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Temporal constraints on (non-)epistemic readings: Further evidence from Korean

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This paper investigates how modal readings are affected by temporal interpretation in natural language sentences, by taking a close look at the Korean *swu*-construction which can receive multiple modal readings. Previous work on the *swu*-construction has attributed its modal readings to syntactic structures (e.g. Ha 2007; Chung 2007; Kim 2010) or lexical ambiguity (e.g. Mun 2016; Lee 2017). I discuss empirical and theoretical problems with these approaches, and provide a non-ambiguity analysis, following Kratzer's (1981; 1991) view that distinct modal readings are contextually determined. I argue that the modal readings are determined by modal-temporal interactions at the semantics-pragmatics interface. Utilizing Condoravdi's (2002) notions of Temporal Perspective (TP) and Temporal Orientation (TO), I provide a novel empirical finding that the non-epistemic readings are available only with future TOs while the epistemic modal reading is not temporally constrained in the *swu*-construction. I develop a compositional analysis of the temporal interpretation, and account for the (un)availability of (non-)epistemic readings in terms of the temporal constraints on the modal bases, along the same line as Condoravdi (2002) and Rullmann & Matthewson (2018). The analysis proposed in this paper is shown to be empirically and theoretically superior to the previous analyses of the *swu*-construction, and provides further crosslinguistic support for the theory of modal-temporal interactions proposed by Rullmann & Matthewson (2018).

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1 Introduction

The concepts of time and possibility/necessity are expressible in all languages. Modality is the linguistic category which expresses the meaning of possibility/necessity, and temporal meaning is typically conveyed by tense and aspect. This paper explores modal-temporal interactions, by investigating how one of the modal constructions in Korean is temporally interpreted by interactions between tense and aspect, and how the temporal interpretation affects the availability of various modal readings. One of the Korean modal constructions, which is made up of the bound noun *swu* and two tensed clauses (henceforth, called a *swu*-construction), can convey three distinct modal readings. For example, the sentence in (1) can be uttered felicitously in the following discourse contexts, each of which illustrates the epistemic, dynamic (ability), and priority (permission) reading according to Portner's (2009) classification.¹

- (1) **Context 1 (epistemic):** Yenghi will go to a party with Chelswu tonight. She asks her roommate if she can give her a ride home after the party. The roommate suggests making the request to Chelswu. Now, Yenghi says:

Context 2 (dynamic): Chelswu's father is allergic to alcohol, and it seems to be hereditary. Now, Chelswu's mother says:

Context 3 (priority): Chelswu and Yenghi have been participating in a medical experiment on the effect of alcohol on the central nervous system. They belong to different groups: treatment group vs. control group. Now, Yenghi says:

Chelswu-nun swul-ul masi-Ø-l swu iss-Ø-e.

Chelswu-TOP alcohol-ACC drink-PRES-ADN SWU exist-PRES-DECL

'Chelswu might drink alcohol.'

[Epistemic]

'Chelswu is able to drink alcohol.'

[Dynamic (ability)]

'Chelswu is allowed to drink alcohol.'

[Priority (permission)]

(adopted from Ha 2007: 315)²

The sentence in (1) asserts that at the utterance time it is epistemically possible that Chelswu will drink beer (in Context 1). A non-epistemic reading also arises from (1); it asserts that it is

¹ The adnominal marker *-(u)l* occurs in the noun-modifying clauses which are represented in the square brackets below.

(i) a. I kes-i [nay-ka ilk-Ø-ul] chay-i-Ø-ta.
This thing-NOM I-NOM read-PRES-ADN book-be-PRES-DECL
'This is the book that I will read.'

b. I kes-i [nay-ka ku chayk-ul ilk-Ø-ul] iyu-i-Ø-ta.
This thing-NOM I-NOM that book-ACC read-PRES-ADN reason-be-PRES-DECL
'This is the reason why I will read the book.'

² Ha (2007) does not deal with the priority (permission) reading in his syntactically-oriented analysis, as will be discussed in §2. Also, Ha's examples are provided without any discourse contexts: I offer separate discourse contexts for each modal reading in (1).

consistent with the present circumstantial facts that Chelswu is able to drink beer (in Context 2) and he is allowed to drink beer (in Context 3).

The availability of the multiple modal readings is affected by the presence of temporal expressions in the embedded clause. The literature (Ha 2007; Chung 2007; Mun 2016; Lee 2017; Myeong 2019, *inter alia*) has noted that if a *swu*-construction contains past tense in the embedded clause, it is available only with the epistemic modal reading, as exemplified in (2).³

- (2) Chelswu-nun swul-ul masi-ess-ul swu iss-Ø-e.
 Chelswu-TOP alcohol-ACC move-PAST-ADN SWU exist-PRES-DECL
 ‘Chelswu might have drunk alcohol.’ [Epistemic]
 #‘Chelswu was able to brink alcohol.’ [Dynamic (ability)]
 #‘Chelswu was allowed to drink alcohol.’ [Priority (permission)]
 (adopted from Ha 2007: 317)

Mun (2016) observes that the presence of a stative predicate in the embedded clause also affects the modal readings of the *swu*-construction: it receives an epistemic reading, but it is not available with a dynamic (ability) or priority (permission) reading, as shown in (3).⁴

- (3) Chelswu-nun pappu-Ø-l swu iss-Ø-e.
 Chelswu-TOP busy-PRES-ADN SWU exist-PRES-DECL
 ‘Chelswu might be busy.’ [Epistemic]
 #‘Chelswu is able to be busy.’ [Dynamic (ability)]
 #‘Chelswu is allowed to be busy.’ [Priority (permission)]
 (Mun 2016: 78)

In this paper, I extend the empirical patterns observed in the literature, and pay attention to the fact that progressive aspect induces the same effect as stative predicates. The *swu*-sentence in (4), which contains the eventive predicate *swul-ul masi-* ‘drink alcohol’ with the progressive *-koiss-*, yields an epistemic reading, but not either a dynamic (ability) or priority (permission) reading.

- (4) Chelswu-nun swul-ul masi-koiss-Ø-ul swu iss-Ø-e.
 Chelswu-TOP alcohol-ACC drink-PROG-PRES-ADN SWU exist-PRES-DECL
 ‘It is possible that Chelswu is drinking alcohol.’ [Epistemic]
 #‘Chelswu is able to be drinking alcohol.’ [Dynamic (ability)]
 #‘Chelswu is allowed to be drinking alcohol.’ [Priority (permission)]

³ The adnominal marker and the accusative case marker in (2) do not belong to the same morpheme. Their allomorphs are as follows: *-ul* or *-lul* (accusative), and *-ul* or *-l* (adnominal).

⁴ The same pattern holds for individual-level statives like *ttokttokha-* ‘smart’ as well.

- (i) Chelswu-nun ttokttokha-Ø-l swu iss-Ø-e.
 Chelswu-TOP smart-PRES-ADN SWU exist-PRES-DECL
 ‘Chelswu might be smart.’ [Epistemic]
 #‘Chelswu is able to be smart.’ [Dynamic (ability)]
 #‘Chelswu is allowed to be smart.’ [Priority (permission)]

Previous authors analyzed the modal readings of the *swu*-construction in terms of structural ambiguity (Ha 2007; Chung 2007; Kim 2010) or lexical ambiguity (Mun 2016; Lee 2017). In the former approach, a *swu*-construction is analyzed as having two separate syntactic structures, each of which gives rise to an epistemic or a non-epistemic reading. In the latter approach, in contrast, a *swu*-construction is analyzed as containing a modal element that lexically specifies distinct modal meanings. These studies on the *swu*-construction are in line with the previous work on the multiple interpretations of a modal sentence, which have been accounted for in terms of (i) structural ambiguity (Jackendoff 1972; Zubizarreta 1982; Piccolo 1990; Cinque 1999; Butler 2003) or (ii) lexical ambiguity (Ross 1969). Kratzer (1981; 1991) argues against these ambiguity analyses, and proposes that distinct modal readings are contextually determined. Following the latter view, I discuss empirical and theoretical problems with the previous ambiguity analyses of the *swu*-construction.

I analyze the observed empirical patterns in terms of modal-temporal interactions, along the same line as Rullmann & Matthewson's (2018) analysis of modal constructions in languages like Dutch, English, Gitksan (Tsimshianic), and St'át'imcets (Lillooet Salish). More specifically, I first illustrate how a *swu*-construction is temporally interpreted. I utilize Condoravdi's (2002) notions of Temporal Perspective (TP) and Temporal Orientation (TO), and show how they are compositionally determined by interactions between tense and (lexical and grammatical) aspect. I present a novel empirical finding that the non-epistemic readings of the *swu*-construction are available only with future TOs (cf. Mun 2016), and account for the unavailability of non-epistemic readings in *swu*-examples like (2)–(4) in terms of the general temporal constraint on the circumstantial modal base (Condoravdi 2002; Werner 2003; Abusch 2012; Thomas 2014; Rullmann & Matthewson 2018, *inter alia*). Furthermore, I delineate that unlike dynamic and priority modal readings, epistemic readings are not temporally restricted in the *swu*-construction. I argue that the observed empirical facts lend further support for von Stechow & Gillies's (2008) and Rullmann & Matthewson's (2018) claim that epistemic modals are not necessarily keyed to the utterance time but an epistemic state can be expressed from a past perspective in natural language sentences (cf. Groenendijk & Stokhof 1975; Iatridou 1990; Piccolo 1990; Abusch 1997; Condoravdi 2002; Stowell 2004; Hacquard 2006; 2011).

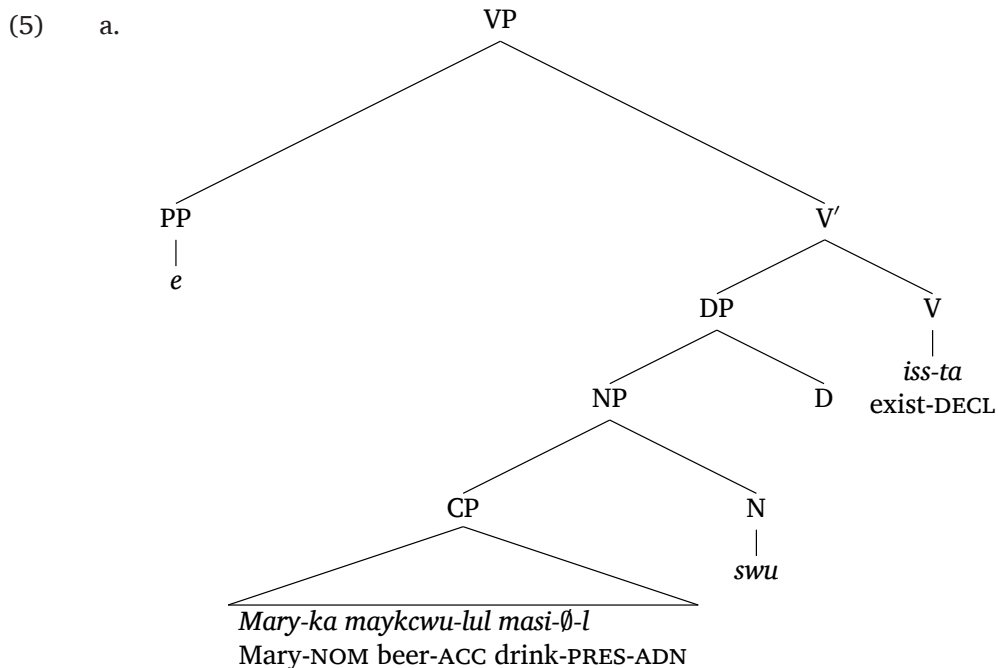
This paper is structured as follows: In §2, I review the previous analyses of the *swu*-construction (Chung 2007; Ha 2007; Kim 2010; Kim 2014; Mun 2016). In §3, I examine the temporal interpretation of the *swu*-construction and show that non-epistemic readings are restricted to future-TO interpretation while epistemic readings are not temporally restricted. In §4, I compositionally analyze the temporal interpretation of the *swu*-construction, and account for the (un)availability of the modal readings in terms of modal-temporal interactions at the semantics-pragmatics interface. §5 concludes the paper with the theoretical implications of this work.

