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A Polarity Phenomenon in the Propositional Domain in Tundra Nenets

In this talk, based on original fieldwork, we explore the semantic contribution of the particle *ky* in Tundra Nenets (Uralic, Samoyedic).

1. The empirical picture

The summary:

Ky-marking in unembedded contexts

- In **assertions**, *ky* contributes a meaning of **epistemic possibility**.
- *Ky* can also occur in **yes–no questions**; in these contexts, **epistemic possibility is not at issue**.

Ky-marking in embedded contexts

- *Ky* shows a restricted embedding pattern:
  - It **cannot** be embedded under **factive verbs** such as *know*, *understand, decide, remember* (with a notable exception of *forget*)
  - Embedding under such verbs becomes possible **only if** the factive verb is itself embedded under:
    - **negation**
    - a **possibility or necessity modal**
    - a **question**
  - When embedding is allowed, the ***ky*-marked clause can only be interpreted as a question**, not as a statement expressing possibility.
  - Under *believe*, *ky* expresses only the possibility.

Below we present the data supporting these generalizations.

1.1. *Ky* in unembedded contexts

1.1.1 *Ky* as a probabilitative mood

In traditional grammar, *ky* is described as a marker of a **probabilitative mood**[1]. In unembedded sentences, it is typically translated as ‘possibly’ or ‘maybe’. This is well established in the previous literature.

[1] *Naki* is a complex particle consisting of *na* (the morpheme marking a participial in non-future tense) and *ky* (the morpheme that is called a probabilitative mood marker in the literature).

(1) Vanja to.na.ky.
Vanja came.PART.ky
'Vanja may be came'.

Ky behaves like a typical existential modal:

(2) Vanja to.na.ky, ni.na.ky tu^{h}.
Vanja came.PART.ky NEG.PART.ky came.
'Vanja maybe came, maybe did not come'

1.1.2. *Ky* in unembedded questions

Ky can also occur in polar (yes–no) questions. We observe that in such cases, it does not appear to contribute a meaning of 'possibly' or 'maybe' at the at-issue level.

Evidence:

- Speakers accept translations into Russian that **do not include 'possibly'**, or where such a meaning is **not part of the question** or at least it is not at issue.

(3) Vanja to.naky?
Vanja came. PART.ky?
'Did Vanja come?'

(4) Anja junras', Vanja to.na.ky.
Anja asked Vanja came.PART.ky
'Anja asked whether Vanja came'.

- The adverbs **'for sure'** or **'truly'** can be inserted in a **question** with *ky*, but **not** in an **assertion**.

(5) Vanja (#jivjer^{q}) to.na.ky.
Vanja (#for sure) came.PART.ky
'Vanja (#for sure) came.PART.ky'

(6) Vanja (jivjer^{q}) to.na.ky?
Vanja (for sure) came.PART.ky?
'Did Vanja indeed/for sure come?'

- Speakers accept these forms as **reports of questions** that **do not contain 'possibly'**.

(7) Tjuku jaljaᵠ jexerana xibjarimᵠ Vanja jadabtas’. Jexerana xibjari Vanja.nᵠ
This day unknown person.ACC Vanja met. Unknown person Vanja.DAT

junras’ **‘Tjuku avtobus martʰ xanta?’** Njebjada maneʰŋada, jexerana xibjari
asked **‘This bus town goes? ’** Mother saw unknown person

Vanja.nᵠ ŋgamgexevamᵠ ma.
Vanja.DAT something said.

Njebjada Vanjanᵠ junras’: ‘Tjuku xibjari ŋamgemᵠ ma?’. Vanja xeta:
Mother Vanja.DAT asked: ‘This person what.ACC said?’. Vanja said:

‘Pyda junras’, tjuku avtobus martʰ xanta.na.ky.’
‘He asked, this bus town goes.PART.ky’.

Today Vanja met a stranger. The stranger asked Vanja: ‘**Does this bus go to the city?**’. Mother saw that the stranger said something to Vanja. Mother asked Vanja: ‘What did this person say?’ Vanja replied: **‘He asked whether this bus goes.ky to the city’.**

1.2. *Ky* in embedded clauses

We observe two constraints:

- A *ky*-marked clause embedded under a factive verb must be interpreted as a question rather than a proposition,
- Such embeddings are only possible when the factive verb itself is embedded under negation, question or a modal (possibility or necessity).

To our knowledge, the restrictions on the embedding of *ky* have not been previously reported in the literature.

1.2.1 *Ky* embedded under ‘know’

***Know ky**

(8) *Nebja.da tjenjeva, Vanja xunjana tu.t.na.ky.
Mother.his knows Vanja tomorrow come.FUT.PART.ky
Int.: ‘Mother knows whether Vanja will come tomorrow.’

Comments from speakers: ‘You said she knows. But *ky* means she is in doubt. This is a contradiction’ ; ‘No, you cannot say *knows* and continue with *ky’*.

