

Mood choice, knowledge, and belief: Evidence from flexible doxastic attitudes

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The subjunctive, nonveridicality, uncertainty

‘The subjunctive is selected by nonveridical verbs, i.e. that **do not express epistemic commitment** of an individual to a proposition’

(Giannakidou 1998, 2011)

Nonveridicality = uncertainty

- The subjunctive is selected when the lexical entry of the propositional attitude verb contains a nonveridical 'do not know' presupposition.
- The indicative reflects a veridical attitude space, namely one that conveys epistemic or doxastic commitment (i.e, knowledge or belief).
- The mood choice reflects an **epistemic** contrast.
- The phenomenon of mood flexibility reflects that doxastic attitudes are encoded in the grammar in two ways: **veridically** (as commitments: beliefs), or **suppositionally** (as conjectures).

Implications

- 1 Propositional attitude and modal meanings have a lot in common: modal bases, veridicality, bias
- 2 We distinguish two types of attitudes: the **veridical** and the **nonveridical**.
- 3 The **indicative** signals a veridical attitude that relies on actual truth, or an individual anchor's *i* veridical **commitment** to the truth.
- 4 The **subjunctive** reflects a nonveridical attitude of **not knowing**.
- 5 The subjunctive, just like modal verbs is an **anti-knowledge** marker (Giannakidou and Mari 2021, to appear).

Subjunctive is incompatible with knowledge or truth of ϕ

Giannakidou 2016: epistemic subjunctive

- (1) Context: I can't see Ariadne.
- (2) **Isos na** ine mesa sto spiti.
maybe subj is inside in-the house
Maybe she is in the house.
- (3) **Paraligo** na eixame atixima.
almost subj had.1pl accident
We almost had an accident. (We didn't).

Evidential component

- (4) Context: I am looking through the window, and it is foggy and dark. I don't fully trust what I am seeing:
It must be raining.
- (5) **Prepi/Isos** na vrehi.
must/maybe subjunctive rain.3sg
It must be raining.
- (6) **Tha** vrehi. (Greek, epistemic future, equivalent to MUST)
future rain.3sg
It must be raining. /It is probably raining.

It is not about direct perception or not, but about **how reliable I take the sensory evidence** to be.

Evidentiality and epistemic modality: evidence creates bias

Faller (2011, 2012, 2020): Quechua evidentials as follows:

(7) Para-mu-sha-*mi/si/cha/chu-sina*.

rain-CISL-PROG-3=BPG/REP/CONJ/RES

p=It is raining.

(i) Direct *mi/n*: s sees, therefore knows, that it is raining.

(ii) Reportative, *si/s*: s was told that it is raining.

(iii) Conjectural *cha*: s conjectures, It **may** be raining

(iv) Partial evidence/inference from results, **MUST** *chu – sina* s infers from evidence: It **must** be raining

Veridical commitment: speaker knows or believes that p

Veridical commitment with present or past tense, knowledge and belief verbs

- (8) I Ariadne is/was sick, #but I am not entirely sure.
Ariadne is/was sick, #but I am not entirely sure.
- (9) #Ariadne is eating now, but I am not entirely sure.
- (10) #I know/believe that Ariadne is eating now, but I am not entirely sure.

Veridical bias is not knowledge or belief

Subjunctive

- (11) a. I Ariadne **prepi** na troi tora, alla den ime
the Ariadne must subj eat.non-past3sg now, but not be.1sg
ke endelos sigouri.
and completely sure.
- b. Giacomo **deve** star mangiando, ma non sono
Giacomo must be eat-gerund, but not be.1sg
completamene sicura.
completely sure
'Giacomo must be eating now, but I am not entirely sure.'

Must in the wild, with explicit denial of knowledge

Lassiter 2016, Goodhue 2018

- (12) This is a very early, very correct Mustang that has been in a private collection for a long time. ... The speedo[meter] shows 38,000 miles and *it must be 138,000, but I don't know for sure.*
- (13) *I don't know for sure*, sweetie, but she *must have been* very depressed. A person doesn't do something like that lightly.
- (14) It must have been a Tuesday (*but I don't know for sure*), I can't remember"

Veridicality Principle of Assertion

Grice's Quality: 1. Do not say what you believe to be false. 2. Do not say that for which you lack adequate evidence.

- (15) Veridicality of Assertion (Giannakidou and Mari 2021)
A sentence S can be asserted by a speaker A if and only if A is **veridically committed** to the content π of S , i.e., if and only if A knows or believes π to be true.

The Veridicality Principle, we argue, is the hallmark of sincere, co-operative conversation.

Knowing and believing rely on *adequate evidence*.

