

# Evidence Acquisition Time as Belief-State Change A View from Mvskoke (Creek)\*

Kimberly Johnson

University of Massachusetts Amherst, Amherst, Massachusetts, U.S.A  
kcjohnson@umass.edu

## Abstract

In some languages a single morpheme appears to encode both tense/aspect meaning and the evidential source for the assertion [7, 4, 5, 3, 9, 13]. I provide evidence from fieldwork that Creek (Muskogean) past tenses also encode evidentiality and show how the Creek data supports an approach which refers to *Evidence Acquisition Time* (EAT) [9, 13]. I then provide a novel formalization of EAT as the time the speaker's belief-state changes and demonstrate how this can be extended to Bulgarian, Korean and Matses.

## 1 Introduction

In recent years, two competing approaches have emerged regarding the puzzling relationship between evidentiality and tense/aspect in certain languages. In these languages, a single morpheme appears to encode both tense or aspect information and the evidential source for the assertion. This type of morpheme has been labeled the 'perfect of evidentiality' [7] and 'non-experienced past' [4]. The two approaches have centered on accounts of the Bulgarian evidential participle [7, 13] and the Korean evidential tense *-te* [3, 9].

Faller [4] and Chung [3] propose that evidential-tense morphemes are spatial deictic tenses which refer to a location at the topic time (TT). Both authors use spatio-temporal traces to model the intuition that direct evidence means the speaker was present as the event took place. Faller's account of Quechua non-experienced past *-sqa* uses two spatio-temporal trace functions. The *e-trace* function identifies the run-time and run-space of the event. The *P-trace* function maps the speaker to the locations she perceives at each point in her lifetime. Indirect evidentials, like *-sqa*, encode that speaker's perceptual field does not overlap with the spatio-temporal event trace. Chung [3] extends the spatial approach to Korean evidential morphemes, arguing that they require the speaker's perceptual field to cross paths with the spatio-temporal trace of the evidence for the event. Direct evidentials on the spatial approach encode that the speaker's perceptual field and the (evidence for the) event overlap in both location and time.

On the other hand, Lee [9] and Smirnova [13] propose that tense-evidential morphemes encode a relation between the *evidence acquisition time* (EAT) and another time. This approach relies on tense (relating EAT and TT) to derive the direct-indirect evidential distinction. Present tense indicates an overlap between EAT and TT; this means evidence was direct. Past and future introduce a precedence relation between TT and EAT so that they do not overlap; this means that evidence must be indirect. Under this view, a direct evidential encodes that

---

\*I owe a debt of gratitude to Jack Martin, Jennifer Johnson, Judy Montiel and Colleen Fitzgerald for paving the way for me to work in the Muscogee (Creek) and Seminole communities. *Mvto* to my language consultants Linda Sulphur Bear, Mary Ann Emarthla, Paul Fixico, Richard Harjo, Juanita Walker Harris, Rosemary McCombs Maxey, Ina Ann Micco Hickey, De Lois Roulston and Lucy Tiger. Thanks also to Seth Cable, Daniel Altshuler, John Kingston, Jack Martin, Ana Arregui, Vincent Homer and audiences at the UMass Semantics Workshop for helpful feedback and discussion. Any errors are my own.

evidence was acquired simultaneously to the event, but doesn't require the speaker to be in the same location as the event. This is not predicted by a spatial approach.

In what follows, I present original data from fieldwork that the tense system of Creek (mus; also Mvskoke, Seminole) also makes an indirect-direct evidential distinction. The contexts that I discuss include simultaneous indirect evidence and direct evidence after the fact. The behavior of Creek tenses in these contexts supports the temporal approach and proves problematic for the spatial approach. I propose that Creek tenses identify TT with EAT, which is in turn related to the event time (ET) through viewpoint aspect. The direct-indirect evidential distinction is derived entirely through the interaction of tense with aspect. I provide a novel formalization of the concept of EAT as the time when the belief state of the speaker changes. This formalization extends to other languages discussed in the literature and reduces cross-linguistic variation to the temporal restriction (if any) encoded in the morphemes.