2 Previous analyses

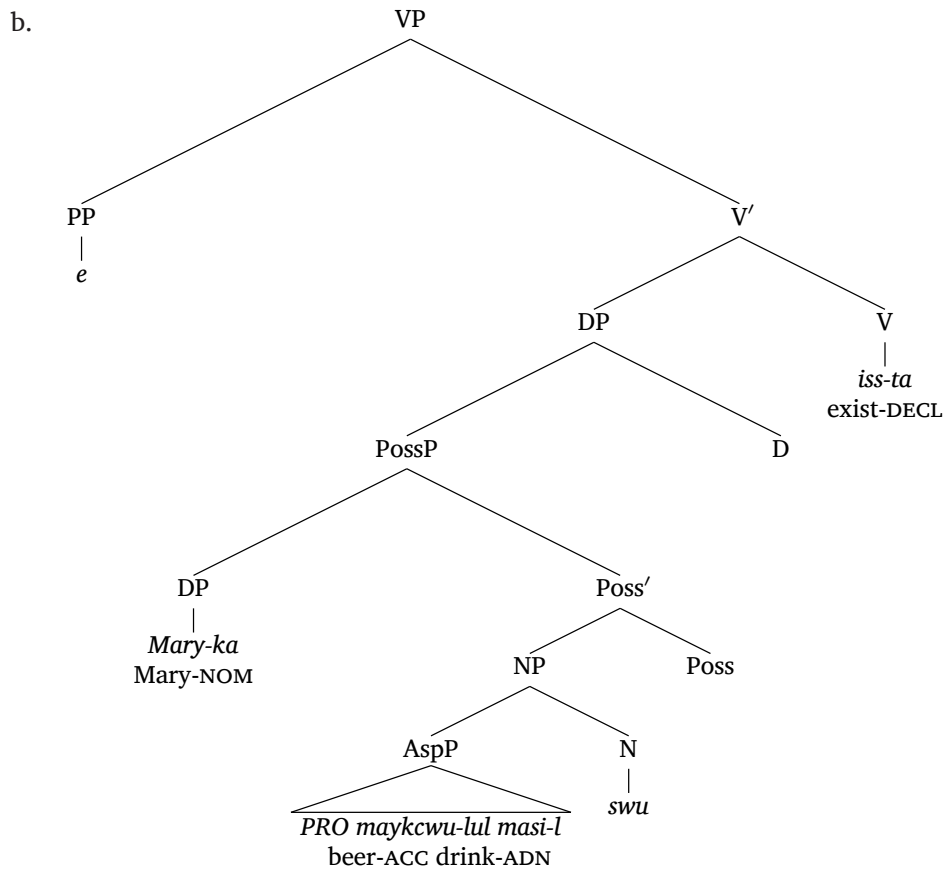
This section reviews the previous approaches to the modal readings of the *swu*-construction. Broadly speaking, they fall into two camps: syntactic ambiguity vs. lexical ambiguity. Most of the previous authors (Ha 2007; Chung 2007; Kim 2010; Kim 2014, inter alia) argue for the former approach; that is, the modal readings of the *swu*-construction are syntactically determined. The other view (Mun 2016; Lee 2017) attributes its various modal readings to the meaning of a particular lexical item occurring in the *swu*-construction. In this section, I discuss how these two different approaches can be extended to the empirical facts presented in the preceding section.

2.1 Syntactically-oriented analyses

Previous researchers such as Ha (2007), Chung (2007), Kim (2010) and Kim (2014) argue that the availability of different modal readings in a *swu*-construction is due to its two possible syntactic structures. Their analyses do not encompass the priority (permission) reading of a *swu*-construction, but they are restricted to epistemic and dynamic (ability) readings, referring to the latter as a root reading. To take an example, Ha (2007) analyzes the syntactic structure of the *swu*-construction in terms of Tsujioka's (1996) proposal on the different types of the existential construction in Japanese, as shown below:⁵



⁵ Glosses in (5) are mine.



(Ha 2007: 316)

In the absolute existential structure in (5a), the surface subject *Mary-ka* occurs in the CP which modifies the bound noun *swu*. In contrast, in the possessive existential structure in (5b), the surface subject *Mary-ka* is positioned as the specifier of the Possessive Phrase (PossP), and the bound noun *swu* combines with the Aspectual Phrase (AspP) which contains PRO. Ha (2007) argues that the structures in (5a) and (5b) induce an epistemic and a non-epistemic reading, respectively.

Slightly different syntactic structures have been proposed for the *swu*-construction in subsequent studies, e.g. Chung (2007); Kim (2010); Kim (2014). These syntactic accounts, however, cannot be extended to the empirical facts observed in this paper, i.e. why non-epistemic readings are not available with a *swu*-construction containing past tense, stative predicates, or progressive aspect whereas its corresponding *swu*-construction with present tense, eventive predicates, or non-progressive aspect can receive non-epistemic readings. One might argue that (i) present vs. past tense, (ii) stative vs. eventive predicate, and (iii) imperfective vs. perfective

aspect occupy different syntactic positions. But as far as I know, any empirical evidence for their syntactic differences have not been provided in the literature on Korean tense and aspect.⁶

2.2 Semantically-oriented analyses

It is not until Mun (2016) provides examples like (2) and (3) that the *swu*-construction is analyzed from a formal semantic perspective. The key idea of Mun's (2016) analysis is that the lexically specified ambiguous meanings of a particular modal expression are responsible for the (un) availability of the epistemic vs. non-epistemic readings. She argues that the modal reading of the *swu*-construction arises from an expression that is made up of the adnominal marker *-ul*, the bound noun *swu*, and the matrix clause predicate *iss*- 'exist', and proposes its three separate lexical entries, as shown in (6):

- (6) a. $\llbracket \text{-ul swu iss-}_{epistemic} \rrbracket^{f,g}$
 $= \lambda P \lambda t \lambda t' \lambda w \exists w' [w' \in Best_{g^{stereotypical}(w,t)}(\cap f_{epis}(w,t)) \ \& \ P(w', t') = 1]$
- b. $\llbracket \text{-ul swu iss-}_{ability} \rrbracket^{f,g}$
 $= \lambda P \lambda x \lambda t \lambda t' \lambda w \forall w' [w' \in Best_{g^{deontic}(w,t)}(\cap f_{circ}(w,t)) \ \& \ x \text{ chooses } P(t') \text{ in } w' \text{ at } t \rightarrow P(x, w', t') = 1]$

⁶ Some previous authors (e.g. Kim 2010) take the distribution of the honorific marker – (*u*)*si*- to argue for a syntactic analysis of the modal readings of the *swu*-construction. Along the same line, a reviewer points out that its presence in a matrix clause results in a dynamic (ability) reading as in (i-a), while its occurrence in an embedded clause gives rises to an epistemic reading as in (i-b).

- (i) a. Apenim-kkeyse ku thakca-lul olmki-Ø-l swu iss-**usi**-Ø-ta.
 father-HON.NOM that table-ACC move-PRES-ADN SWU exist-HON-PRES-DECL
 #‘The father might move the table.’ [Epistemic]
 ‘The father is able to move the table.’ [Dynamic (ability)]
- b. Apenim-kkeyse ku thakca-lul olmki-**si**-Ø-l swu iss-Ø-ta.
 father-HON.NOM that table-ACC move-HON-PRES-ADN SWU exist-PRES-DECL
 ‘The father might move the table.’ [Epistemic]
 #‘The father is able to move the table.’ [Dynamic (ability)]

However, Mun (2016) claims that examples like (i-b) are available with both epistemic and dynamic readings, as follows:

- (ii) Ku pwun-i ku mwuncey-lul phwu-**si**-Ø-l swu iss-Ø-ta.
 that person.HON-NOM that problem-ACC solve-HON-PRES-ADN SWU exist-PRES-DECL
 ‘It is possible that that person will solve the problem.’ [Epistemic]
 ‘That person is able to solve the problem.’ [Dynamic (ability)]
 (Mun 2016: 82)

For reasons of space, this paper does not present further discussion on the effect of the honorific on the modal reading of a *swu*-construction. I leave more accurate empirical generalization and its theoretical implication for future studies.

- c. $\llbracket \text{-ul swu iss}_{\text{-permission}} \rrbracket^{f,g}$
 $= \lambda P \lambda x \lambda t \lambda t' \lambda w \exists w' [w' \in \text{Best}_{g\text{stereotypical}(w,t)}(\cap f_{\text{circ}}(w, t)) \ \& \ x \text{ chooses } P(t') \text{ in } w' \text{ at } t \ \& \ P(x, w', t') = 1]$
- (Mun 2016: 104)

In (6), the non-epistemic $\text{-ul swu iss}_{\text{-ability}}$ and $\text{-ul swu iss}_{\text{-permission}}$ differ from the epistemic $\text{-ul swu iss}_{\text{-epistemic}}$ in that they encode a choosing function which is defined in terms of two presuppositions, as follows:

- (7) Definition of **chooses**: x chooses P in w at t iff
- a. **The diversity requirement**: P and not- P are in the set of x 's options in w at t .
 - b. **The agentivity requirement**: P goes onto x 's private *To-Do List* in w at t .
- (Mun 2016: 104)

The diversity presupposition in (7a) is stated in terms of the agent x 's options, but it is conceptually the same as the diversity condition proposed by Condoravdi (2002). The agentivity presupposition in (7b) says that the overt subject in a *swu*-construction should play the role of an agent, and the preajcent proposition should be added to his/her private *To-Do List*.⁷ Mun (2016) accounts for the lack of non-epistemic readings in *swu*-examples with past tense and those with a stative predicate in terms of the choosing function. In her analysis, they are not available with the non-epistemic readings because the choosing function remains undefined. More specifically, the diversity presupposition is not satisfied in the case with past tense, and the agentivity presupposition is not satisfied in the case with a stative predicate.

Mun's (2016) analysis in terms of Kratzer's (1981; 1991) modal theory and the diversity condition provides an important insight on the modal-temporal interactions. However, her analysis is not without limitations. First of all, Mun's proposal on lexical ambiguity is *not* in accordance with the basic assumption in Kratzer's modal theory, according to which the conversational backgrounds are *contextually* determined and thus no lexical ambiguity is posited for a variety of modal readings that arise from a single modal expression.

Besides, the *swu*-construction with progressive aspect remains unaddressed in her work. She accounts for the lack of non-epistemic readings with stative predicates in terms of the agentivity presupposition, i.e. the *swu*-construction is not available with non-epistemic readings because a stative predicate like *pappu*- 'busy' is not compatible with an agentive subject and thus the choosing function remains undefined. Crucially, it should be noted that the agentivity

⁷ Mun (2016) adopts the notion of *To-Do List* from Portner's (2004) work on imperatives in which imperatives are analyzed as contributing to the addressee's *To-Do List*. Mun (2016: 102) argues that the choosing function contributes to the agent's private *To-Do List*: more specifically, it imposes an ordering to the worlds, according to which the agent determines what to choose.

requirement is inapplicable to the case with progressive aspect: this is because the progressive must occur with an eventive predicate which allows for an agentive subject as in (4).

Furthermore, the agentivity requirement is empirically untenable. In Mun's (2016) analysis, any *swu*-sentences with inanimate subjects are predicted not to yield a non-epistemic reading since the choosing function is not defined with a non-agentive subject. However, it is not difficult to find naturally-occurring *swu*-sentences with inanimate subjects that *can* give rise to a non-epistemic reading. Some such examples are given below:⁸

- (8) a. Pihayngki aphccok nalkay-nun wi-lo/alay-lo cep-ko, swucik kkori
 plane front wing-TOP upward/downward fold-and, horizontal tail
 nalkay(poco.nalkay)-lul wi-lo/alay-lo cep-eya **pihayngki-ka**
 wing(supplementary.wing)-ACC upward/downward fold-if plane-NOM
 nal-Ø-l swu iss-Ø-ta.
 fly-PRES-ADN SWU exist-PRES-DECL
 'Planes can fly if they fold the front and back wings upward/downward.'
- b. Ondo-ka noph-ul.swulok **kongki-ka** te manhun swucungki-lul
 temperature-NOM high-the.more air-NOM the more vapor-acc
 huphswuha-Ø-l swu iss-Ø-supnita.
 absorb-PRES-ADN SWU exist-PRES-DECL.POLITE
 'The higher the temperature gets, the more vapor air can absorb.'