(9) *Anja tjenjeva, Vanja tanjana ile.na.ky.
Anja knows Vanja here lives.PART.ky
Int.: 'Anja knows whether Vanja lives here.'

Comments from speakers: 'This sounds funny. As if you are saying that she knows and does not know'; 'This is bad, you cannot say *knows* and *ky* simultaneously. *Ky* means she does not know'.

Speaker ignorance doesn't save *know ky*:

(10) Manᵠ jexeradmᵠ Vanja xunjana tu.t.na.ky,
I not-know Vanja tomorrow come.FUT.PART.ky

*Nebja.da.nᵠ junraᵠ, pyda tjenjeva, Vanja tu.t.na.ky
Mother.his.DAT. ask.IMP she knows Vanja come.FUT.PART.ky
Int.: 'I don't know whether Vanja comes tomorrow. Ask his mother, she knows whether Vanja will come.'

Preliminary conclusion: When *ky* is embedded under *know*, it conveys a lack of confidence on the part of the holder (not the speaker), which conflicts with the truth-commitment implied by *know*.

✓Not know ky:

There are two ways of expressing this meaning: via the dedicated verb *jexjera*, or via *negation + tjeneva*. Both are completely acceptable.

(11) Anja ni tjenjeva, Vanja to.na.ky.
Anja NEG know, Vanja came.PART.ky
'Anja doesn't know whether Vanja came.'

(12) Anja jexjera, Vanja to.na.ky.
Anja not-know, Vanja came.PART.ky
'Anja doesn't know whether Vanja came.'

✓Possibly know ky:

There are multiple strategies for expressing this, all of which are acceptable, including know+ky.

(13) Anja tjenjeva.na.ky, Vanja tjukoxona ile.na.ky.
Anja know.PART.ky Vanja here lives.PART.ky
'Anja maybe knows whether Vanja lives here.'

(14) Anja tjenjeva.ŋgabja, Vanja tjukoxona ile.na.ky.
Anja know.POSS Vanja here lives.PART.ky
'Anja maybe knows whether Vanja lives here.'

(15) Anja tjenjeva.naraxa, Vanja tjukoxona ile.na.ky.
Anja know.POSS Vanja here lives.PART.ky
'Anja maybe knows whether Vanja lives here.'

(16) Anja xarvabta tjenjeva, Vanja tjukoxona ile.na.ky.
Anja possibly know Vanja here lives.PART.ky
'Anja maybe knows whether Vanja lives here.'

✓Must know ky

Acceptable both in epistemic and deontic contexts:

(17) Anja tjenjeva.bta tara, Vanja tjukoxona ile.na.ky.
Anja know.X must Vanja here lives.PART.ky
'Anja must know whether Vanja lives here.'

✓? knows ky:

(18) Xibja tjenjeva, Vanja to.na.ky?
Who knows Vanja came.PART.ky
'Who knows whether Vanja came?'

(19) Pydar tjenjevan, Vanja to.na.ky?
You know Vanja came.PART.ky
'Do you know whether Vanja came?'

The summary:

Know ky	*
Not know ky	✓
Might know ky	✓
Must know ky	✓
Does know ky?	✓

This pattern extends to all factive verbs: *tenes'* ('remember'), *xamadas'* ('understand'), *tasladas'* ('decide') with a notable exception of *yuras'* ('forget').

This pattern parallels those of question focus particles like *kya* in Hindi (Dayal 2020; Bhatt & Dayal 2020; Biezma et al. 2025) and *li* in Bulgarian (Dukova-Zheleva 2010), but *ky* differs in not requiring a question context and not having focus sensitivity.

(20) Man' jura.v', Anja tjukoxona ile.na.ky.
I forgot.S1sgO3sg Anja here lives.PART.ky
'I forgot whether Anja lives here.'

1.2.2 Only question interpretations under factive embeddings

Recall from (1) that in assertion *ky* contributes the meaning of 'possibly'.

However, when *ky* is embedded under negated factive verbs such as *not know*, only the question interpretation is available; the possibility ('maybe') reading is not.

A sentence like (21) does not entail that Vanja possibly came.

(21) Anja jexjera, Vanja to.na.ky.
Anja not-know, Vanja came.PART.ky
'Anja doesn't know whether Vanja came.'

Illustration:

(22) Xibjaxart^{q} jexjera, Vanja to.na.ky. Man' ibedorŋam^{q}, pyda nivy tu^{h}.
Who-even not.knows Vanja came. PART.ky. I think he NEG came
'Nobody knows whether Vanja came. I think he didn't come.'

In (22), if the first sentence presupposed that Vanja *possibly* came, the continuation would be infelicitous. However, the continuation in (22) is fully felicitous.

Compare to (23) in English:

(23) No one knows that Vanja maybe came. #I think he did not come.