## 2 Evidential Tenses in Creek

Creek is a severely endangered Muskogean language spoken by a little over 600 people in Oklahoma and Florida. Creek has four (previously five) past tenses [6, 10, a.o.]. One of these is a general, unrestricted past marker ('P4'), while the others ('P1-P3') cover increasingly broad intervals of past time (P1 = today; P2 = up to 5 years ago; P3 = up to 70 years ago). In matrix clauses, Gricean competition between the restricted past tenses results in their covering disjoint intervals of time, (1) and (2).<sup>1</sup> The restricted tenses are exemplified below. Imperfective and perfective aspect differ in the tonal pattern of the word. Note that P1 can appear as an infix, especially when combining with perfective aspect.<sup>2</sup>

(1) Perfective Past Tenses	(2) Imperfective Past Tenses
a. Mary lat <b>éy</b> k-is Mary fall. <b>P1</b> .PFV-IND 'Mary fell.' (today/last night)	a. ni:s- <b>êy</b> -s buy.IMP- <b>P1</b> -IND 'He/she was buying it.'
b. Mary lâ:tk- <b>ánk</b> -s Mary fall.PFV- <b>P2</b> -IND 'Mary fell.' (yesterday-5 yrs ago)	b. ni:s- <b>ánk</b> -s buy.IMP- <b>P2</b> -IND 'He/she was buying it.'
c. Mary lâ:tk- <b>imát</b> -s Mary fall.PFV- <b>P3</b> -IND 'Mary fell.' (long ago) (PF-Mus-06/2018)	c. ni:s- <b>imát</b> -s buy.IMP- <b>P3</b> -IND 'He/she was buying it.' [11, 263-66]

I claim P4 is not restricted to a specific interval of past time, but pragmatic competition with P1-P3 results in P4 usually triggering an inference that the event happened in the remote past, (3).

<sup>1</sup>I argue elsewhere based on their behavior in questions and remoteness indeterminacy contexts that the tenses cover increasingly broad intervals of time instead of disjoint intervals [8].

<sup>2</sup>Examples are in a phonemic transcription (following Martin [11]). Personal field-notes are cited by speaker code, dialect (Mus-Muskogee; Sem-Seminole), and date of elicitation. The abbreviations used are as follows: ACC accusative; CAUS causative; COMP complementizer; DAT dative; DEM demonstrative; DS different subject; DUR durative; IMP imperfective aspect; IND indicative; IP medio-passive; NOM nominative; NZL nominalizer; P1 recent past; P2 intermediate past; P3 distant past; P4 remote past (P5 in the Muskogean tradition); PASS impersonal passive; PAT patient; PFV perfective aspect; PL plural; RECP reciprocal; SG singular; SS same subject; TPL triplural.

- (3) Pòkkicc-a:k-**atí**:-s.  
 play.ball-PL.IMP-**P4**-IND  
 ‘They played stickball.’ (long ago) (RH-Sem-07/2019)

P4 typically combines with imperfective aspect (according to [11]) - a puzzle for future research.

**Evidentiality** The graded past tense system also encodes a direct-indirect evidential distinction. The sentences in examples (1) and (2) are most naturally used in direct witness contexts. The sentence in (3) generally imply that the speaker did not witness the ball game. Likewise in reported contexts, speakers reject the restricted tenses (P1-P3) and instead accept P4. Speaker comments for each of the tenses point to the direct witness meaning associated with P1-P3. Example (4) establishes a reported evidence context within the day of utterance (an interval compatible with P1). In this context, a sentence marked with P4 is felicitous, but a sentence marked with P1 is infelicitous.

- (4) Context: Imagine your friend Mary tells you that she talked to the chief today.
- a. Mary mocá nítta míkko im-ponây-**atí**:-s.  
 Mary this day chief 3.DAT-talk.PFV-**P4**-IND  
 ‘Mary talked to the chief today.’
- b. #Mary míkko im-pona:yêyy-s.  
 Mary chief 3.DAT-talk.**P1**.PFV-IND  
 ‘Mary talked with the chief.’ (today)  
 Speaker Comment: That would be if you saw her talking to him. (DLR-Mus-06/2019)

Example (5) establishes a reported evidence context within a temporal interval compatible with P2. In this context, a P4-marked sentence is felicitous, but a P2-marked sentence is not.