The examples in (8) contain inanimate subjects such as *pihayngki-ka* 'plane-NOM' and *kongki-ka* 'air-NOM', but they receive a dynamic (ability) reading. Examples like (8) show that agentivity does *not* need to be specified as a presupposition for the key component of non-epistemic modals.

2.3 Looking ahead

The analysis proposed in this paper builds on Mun's proposal, in that I formalize the modal readings of the *swu*-construction in Kratzer's modal theory and account for the unavailability of its non-epistemic readings in terms of the diversity condition. However, the proposed analysis differs from Mun's proposal in significant ways. I argue that the modal readings arise from the expression *swu*, but it is not lexically ambiguous. Furthermore, I extend the empirical coverage to those containing the progressive such as (4). In this paper, the fact that the *swu*-sentences with lexically-encoded or grammatically-modified statives are unavailable with non-epistemic readings unless their TOs are future is taken to indicate that the non-epistemic readings are temporally constrained, rather than restricted by another constraint such as the agentivity

⁸ (8a) and (8b) are available at:

<https://www.chegg.com/flashcards/dc976131-c36e-4702-a9b2-d11c8341d81d/deck>

<https://manuals.plus/ko/bosch/ptd-1-thermal-detector-manual#axzz84AWHfgL8>

condition. I provide a uniform analysis of the *swu*-examples with past tense, a stative predicate, and progressive aspect.

In the next section, I elaborate on how each clause of the *swu*-construction is temporally interpreted in interactions with tense and aspect. In the analysis of the temporal interpretation of English modal sentences, Condoravdi (2002) introduces two different temporal parameters: Temporal Perspective (TP) and Temporal Orientation (TO). The former refers to the time at which a modal meaning is evaluated, and the latter refers to the time at which an eventuality described is located with respect to TP. Mun (2016) observes that the TP of a *swu*-sentence is located by a matrix clause tense, and its TO is constrained by an embedded clause tense. However, she does not address how the temporal interpretation is affected by lexical and grammatical aspect in the *swu*-construction. I present a novel empirical generalization on the temporal constraint on the modal readings of the *swu*-construction, by spelling out the contribution of aspect to the temporal interpretation of the *swu*-construction. Particularly, I provide examples with discourse contexts; this approach is sharply distinguished from the previous work that argued for the availability of modal readings only by providing their English translations. I compositionally analyze the temporal interpretation, and show how the non-epistemic readings are pragmatically ruled out due to their violation of the diversity condition on the TO-interpretation.

3 Temporal interpretation of the *swu*-construction

3.1 TP-interpretation of the *swu*-construction

In the *swu*-construction, matrix clause tense is responsible for its TP-interpretation, as noted by Mun (2016). In this section, I will show how each TP is associated with matrix clause tense by creating separate discourse contexts for different TP-interpretations.

First, the matrix clause must be realized with present tense for the present-TP interpretation. The sentence in (9) asserts that it is epistemically possible at the utterance time that Chelswu will move the table (in Context 1), or it is compatible with the circumstantial facts at the utterance time that Chelswu is able to move the table (in Context 2) or he is allowed to move the table (in Context 3). This present-TP reading is not available if the matrix clause contains past tense.

(9) **Present TP**

Context 1 (epistemic): Yenghi heard that Chelswu would be rearranging some furniture in his office. Yenghi asks his secretary which furniture he will be moving, and the secretary replies:

Context 2 (dynamic): Yenghi heard that Chelswu and his wife would be moving into a new apartment without any help from others. Yenghi knows that they have a very heavy marble table. Yenghi asks Chelswu's wife about the heavy table, and she replies:

Context 3 (priority): Chelswu has been using the faculty lounge while working on a department-level project as a graduate assistant. Chelswu asked the department staff if he could move a table closer to the window. The staff emailed the department chair about it. Now, the chair replies:

Chelswu-ka ku thakca-lul olmki- \emptyset -l swu iss- \emptyset /#**ess**-e.
 Chelswu-NOM that table-ACC move-PRES-ADN SWU exist-PRES/PAST-DECL

‘Chelswu might move the table.’

‘Chelswu is able to move the table.’

‘Chelswu is allowed to move the table.’

The presence of past tense in the matrix clause results in a past-TP interpretation, as shown in (10). In Context 1, the speaker is responding to a question about her past epistemic state; at the utterance time she knows that Chelswu did not go to the toy store alone, but yesterday she considered it possible that he would do that. The sentence in (10) also has a non-epistemic reading with past TP, according to which it was compatible with the past circumstances that Chelswu was able to go there (in Context 2) or that he was allowed to go there (in Context 3). Using present tense in the matrix clause is infelicitous for this past-TP meaning.⁹

(10) **Past TP**

Context 1 (epistemic): Yenghi was told yesterday that her 6-year-old son Chelswu was missing. She stopped by several places, and found him at the park. Now, Yenghi’s boss asks her why she visited the toy store yesterday during working hours, and she replies:

Context 2 (dynamic): Chelswu is an elementary school student, and loves visiting his cousin. After visiting there with his brother several times, he got used to using public transportation alone. Chelswu’s teacher, Yenghi, got to know about Chelswu’s travel and was very shocked because she thought that Chelswu was too young to travel alone. Now, Chelswu’s brother is trying to put her mind at ease, and says:

Context 3 (priority): Whenever Chelswu goes out at night, his parents accompany him worrying about his safety. Yesterday Chelswu’s friends got together, and Chelswu’s parents allowed him to go without them for the first time. Now, Yenghi says:

Chelswu-ka honca keki-ey ka- \emptyset -l swu iss-# \emptyset /#**ess**-e-yo.
 Chelswu-NOM alone that.place-LOC go-PRES-ADN SWU exist-PRES/PAST-DECL-POL

‘Chelswu might have been there alone.’

‘Chelswu was able to go there alone.’

‘Chelswu was allowed to go there alone.’

⁹ When a *swu*-sentence is past tensed in the matrix clause and it receives an ability reading, it gives rise to the so-called actuality inference, e.g. ‘Chelswu actually went there alone’ in (10). See, e.g. Bhatt (1999); Hacquard (2006); Mari & Martin (2007); Homer (2011) for the relevant discussion.

3.2 TO-interpretation of the *swu*-construction

The TO-interpretation of a *swu*-construction is constrained by the tense and aspect in the embedded clause. Particularly, the stativity of an embedded predicate and the presence of progressive aspect play a crucial role in the TO-interpretation. This section shows how TO is determined in the *swu*-construction by interactions among lexical aspect, grammatical aspect, and tense.

3.2.1 Eventive predicates

If the *swu*-construction contains an eventive predicate in the embedded clause, its cooccurring past tense induces a past-TO interpretation, irrespective of its TP: (11a) has a present-TP (as indicated by the matrix clause present tense), and (11b) has a past-TP (as indicated by the matrix clause past tense). Examples in (11) both receive a past-TO interpretation, according to which the eventuality denoted by the embedded clause (called a described eventuality, hereafter) is temporally located in the past of the TP. This past-TO reading is available only with embedded past tense.¹⁰

(11) a. **Present TP, Past TO**

Context (epistemic): Yenghi had no problem with her laptop until she could not boot it this morning. Yenghi suspects that somebody used it secretly, and says:

Chelswu-ka ku khomphyuthe-lul sayongha-**yess**/**#**∅-ul swu iss-∅-e.
 Chelswu-NOM that computer-ACC use-PAST/PRES-ADN SWU exist-PRES-DECL
 ‘Chelswu might have used the computer.’

b. **Past TP, Past TO**

Context (epistemic): Yenghi found a USB stick plugged into the department computer. She thought that the USB belonged to Chelswu, and called him several times. Now, Chelswu’s girlfriend asks Yenghi why she called him a lot yesterday morning while they were taking an exam, and Yenghi says:

Chelswu-ka ku USB-lul noh-ko ka-**ss**/**#**∅-ul swu iss-ess-e.
 Chelswu-NOM that USB-ACC put-and go-PAST/PRES-ADN SWU exist-PAST-DECL
 ‘Chelswu might have left the USB stick.’

In the presence of present tense in the embedded clause, TO is constrained to future time. Again, this is independent of whether TP is present or past. In (12a), the whole course of the described eventuality is construed as extending over the future time while its onset immediately

¹⁰ In each example of (11), the described eventuality is temporally located in the past of TP. Merely being in the past of the utterance time is not sufficient to license the past TO. For example, in (11b), the eventuality of Chelswu’s leaving the USB stick is located prior to the contextually-provided TP, i.e. yesterday morning. The sentence cannot be uttered felicitously in a context where the described eventuality occurs prior to the utterance time, but after the TP, e.g. yesterday night. This indicates that the described eventuality is temporally located relative to the TP, but not relative to the utterance time.

follows the utterance time. This future-TO interpretation also arises from (12b): the described eventuality is not in progress at the contextually-supplied past TP, but it is located in the future of the TP. For instance, in Context 1 of (12b), the speaker is talking about her past epistemic state: at the utterance time she knows that Chelswu did not participate in the competition, but she considered it epistemically possible at the time when she bought the suit.

(12) a. **Present TP, Future TO**

Context 1 (epistemic): Yenghi heard that Chelswu would be rearranging some furniture in his office. Yenghi asks his secretary which furniture he will be moving, and the secretary replies:

Context 2 (dynamic): Yenghi heard that Chelswu and his wife would be moving into a new apartment without any help from others. Yenghi knows that they have a very heavy marble table. Yenghi asks Chelswu's wife about the heavy table, and she replies:

Context 3 (priority): Chelswu has been using the faculty lounge while working on a department-level project as a graduate assistant. Chelswu asked the department staff if he could move a table closer to the window. The staff emailed the department chair about it. Now, the chair replies:

Chelswu-ka ku thakca-lul olmki-#ess/Ø-l swu iss-Ø-e.
Chelswu-NOM that table-ACC move-PAST/PRES-ADN SWU exist-PRES-DECL

'Chelswu might move the table.'

'Chelswu is able to move the table.'

'Chelswu is allowed to move the table.'

b. **Past TP, Future TO**

Context 1 (epistemic): Yenghi bought Chelswu a nice suit for his piano competition. But he had a car accident three days before the competition, and gave up on it. Yenghi is asked why she bought him the suit, and she replies:

Context 2 (dynamic): Anyone who wants to participate in the national piano competition should go through the local preliminaries. Last month Chelswu won first place at the preliminaries. Now, Chelswu's teacher says:

Context 3 (priority): A premier piano competition will be held in France. Chelswu must get approval from the school principal in order to travel abroad. Last week he finally obtained the principal's approval. Now, Chelswu's teacher says:

Chelswu-ka ku piano tayhoy-ey chamyeha-#yess/Ø-l swu
Chelswu-NOM that piano competition-at participate-PAST/PRES-ADN SWU
iss-ess-e.
exist-PAST-DECL

'Chelswu might have participated in the piano competition.'

'Chelswu was able to participate in the piano competition.'

'Chelswu was given permission to participate in the piano competition.'

If an eventive predicate is inflected for progressive aspect as well as present tense, TO is located in the present or future time of TP. In each example of (13), the described eventuality is located at the same time as the TP (as shown in Context 1) or the time following it (as shown in Context 2). This TO-interpretation distinguishes them from their corresponding *swu*-sentences that do not contain the progressive: their TOs are restricted to future time, as we have seen in (12). In either of the present-TO or future-TO contexts, the *swu*-sentence with past tense is not felicitous.