Mood in complement clauses: indicative

- (16) Indicative verbs in Greek (**oti**, **pos**, **pu**)
- a. epistemic and emotive factive verbs: ksero, gnorizo (know), metaniono (regret), xairomai (be glad)
 - b. fiction verbs: onirevome (dream), fandazome (imagine)
 - c. doxastic (non-factive): pistevo (believe), nomizo (think), theoro (consider), vrisko (find)
 - d. conciousness: exo epignosi (be aware), katalaveno (understand)
 - e. purely assertive: leo (say), dhiavazo (read), isxirizome (claim), dilono (declare, assert)
 - f. memory verbs: thimame (remember)
 - g. perception verbs: vlepō (see), akouo (hear)

Similarly in French, Spanish, Catalan, Portuguese, Romanian (Farkas 1992, Villalta 2008, Quer 1998, Marques 2014, Baunaz 2015, Puskas 2014, Bove and Limerick 2021, a.o.)

Examples: epistemic and doxastic verbs

- (17) O Nicholas **kseri** oti/pos/*na efije i Ariadne.
the Nicholas knows.3SG that.IND/*SUBJ left. 3SG Ariadne
Nicholas knows that Ariadne left.
- (18) O Nicholas **pistevi** oti/*na efije i Ariadne.
the Nicholas believe.3SG that.IND left.3SG the Ariadne.
Nicholas believes that Ariadne left.
- (19) O Nicholas **fantazetai** oti/*na i Ariadne ton voithise.
the Nicholas imagines.3SG that.IND the Ariadne him helped.3sg
Nicholas imagines that Ariadne helped him.
- (20) O Nicholas **onireftike** oti/*na efije i Ariadne.
the Nicholas dreamt.3SG that.IND left.3SG the Ariadne.
Nicholas dreamt that Ariadne left.

Greek modal verbs: all subjunctive

- (21) **Prepi** na/*oti vrehi.
must subjunctive/indicative rain.3sg
It must be raining.
- (22) **Bori** na/*oti vrehi.
may subjunctive rain.3sg
It may be raining.
- (23) **Prepi** na/*oti evrekse.
must subjunctive/indicative rain.PAST.3sg
It must have rained.
- (24) **Bori** na/*oti evrekse.
may subjunctive rain.PAST.3sg
It may have rained.

Italian doxastics: flexible mood

- (25) Credo/Penso che Maria sia/é incinta.
believe/think.1SG that Mary is.3SG.SUBJ /IND pregnant.
'I believe that Mary is pregnant.'
- (26) Sono sicura che Maria sia/é incinta.
am certain.1SG that Mary is.3SG.SUBJ /IND pregnant.
'I am certain that Mary is pregnant.'

Giannakidou and Mari 2021: **Suppositional** doxastics: believe but not know. Greek doxastics are **solipsistic**, *select* indicative.

Portuguese doxastic verbs

Portuguese belief and assumption verbs may also allow the subjunctive:

(27) Acredito que a Maria esta doente.

believe-1sg that the Maria is-IND-3sg ill.

'I believe that Maria is ill.'

(28) Acredito que a Maria esteja doente.

believe.1sg that the Maria is.SUBJ.3sg ill.

'I believe that Maria might be ill.'

"The concept of veridicality accounts for this case of mood variation. With the indicative, the inference follows that the relevant proposition is true (according to the subject of the main clause), contrary to what happens if the subjunctive is selected." (Marques 2010, p. 145).

No flexibility with knowledge

- (29) So che Maria é/*sia incinta.
Know that Mary is.ind/is.subj pregnant.
'I know that Mary is pregnant.'

Mood flexibility in Greek with appearance

- (30) Ta paidia fenonde **na** ine kourasmena (ala bori
the children seem.3pl that.SUBJ be.3sg tired (but might
ke na min ine).
and subj not be.3pl).
The children seem to be tired (but they might not be).
- (31) Ta paidia fenonde **oti** ine kourasmena (#ala bori
the children seem.3pl that.IND be.3sg tired (but might
ke na min ine).
and subj not be.3pl).
It is obvious that the children are tired (#but they might not be).
- (32) Ta paidia fenonde **pu** ine kourasmena (#ala bori
the children seem.3pl that.IND be.3sg tired (but might
ke na min ine).
and subj not be.3pl).
The children are tired, and it is apparent.

Mood flexibility with perception

- (33) O Nicholas idhe ton Flavio **na** kleini tin
the Nicholas saw.3sg the Flavio SUBJ close.nonpast.3sg. the
porta, alla i porta dhen ine kleisti.
door, but the door not is closed.
'Nicholas saw Flavio closing the door, but the door is not closed.'
- (34) O Nicholas idhe **oti** o Flavio eklise ton porta,
the Nicholas saw.3sg that.IND the Flavio closed.3sg. the door,
#alla i porta den ine klisti.
but the door not is closed.
'#Nicholas saw that Flavio closed the door, #but the door is not
closed.'