- (5) Context: Last year, a woman you know, Mary, spoke with Chief Leonard Harjo and she told you about it.
- a. Mary ohłolopí: hank-ánk-i: míkko Leonard im-ponâ:y-**atí**:-s.  
 Mary year one-P2-NLZ chief Leonard 3.DAT-speak.PFV-**P4**-IND  
 ‘Last year, Mary spoke with Chief Leonard.’
- b. #Mary ohłolopí: hank-ánk-i: míkko Leonard im-ponâ:y-**ánk**-s.  
 Mary year one-P2-NLZ chief Leonard 3.DAT-speak.PFV-**P2**-IND  
 ‘Last year, Mary spoke with Chief Leonard.’  
 Speaker Comment: That’s like I saw Mary talking to him. (JWH-Sem-07/2018)

In example (6), the reported evidence is established in a subordinate chained clause “It was written in the newspaper” and the event in question is 30-40 years ago. Although this falls within P3 interval, P3 is unacceptable. Instead, the speaker corrected the sentence to (6-a).

- (6) Prompt: Imagine you read a newspaper story about the chief in which you learned that he frequented a certain church when he was young (30-40 years ago).
- a. Coka-talámi: hocéyhoc-â:t, míkko má mi:kosapka-cóko  
 paper-daily write.IMP-CAUS.PASS-COMP.SS chief DEM prayer-house  
 a:r-í:-t o:w-**atí**:-s.  
 go.SG.IMP-DUR-SS be.IMP-**P4**-IND  
 ‘It was written in the newspaper, the chief went to that church.’

- b. #Coka-talámi: hocéyhoc-â:t, míkko má mi:kosapka-cóko  
 paper-daily write.IMP-CAUS.PASS-COMP.SS chief DEM prayer-house  
 a:r-í:t ô:w-i:mát-s.  
 go.SG.IMP-DUR-SS be.PFV-P3-IND  
 ‘It was written in the newspaper, the chief went to that church.’  
 Speaker Comment: No, if it’s according to the paper it would be [(6-a)]  
 (MAE-Sem-07/2018)

These three examples have demonstrated that P1-P3 are infelicitous in indirect evidence contexts. Instead, P4 is used for an utterance based on reported evidence at any past time. Normally, P4 is infelicitous in direct evidence contexts.

- (7) a. Context: Imagine you’ve been telling your brother there’s a girl who wants to see him. Then last week you drove by the diner and saw them together. To tell me that they saw each other, could you say...  
 b. #Iti-hi:c-â:k-ati:s.  
 RECP-see-PL.PFV-P4-IND  
 ‘They saw each other.’  
 Speaker Comment: Not if I saw them at the diner. (LSB-Mus-06/2017)

One explanation could be that P4 is an indirect evidential, as proposed in previous literature [2, 12]. Under this view, P1-P3 are not necessarily evidential, since their use in direct evidence contexts could be an implicature arising from competition with the indirect P4. A strong argument against this explanation is that P4 can be used in direct witness contexts when it appears in a downward entailing environment, such as in the restrictor of a universal quantifier.

- (8) a. Context: Imagine you and your preacher were going around town together this month. Every time he invited someone to your next church meeting you were with him and saw him do it. When your Sunday meeting rolled around, everyone he invited came. On Monday you want to tell me about it.  
 b. Iġkanáka istí: im-pohátt-ati: omâlk-a:t, foll-â:k-ânk-s.  
 preacher people 3.DAT-invite-P4 all.PFV-COMP go.about.TPL-PL.PFV-P2-IND  
 ‘All the people the preacher invited showed up/came.’ (LSB-Mus-11/2019)<sup>3</sup>

Implicatures do not arise in downward entailing environments, but semantic meaning is preserved. If indirect evidence was part of the semantic meaning of P4, then it is predicted to be infelicitous in a direct evidence context even when it is in the restrictor of the universal quantifier *omalka* ‘all, every’. I take this as evidence that the indirect meaning associated with P4 is a scalar implicature.