(13) a. **Present TP, Nonpast TO**

Context 1 (epistemic with present TO): Yenghi saw Chelswu going to the gym 30 minutes ago. She asks Chelswu's roommate what Chelswu is doing now at the gym. Now, he replies:

Context 2 (epistemic with future TO): Yenghi is supposed to deliver an important document to Chelswu tomorrow. She tried contacting him to make an appointment beforehand, but she could not reach him. His roommate tells her to stop by the gym tomorrow afternoon, saying:

Chelswu-ka keki-ese theynisu-lul chi-koiss-#ess/∅-ul swu
 Chelswu-NOM there-LOC tennis-ACC play-PROG-PAST/PRES-ADN SWU
 iss-∅-e.
 exist-PRES-DECL
 'Chelswu might be playing tennis there.'

b. **Past TP, Nonpast TO**

Context 1 (epistemic with present TO): Yenghi has a conversation with Chelswu on the phone almost every night. Yenghi's roommate observed that they did not talk last night. Now, the roommate asks Yenghi why she did not call him yesterday, and she replies:

Context 2 (epistemic with future TO): Yesterday morning Yenghi's mother asked her to run an errand for Chelswu in the afternoon, but Yenghi refused the request. Yenghi's roommate asks her why she declined it, and now she replies:

Chelswu-ka ku ttay sihem-lul chi-koiss-#ess/∅-ul swu
 Chelswu-NOM that time exam-ACC take-PROG-PAST/PRES-ADN SWU
 iss-ess-e.
 exist-PAST-DECL
 'Chelswu might have been taking the exam at that time.'

If the progressive is realized with past tense, TO is in the past time of TP, as exemplified in (14). This past-TO interpretation also arises from the *swu*-sentence which is inflected only with past tense in its embedded clause. However, unlike such examples in (11), the described eventualities of (14) are construed as being in progress at the past time.

(14) a. **Present TP, Past TO**

Context (epistemic): Chelswu did not show up at the neighborhood meeting yesterday. Yenghi knows that his final exam is scheduled for today. Now, Yenghi is asked why he did not appear at the meeting yesterday, and she replies:

Chelswu-ka sihem kongpwu-lul ha-**koiss-ess/#Ø**-ul swu
 Chelswu-NOM exam study-ACC do-PROG-PAST/PRES-ADN SWU
 iss-Ø-e.
 exist-PRES-DECL

‘Chelswu might have been studying for the exam.’

b. **Past TP, Past TO**

Context (epistemic): While Yenghi was looking for Chelswu yesterday, she dropped by the city library. Yenghi’s roommate asks why she went there yesterday, and now she replies:

Chelswu-ka ku tosekwan-eyse kongpwuha-**koiss-ess/#Ø**-ul swu
 Chelswu-NOM that library-LOC study-PROG-PAST/PRES-ADN SWU
 iss-ess-e.
 exist-PAST-DECL

‘Chelswu might have been studying in the library.’

3.2.2 Stative predicates

This section shows how TO is determined in a *swu*-construction that contains a stative predicate in its embedded clause. Since statives cannot occur with the progressive, TO is determined solely by tense marking: (i) past-TO with past tense, and (ii) nonpast-TO with present tense.

First, the *swu*-sentences in (15) illustrate that embedded past tense realized with a stative predicate induces a past-TO interpretation, just like the corresponding sentences with an eventive predicate in (11). In all of the *swu*-examples in (11) and (15), a described eventuality is temporally located prior to the TP.

(15) a. **Present TP, Past TO**

Context (epistemic): The organizing committee of the workshop usually includes a faculty member of the department. But yesterday Chelswu heard that all the faculty members might have been unavailable this semester for various reasons. Now, Yenghi asks Chelswu about which professor was on the committee this year, and he replies:

Ku wiwenhoy-nun haksayng-tul-lo-man kusengtoy-**ess/#Ø**-ul swu
 that committee-NOM student-PL-with-only consist.of-PAST/PRES-ADN SWU
 iss-Ø-e.
 exist-PRES-DECL

‘The committee might have consisted of only students.’

b. **Past TP, Past TO**

Context (epistemic): Chelswu's family are all at work or school during the daytime. When Chelswu arrived home from work yesterday evening, he found muddy footprints on the kitchen floor. Now, he is asked why he called the police last night, and he replies:

Nwukwun-ka nac-ey cip-ey iss-ess/#∅-ul swu iss-ess-e.
 somebody-NOM day-at home-LOC exist-PAST/PRES-ADN SWU exist-PAST-DECL

'Somebody might have been home during the day time.'

In the presence of present tense, a stative predicate results in a nonpast-TO interpretation. This is parallel to the case where an eventive predicate is inflected for present tense and progressive aspect, as we have seen in (13).

(16) a. **Present TP, Nonpast TO**

Context 1 (epistemic with present TO): Chelswu has very bad eyesight. He is at a party with famous actresses. He sees two of them from a distance, and says:

Context 2 (epistemic with future TO): Two famous actresses will be participating in a film festival next week. Chelswu knows that they recently hired the same beauty stylist. Now, he says:

Twu yepaywu-ui uisang-i pisusha-#ess/∅-l swu iss-∅-e.
 two actress-GEN attire-NOM similar-PAST/PRES-ADN SWU exist-PRES-DECL

'The two actresses' attire might be similar.'

b. **Past TP, Nonpast TO**

Context 1 (epistemic with present TO): Before Chelswu went out yesterday, he saw a person wearing a leather jacket through the window. Now, Yenghi asks Chelswu why he wore a winter coat at the picnic yesterday, and he replies:

Context 2 (epistemic with future TO): Chelswu planned to go on a picnic yesterday afternoon, but canceled it after he checked the weather forecast in the morning. Now, Yenghi asks Chelswu why he canceled the picnic, and he says:

Nalssi-ka chwu-#ess/∅-ul swu iss-ess-e.
 weather-NOM cold-PAST/PRES-ADN SWU exist-PAST-DECL

'The weather might have been cold.'

3.3 Interim summary

In this section, I elaborated on how the *swu*-construction in Korean is temporally interpreted: (i) the matrix clause tense determines TP, and (ii) the embedded tense determines TO in interactions with the stativity of an embedded predicate and the presence of progressive aspect. The temporal interpretation of a *swu*-sentence is summarized in **Table 1**, along with the availability of each of the three modal readings, i.e. epistemic, dynamic (ability), and priority (permission) reading.

Aspect		Tense		Temporal interpretation		Modal interpretation			e.g.
Lexical aspect	Grammatical aspect	Matrix clause	Embedded clause	TP	TO	Epistemic	Dynamic	Priority	
Eventive	without progressive	past	past	Past	Past	✓	*	*	(11b)
		past	present	Past	Future	✓	✓	✓	(12b)
		present	past	Present	Past	✓	*	*	(11a)
		present	present	Present	Future	✓	✓	✓	(12a)
Stative	with progressive	past	past	Past	Past	✓	*	*	(14b)
		past	present	Past	Nonpast	✓	*	*	(13b)
		present	past	Present	Past	✓	*	*	(14a)
		present	present	Present	Nonpast	✓	*	*	(13a)
Stative	without progressive	past	past	Past	Past	✓	*	*	(15b)
		past	present	Past	Nonpast	✓	*	*	(16b)
		present	past	Present	Past	✓	*	*	(15a)
		present	present	Present	Nonpast	✓	*	*	(16a)

Table 1: Temporal and modal interpretations of a *swu*-construction.

In terms of the modal-temporal interactions, it is crucial to note that epistemic readings are available with all the combinations of TPs and TOs. This contrasts with non-epistemic readings that are available if and only if an eventive predicate occurs without the progressive and it receives a future-TO reading.¹¹

4 Proposed analysis

In this section, I develop a compositional analysis of the temporal interpretation of the *swu*-construction, and account for how it is associated with the (un)availability of its modal readings in terms of the general temporal constraints on modal bases.

4.1 Meaning of temporal and modal expressions in the *swu*-construction

In the proposed analysis, I use three temporal reference intervals within the Reichenbachian framework: **RT** (reference time), **ET** (event time), and **UT** (utterance time). I discuss the meanings of lexical/ grammatical aspect and tense in Korean (in §4.1.1–4.1.2), and propose to analyze the expression *swu* as lexically encoding a modal meaning (in §4.1.3).

4.1.1 Meaning of lexical and grammatical aspects in Korean

The literature has assumed that lexical and grammatical aspect affects temporal interpretation by constraining the temporal location of **ET** with respect to the **RT** (Kamp & Rohrer 1983; Partee 1984; Dowty 1986; Hinrichs 1986; Klein 1994, inter alia). The following examples illustrate such meaning contributions of lexical and grammatical aspect in Korean. The eventive predicate *ku thakca-lul olmki* ‘move the table’ and the stative predicate *pappu* ‘busy’ occur in (17) and (18), respectively. As we have already seen in the preceding sections, the progressive *-koiss-* is compatible with eventives as in (17b), but not with statives as in (18b):

- (17) Context: Yenghi met Chelswu in the library yesterday. Now, she says:
- a. Chelswu-ka (ecey) ku thakca-lul olmki-ess-e.
Chelswu-NOM yesterday that table-ACC move-PAST-DECL
‘Chelswu moved the table (yesterday).’ [RT ⊆ yesterday’, [ET ⊂ RT]
 - b. Chelswu-ka (ecey) ku thakca-lul olmki-koiss-ess-e.
Chelswu-NOM yesterday that table-ACC move-PROG-PAST-DECL
‘Chelswu was moving the table (yesterday).’ [RT ⊆ yesterday’, [RT ⊆ ET]

¹¹ The *swu*-sentences with a nonpast-TO interpretation such as (13) and (16) are available with epistemic readings by default. But when the described eventuality is construed as occurring only in the future time of the TP, it can also receive non-epistemic readings although epistemic readings are more preferred (even out of context). The relevant examples and discussion are given in footnote 16.

- (18) Context: the same as (17)
- a. Chelswu-ka (ecey) pappu-ass-e.
Chelswu-NOM yesterday busy-PAST-DECL
'Chelswu was busy (yesterday).' [RT \subseteq yesterday'], [RT \subseteq ET]
- b. *Chelswu-ka (ecey) pappu-koiss-ess-e.
Chelswu-NOM yesterday busy-PROG-PAST-DECL
intended: 'Chelswu was busy (yesterday).'

In (17) and (18), the **RT** is constrained by the time adverb *ecey* 'yesterday', but its exact temporal location is contextually determined (Partee 1984; Hinrichs 1986; Dowty 1986; Kamp & Reyle 1993, inter alia), e.g. in the above discourse context, the **RT** is the time at which the speaker met Chelswu in the library yesterday. Crucially, (17a) and (18a) have different temporal interpretations in terms of the **ET-RT** relationship. (17a) has a perfective interpretation, according to which the event of Chelswu's moving the table has a culmination point within the **RT**. By contrast, (18a) receives an imperfective interpretation, i.e. the described state has no change within the **RT**, but it holds at the larger interval including the **RT**. This imperfective interpretation is available with eventive predicates as well, if they occur with the progressive *-koiss-*, as shown in (17b): the event of Chelswu's moving the table holds at the larger interval including the **RT**.

This semantic function of the progressive has been observed in the literature (e.g. Vlach 1981; Moens & Steedman 1988; Parsons 1990; Kamp & Reyle 1993; De Swart 1998). Along the same lines, I analyze *-koiss-* as a kind of imperfective aspect, as given in (19a).¹² The eventive untensed sentence radical in (19b) is unspecified in terms of the **RT-ET** relationship, but the **ET** of the described event is constrained to include the **RT** by *-koiss-*, as given in (19c):

- (19) a. *-koiss-* 'PROG' $\Rightarrow \lambda p \lambda w \lambda t' \exists t [t' \subseteq t \wedge p(w, t)]$
b. *Chelswu-ka ku thakca-lul olmki-* 'Chelswu-NOM that table-ACC move'
 $\Rightarrow \lambda w \lambda t [chelswu.move.table'(w, t)]$
c. *Chelswu-ka ku thakca-lul olmki-koiss-* 'Chelswu-NOM that table-ACC move-PROG'
 $\Rightarrow \lambda w \lambda t' \exists t [t' \subseteq t \wedge chelswu.move.table'(w, t)]$

Similarly, I assume that the perfective meaning (**ET** \subset **RT**) of examples like (17a) arises from a perfective aspect, which is phonologically null. It combines with an eventive untensed sentence radical, as follows:

- (20) a. \emptyset_{perf} 'PERF' $\Rightarrow \lambda p \lambda w \lambda t' \exists t [t \subset t' \wedge p(w, t)]$
b. *Chelswu-ka ku thakca-lul olmki-* \emptyset_{perf} 'Chelswu-NOM that table-ACC move-PERF'
 $\Rightarrow \lambda w \lambda t' \exists t [t \subset t' \wedge chelswu.move.table'(w, t)]$

¹² The progressive has been analyzed as encoding a modal meaning in the literature (Dowty 1977; Landman 1992; Portner 1998; Ferreira 2016; Ogihara 2020, inter alia). For the sake of simplicity, I do not reflect it in the meaning of *-koiss* in (19a), but it can be straightforwardly incorporated in the proposed analysis.