1.2.3 No general ban on embedding possibility modals under *know*

As shown above, there are multiple ways of expressing possibility in the language, and all of them are freely embeddable under *know*.

(24) Anja tjeneva, Vanja to.vaŋgabja.
Anja know, Vanja came.POSS
'Anja know that it is possible that Vanja came.'

(25) Anja tjeneva, Vanja xarvabta to.s'.
Anja know, Vanja possibly came.PAST
'Anja know that it is possible that Vanja came.

1.3 Embeddings under anti-rogative verbs

Anti-rogative predicates like *yibyidorŋa* (‘think’) are compatible with an embedded *ky* if it means ‘possibly’:

(26) Man’ yibyidorŋadmᵠ, Vanja to.va.ky,
I think Vanja came.PastPART.ky

valkada man’ tykymᵠ savarivna not.know
but I this.ACC well jexjeradm’.
‘I think that Vanja possibly came, but I don’t know for sure.’

2. The presuppositional account

Our goals:

- Ideally, we aim to connect the epistemic possibility meaning of *ky* with its restrictions on embeddability under factive verbs**.**
- We also aim to provide a unified account of the question and possibility uses of *ky*.
- However, in questions, epistemic possibility does not appear to be at issue, which creates a challenge for such a unified analysis.

The idea in a nutshell:

- The basic meaning of *ky* is that of a **question operator**.
- *Ky* introduces a **presupposition** that the proposition *p* it combines with is **epistemically possible**.
- The **possibility reading** arises through an operation that **turns this presuppositional content into asserted content**.

Explaining embeddings under factives:

- Epistemic possibility is always evaluated **relative to a world and to an individual’s epistemic perspective**.
- In **unembedded contexts**, the relevant world is the **actual world** and the relevant individual is the **speaker**.
- We propose that **factive verbs** (such as *know*) **fix** the world of evaluation of *ky*’s presupposition to the **actual world** and shift the relevant individual to be the **attitude holder**.
- As a result, **A knows p-ky** and **A knows that p** end up with **the same meaning**.
- **A knows p-ky** is therefore ruled out by **Maximize Presupposition**, since it carries a **weaker presupposition** than **A knows that p**.
- Under **negation**, this competition does not arise, so *ky*-embedding becomes possible.
- **Modal operators** can introduce an additional level of **shifting**, which also allows *ky* to be embedded under factive verbs.

2.1 *Know ky*

The question meaning is the basic contribution of *ky*: it is, in essence, a polar question operator.

- *Ky* composes with a proposition *p* and returns a set of propositions containing *p* and its negation.
- It also introduces a presupposition: namely, that *p* is epistemically accessible to a particular individual from a particular world.
- Building on theories of indexical shift (Schlenker 1999; Anand & Nevins 2004), we formalize this by introducing perspectival parameters: a center and a perspective world.
- *Ky* is sensitive to these parameters.
- In matrix clauses, the speaker is the default center, and the perspective world coincides with the world of evaluation.

(27) $[\![\text{ky}]\!]^{w'', <P\mathbf{speaker}, Pw>} = \lambda p_{<s,t>}: \exists w'[\mathbf{w}R^{\mathbf{Speaker}} w' \& p(w')]. \lambda q_{<s,t>}. q=p \vee q=\neg p$

- Factive verbs such as *know* shift these perspectival parameters.

- In particular, *know* fixes the perspective world to the world of evaluation and shifts the center to the attitude holder.

(28) $[\![\text{know } \varphi]\!]^{w, <Pspeaker, Pw>} = \lambda x:\lambda w'.[\![\varphi]\!]^{w', <Px, Pw>}(w).$
$\forall w''[wR^{x}w'' \rightarrow \lambda w'.[\![\varphi]\!]^{w', <Px, Pw>}(w'')]$

Now, let us consider what happens when a ky-question is **embedded under *know***.

- The at issue meaning is that **A knows the correct answer to the question whether V came** (we assume the strong answerhood operator below *know* that turns a question into a proposition).

(29) $[\![\text{A know } [\text{Ans}_{str} ? [\text{ky V came}]]]\!]^{w, < Pspeaker, Pw>} = \text{T iff}$
$\forall w'[wR^{Anja}w' \rightarrow \lambda w''.\text{V came in } w''(w') = \lambda w'''.\text{V came in } w'''(w)]$

- *Ky* introduces the presupposition that the evidence compatible with the perspectival center in the world of the perspective is compatible with V coming.
- *Know* sets the world parameter to be the actual world, the center to be the holder – Anja.
- This means that the presupposition is simply **that the evidence available to Ann in the real world is compatible with V coming.**

(30) $[\![\text{A know } [\text{Ans}_{str} ? [\text{ky V came}]]]\!]^{w,P<speaker,w>}$ is defined only if
$\exists w'[wR^{Anja}w' \& \text{V came } w']$

Now we can reason about the resulting meaning:

- Since A knows the answer to the question of whether V came, she must either **know that V came** or **know that V did not come**.
- But we also know that **the evidence available to Ann is compatible with V coming.**
- Imagine, A knows in world *w* that V did not come. Then, of course her evidence in *w* cannot be compatible with V coming.
- Thus, we conclude that this is consistent only if ***A knows that V came***.