I argue instead that P1-P3 are semantically restricted to direct evidence contexts as well as to certain time intervals. Based on speaker comments, an initial hypothesis would be that P1-P3 are direct witness evidentials. If a speaker directly witnesses an event, it follows that there was overlap both in times (of the event and of evidence acquisition) and in locations (the location of the event and the speaker’s perceptual field). As such, the contexts in (4), (5), and (6) do not allow us to choose between the two approaches to evidential tense. There are, however, two challenges to analyzing these morphemes as encoding overlap in location.

<sup>3</sup>I would like to thank Jack B. Martin for eliciting this example for me.

**Simultaneous Indirect Evidence** First, P1-P3 can be used in indirect contexts if the speaker learned of the event as it took place. For example, P2 is acceptable in contexts where the speaker got evidence over the phone (9) as the event was happening. In this context, the speaker acquires evidence simultaneously to the event without the event being inside their perceptual field. There is overlap in times, but not in locations.

- (9) a. Context: Your friend called yesterday and said, “I’m at the Salon right now and my wife is getting her hair cut.” Today I ask you what your friend’s wife did yesterday.  
 b. An-híssi: i:héywa-n iké-yssi:-n ín-tonhô:w-**ank-s**.  
 1.SG.DAT-friend 3.PAT.wife-ACC hair-ACC 3.DAT-cut.PFV.PASS-**P2-IND**  
 ‘My friend’s wife got her hair cut.’ (RMM-Mus-06/2019,PF-Mus-11/2018)

The use of P2 in (9) is unexplained on the spatial approach. As such, this supports the temporal approach which derives direct evidentiality through temporal overlap and not necessarily spatial overlap.

**Direct Evidence After the Fact** Furthermore, P1-P3 can be used in contexts where the speaker learned of the event after the fact, so long as the morpheme appears on a special verbal auxiliary. In the indirect context below, P1 is unacceptable on the main verb. Instead it must occur on the auxiliary verb. In a direct witness context, speakers report opposite judgments: (10-b) is unacceptable and P1 must be marked on the main verb.

- (10) P1 Context: Imagine your friend Bill called you on the phone just now and told you he just cut his hair. Would it sound okay to say the following sentence?  
 a. #An-híssi-t an-hôyheyk-it ika-éyssi: wá:hł-is.  
 1.SG.DAT-friend-NOM 1.SG.DAT-call.PFV-SS head-hair cut.**P1**.PFV-IND  
 Speaker Comment: No, you’d say (10-b).  
 b. An-híssi-t an-hôyheyk-it ika-éyssi: wał-î:p-at  
 1.SG.DAT-friend-NOM 1.SG.DAT-call.PFV-SS head-hair cut-IP.PFV-P4  
**hâ:k-éy-s**.  
**become.PFV-P1-IND**  
 ‘My friend called, he cut his hair.’ (AM-Mus-Elic11/2018)

P2 also cannot appear on the main verb in an indirect witness context like in (11). It is only acceptable if it marks the auxiliary. Again, in a direct witness context, the (a) example is acceptable and the (b) example is not. There is parallel data for P3.

- (11) P2 Context: A month ago, you weren’t home when Sam called, but you saw it on the answering machine.  
 a. #Hasí: hank-ank-í: Sam ahokkolá-n a:-an-hôyhk-**ank-s**.  
 month one-P2-NLZ Sam twice-ACC DIR-1.SG.DAT-call-**P2-IND**  
 ‘Sam called me twice, one month ago.’  
 Speaker Comment: No, that would be if you were home when your phone rang.  
 b. Hasí: hank-ank-í: Sam ahokkolá-n a:-an-hôyhk-at **hâ:k-ánk-s**.  
 month one-P2-NLZ Sam twice-ACC DIR-1.SG.DAT-call-P4 **become.PFV-P2-IND**  
 ‘Sam called me twice, one month ago.’ (MAE-Sem-07/2018)

- (12) P3 Context: Two years ago, Sam called you on the phone. You weren't in your house when he called, but you saw his message on the answering machine.
- a. #Ohłolopí: hokkol-ánk-i: mâ:h-in Sam an-hôyhk-**i:mát-s**.  
 year two-P2-NLZ about.PFV-DS Sam 1.SG.DAT-call.PFV-**P3**-IND  
 'About two years ago, Sam called me.'  
 Speaker Comment: This would mean that you were home when he called and saw your phone.
- b. Ohłolopí: hókkol-ánk-i: mâ:h-in Sam an-hôyhk-at  
 year two-P2-NLZ about.PFV-DS Sam 1.SG.DAT-call.PFV-P4  
**hâ:k-imát-s**  
**become.PFV-P3-IND**  
 'About two years ago, Sam called me.' (MAE-Sem-08/2018)