Mood flexibility also with memory

- (35) O Nicholas thimate na kleini
the Nicholas remembered.3sg that.SUBJ close.NONPAST.3sg.
ton porta, alla den ine sigouros.
the door, but not is sure.
'Nicholas remembers closing the door, but he is not entirely sure.'

The subjunctive is compatible with a context where Nicholas is not fully sure about his memory, and he has some doubt

- (36) #O Nicholas thimate oti eklise ton porta,
the Nicholas remembered.3sg that.IND closed.3sg. the door,
alla den ine sigouros.
but not is sure.
'#Nicholas remembers that he closed the door, but he is not entirely sure.'

What does mood flexibility with these verbs tell us?

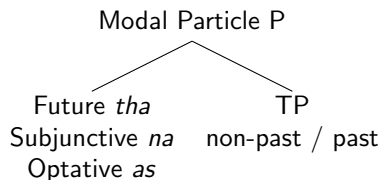
Giannakidou and Mari 2021:

- Appearance, seeing and memory can be conceptualized in two ways: either as veridical belief states, or as nonveridical states which are suppositional.
- The indicative is the indication that a veridical belief is formed.
- The subjunctive is the indication of epistemic uncertainty 'do not know'.
- No ambiguity, but addition of an epistemic nonveridical presupposition.

Greek: modality distinct from lower tense

Giannakidou 2009

(37)



The future particle in the same position as subjunctive, optative moods; modal and temporal information as syntactically distinct in Greek

The tenses of Greek

Giannakidou 2009, 2014

- (38) graf- -o. (imperfective nonpast: PRES)
write.IMPERF NON-PAST.1SG.
I am writing (right now).
'Write' (generally).
- (39) *grap- s- o
write- PERF NON-PAST.1SG.
(Greek perfective nonpast: * on its own: Prospective NON-PAST)
- (40) e- graf- a. (Greek imperfective past)
PAST- write.IMPERF- PAST.1SG.
'I used to write.' / 'I was writing.'
- (41) e- grap- s- a. (Greek aorist: PAST)
PAST- write- PERF- PAST.1SG.
I wrote.

Veridicality as actual truth

Truth entailing functions (Zwarts (1995), Giannakidou (1994, 1997, 1998, 1999, 2013))

(42) Def 1. **Objective veridicality.**

(i) A propositional function F is veridical iff $Fp \rightarrow p$ is logically valid.

(ii) F is nonveridical iff $Fp \nrightarrow p$;

(iii) F is antiveridical iff $Fp \rightarrow \neg p$.

objective veridicality = actuality

Objectively veridicality: *know* versus *believe*

(43) I know that Nicholas brought dessert.

(44) *Know* is veridical because know (p) entails that p is true in the actual world.

But *believe*

(45) Anastasia believes that Nicholas brought dessert.

Believe is not objectively veridical because it does not entail that p is true in the actual world. But it is subjectively veridical.

Individual anchors

Individual anchors (Giannakidou 1998; anchoring of propositions with respect to a time (Enc), an event (Hacquard))

(46) Def. 3. *Epistemic state of an individual anchor i* (Giannakidou 1999: (45))

An epistemic state $M(i)$ is a set of worlds associated with an individual i representing worlds compatible with what i knows or believes, or remembers, etc.

Quer 1998: these models are crucial for mood choice. Mood choice indicates model shift.

Subjective veridicality: homogenous model

(47) Def. 4 *Subjective veridicality*

A function F that takes a proposition p as its argument is subjectively veridical with respect to an individual anchor i iff Fp entails that i knows or believes that p is true.

This means that i 's epistemic state $M(i)$ is **homogenous**, epistemically settled: $M(i) \subseteq p$.

Veridicality, assertability

- (48) a. John won the race.
b. $[[\text{John won the race}]]^{M(\text{speaker})} = 1$ iff
 $\forall w [w \in M(\text{speaker}) \rightarrow w \in \{w' \mid \text{John won the race in } w'\}]$

If the speaker asserts *John won the race*, she believes or knows that John won the race, hence p is settled in $M(\text{speaker})$. $M(\text{speaker})$ is thus a **veridical modal space**.

The veridicality of knowledge

(49) $\llbracket \text{Nicholas knows that } p \rrbracket$ is defined in w iff $w \in p$; if defined, $\llbracket \text{Nicholas knows that } p \rrbracket$ is true in w wrt $M(\text{Nicholas})$ iff:
 $\forall w' [w' \in M(\text{Nicholas}) \rightarrow w' \in \lambda w'' \{w'' \mid p(w'')\}]$

- $M(\text{Nicholas})$ is a non-partitioned, homogenous epistemic space that positively settles p .
- Therefore knowing p and asserting p are **stronger** than any variant of MUST p .