This contextual equivalence in meaning triggers the competition with *A knows that V came* by **Maximize Presupposition**. This principle disallows the use of an expression when there is another expression with stronger presuppositions and the same meaning.

- Let us compare the presuppositions of ***A knows that V came*** and ***A knows V came-ky.***
- *A knows that V came* presupposes that *V came*
- *V came* is stronger than *The evidence available to Ann is compatible with V coming* (p entails that it is possible that p)
- Thus*, **A knows V came-ky*** is predicted to be blocked by Maximize Presupposition.

2.2 Not know ky

The situation is different under negation. The presupposition remains the same *The evidence available to Ann is compatible with V coming*:

(31) $[\![$ NEG A know [Ans_{str} ? [ky V came]]$]\!]^{w, <Pspeaker, Pw>}$ is defined only if
$\exists w'[wR^{Anja}w' \& V \text{ came } w']$

But the assertive content is that Ann does not know the correct answer to the question of whether V came:

(32) $[\![$ NEG A know [Ans_{str} ? [ky V came]]$]\!]^{w, <Pspeaker, Pw>} = T$ iff
$\neg\forall w'[wR^{Anja}w' \rightarrow \lambda w''.V \text{ came in } w''(w') = \lambda w'''.V \text{ came in } w'''(w)]$

In this case, the meaning is consistent and does not trigger competition under Maximize Presupposition with any other statement.

A side note:

This proposal also accounts for the embeddability of ky-questions under *forget*: the predicted presupposition is the same as in (31), and the at-issue meaning is that A does not remember the correct answer to the question. This is consistent, and no competition via Maximize Presupposition is expected.

2.3. Capturing *might know* and *must know*

The current account does not predict the ungrammaticality of modal embeddings, especially if local accommodation of the presupposition is allowed.

However, it derives some meanings that are not attested and fails to derive the meanings that are actually observed.

The sentence in (33) does not require any bias on Anja's part.

(33) Anja tjenjeva.bta tara, Vanja to.na.ky.
Anja know.X must Vanja came.PART.ky
'Anja must know whether Vanja came.'

This sentence does not require that Anja allows for the possibility that Vanja came.

Rather, it simply means that the speaker does not know the answer to the question, but based on the speaker's evidence, Anja knows the answer and it can be any answer.

The intuition:

- In these cases, the center with respect to which the epistemic possibility is evaluated is the speaker, not the attitude holder (Anja).
- This is possible because modals introduce another level of displacement, and the relevant perspective in that context is that of the speaker.
- Informally, the presupposition in (33) is that **the speaker in the real world allows for the possibility of V living here.**
- The assertion is equivalent to the English translation: all of the speaker's evidence indicates that Anja knows the correct answer to the question of whether V came.

Note that in *know*-embeddings the shifting is mandatory: if the speaker is allowed to be the perspectival centre, we will not derive the ungrammaticality of 'knows ky'.

Thus, we want a system in which quantifiers over worlds mandatorily perform the shifting and the matrix perspective is not available, but all parameters introduced by structurally higher modal operators remain accessible at any level of embedding.

We implement this formally by adapting the Index Storage approach (Bäuerle 1983; Percus 2020) for our purposes.

Key idea:

- parameters are piled in a 'storage', [];
- the current parameter occupies the highest (leftmost) position in the storage;
- whenever a parameter gets shifted to π', storage [π] turns into [π', π];
- stored parameters are still accessible;
- an operator, OP^n (where *n* is a number), can accompany a parameter-sensitive expression E, shifting E's interpretation to one of the stored parameters.

Illustration:

(34) a. $[\![ky]\!]^{[<i, w>,<i',w'>,<i'',w''>]} = [\![ky]\!]^{[<i, w>]} = \lambda p_{<s,t>}: \exists w'[wR^{i}w' \,\&\, p(w')]$. {p, ¬p}

b. $[\![OP^1\ ky]\!]^{[<i, w>,<i',w'>,<i'',w''>]} = [\![ky]\!]^{1[<i, w>,<i',w'>,<i'',w''>]} = [\![ky]\!]^{[<i, w>]} =$
$\lambda p_{<s,t>}: \exists w'''[wR^{i}w''' \,\&\, p(w''')]$. {p, ¬p}

c. $[\![OP^2\ ky]\!]^{[<i, w>,<i',w'>,<i'',w''>]} = [\![ky]\!]^{2[<i, w>,<i',w'>,<i'',w''>]} = [\![ky]\!]^{[<i', w'>]} =$
$\lambda p_{<s,t>}: \exists w'''[w'R^{i'}w''' \,\&\, p(w''')]$. {p, ¬p}

Assumption:

(35) an empty storage, [ ], is by default equal to [<speaker, world of evaluation>].