The generalization that emerges from these data is that when the restricted tenses appear on the main verb, the time of the event and the time of evidence acquisition must coincide. When the restricted tenses appear on the auxiliary *hak-*, the time of the event must precede the time of learning about the event. The spatial approach incorrectly predicts that P1-P3 should be unacceptable in *simultaneous* and *after-the-fact* contexts. I argue that when P1-P3 appear on the main verb, ET and EAT must overlap, but when P1-P3 appear on the special auxiliary *hak-*, ET must precede EAT.

### 3 Formalizing Evidence Acquisition Time

Similarly to Smirnova's account for Bulgarian and Lee's for Korean, I propose that Creek evidential tenses locate the EAT with respect to another time. Whereas Smirnova and Lee augmented the Neo-Reichenbachian system of times with EAT as distinct from ET, TT and UT, I propose instead that P1-P3 identify the TT as the time at which the speaker 'came to believe' the proposition - the Belief-State Change time. The difference between monoverbal and auxiliary constructions with P1-P3 is derived through the tenses' interaction with viewpoint aspect.

In monoverbal constructions EAT and ET overlap. The main verb is inflected for either imperfective or perfective aspect, both of which require ET to overlap with TT. P1-P3 then restrict the TT in two ways. First, they place it within an interval of time that is a certain distance from UT. Second, they restrict it to the time the speaker learned of the prejacent (the EAT). This derives the direct witness contexts as well as the simultaneous contexts. In auxiliary constructions ET precedes EAT. I take auxiliary constructions to be complex tense constructions equivalent in meaning to past perfect. The main verb bears both (im)perfective aspect and P4; aspect places the ET overlapping with an interval of time contributed by P4, which precedes another interval, contributed by tense on the auxiliary verb. The evidential tense on the auxiliary then relates that interval to the UT and identifies it as the time of learning. In essence, auxiliary constructions communicate that the speaker learned of a past event at a subsequent past time. This derives the use of P1-P3 on the auxiliary in the indirect contexts in (10) - (12). Monoverbal constructions with P4, on the other hand, quite simply locate an event in the past of the utterance. Thus under this approach, P4 is an unrestricted past tense similar to English past.

**EAT as Belief-State-Change** I formalize EAT as the time at which someone comes to believe a proposition, and define a meta-language predicate COME-TO-BELIEVE.  $\text{COME-TO-BEL}(x,t,p) = \text{T}$  iff at all times prior to  $t$ , not all  $x$ 's belief worlds were compatible with  $p$ , but at all times following  $t$ , all  $x$ 's belief worlds are  $p$ -worlds.

$$(13) \quad \lambda x_e \lambda t_i \lambda P_{\langle st \rangle} : \text{COME-TO-BEL}(x,t,P) = \lambda x_e \lambda t_i \lambda P_{\langle st \rangle} [\forall t' : t' \prec t. \neg \forall w' \in \text{BEL}(x,w,t') : P(w') = \text{T} \ \& \ \forall t'' : t \preceq t''. \forall w'' \in \text{BEL}(x,w,t'') : P(w'') = \text{T}]$$

I propose that P1-P3 are temporal operators that introduce a temporal index  $i$  and restrict that time to the appropriate interval associated with P1-P3 and to the time the speaker 'came to believe' a given proposition. That is, P1-P3 state that the speaker 'came to believe' the proposition at the TT which overlaps with a particular time interval. I abstract away from the precise semantics of the time intervals and refer to them as the P1-interval, P2-interval, and P3-interval. I illustrate with P2.

$$(14) \quad \llbracket \text{P2}_i \rrbracket^{c,w,g,t} = [\lambda P_{\langle i,t \rangle} . g(i) \circ \text{P2-interval}(t) \ \& \ \text{COME-TO-BEL}(\text{sp}(c),g(i),P(g(i)))].$$

This denotation for P2 states that  $g(i)$  lies within the P2-interval and the speaker came to believe - at  $g(i)$  - that the proposition was true at  $g(i)$ . The semantics in (14) correctly predicts that the event of learning must also take place in the P2-interval.