Stative predicates have an imperfective meaning ($\mathbf{RT} \subseteq \mathbf{ET}$) by themselves, as we have seen in (18). I analyze it as being lexically encoded in the meaning of stative predicates, as follows:

- (21) a. *pappu*- ‘busy’ $\Rightarrow \lambda x \lambda w \lambda t' \exists t [t' \subseteq t \wedge \text{busy}'(x, w, t)]$
 b. *Chelswu-ka pappu*- ‘Chelswu-NOM busy’ $\Rightarrow \lambda w \lambda t' \exists t [t' \subseteq t \wedge \text{chelswu.busy}'(w, t)]$

4.1.2 Meaning of Korean tenses

While aspect relates \mathbf{ET} and \mathbf{RT} , tense is responsible for the temporal location of \mathbf{RT} with respect to some evaluation time, such as the \mathbf{UT} in a matrix clause. The examples in (22) illustrate that past tense locates \mathbf{RT} prior to the \mathbf{UT} , irrespective of the stativity of a predicate. In contrast, present tense constrains \mathbf{RT} to be located in the nonpast time of the \mathbf{UT} , as shown in (23).

- (22) a. *Chelswu-ka ecey/#cikum/#nayil ku thakca-lul olmki-ess-e.*
Chelswu-NOM yesterday/now/tomorrow that table-ACC move-PAST-DECL
 ‘Chelswu moved the table yesterday/#now/#tomorrow.’
 b. *Chelswu-ka ecey/#cikum/#nayil pappu-ass-e.*
Chelswu-NOM yesterday/now/tomorrow busy-PAST-DECL
 ‘Chelswu was busy yesterday/#now/#tomorrow.’
- (23) a. *Chelswu-ka cikum/nayil/#ecey ku thakca-lul olmki-Ø-e.*
Chelswu-NOM now/tomorrow/yesterday that table-ACC move-PRES-DECL
 ‘Chelswu moves the table now/tomorrow/#yesterday.’
 b. *Chelswu-ka cikum/nayil/#ecey pappu-Ø-e.*
Chelswu-NOM now/tomorrow/yesterday busy-PRES-DECL
 ‘Chelswu is busy now/tomorrow/#yesterday.’

These temporal meanings of Korean tenses are formalized in (24).¹³

- (24) a. *-ess* ‘PAST’ $\Rightarrow \lambda p \lambda w \lambda t [t' < t \wedge p(w, t')]$
 b. *-Ø_{pres}* ‘PRES’ $\Rightarrow \lambda p \lambda w \lambda t [t \leq t' \wedge p(w, t')]$

In (24), I assume that \mathbf{RT} is not existentially bound (cf. Prior 1967), but its exact temporal location is contextually determined, following dynamic semantic theories of temporal interpretation (e.g. Partee 1984; Hinrichs 1986; Dowty 1986; Kamp & Reyle 1993).

4.1.3 Meaning of the modal expression *swu*

In Kratzer’s (1981; 1991) modal theory, a variety of modal flavors that arise from a single expression like *must* are not attributed to lexical ambiguity. Its core claim is that the modal flavor

¹³ Korean tenses have phonologically-conditioned variants. The translations in (24) are applicable to all of their allomorphs.

is *contextually determined* by two conversational backgrounds, i.e. Modal Base (**MB**) and Ordering Source (**OS**). The former first gives a set of accessible worlds to a modal sentence, and then the latter imposes a particular ordering among the accessible worlds. For instance, the epistemic modal reading of (25a) arises from the epistemic MB and the doxastic/stereotypical OS, and the deontic modal reading of (25b) arises from the circumstantial MB and the deontic OS:

- (25) a. John **must** have the flu.
- i. Epistemic Modal Base
= { John has a fever, John has a cough, John did not get a flu shot, ... }
 - ii. Doxastic/Stereotypical Ordering Source
= { Flu leads to a fever, Many people in town are suffering from the flu right now, People suffering from the same symptoms in the same town all have the same illness, ... }
- (Portner 2009: 64–65)
- b. John **must** go to jail.
- i. Circumstantial Modal Base
= { John robbed Mary, John is an adult, John is mentally competent, ... }
 - ii. Deontic Ordering Source
= { Robbery by competent adults is to be punished by time in jail, ... }
- (Portner 2007: 11)

(25a) asserts that in all worlds in which all of the facts given by the epistemic MB hold, and which are most highly ranked according to the OS, John has the flu. Similarly, (25b) says that among the worlds in which all of the facts in the circumstantial MB hold, the relevant rules rank most highly those worlds in which John goes to jail. The point here is that the modal expression *must* does not have two separate lexical entries for its availability of epistemic and deontic readings, but its modal readings are contextually determined by the two conversational backgrounds.

In this paper, I follow Kratzer’s assumption on a range of modal readings that arise from a single expression. I analyze the expression *swu* as encoding a modal meaning, but I do not postulate separate lexical entries for the range of modal readings available with the *swu*-construction (cf. (Mun 2016; Lee 2017)). The translation of *swu* is given in (26), which incorporates Portner’s (1998) **BEST**-function:

$$(26) \quad swu \Rightarrow \lambda p \lambda w \lambda t \exists w' [w' \in \mathbf{BEST}(\mathbf{MB}, \mathbf{OS}, w, t) \wedge p(w', t)]$$

According to (26), among the worlds in which all of the facts given by the MB hold, at least one of the worlds most highly ranked by the OS is one in which the prejacent proposition *p* of the *swu*-sentence is true.

4.2 Semantic derivation of the temporal interpretation in the *swu*-construction

This section shows how the temporal interpretation of the *swu*-construction is compositionally derived by interactions between tense and aspect. Particularly, I show how the future-TO interpretation is compositionally computed from a *swu*-sentence like (12), which yields the three different modal readings (§ 4.2.1). It will be compared with the *swu*-sentences that occur with a stative predicate, progressive aspect, or past tense; recall that they are not available with non-epistemic readings. I provide a semantic derivation of their temporal interpretations according to which their TOs are *not* restricted to the future time of TP (§4.2.2).

4.2.1 A *swu*-sentence with three available modal readings

I first provide the derivation of a *swu*-sentence that allows all three modal readings. The relevant example in (12) is reproduced below. I assume that examples like (27) contain a phonologically null perfective aspect, as discussed in the preceding section.

(27) **Present TP, Future TO**

Chelswu-ka ku thakca-lul olmki- \emptyset_{perf} - \emptyset_{pres} -l swu iss- \emptyset_{pres} -e.
 Chelswu-NOM that table-ACC move-PERF-PRES-ADN SWU exist-PRES-DECL

‘Chelswu might move the table.’

‘Chelswu is able to move the table.’

‘Chelswu is allowed to move the table.’

The compositional derivation of (27) is given in (28); the adnominal marker *-(u)l* and the matrix clause verb *iss-* ‘exist’ are assumed not to make any semantic contribution, and are thus analyzed as an identity function. The untensed sentence radical is first taken by perfective aspect, and then by present tense, as shown in (28a) and (28b), respectively. The adnominal marker *-(u)l* combines with the tensed embedded clause as in (28c), and the resulting phrase is taken by *swu* which encodes the modal meaning as in (28d). Next, the *swu*-phrase is taken by the matrix clause predicate *iss-* ‘exist’ as in (28e), and then present tense combines with the resulting untensed sentence radical as in (28f). Finally, the declarative mood in (28g) combines with the tensed sentence radical, which results in the final truth-conditional translation in (29).¹⁴

- (28) a. Chelswu-ka ku thakca-lul olmki- \emptyset_{perf}
 $\Rightarrow \lambda w \lambda t' \exists t [t \subset t' \wedge chelswu.move.table' (w, t)]$
- b. Chelswu-ka ku thakca-lul olmki- \emptyset_{perf} - \emptyset_{pres}
 $\Rightarrow \lambda w \lambda t'' \exists t [t'' \leq t' \wedge t \subset t' \wedge chelswu.move.table' (w, t)]$
- c. Chelswu-ka ku thakca-lul olmki- \emptyset_{perf} - \emptyset_{pres} -l
 $\Rightarrow \lambda w \lambda t'' \exists t [t'' \leq t' \wedge t \subset t' \wedge chelswu.move.table' (w, t)]$

¹⁴ In (28g), w^* and now stand for the actual world and the utterance time, respectively.

- d. Chelswu-ka ku thakca-lul olmki- \emptyset_{perf} - \emptyset_{pres} -l swu
 $\Rightarrow \lambda w \lambda t'' \exists w' \exists t [w' \in \mathbf{BEST}(\mathbf{MB}, \mathbf{OS}, w, t'') \wedge t'' \leq t' \wedge t \subset t' \wedge \text{chelswu.move.table}'(w', t)]$
- e. Chelswu-ka ku thakca-lul olmki- \emptyset_{perf} - \emptyset_{pres} -l swu iss-
 $\Rightarrow \lambda w \lambda t'' \exists w' \exists t [w' \in \mathbf{BEST}(\mathbf{MB}, \mathbf{OS}, w, t'') \wedge t'' \leq t' \wedge t \subset t' \wedge \text{chelswu.move.table}'(w', t)]$
- f. Chelswu-ka ku thakca-lul olmki- \emptyset_{perf} - \emptyset_{pres} -l swu iss- \emptyset_{pres}
 $\Rightarrow \lambda w \lambda t''' \exists w' \exists t [t''' \leq t'' \wedge w' \in \mathbf{BEST}(\mathbf{MB}, \mathbf{OS}, w, t'') \wedge t'' \leq t' \wedge t \subset t' \wedge \text{chelswu.move.table}'(w', t)]$
- g. -e 'DECL' $\Rightarrow \lambda p [p(w^*, \text{NOW})]$

The two free variables t' and t'' in (29) are existentially bound in discourse context.

(29) Final truth-conditional translation of (27)

$$\Rightarrow \exists w' \exists t [\text{NOW} \leq t'' \wedge w' \in \mathbf{BEST}(\mathbf{MB}, \mathbf{OS}, w^*, t'') \wedge t'' \leq t' \wedge t \subset t' \wedge \text{chelswu.move.table}'(w', t)]$$

According to the truth-conditional meaning in (29), the conversational backgrounds are evaluated in the nonpast time of the UT due to the matrix clause present tense. However, crucially, this compositionally calculated temporal interpretation is pragmatically restricted as well. Note that both epistemic and circumstantial modal bases cannot be interpreted with respect to the future time of the UT. This is because at the time of utterance, we cannot tell the future state of our knowledge or circumstances related to the described eventuality. This restricts the TP to the present time, yielding a present-TP interpretation. When it comes to the TO-interpretation, the ET of the described event is located within the future time of the UT. This is because the RT is in the nonpast time of the UT due to the embedded present tense, and the perfective aspect combining with the eventive predicate locates the ET within the RT. This correctly captures the future-TO interpretation of (27).

4.2.2 A *swu*-sentence with non-epistemic readings unavailable

When past tense occurs in the embedded clause, a *swu*-sentence receives a past-TO interpretation, irrespective of the stativity of the embedded predicate. Among the relevant examples such as (11), (14), and (15), I repeat the *swu*-sentence below that contains an eventive predicate with past tense in the embedded clause. Assuming that sentences like (30) also contain a phonologically null perfective aspect, its semantic derivation is the same as the corresponding sentence with present tense in (27), except that the RT of the described eventuality is in the past of the UT due to the embedded past tense. Its final truth-conditional translation is provided in (31).

(30) Present TP, Past TO

Chelswu-ka ku khomphyuthe-lul sayongha- \emptyset_{perf} -yess-ul swu iss- \emptyset_{pres} -e.
 Chelswu-NOM that computer-ACC use-PERF-PAST-ADN SWU exist-PRES-DECL
 'Chelswu might have used the computer.'