Consequently,

- A matrix ky-question, like (3) (*Vanja came-ky?* ('Did Vanja come?')) is interpreted w.r.t. the empty parameter [ ]. By (35), its analysis is equivalent to the one given above.

- In knowledge reports like *#Anja knows Vanja came-ky*, and like, *Anja doesn't know Vanja came-ky*, *know* shifts the parameter overwriting [ ] as [<Anja, w>]. The resulting interpretation is as suggested above.

However, for (33), presented as (36) the analysis is different.

(36) Necessarily Anja knows Vanja came.ky

We assume that (the epistemic) *NEC* also shifts its prejacent's perspective parameter to the holder of the epistemic perspective and the world of evaluation:

(37) $[\![NEC\ \varphi]\!]^{w,c\ []} = \forall w''[wR^{Speaker}w'' \rightarrow \lambda w'.[\![\varphi]\!]^{\mathbf{w', [<Pspeaker,Pw>]}}(w'')]$

This leads to there being two parameters in the storage when (36) is interpreted:

(38) ⟦ NEC [A knows [Ans_{str} [Vanja came.ky]]]⟧ $^{w,[\ ]}$ = T iff

$\forall w'' [wR^{speaker}w'' \rightarrow \lambda w'.[\![[A\ knows\ [\ Ans_{str}\ [Vanja\ came.ky]]]]\!]^{w',\ [<Ps,Pw>]}\ (w'')]$ iff

$\forall w'' [wR^{sp}w'' \rightarrow \forall w''' [w''R^{Anja}w''' \rightarrow \lambda w''''[\![[\ Ans_{str}\ [Vanja\ came.ky]]]\!]^{w'''',[<PAnja,Pw''>,<Ps,Pw>]}\ (w''')]$

There are three options for ky in the clause *Vanja came.ky*:

- it is not accompanied by any operator;
- it is accompanied by OP^1;
- it is accompanied by OP^2.

In the first two cases, the reading is problematic, as discussed above: the sentence does not require that Anja allow for the possibility that Vanja came.

However, the third option suggests the LF in (39), which gives the desired paraphrase repeated in (40):

(39) LF: NEC [A knows [Ans_{str} [[OP^2 ky] V came]]]

(40) In the actual world, the speaker allows for the possibility that V came and in all of the accessible worlds w' A. knows whether V. came.

Prediction:

(41) ⟦ NEC [A knows [Ans_{str} [[OP^2 ky] V came]]]⟧$^{w,[\ ]}$ = T iff

$\forall w'' [wR^{sp}w'' \rightarrow \forall w''' [w''R^{Anja}w''' \rightarrow \lambda w''''[\![[\ Ans_{str}\ [\ [OP^2\ ky]\ V\ came]]]\ ]\!]^{w'''',[<Pa,Pw''>,<Ps,Pw>]}\ (w''')]$

iff $\forall w'' [wR^{speaker}w'' \rightarrow \forall w''' [w''R^{Anja}w''' \rightarrow [\![Ans_{str}]\!]^{w'''}([\![ky]\!]^{w''',[\ <Ps,Pw>]}\ ([\![V\ came]\!]^{\ w'''}))]]$

iff

$\forall w'' [wR^{sp}w'' \rightarrow \forall w''' [w''R^{A}w''' \rightarrow \lambda w''''.V\ came\ in\ w''''\ (w''') = \lambda w''''.V\ came\ in\ w''''(w'')]]$

defined iff $\exists w'[c_wR^{speaker}w' \&$ V came in w']

3. From a question to a possibility modal

- We proposed that *ky* is essentially a question operator.
- The possibility meaning comes from the presupposition it introduces.

- The question then is: how does the non-interrogative possibility meaning arise in (1) repeated below as (42)?

(42) Vanja to.na.ky.
Vanja came.PART.ky
'Vanja may be came'.

We propose that this meaning arises via two operations:

- existential closure (∃) over the set of propositions
- B operator turning the presupposition into an assertive content.

(43) [B ∃ Ky Vanja came]

(44) $[\![\exists]\!]^w = \lambda P_{<<st>t>}. \exists p[p \in P \& p(w)=1]$

(45) $[\![B]\!]^w = \lambda p.$ 1 if $p(w)=1$, 0 if $p \neq 1$ (Beaver & Krahmer 2001)

The final interpretation is as shown in (46).

(46) $[\![B \exists$ Ky Vanja came$]\!]^{w, []} =$ T iff $\exists p[p \in \{\lambda w'.$V came in w'; $\lambda w'.\neg$V came in w'$\} \&$ $p(w)=1] \& \exists w'[wR^{Speaker}w' \&$ V came w']

- The perspectival parameter is empty, and by assumption it is mapped to the actual world and the speaker.
- The existential quantification over propositions contributes nothing at all: it yields a tautology (*Vanja came or Vanja did not come*), which is always true.
- As a result, the sentence is true just in case it is compatible with the speaker's evidence that V came.
- The desired meaning is therefore derived.