**Interactions with Viewpoint Aspect** Given the proposed semantics for P1-P3, the puzzling facts in (9) - (12) follow from their interaction with aspectual morphology. When P1-P3 are affixed to the main verb, I argue the verb is inflected for perfective or imperfective aspect. Imperfective aspect requires ET to contain TT; perfective aspect requires TT to contain ET. The semantics are found in (15).

$$(15) \quad \begin{array}{l} \text{a.} \quad \llbracket \text{Perfective} \rrbracket^{w,g,t} = [\lambda P_{\langle et \rangle} . [\lambda t'_i . \exists e. \tau(e) \subseteq t' \ \& \ P(e) = \text{T}]] \\ \text{b.} \quad \llbracket \text{Imperfective} \rrbracket^{w,g,t} = [\lambda P_{\langle et \rangle} . [\lambda t'_i . \exists e. t' \subseteq \tau(e) \ \& \ P(e) = \text{T}]] \end{array}$$

Given the contribution of P1-P3, the ET will end up overlapping with the EAT, so that the speaker 'comes to believe' the proposition as the event is taking place. (16) shows the LF and truth conditions for the monoverbal sentence (5).

$$(16) \quad \begin{array}{l} \text{a.} \quad \text{LF for (5): } [\text{TP P2}_i [\text{AspP PFV } [\text{vP Mary } v [\text{vP Chief Leonard } [\text{v talk.to} ] ] ] ] ] \\ \text{b.} \quad \text{Truth conditions: } \llbracket (5) \rrbracket^{c,w,g,t} = \text{T iff } g(i) \circ \text{P2-interval}(t) \ \& \ \text{COME-TO-BEL}(\text{sp}(c), \\ g(i), \exists e. \underline{\tau(e)} \subseteq g(i) \ \& \ \text{talk.to}(e,\text{Mary},\text{Chief-Leonard})) = \text{T} \end{array}$$

Since the semantics require the time of belief-state change to coincide with the run-time of the event, these truth conditions of (5) are satisfied in direct witness contexts as well as simultaneous contexts. This accounts for the judgments in (4), (5), (6) and (9).

I further argue that the special auxiliary construction in (10) - (12) is a complex tense construction with a sequence of two past tenses - P4 on the main verb and P1-P3 on the auxiliary. (Im)perfective aspect on the main verb requires that the ET overlap with the interval contributed by P4. P4 in turn encodes a precedence relation between that time and the TT. The semantics I assume for P4 are given below.

$$(17) \quad \llbracket \text{P4}_i \rrbracket^{w,g,t} = [\lambda P_{\langle i,t \rangle} . [\lambda t'_i . g(i) \prec t' \ \& \ P(g(i)) = \text{T}]]$$

Consequently an auxiliary construction combining with P1-P3 will require that the ET precede the EAT. Thus sentences like (11) have the following LF and truth conditions.

- (18) a. LF for (11):  $[_{TP} P2_i [_{TP} P4_j [_{AspP} PFV [_{vP} Sam [_{\bar{v}} v [_{VP} pro_{1.sg.obj} call ] ] ] ] ] ] ] ]$   
 b. Truth conditions:  $\llbracket (11) \rrbracket^{c,w,g,t} = T$  iff  $g(i) \circ P2\text{-interval}(t) \ \& \ \text{COME-TO-BEL}(\text{sp}(c), g(i), \exists e. g(j) \prec g(i) \ \& \ \tau(e) \subseteq g(j) \ \& \ \text{call}(e, \text{Sam}, \text{sp}(c))) = T$

These truth conditions will be satisfied if the speaker learned of the event within the P2-interval, and the learning followed the event - this accounts for the auxiliary constructions in *after-the-fact* contexts.