(31) Final truth-conditional translation of (30)

$$\Rightarrow \exists w' \exists t [\text{NOW} \leq t'' \wedge w' \in \text{BEST}(\text{MB}, \text{OS}, w^*, t'') \wedge t' < t'' \wedge t \subset t' \wedge \text{chelswu.use.computer}'(w', t)]$$

In (31), TP is in the nonpast time of the UT, but again, it is pragmatically adjusted to be cotermporal with the UT for the same reason as (29); that is, we cannot determine the truth value of the prejacent from the perspective of our future epistemic or circumstantial state. This yields a present-TP interpretation. The embedded past tense locates the RT prior to the TP, and the perfective aspect constrains the ET of the described event within the RT. This correctly results in the past-TO interpretation.

A *swu*-sentence with progressive aspect is also semantically derived in the same fashion as its corresponding sentence with perfective aspect. The only difference in the temporal interpretation is attributed to the progressive, by which the RT of the embedded clause is the same as or within the ET. The relevant example in (13a) and its final truth-conditional translation are given below:

(32) Present TP, Nonpast TO

Chelswu-ka keki-ese theynisu-lul chi-koiss- \emptyset_{pres} -ul swu iss- \emptyset -e.
 Chelswu-NOM there-LOC tennis-ACC play-PROG-PRES-ADN SWU exist-PRES-DECL
 ‘Chelswu might be playing tennis there.’

(33) Final truth-conditional translation of (32)

$$\Rightarrow \exists w' \exists t [\text{NOW} \leq t'' \wedge w' \in \text{BEST}(\text{MB}, \text{OS}, w^*, t'') \wedge t'' \leq t' \wedge t' \subseteq t \wedge \text{chelswu.play.tennis}'(w', t)]$$

The TP of (33) is also pragmatically constrained to the UT, i.e. the present-TP interpretation. The nonpast-TO is determined by interactions between the embedded present tense and the progressive aspect. The present tense restricts the RT of the described eventuality in the nonpast time of the UT, but its exact temporal location is determined by discourse context. The ET of the described eventuality extends over the RT due to the progressive. This correctly captures the nonpast-TO interpretation, where TO is located at or after the UT.

Exactly the same temporal interpretation arises from a *swu*-sentence with a stative predicate, but its imperfective interpretation is attributed to the lexically encoded meaning of the stative predicate. The relevant example in (16a) is repeated in (34), along with its final truth-conditional translation.

(34) Present TP, Nonpast TO

Twu yepaywu-ui uisang-i pisusha- \emptyset_{pres} -l swu iss- \emptyset -e.
 two actress-GEN attire-NOM similar-PRES-ADN SWU exist-PRES-DECL
 ‘The two actresses’ attire might be similar.’

(35) Final truth-conditional translation of (34)

$$\Rightarrow \exists w' \exists t [\text{NOW} \leq t'' \wedge w' \in \text{BEST}(\text{MB}, \text{OS}, w^*, t'') \wedge t'' \leq t' \wedge t' \subseteq t \wedge \text{attire.similar}'(w', t)]$$

In (35), all the temporal reference intervals are located in the same way as in (33); TP is cotermporal to the UT, and the TO is located in the nonpast time of the TP.

This section has shown how the TP and TO interpretations of the *swu*-sentences are compositionally computed by interactions between tense and aspect. I provided a compositional derivation according to which *swu*-sentences with three modal readings receive a future-TO interpretation while their cooccurrence with stative predicates, progressive aspect, or past tense results in a past-TO or nonpast-TO interpretation. I propose that the availability of the modal readings in the *swu*-sentence is pragmatically determined by the temporal constraints on different kind of modal bases, as will be discussed in the next section.

4.3 Temporal constraints on modal readings

I assume that the diversity condition (Condoravdi 2002; Werner 2003; Abusch 2012; Thomas 2014; Rullmann & Matthewson 2018, inter alia) temporally constrains the circumstantial modal base to descriptions of future eventualities, and account for the unavailability of non-epistemic modal readings in a *swu*-construction in terms of its violation of the diversity condition (§4.3.1). I argue that, in contrast, such a temporal constraint is not imposed on the epistemic modal base, and thus all the TP-TO combinations are allowed for epistemic modal readings in the *swu*-construction (§4.3.2).

4.3.1 Temporal constraint on circumstantial modal base

Condoravdi (2002) introduces the diversity condition to account for what she calls a metaphysical interpretation in English modal sentences like *She might have won the game*. She argues that a metaphysical interpretation is available only with the description of a future eventuality since the truth value of its prejacent is not yet settled to be true or false. Conversely, with a past or present eventuality, its prejacent proposition is metaphysically settled at the time of TP, and thus the metaphysical interpretation is pragmatically ruled out. Condoravdi's (2002) diversity condition is given below:

- (36) Condoravdi's (2002) Diversity Condition
 There are $w \in cg$ and $w', w'' \in \mathbf{MB}(w, t)$ such that $AT([t, _], w', p)$ and $\neg AT([t, _], w'', p)$,
 where $[t, _]$ indicates a time interval whose initial subinterval is t and it extends to the
 end of time. (Condoravdi 2002: 71, 83).

According to (36), there should be at least one world in which a prejacent proposition p is true, and another world in which it is false.

Condoravdi (2002) applies the diversity condition to the temporal restrictions on metaphysical modal bases to non-future TOs, drawing on English modal sentences with *might*. Rullmann & Matthewson (2018) show that the same TO-restrictions are extensively observed

with circumstantial modals in other languages, and claim that the diversity condition suffices to account for their TO-restrictions.¹⁵ I argue that the non-epistemic readings with non-Future TOs are excluded in the Korean *swu*-construction for the same reason: when a modal utterance with *swu* is contextually construed as involving a circumstantial modal base, the dynamic (ability) and the priority (permission) interpretations can arise unless the TO is non-future, which would violate the Diversity Condition.

In the preceding section, we have seen how TOs are compositionally determined in the *swu*-sentences. The *swu*-sentence in (27) is available with the non-epistemic readings as well as the epistemic reading. I argue that this is because it receives a future-TO interpretation. In contrast, when TO is determined as past or present, the dynamic (ability) and the priority (permission) readings are pragmatically ruled out due to the diversity condition on the circumstantial modal base. More specifically, the occurrence of past tense in *swu*-examples like (30) constrains TO to be in the past time of the TP, which in turn violates the diversity condition. This eventually leads to the unavailability of the non-epistemic readings in (30).

The modal readings of the *swu*-sentence with progressive aspect or a stative predicate can be accounted for in terms of the diversity condition as well. The preceding section has shown that the TOs of such *swu*-sentences are correctly computed to be located in the nonpast time of the TP. In particular, due to the aspectual meaning of the progressive and a stative predicate, the ET of a described eventuality is construed as extending over its RT. This engenders an implicature that the described eventuality holds at the TP as well, unless discourse context specifies that the ET of the described eventuality is restricted only to the future time of the TP. This implicature causes the diversity condition to be violated, which in turn induces the infelicity of non-epistemic readings in *swu*-sentences occurring with the progressive or a stative predicate as in (32) and (34). Instead of such an imperfective *swu*-sentence, the corresponding perfective *swu*-sentence like (27), which does not pose any problem with the diversity condition, is preferred for non-epistemic readings.¹⁶

¹⁵ Rullmann & Matthewson (2018) assume that Condoravdi's (2002) metaphysical modality is actually circumstantial modality with past TP, and account for the modal-temporal interaction under the assumption of the epistemic vs. circumstantial dichotomy.

¹⁶ If discourse context makes it clear that TO is restricted to the future time of the TP, a non-epistemic reading can arise from a *swu*-sentence, as illustrated by the progressive *swu*-sentence in (i) and the one with a stative predicate in (ii). Although their corresponding perfective sentences with *swu* are more preferred, (i) and (ii) are available with non-epistemic readings in Contexts 2 and 3, where the TOs are in the future of the TP, and thus the relevant circumstantial facts are not yet settled at the TP.

(i) **Present TP, Future TO**

Context 1 (epistemic with future TO): Yenghi has to deliver an important document to Chelswu tomorrow. She tried contacting him to make an appointment beforehand, but she could not reach him. His roommate tells her to stop by the lounge tomorrow afternoon, saying:

Context 2 (dynamic with future TO): Chelswu, who recently overcame claustrophobia, is scheduled to get a vaccine shot tomorrow. Now, his wife is asked if he would be okay with taking a rest in the windowless lounge after getting a shot tomorrow.

4.3.2 No temporal constraint on epistemic modal base

Unlike non-epistemic readings, there is no TO-restriction on epistemic readings. This is because the truth value of a prejacent proposition is *not* settled in epistemic modal bases, irrespective of whether the TO is future or non-future. In other words, when we utter an epistemically modalized sentence to describe a past or present eventuality, its prejacent proposition can still be true or false. Thus, the effect of the diversity condition is not observed in epistemic readings.

With regard to the TP of epistemic modals, a majority of previous studies have assumed that it is necessarily keyed to the utterance time, and thus a past perspective is not expressible with epistemic modals in natural language sentences (e.g. Groenendijk & Stokhof 1975; Picallo 1990; Iatridou 1990; Abusch 1997; Condoravdi 2002; Stowell 2004; Hacquard 2006; 2011). However, some authors like von Fintel & Gillies (2008) argue that a past-TP interpretation is actually available in natural language sentences, as illustrated with the following example:

- (37) Context: At the time of utterance, the speaker knows that there is no ice cream in the freezer, but when she is asked about why she opened the freezer, she says:
There might have been ice cream in the freezer. (von Fintel & Gillies 2008: 87)

von Fintel & Gillies (2008) argue that the modal utterance in (37) expresses the speaker's past epistemic perspective on the truth value of the prejacent proposition.

In line with von Fintel & Gillies's (2008) view, Rullmann & Matthewson (2018) develop a theory of modal-temporal interaction, according to which there is no grammatical TP-restriction

Context 3 (priority with future TO): Chelswu suddenly fell and hit his head on the ground during the PE class. Now, his friend Yenghi is asked why he is being carried to the faculty lounge:

Chelswu-nun ku hyukeysil-eyse camsi swi-koiss-Ø-ul swu iss-Ø-e.
Chelswu-TOP that lounge-LOC for.a.while rest-PROG-PRES-ADN SWU exist-PRES-DECL

'Chelswu might be taking a rest at the lounge for a while.'

'Chelswu is able to be taking a rest at the lounge for a while.'

'Chelswu is allowed to be taking a rest at the lounge for a while.'

(ii) **Present TP, Future TO**

Context 1 (epistemic with future TO): Chelswu will go to church tomorrow, and his mom will buy him a toy robot if he behaves well during the service. Now, his sister says:

Context 2 (dynamic with future TO): Chelswu has been suffering from ADHD, but the symptoms are not severe. He can sit still during the 30-minute service that his church provides for the disabled. He will go to church tomorrow, and his mother says now:

Context 3 (priority with future TO): Anyone who is sick can stay silent during the service under the pastor's permission. Chelswu has a sore throat, but he will go to church tomorrow:

Chelswu-nun kyohoy yeypay cwung-ey mal-epsi coyonghi iss-Ø-ul swu iss-Ø-e.
Chelswu-TOP church service during speech-without quietly be-PRES-ADN SWU exist-PRES-DECL

'Chelswu might stay quiet without a word during the church service.'

'Chelswu is able to stay quiet without a word during the church service.'

'Chelswu is allowed to stay quiet without a word during the church service.'

on an epistemic modal base. They empirically support the theory by investigating the temporal interpretation of modal sentences in languages like Dutch, English, Gitksan (Tsimshianic), and St'át'imcets (Lillooet Salish). Specifically, they argue that their proposal is supported by Dutch, wherein TP is overtly expressed by tense marking on epistemic modals, as illustrated below:¹⁷

- (38) a. De sleutel **moet** / **kan** (wel) (eens) in de la ligg-en.
 the key NEC.PRS.3SG / POS.PRS.3SG (PTCL) (PTCL) in the drawer lie-INF
 'The key must/might be in the drawer.' [Present TP, Present TO]
- b. De sleutel **moest** / **kon** (wel) (eens) in de la ligg-en.
 the key NEC.PST.3SG / POS.PST.3SG (PTCL) (PTCL) in the drawer lie-INF
 'The key {had to be}/{might have been} in the drawer.' [Past TP, Present TO]
 (Rullmann & Matthewson 2018: 289–290)

In (38a), the present tense realization with the necessity or the possibility modals results in a present-TP interpretation. In contrast, if the modals are marked with past tense, they give rise to a past-TP interpretation as in (38b).