4. Embeddings under non-factive verbs

Recall that *ky* embedding is possible under *think*, where it receives a non-interrogative possibility meaning.

(47) Man' yibyidorŋadmᵠ, Vanja to.va.ky,
I think Vanja came.PastPART.ky

valkada man' tykymᵠ savarivna not.know
but I this.ACC wel jexjeradm'.
'I think that Vanja possibly came, but I don't know for sure.'

We propose that in this case

- the entire structure shown in (46), *B ∃Ky Vanja came*, is embedded, since *think* is incompatible with a question denotation.
- *think* shifts the perspective parameter to the *origo* and the doxastic alternative as in (48).
- a standard embedded modal interpretation arises.

(48) $[\![\text{think } \phi]\!]^{w,[]} = \lambda x\ .\ \forall\langle y,w''\rangle[wR^{x}w'' \rightarrow \lambda w'.[\![\varphi]\!]^{w',\langle Py, Pw''\rangle}(w'')]$

(49) $[\![\text{I think } B\ \exists Ky\ Vanja\ came]\!]^{w,[]} = 1$ iff $\forall\langle y,w''\rangle[wR^{Speaker}w'' \rightarrow \lambda w'.\ [\![B\ \exists Ky\ Vanja\ came]\!]^{w',\langle Py, Pw''\rangle}(w'')]$

iff $\forall\langle y,w''\rangle[wR^{Speaker}w'' \rightarrow$
$\exists p[p \in \{\lambda w'.V \text{ came in } w';\ \lambda w'.\neg V \text{ came in } w'\} \& p(w)=1] \& \exists w'[w''R^{y}w' \& V \text{ came } w']$

iff $\forall\langle y,w''\rangle[wR^{Speaker}w'' \rightarrow \exists w'[w''R^{y}w' \& V \text{ came } w']$

5. Why cannot a possibility meaning of ky be embedded under *know*?

We now address the final aspect of our puzzle: why *ky*-embeddings under factive verbs must receive a question interpretation and cannot receive a possibility interpretation.

After all, possibility modals can be embedded under *know*:

(50) Anja tjeneva, Vanja to.vaŋgabja.
Anja know, Vanja came.POSS
'Anja know that it is possible that Vanja came.'

We proposed that *know* obligatorily changes the perspectival parameters so that the world of evaluation for the modal claim is fixed to the same world in which *know* is evaluated (the actual world).

Embedding *B ∃Ky Vanja came* under *know* as in (51) is interpreted as (52) and:

(51) LF: [Anja knows [B ∃ Ky Vanja came]]
(52) $[\![(51)]\!]^{w,[]}$ defined only if $\exists w'[wR^{Anja}w' \&$ Vanja came in $w'] \& \exists p[p \in \{\lambda w.V$ came in $w;$ $\lambda w'.\neg V$ came in $w'\} \& p(w)=1]$
(53) $[\![(51)]\!]^{w,[]} = 1$ iff $\forall w''[wR^{Anja}w'' \rightarrow \exists w'[wR^{Anja}w' \&$ Vanja came in $w'] \& \exists p[p \in \{\lambda w.V$ came in $w;$ $\lambda w'.\neg V$ came in $w'\} \& p(w)=1]$

Here, the assertion does not add anything. The presupposition entails the assertion. Consequently, the structure is ruled out.

A further question:

Why can't the B-operator be applied at the matrix level as shown in (54) giving us a reading like (55), which should not be ruled out?

(54) LF: [B [Anja knows [B ∃ Ky Vanja came]]]
(55) Anja allows for the possibility that Vanja came.

To rule out this reading, we observe that the same interpretation will be predicted for all factive sentences:

(56) Anja knows V came-ky
Anja remembers V came-ky
Anja decided V came-ky
Anja forgot V came-ky –

In other words, no matter what verb we use, the meaning is the same.

In the spirit of Buccola and Spector's (2016: 165) Pragmatic Economy Constraint, we propose a pragmatic constraint that rules out these types of structures.

Conclusion

In this talk, we attempted to develop a unified account of the contribution of *ky* in questions and assertions.

We aimed to derive the restrictions on the embedding of *ky* from its meaning as an epistemic modal.

We proposed that factive verbs shift the world and holder parameters of *ky* in a way that triggers competition with propositional embeddings and leads to blocking by Maximize Presupposition.

We also proposed that modal verbs introduce an additional level of shifting, which derives the correct meanings for *ky* embeddings under *must know* and *might know*.