## 4 Extending the Approach

The Belief-State Change system can be extended to Bulgarian and Korean. Formalizing EAT as time of ‘coming to believe’ combined with the tense-aspect systems of each language reduces cross-linguistic variation to the temporal restriction the morpheme places on the EAT/TT. For the sake of space, I will demonstrate how the Belief-State Change system accounts for the Bulgarian data. The Bulgarian past participle takes two forms depending on what Arregui et al. [1] characterize as viewpoint aspect.<sup>4</sup> I propose that the Bulgarian evidential participle identifies TT as the Belief-State Change time just as in Creek, but places no temporal restriction on the TT. I give the evidential component of the Bulgarian evidential participle the denotation in (19).

- (19) Denotation of the Bulgarian Evidential:  
 $\llbracket EV_i \rrbracket^{c,w,g,t} = [\lambda P_{\langle i,t \rangle} : \text{COME-TO-BEL}(\text{sp}(c), g(i), P(g(i)))]$

The temporal index  $g(i)$  receives its value entirely from context, which accounts for the evidential participle being used in both past and present tense contexts. Combined with imperfective aspect, the evidential participle denotes that the speaker learned of the event as it was ongoing. In past contexts, this implies direct evidence or simultaneous learning. In present contexts, it means the speaker is just learning of an ongoing event or state. This accounts for the data in (20) and (21).

- (20) Imperfective Bulgarian Evidential Participle  
 a. *Past Tense Context-Simultaneous Learning*: Last month at the class reunion Ivan told you that Maria is busy writing a book. You believe Ivan. Today your old friend asks you what kept Maria from coming to the class reunion last month. You say:  
 b. Maria **pišela** kniga.  
 Maria **write.IMP.EV** book  
 ‘Maria was writing a book, [I heard].’ [13, 481, glossing adapted]
- (21) Imperfective Bulgarian Evidential Participle  
 a. *Present Tense Context-Simultaneous Learning*: Ivan tells you that Maria has a successful academic career. In fact, right now she is busy writing a book. Upon hearing this news, you say:  
 b. Maria **pišela** kniga!  
 Maria **write.IMP.EV** book  
 ‘Maria is writing a book, [I hear]!’ [13, 487, glossing adapted]

The truth conditions for both (20-b) and (21-b) are given in (22).

<sup>4</sup>Smirnova analyzes the forms as differing in tense. This makes no difference for my analysis.



- (22) Truth Conditions for (20-b) and (21-b):  $\llbracket \text{Maria pišela kniga} \rrbracket^{c,w,g,t} = \text{T}$  iff  
 COME-TO-BEL(sp(c),g(i), $\exists e. g(i) \subseteq \tau(e) \ \& \ \text{write}(e,\text{Maria},\text{book}) = \text{T}$ )

The temporal pronoun  $g(i)$  will receive its value from a contextually determined variable assignment function  $g$ , so that in a past context it refer to the contextually salient past time and in a present tense contexts it refers to the time of utterance.

Arregui et al. [1] characterize the perfective aspect form of the participle as enforcing a strict precedence relation between ET and TT. In this way, their intuition about the temporal contribution of the perfective participle aligns with the past tense semantics that Smirnova gives it. I model this with the semantics in (23).

- (23) Bulgarian Perfective Semantics:  
 $\llbracket \text{PFV} \rrbracket^{w,g,t} = [\lambda P_{\langle \epsilon, t \rangle}. [\lambda t'_i. \exists e. \tau(e) \prec t' \ \& \ P(e) = T]]$

When the evidential participle combines with perfective aspect, its truth conditions are satisfied if the speaker learned of an event after it is finished. In past contexts, this will mean that the speaker learned at some past time of a completed event, (24). In present tense contexts, my approach predicts it will mean that the speaker just learned of a past event or state. Smirnova, unfortunately, does not provide a good example of a perfective evidential participle in a present tense context.

- (24) Perfective Bulgarian Evidential Participle
- a. *Past Tense Context-Learning after-the-fact*: Last month Ivan told you that Maria your former classmate, spend last year writing a book and that it has just been published. You believe Ivan. Today, your friend asks what Maria was doing last year. You say:
  - b. Maria pisala kniga.  
 Maria write.PFV.EV book  
 ‘Maria was writing/wrote a book, [I heard].’ [13, 481, glossing adapted]

For the above example, the evidential meaning of the participle combines with perfective aspect to yield the truth conditions in (25).