It is noteworthy that the Korean *swu*-construction exhibits the same pattern as Dutch modal constructions. In the *swu*-construction, TP is determined by the matrix clause tense which scopes over the modal *swu*. Recall that the modal meaning is encoded only in the semantics of *swu*, and the semantic contribution of the matrix clause predicate *iss*- 'exist' is nothing but an identity function. In other words, the tense realization on the matrix clause predicate in the *swu*-construction is analogous to the overt tense markings on Dutch modals. Given the parallels in Dutch modal constructions and the Korean *swu*-construction, I argue that the empirical patterns observed with the latter provide further support for Rullmann & Matthewson's (2018) claim that there should *not* be any *grammatical* restrictions on the past-TP epistemic readings.

Although expressing a past epistemic perspective is not grammatically constrained in the *swu*-sentence, it is often dispreferred over other types of Korean sentences that express a past epistemic perspective. For example, (39) contains the attitude verb *sayngkakhha*- 'think' with past tense. It is preferred over the simple *swu*-sentence (39b) in the given context.

- (39) Context: same as (37)
- a. Nayngcangko-ey aisu khulim-i iss- \emptyset _{pres}-ta-ko sayngkakhay-ss-e.
 freezer-LOC ice cream-NOM exist-PRES-DECL-COMP think-PAST-DECL
 'I thought that there was ice cream in the freezer.'

¹⁷ I follow Rullmann & Matthewson's (2018) glosses in the Dutch examples: 3, 3rd person; INF, infinitive; NEC, necessity modal; PST, past tense; PRS, present tense; POS, possibility modal, PTCL: particle; SG, singular.

- b. Nayngcangko-ey aisu khulim-i iss- \emptyset_{pres} -ul swu iss-ess-e.
 freezer-LOC ice cream-NOM exist-PRES-ADN SWU exist-PAST-DECL
 ‘There might be some ice cream in the freezer.’

Rullmann & Matthewson (2018) account for why expressing a past epistemic perspective with English sentences containing modal auxiliary verbs are often dispreferred in some discourse context in light of various factors. Particularly, they attribute the empirical patterns to the fact that (i) English sentences with modal auxiliaries do not have overt markers for TP (unlike Dutch modal sentences), and (ii) the conversational backgrounds of the modal are not-at-issue. A *swu*-sentence is more like a Dutch sentence in terms of overt TP-marking, but the second point still holds for the Korean *swu*-construction. When we express the possibility or necessity of a proposition in view of our knowledge, we typically use the utterance time as our reference point for the time of our knowledge. While it is also possible for us to express a past epistemic perspective, this non-default past perspective cannot be easily established without any particular support of discourse context. In order to ensure that the perspective expressed is a non-default one, we tend to use other expressions or constructions that explicitly mark the non-default TP. This explains why using the attitude verb *sayngkakha*- ‘think’ with past tense in the matrix clause is preferred over its corresponding *swu*-sentence in (39).

4.4 Pragmatic coercion

One challenge in the formalization of the temporal interpretation is that examples like (27), which contain an eventive predicate with perfective aspect and present tense in the embedded clause, are compatible with the time adverb *cikum* ‘now’, as shown in (40).

- (40) Chelswu-ka cikum kakey mwun-ul tat- \emptyset_{perf} - \emptyset_{pres} -ul swu iss- \emptyset_{pres} -e.
 Chelswu-NOM now store door-ACC close-PERF-PRES-ADN SWU exist-PRES-DECL
 ‘Chelswu might close the store now.’
 ‘Chelswu is able to close the store now.’
 ‘Chelswu is allowed to close the store now.’

This presence of *cikum* ‘now’ in the *swu*-construction might lead us to generalize that TO can be located in the present time of TP by the embedded present tense. Mun (2016) also claims that examples like (40) receive a present-TO interpretation due to the occurrence of *cikum*.¹⁸

¹⁸ An example like (40) poses significant problems for Mun’s (2016) analysis which also accounts for the (un)availability of the modal readings in terms of the diversity condition. Recall that the diversity condition restricts non-epistemic modal readings to the descriptions of future eventualities. Consequently, examples like (40), which yield a present-TO interpretation according to Mun, are *incorrectly* predicted to be unavailable with non-epistemic readings, contrary to the facts.

Crucially, however, examples like (40) receive a future-TO interpretation even with the adverb *cikum* ‘now’. (40) is felicitous in the discourse context for future TO like (41a), wherein the onset of the **ET** of the described eventuality immediately follows the **UT**. In contrast, it cannot be uttered felicitously in a discourse context like (41b), wherein TO overlaps with TP.

(41) a. Discourse context for **Future TO**

Yenghi is about to go out to pick up some vegetables at Chelswu’s grocery store.
Now, Yenghi’s roommate says that the store might be closing soon.

b. Discourse context for **Present TO**

Chelswu is supposed to bring some vegetables to Yenghi, but he has not arrived yet.
Now, Yenghi’s roommate says that he might be busy with closing the store now.

In a discourse context for Present TO, the progressive is obligatory. The progressive sentence in (42) is felicitous in the context given in (41b).

- (42) Chelswu-ka cikum kakey mwun-ul tat-koiss- \emptyset_{pres} -ul swu iss- \emptyset_{pres} -e.
Chelswu-NOM now store door-ACC close-PROG-PRES-ADN SWU exist-PRES-DECL
‘Chelswu might be closing the store now.’

In what follows, I discuss how the future-TO interpretation of (40) can be captured in my analysis. I focus on the temporal semantics of the adverb *cikum* ‘now’ and perfective aspect, and how it undergoes pragmatic coercion. The adverb *cikum* ‘now’ constrains the **RT** of the embedded clause to be cotermporal to the **UT**, as shown in the first underlined part in (43). Perfective aspect constrains the **ET** of the embedded clause to be located within the **RT**, as shown in the second underlined part in (43):

- (43) $\exists w' \exists t [\text{NOW} \leq t' \wedge w' \in \text{BEST}(\text{MB}, \text{OS}, w', t') \wedge t' \leq t \wedge \underline{t} = \text{NOW} \wedge \underline{t} \subset t' \wedge \text{chelswu.}$
 $\text{close.store}'(w', t)]$

However, since **UT** is a short time interval, it is pragmatically impossible that **ET** is located within it. I argue that this invokes a pragmatic coercion that the **RT** of the embedded clause is extended to the immediate future time, yielding an inchoative future-TO interpretation. This kind of pragmatic coercion with short time intervals is attested across languages. For instance, the following English examples illustrate that an inchoative interpretation arises when the reference time is a short time interval, whether it is in the past or future of the utterance time.

- (44) a. #John sang in the shower when the mailman arrived. OK if inchoative
b. John was singing in the shower when the mailman arrived.

- (45) a. #John will sing in the shower when the mailman arrives. OK if inchoative
b. John will be singing in the shower when the mailman arrives.

(Wurmbrand 2014: 428)

In (44) and (45), the **RT** of the matrix clauses is constrained by the adverbial clause, i.e. it is the time at which the mailman arrives. It is in the past of the **UT** in (44), and in the future of the **UT** in (45). Given that the **RT** is a short time interval, the *b*-sentences with the progressive are felicitous (because there is no problem for the **RT** to be included by the **ET**), but their corresponding sentences without the progressive are not felicitous (because the **ET** cannot be included by the **RT**), as shown in the *a*-examples. It is important to note that the *a*-examples are ‘coerced’ to receive an inchoative interpretation, according to which the **ET** of John’s singing in the shower is located right after the **ET** of the mailman’s arrival.

I argue that the exactly same aspectual coercion occurs in (40), as reflected in its final interpretation below:

- (46) Final interpretation of (40)
 $\Rightarrow \exists w' \exists t [\text{NOW} \circ t'' \wedge w' \in \text{BEST}(\text{MB}, \text{OS}, w', t'') \wedge t'' \leq t' \wedge \text{NOW} \leq t' \wedge t \subset t' \wedge \text{chelswu.close.store}'(w', t)]$

In (46), the exact values of the **RTs** are contextually determined. Recall that in the proposed analysis, the **RT** of the matrix clause is compositionally determined as the nonpast time by the matrix clause present tense, but it is pragmatically constrained to be cotermporal to the **UT** since it is pragmatically impossible for the modal bases to be evaluated after the **UT**. Similarly, the **RT** of the embedded clause is located by the embedded nonpast tense and constrained by the time adverb *now*, but it is ‘coerced’ to be extended to the future time of the **UT** due to the aforementioned restriction on a short time interval. The final interpretation in (46) captures the future-TO interpretation of (40), and thus it is correctly predicted that *swu*-sentences like (40) are available with non-epistemic readings as well as epistemic readings without violating the diversity condition.¹⁹

4.5 Summary of the proposed analysis

In this section, I developed a compositional analysis of the temporal interpretation of the *swu*-construction, and accounted for the observed empirical facts on the availability of its modal readings in terms of the temporal constraints on the modal bases, along the same line as Rullmann & Matthewson (2018). That is, non-epistemic readings are available only with future-TOs due to the diversity condition which restricts the circumstantial modal base to future eventualities (Condoravdi 2002; Werner 2003; Abusch 2012; Thomas 2014; Rullmann & Matthewson 2018, inter alia). In contrast, no such temporal constraint is imposed on the epistemic modal base, and thus an epistemic reading can arise from any combinations of TPs and TOs in the *swu*-construction.

¹⁹ As pointed out by a reviewer, the proposed coercion account can be implemented under the assumption of the extended **NOW**. I do not provide this alternative analysis in this paper, but see Hunter (2012) and Stojnic & Altshuler (2021) for the non-**UT** interpretations of **NOW**.

The proposed analysis makes a correct prediction on the modal readings of a *swu*-construction with past tense, progressive aspect, or stative predicates. The presence of such elements in the *swu*-construction gives rise to the temporal interpretation according to which the TO of the described eventuality is not necessarily restricted to the future time of the TP, and thus results in the unavailability of non-epistemic readings in violation of the diversity condition on the circumstantial modal base. I showed how the modal-temporal interaction occurs in the *swu*-construction at the semantics-pragmatics interface, which cannot be captured by merely considering its syntactic structure or the lexical meaning of a relevant expression as proposed by previous authors.

5 Concluding remarks

In this paper, I investigated how modal readings are affected by temporal interpretation in natural language sentences. The empirical focus was one of the Korean modal constructions realized with *swu*; The *swu*-construction can receive both epistemic and non-epistemic modal readings, but the non-epistemic readings are not available when the *swu*-construction contains past tense, progressive aspect, or a stative predicate. Building on Rullmann & Matthewson (2018), I analyzed the observed facts in terms of modal-temporal interactions at the semantics-pragmatics interface. I first investigated the temporal interpretation of the *swu*-construction in terms of the notions of TP and TO (Condoravdi 2002), and provided a novel empirical generalization that its non-epistemic readings arise only from future-TOs while epistemic readings are available with all possible TP-TO combinations. I elaborated on how the presence of a stative predicate, progressive aspect, and past tense in a *swu*-construction affects the temporal interpretation, which in turn results in the violation of the diversity condition. I argued that the epistemic readings, in contrast, are not temporally constrained, and thus they are available with the *swu*-sentences with such elements.

Previous studies on the *swu*-construction have attributed its modal readings to syntactic structures (e.g. Ha 2007; Chung 2007; Kim 2010) or lexical ambiguity (e.g. Mun 2016; Lee 2017). I discussed empirical and theoretical problems with these approaches, and provided a non-ambiguity analysis of the multiple modal readings of the Korean *swu*-construction, following Kratzer's (1981; 1991) view that distinct modal readings are contextually determined. The theoretical implication of this study is not restricted to the analysis of the *swu*-construction. It is well known that a single modal sentence can receive multiple readings like the following sentences from other languages:

- (47) a. You may go. [English]
 b. Tu peux partir.
 you may go
 ‘You may go.’ [French]
 c. Kamu boleh pergi.
 you may go
 ‘You may go.’ [Indonesian]

Exactly the same line of accounts have been proposed for the multiple readings of a modal sentence in general; (i) structural ambiguity (Jackendoff 1972; Zubizarreta 1982; Picallo 1990; Cinque 1999; Butler 2003) or (ii) lexical ambiguity (Ross 1969). The present work shows that the multiple readings of a single modal construction are affected by its temporal interpretation, and I captured the modal-temporal interaction within Kratzer’s theory in line with Rullmann & Matthewson (2018).