Appendix: Alternative approach in terms of Exh

1. Parallelism with epistemic indefinites

Recall the pattern of embedding of ky we observe:

(1)

Know ky	*
Not know ky	✓
Might know ky	✓
Must know ky	✓
Does know ky?	✓

The pattern we observe with the embedding of *ky* parallels that found with epistemic indefinites and free-choice items such as Italian *un N qualsiasi*, German *irgendein N*, and Mandarin *shenme* (Alonso-Ovalle & Méndez-Benito 2010; Aloni & Port 2010; Chierchia & Liao 2015; Liao 2010; Chierchia 2013, a.o.).

Thus, we could consider extending Chierchia's (2013) Exh-based analysis of indefinites to the Tundra Nenets data.

2. Previous treatment of question embeddings in terms of Exh

Mayr (2019) proposed an Exh-based account of the contrast between the grammaticality of question embeddings with *certain* and *not certain*.

(2) *Anja is certain whether Vanja came.
(3) Anja is not certain whether Vanja came.

The idea is that the alternatives to an embedded question are the individual embedded propositions in the question denotation.

Accordingly, the alternatives for (2) are the propositions derived from (4), and the alternatives for (3) are the propositions denoted by the sentences in (5).

The Exh used to derive this pattern is the contradiction-generating one, since Exh based on IE would not work in this case, as it fails to distinguish between the positive and the negative cases.

(4) {Anja is certain that Vanja came; Anja is certain that V did not come}
(5) {Anja is not certain that Vanja came; Anja is not certain that V did not come}

(6) $[\![\text{Exh}_{\text{Alt}}\ \varphi]\!]^w = [\![\varphi]\!]^w \,\&\, \forall p[p \in \text{Alt} \,\&\, \lambda w.[\![\varphi]\!]^w \not\models_s p \rightarrow \neg p(w)]$

Let us assume that the meaning of the prejacent of Exh in (7) is as expected: Anja is certain of the true answer to the question of whether Vanja came.

(7) [Exh Anja is certain whether Vanja came]

As we inspect the alternatives in (4), we observe that none of them is entailed by the prejacent, so both are negated.

- The resulting meaning of the sentence is contradictory: Anja believes the true answer, but she believes neither that V came nor that he did not come.
- Since this interpretation is contradictory, the sentence is correctly predicted to be ungrammatical.

The situation is different under negation.

- If there is no true proposition in the question denotation that Anja believes, it follows both that Anja does not believe that V came and that she does not believe that he did not come.
- In this case, Exh has nothing to negate, and the sentence is grammatical.

(8) [Exh NEG Anja is certain whether Vanja came]

In English, factive verbs can take embedded questions regardless of the presence of higher negation.

(9) Anja knows whether Vanja came.
(10) Anja does not know whether Vanja came.

The idea here is that Exh takes into account not only the assertive content when assessing entailment patterns, but also the presuppositions.

- Consider the propositional alternatives in (11) for (9).
- Each of them presupposes the embedded proposition.
- Now let us evaluate the entailment patterns in contexts where the presupposition is satisfied.
- Consider the situation where V came. In that situation, if A knows the correct answer to the question, she knows that V came.
- The same applies to the second alternative: consider it in a context where the presupposition is satisfied, so V did not come. In that context, if A knows the correct answer to the question, she knows that he did not come.

(11) {Anja knows that Vanja came; Anja knows that V did not come}

This is reflected in the denotation of Exh in (6): it evaluates Strawson entailment (von Fintel 1999) rather than simple entailment.

With this background in mind, we can consider the changes to this theory that would be required to extend the account to the Tundra Nenets pattern of ky-embeddings.

3. The Exh account of *ky*-embeddigns.

Let us consider that the basic semantics of *ky* is that of a question operator: it combines with a proposition and yields a polar question.

(12) $[\![ky]\!]^w = \lambda p_{<s,t>}. \{p, \neg p\}$

The obvious change we need to make is to make Exh sensitive to simple entailment rather than Strawson entailment, in order to avoid generating the English pattern.
Another change we will make is that, in negating the alternatives, Exh will treat the presupposition and the assertion on a par; in other words, it will state that the alternative is not true (either false or undefined) (Chierchia 2013; Spector and Sudo 2017).

(13) $[\![Exh_{Alt}\ \varphi]\!]^w = [\![\varphi]\!]^w \& \forall \phi[\phi \in Alt \& \lambda w.[\![\varphi]\!]^w \not\models \lambda w.[\![\phi]\!]^w \rightarrow [\![\phi]\!]^w \neq 1]$

3.1 Case 1: * Knows ky

(14) [Exh [A knows [ky V came]]]

(15) Alternatives: {A knows V came, A knows V did not come}

- The entailment is evaluated without taking the presuppositions into account. As a result, none of the propositions is entailed by the prejacent.
- As a result, both can be negated.
- We negate the alternatives by stating that either their presupposition is not satisfied or the assertive content is false.