- (25) Truth Conditions for (24-b):  $\llbracket \text{Maria pisala kniga} \rrbracket^{c,w,g,t} = \text{T}$  iff  
 COME-TO-BEL(sp(c),g(i), $\exists e. \tau(e) \prec g(i) \ \& \ \text{write}(e,\text{Maria},\text{book}) = \text{T}$ )

Smirnova spends a great deal of time accounting for the exclamatory intonation which is obligatory in present tense contexts. Under the Belief-State Change account, this follows quite naturally. In present tense contexts, the use of the evidential participle conveys that the speaker is learning of the event/state at the present time. This accounts for the exclamatory intonation that must accompany the evidential participle in such contexts and why the evidential participle is unacceptable if the speaker was previously aware of the truth of  $p$ , (26).

- (26) a. *Previous knowledge context*: Stojan sustained an injury and was unable to play four games. You know that he has fully recovered and is scheduled to play the game today. When you go to the game and see Stojan scoring the goal, you say:  
 b. #Stojan igrael!  
 Stojan play.IMP.EV  
 ‘Stojan is playing, [I see]!’ [13, 509-10, glossing adapted]

In conclusion, I have shown how the Belief-State Change system can be extended to account

for the Bulgarian evidential participle. Just as in Creek, the evidential interacts with viewpoint aspect. However I proposed that the evidential in Bulgarian does not place a temporal restriction on the Belief-State Change time, but that it receives its value from context. Furthermore, formalizing EAT as the time one's beliefs change provides an explanation of the Bulgarian evidential participle's mirative-like behavior in present tense contexts.

## 5 Conclusion

I have argued that Creek restricted past tenses encode the time a speaker came to believe a proposition. We saw evidence from Creek that adjudicated in favor of a temporal and not a spatial approach to evidential tenses. I formalized *evidence acquisition time* in terms of time of belief-state change and was able to account for the Creek data and extend my approach to Bulgarian. In ongoing work, I have explored how this system extends to Korean [9] and Matses [5]. My account reduces cross-linguistic variation in evidential tense systems to the temporal restriction the marker imposes on the topic time, identified as the time of coming to believe. The direct and indirect evidential meanings are derived through the tenses' interaction with lower tense and aspectual morphology.

## References

- [1] Ana Arregui, María Luisa Rivero, and Andrés Salanova. Aspect and tense in evidentials. In Ana Arregui, María Luisa Rivero, and Andrés Salanova, editors, *Modality across syntactic categories*, pages 211–234. Oxford University Press, first edition, 2017.
- [2] D. G. Brinton. Contributions to a grammar of the Muskokee language. In *Proceedings of the American Philosophical Society*, volume 11, pages 301–309, 1870.
- [3] Kyung-Sook Chung. Spatial deictic tense and evidentials in Korean. *Natural Language Semantics*, 15(3):187–219, 2007.
- [4] Martina Faller. The deictic core of "non-experienced past" in Cuzco Quechua. *Journal of Semantics*, 21:45–85, 2004.
- [5] David W. Fleck. Evidentiality and double tense in Matses. *Language*, 83(3):589–614, 2007.
- [6] Mary R. Haas. Ablaut and Its Function in Muskogee. *Language*, 16(2):141, 1940.
- [7] Roumyana Izvorski. The Present Perfect as an Epistemic Modal. In Aaron Lawson, editor, *SALT VII*, pages 222–239, Ithaca, NY: Cornell University, 1997.
- [8] Kimberly Johnson. Graded and Evidential Tenses in Mvskoke (Creek). 2019.
- [9] Jungmee Lee. Temporal constraints on the meaning of evidentiality. *Natural Language Semantics*, 21(1):1–41, 2013.
- [10] Jack B. Martin. How to Tell a Creek Story in Five Past Tenses. *International Journal of American Linguistics*, 76(1):43–70, 2010.
- [11] Jack B. Martin. *A grammar of Creek (Muskogee)*. University of Nebraska Press, 2011.
- [12] Michelle Nathan. *Grammatical description of the Florida Seminole dialect of Creek*. Ph.D. dissertation, Tulane University, New Orleans, 1977.
- [13] A. Smirnova. Evidentiality in Bulgarian: Temporality, Epistemic Modality, and Information Source. *Journal of Semantics*, 30(4):479–532, 2013.