De re reading of PRES-under-*will*	48.03%	51.97%	1048	No

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