The negated alternatives are shown in (16):

(16)
$\neg$ V came in w $\vee$ $\neg\forall$w'[wR^{A}w'$\rightarrow$ V came in w']
&
V came in w $\vee$ $\neg\forall$w'[wR^{A}w'$\rightarrow$ $\neg$V came in w']

The meaning of the prejacent is as shown in (17).

(17) $\exists p[p \in \{\lambda w''.$V came in w''; $\lambda w'''.\neg$V came in w'''$\} \& \forall w'[wR^A w' \rightarrow p(w')]]$

Let us check whether the negated alternatives are consistent with the prejacent.

- Assume that the first disjunction is true because the first disjunct is true: V did not come.
- Then the second disjunction must be true because A does not know that V did not come, which means that A allows for the possibility that V came.
- But this is incompatible with A's knowing the correct answer to the question of whether V came in the actual world.
- This contradicts the prejacent.
- If the first disjunction is true because of the second disjunct, then neither disjunct of the second disjunction can be true in a way that is consistent with the prejacent. This means that a contradiction is generated, which rules out the sentence.

3.2 Case 2: Neg know

(18) Exh A does not know whether V came.

(19) Alternatives:
A does not know V came
A does not know V did not come

The entailment is checked without taking the presuppositions into account. Since both alternatives are entailed, there is nothing to negate.

3.3 Case 3: embedded under universal

(20) Exh □A knows whether V came

(21) Alternatives:
□A knows V came
□A knows V did not come

Let's assume presuppositions project to the matrix level (this is not very important, as this will not change the outcome):

(22) The negation of 0:
¬V came ∨ ¬□A knows V came
&
V came ∨ ¬□A knows V did not come

- This is consistent, as second disjuncts in both of the disjunctions can be true consistently with the prejacent.

- It must be the case that Anja knows the correct answer, but there is no obligation for her to know the specific answer.

3.4 Case 4: Embedded under possibility

(23) [Exh ◊A knows whether V came]

Alternatives have to be 'pre-exhaustified': this is **as if** they were of the following form, but there is no real Exh in the structure: Exh Alt1; Exh Alt2 (Chierchia 2013).

The intuition: these alternatives have the following shape:

(24) ◊Ania only knows that V came (and not the opposite),
◊Ania only knows that ¬V came (and not the opposite)

A further problem is that the presupposition must be locally accommodated below the scope of the modal; otherwise, we obtain an odd interpretation.

The computation of the meaning of ALT1:

(25) ◊ (V came & A knows V came) & (not the opposite) ¬ ◊(¬V come & A knows ¬V come)

The computation of the meaning of ALT2:

(26) ◊(¬V come & A knows ¬V come) & (not the opposite) ¬◊ (V came & A knows V came)

Going back to the matrix computation.

Exh will assert the prejacent (◊A knows whether V came) and negates ALT1 and ALT2

(27) NEG ALT1
¬ ◊ (V came & A knows V came)) OR ◊(¬V come & A knows ¬V come)

Equivalently:
◊ (V came & A knows V came) → ◊(¬V come & A knows ¬V come)

(28) NEG ALT2
¬ ◊(¬V come & A knows ¬V come) OR ◊ (V came & A knows V came)

Equivalently:
◊(¬V come & A knows ¬V come) →◊ (V came & A knows V came)

(29) All together:
◊A knows whether V came (the prejacent) &
◊ (V came & A knows V came) → ◊(¬V come & A knows ¬V come) &
◊(¬V come & A knows ¬V come) →◊ (V came & A knows V came)

The overall meaning is free choice: it may be that the answer is yes and she knows it and it may be that the answer is no and she knows it.

4. Unembedded ky

The challenge for this type of approach is how to derive the possibility reading of unembedded *ky*.

One idea we entertained is that the ignorance meaning of unembedded *ky* arises by inserting a K operator between *Exh* and the prejacent (Meyer 2013; Fox 2016; Crnič 2021, 2024; Buccola & Haida 2020).

Because the modal K composes with a proposition rather than a set of propositions, we posit an existential closure operator ∃.

The resulting meaning, in (31), can be paraphrased as: the speaker knows that V either came or did not, but is ignorant about each specific outcome.

(30) [Exh K ∃ [[V came] ky]]
(31) $[\![(30)]\!]^w$ = T iff □ $_{ww"}$ ∃p[∈{λw.V came in w, λw.¬V came in w} & p(w")=1] & ◊ $_{ww"}$¬V came(w")] & ◊ $_{ww"}$ V came(w")]

The problem with this approach is twofold.

- To our knowledge, a statement of the form *Vanya came-ky* does not require that the evidence be compatible with the opposite proposition.
- If the possibility reading is derived by inserting a silent universal modal, it is unclear why this modal could not be inserted in *A knows Vanya came-ky* above *know* to rescue the sentence.
- We do not see why the full set of operations in (30)could not apply under the scope of know and yield an embedded possibility reading (i.e., ‘A knows that V maybe came and maybe did not come’).