Given the typological difference from languages such as Dutch, English, Gitksan (Tsimshianic), and St’át’imcets (Lillooet Salish), the empirical facts observed in the Korean *swu*-construction provide further support for the theory of modal-temporal interactions proposed by Rullmann & Matthewson (2018). The key part of the theory is that epistemic modals are not necessarily keyed to the utterance time but a past epistemic state can be expressed by natural language sentences (cf. Groenendijk & Stokhof 1975; Picallo 1990; Iatridou 1990; Abusch 1997; Condoravdi 2002; Stowell 2004; Hacquard 2006; 2011). The availability of a past-TP epistemic reading in the *swu*-construction lends further cross-linguistic support for Rullmann & Matthewson’s (2018) theory. The effect of the diversity condition on the non-epistemic readings has also been observed in the Korean *swu*-construction, which reinforces their analysis as well. I hope the proposed analysis can be extended to other modal constructions in Korean and similar constructions in other languages in future research.

Abbreviations

ADN = adnominalizer, PAST = past, POL = politeness, PRES = present. I glossed *swu* as SWU. For the other abbreviations, I followed the conventions outlined in the Leipzig glossing rules (<https://www.eva.mpg.de/lingua/resources/glossing-rules.php>).

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The author has no competing interests to declare.

References

- Abusch, Dorit. 1997. The now parameter in future contexts. In Partee, Barbara & Kamp, Hans (eds.), *Context dependency in the analysis of linguistic meaning*, 1–20. Stuttgart: IMS Working Papers.
- Abusch, Dorit. 2012. Circumstantial and temporal dependence in counterfactual modals. *Natural Language Semantics* 20. 273–297. DOI: <https://doi.org/10.1007/s11050-012-9082-5>
- Bhatt, Rajesh. 1999. *Covert modality in non-finite contexts*: University of Pennsylvania dissertation.
- Butler, Jonny. 2003. A minimalist treatment of modality. *Lingua* 113. 967–996. DOI: [https://doi.org/10.1016/S0024-3841\(02\)00146-8](https://doi.org/10.1016/S0024-3841(02)00146-8)
- Chung, Daeho. 2007. Korean modal *v-(u)l swu/li iss/eps* and polarity licensing. *Studies in Generative Grammar* 17(4). 612–651. DOI: <https://doi.org/10.15860/sigg.17.4.200711.620>
- Cinque, Guglielmo. 1999. *Adverbs and functional heads*. Oxford: Oxford University Press.
- Condoravdi, Cleo. 2002. Temporal interpretation of modals: Modals for the present and for the past. In Beaver, David & Martínez, Luis Casillas & Clark, Brady & Kaufmann, Stefan (eds.), *The construction of meaning*, 59–87. Stanford, CA: CSLI Publications.
- De Swart, Henriette. 1998. Aspect shift and coercion. *Natural Language and Linguistic Theory* 16. 347–385. DOI: <https://doi.org/10.1023/A:1005916004600>
- Dowty, David. 1977. Towards a semantic analysis of verb aspect and the English ‘imperfective progressive’. *Linguistics and Philosophy* 1. 45–78. DOI: <https://doi.org/10.1007/BF00351936>

- Dowty, David. 1986. The effects of aspectual class on the temporal structure of discourse: Semantics or pragmatics? *Linguistics and Philosophy* 9. 37–61. DOI: <https://doi.org/10.1007/BF00627434>
- Ferreira, Marcelo. 2016. The semantic ingredients of imperfectivity in progressives, habituais, and counterfactuals. *Natural Language Semantics* 24. 353–397. DOI: <https://doi.org/10.1007/s11050-016-9127-2>
- Groenendijk, Jeroen A.G. & Stokhof, Martin J.B. 1975. Modality and conversational information. *Theoretical Linguistics* 2. 61–112. DOI: <https://doi.org/10.1515/thli.1975.2.1-3.61>
- Ha, Iljoo. 2007. NPI licensing in Korean modal constructions. In *Japanese/Korean linguistics* 15. 312–323. Stanford, CA: CSLI.
- Hacquard, Valentine. 2006. *Aspects of modality*: MIT dissertation.
- Hacquard, Valentine. 2011. Modality. In Maienborn, Claudia & von Stechow, Rainer & Portner, Paul (eds.), *Semantics: An international handbook of natural language meaning*, 1484–1515. Berlin: Mouton de Gruyter.
- Hinrichs, Erhard. 1986. Temporal anaphora in discourses of English. *Linguistics and Philosophy* 9. 63–82. DOI: <https://doi.org/10.1007/BF00627435>
- Homer, Vincent. 2011. French modals and perfective: A case of aspectual coercion. In Washburn, Mary Byram & McKinney-Bock, Katherine & Varis, Erika & Sawyer, Ann & Tomaszewicz, Barbara (eds.), *Proceedings of the West Coast Conference on Formal Linguistics* 28. 106–114. Somerville, Massachusetts: Cascadilla Proceedings Project.
- Hunter, Julie. 2012. *Now*: A discourse-based theory. In Aloni, Maria & Kimmelman, Vadim & Roelofsen, Floris & Sassoon, Galit W. & Schulz, Katrin & Westera, Matthijs (eds.), *Logic, language and meaning. lecture notes in computer science*, 483–497. Berlin, Heidelberg: Springer.
- Iatridou, Sabine. 1990. The past, the possible, and the evident. *Linguistic Inquiry* 21(1). 123–129.
- Jackendoff, Ray. 1972. *Semantic interpretation in Generative Grammar*. Cambridge, MA: MIT Press.
- Kamp, Hans & Reyle, Uwe. 1993. *From discourse to logic*. Dordrecht: Kluwer. DOI: <https://doi.org/10.1007/978-94-017-1616-1>
- Kamp, Hans & Rohrer, Christian. 1983. Tense in texts. In Bäuerle, Rainer & Schwarze, Christoph & von Stechow, Armin (eds.), *Meaning, use and interpretation of language*, 250–269. Berlin: Mouton de Gruyter.
- Kim, Shin-Sook. 2010. The structures of modality in Korean. In Maezawa, Hiroki & Yokogoshi, Azusa (eds.), *Proceedings of the 6th Workshop on Altaic Formal Linguistics*. 171–180. Cambridge, MA: MIT Working Papers in Linguistics.
- Kim, Tae Sik. 2014. Bound noun *swu* in Korean. *Studies in Generative Grammar* 24. 385–406. DOI: <https://doi.org/10.15860/sigg.24.2.201405.385>
- Klein, Wolfgang. 1994. *Time in language*. New York: Routledge.
- Kratzer, Angelika. 1981. The notional category of modality. In Eikmeyer, Hans-Jürgen & Rieser, Hannes (eds.), *Words, worlds, and contexts: New approaches in word semantics*, vol. 6 (Research in Text Theory), 38–74. Berlin: W. de Gruyter.

- Kratzer, Angelika. 1991. Modality. In von Stechow, Arnim & Wunderlich, Dieter (eds.), *Semantics: An international handbook of contemporary research*, 639–650. Berlin: Mouton de Gruyter. DOI: <https://doi.org/10.1515/9783110126969.7.639>
- Landman, Fred. 1992. The progressive. *Natural Language Semantics* 1(1). 1–32. DOI: <https://doi.org/10.1007/BF02342615>
- Lee, Jungmee. 2017. Epistemic vs. root modality in interactions with tense. *Korean Journal of Linguistics* 42(4). 805–825. DOI: <https://doi.org/10.18855/lisoko.2017.42.4.008>
- Mari, Alda & Martin, Fabienne. 2007. Tense, abilities, and actuality entailment. In Aloni, Maria & Dekker, Paul & Roelofsen, Floris (eds.), *Proceedings of the 16th Amsterdam Colloquium*, 151–156. Institute for Language, Logic and Information, University of Amsterdam.
- Moens, Marc & Steedman, Mark. 1988. Temporal ontology and temporal reference. *Computational Linguistics* 14. 15–28.
- Mun, Bokyung. 2016. *The interaction between modal and tense in Korean*: Georgetown University dissertation.
- Myeong, Jeong-hee. 2019. ‘-ul swu iss-’uy yangtay-wa sikan haysek (the interaction of modality and tense of ‘eul su iss-’). *Korean Linguistics* 82. 1–29. DOI: <https://doi.org/10.20405/kl.2019.02.82.1>
- Ogihara, Toshiyuki. 2020. Aspect and thematic roles. *Journal of Semantics* 37. 83–115. DOI: <https://doi.org/10.1093/jos/ffz020>
- Parsons, Terence. 1990. *Events in the semantics of English: A study in subatomic semantics*. Cambridge, MA: MIT Press.
- Partee, Barbara Hall. 1984. Nominal and temporal anaphora. *Linguistics and Philosophy* 7. 243–286. DOI: <https://doi.org/10.1007/BF00627707>
- Picallo, Carme. 1990. Modal verbs in Catalan. *Natural Language and Linguistic Theory* 8. 285–312. DOI: <https://doi.org/10.1007/BF00208525>
- Portner, Paul. 1998. The progressive in modal semantics. *Language* 74. 760–787. DOI: <https://doi.org/10.2307/417002>
- Portner, Paul. 2004. The semantics of imperatives within a theory of clause types. In Watanabe, Kazuha & Young, Robert B. (eds.), *Proceedings of Semantics and Linguistic Theory 14*, 235–252. Ithaca, NY: CLC Publications. DOI: <https://doi.org/10.3765/salt.v14i0.2907>
- Portner, Paul. 2007. Imperatives and modals. *Natural Language Semantics* 15. 351–383. DOI: <https://doi.org/10.1007/s11050-007-9022-y>
- Portner, Paul. 2009. *Modality*. Oxford: Oxford University Press.
- Prior, Arthur. 1967. *Past, present and the future*. Oxford: Clarendon Press. DOI: <https://doi.org/10.1093/acprof:oso/9780198243113.001.0001>
- Ross, John Robert. 1969. Auxiliaries as main verbs. In William, Todd (ed.), *Studies in Philosophical Linguistics*, 77–102. Evanston, IL: Great Expectations.

- Rullmann, Hotze & Matthewson, Lisa. 2018. Towards a theory of modal-temporal interaction. *Language* 94. 281–331. DOI: <https://doi.org/10.1353/lan.0.0227>
- Stojnic, Una & Altshuler, Daniel. 2021. Formal properties of *now* revisited. *Semantics and Pragmatics* 14(3). 1–44. DOI: <https://doi.org/10.3765/sp.14.3>
- Stowell, Tim. 2004. Tense and modals. In Guéron, Jacqueline & Lecarme, Jacqueline (eds.), *The syntax of time*, 495–537. Cambridge, MA: MIT Press.
- Thomas, Guillaume. 2014. Circumstantial modality and the diversity condition. In Etxeberria, Urtzi & Fălăuş, Anamaria & Irurtzun, Aritz & Leferman, Bryan (eds.), *Proceedings of Sinn und Bedeutung 18*, 433–450.
- Tsujioka, Takae. 1996. *The syntax of possession in Japanese*: Georgetown University dissertation.
- Vlach, Frank. 1981. The semantics of the progressive. In Tedeschi, Philip & Zaenen, Annie (eds.), *Syntax and semantics 14: Tense and aspect*, 271–292. New York: Academic Press. DOI: https://doi.org/10.1163/9789004373112_015
- von Fintel, Kai & Gillies, Anthony S. 2008. CIA leaks. *Philosophical Review* 117(1). 77–98. DOI: <https://doi.org/10.1215/00318108-2007-025>
- Werner, Thomas. 2003. *Deducing the future and distinguishing the past: Temporal interpretation in modal sentences in English*: Rutgers University dissertation.
- Wurmbrand, Susi. 2014. Tense and aspect in English infinitives. *Linguistic Inquiry* 45. 403–447. DOI: https://doi.org/10.1162/LING_a_00161
- Zubizaretta, Maria Luisa. 1982. *On the relationship of the lexicon to syntax*: MIT dissertation.