The subjective veridicality of belief

- (50) $\llbracket \text{Nicholas believes that } p \rrbracket$ is true in w with respect to $M(\text{Nicholas})$ iff:
 $\forall w' [w' \in M(\text{Nicholas}) \rightarrow w' \in \lambda w'' \{w'' \mid p(w'')\}]$

Therefore believing p is solipsistic; verbs of belief express private commitment (and is also **stronger** than any variant of MUST p).

Modal verbs: nonveridical modal bases

Giannakidou 1998, 1999; Giannakidou and Mari 2016, 2018, 2021:

- All modals, thus also MUST, presuppose a nonveridical modal base (*Nonveridicality Axiom*); see also: Condoravdi's 2002 diversity condition; also Beaver and Frazee (2011)
- This renders MUST incompatible with knowledge or belief of ϕ .
- Bias is produced by a meta-evaluation function always present in the modal structure; it judges the positive worlds as *better possibilities*.

The Nonveridicality Axiom

Giannakidou and Mari 2016, 2016, 2021)

(51) *Nonveridicality Axiom of modals*

MODAL (M) (p) can be defined only if the modal base M is nonveridical, i.e. only if **M contains p and non- p worlds.**

Non-aleithic modals (epistemic, deontic, bouletic, etc) obey this principle; also **suppositional doxastic attitudes**

Nonveridicality: epistemic uncertainty

(52) *Subjective nonveridicality*

A function F that takes a proposition p as its argument is **subjectively nonveridical** with respect to an individual anchor i and an epistemic state $M(i)$ iff Fp does **not entail that i knows or believes that p is true.**

- A nonveridical $M(i)$ does not as a whole support p : there is a subset of $M(i)$ supporting p , maybe the subset that best complies with knowledge or evidence of i .
- This renders $M(i)$ nonveridical, non-homogenous. **The presence of such M in the lexical entry triggers the subjunctive.**

The semantics of MUST

- (53) Ariadne must have passed the test.
- (54) I know/believe that Ariadne passed the test.
- (55) $\llbracket \text{prepi}/\text{tha}/\text{futuro}/\text{MUST (PAST (}p\text{))} \rrbracket^{M,i,\mathcal{S},t_u}$ will be defined only if the modal base $M(i)(t_u)$ is nonveridical;
if defined, $\llbracket \text{prepi}/\text{tha}/\text{futuro}/\text{MUST (PAST (}p\text{))} \rrbracket^{M,i,\mathcal{S},t_u} = 1$ iff $\forall w' \in \text{Ideal}_{\mathcal{S}} : \exists t' \prec t_u \wedge p(w', t')$
- (56) $\llbracket \text{prepi}/\text{tha}/\text{futuro}/\text{MUST (PRES (}p\text{))} \rrbracket^{M,i,\mathcal{S},t_u}$ will be defined only if the modal base $M(i)(t_u)$ is nonveridical;
if defined, $\llbracket \text{prepi}/\text{tha}/\text{futuro}/\text{MUST (PRES (}p\text{))} \rrbracket^{M,i,\mathcal{S},t_u} = 1$ iff $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

Veridical vs. suppositional belief

Giannakidou and Mari 2021: Suppositional doxastics have a nonveridical 'do not know' presupposition.

(57) **Veridical** belief: pure doxastic commitment

$$\llbracket i \text{ believe}_{\text{ver}} p \rrbracket^{Dox,i} = 1 \text{ iff } \forall w' (w' \in \cap Dox \rightarrow p(w'))$$

(58) **Suppositional** belief: believe but not know

$$\llbracket i \text{ believe}_{\text{sup}} p \rrbracket^{M,Dox,i} \text{ is defined iff } = 1 \text{ iff } M(i) \text{ is nonveridical} \\ \text{(partitioned epistemic modal base). If defined,} \\ \forall w' (w' \in Dox) \rightarrow p(w')$$

Suppositional belief is thus an enriched, double layer belief with **mixed veridicality**.

Veridical vs. suppositional SEEM

- (59) Veridical SEEM (*fenete oti*: belief formation)
 $\llbracket i \text{ SEEM}_{\text{ver}} p \rrbracket^{w, \text{Dox}, \text{speaker}}$ is = 1 iff $\forall w'' \in \text{Dox}(\text{speaker})(p(w''))$.
- (60) Suppositional SEEM (*fenete with subjunctive*: ...but not know):
 $\llbracket i \text{ SEEM}_{\text{sup}} p \rrbracket^{M, \text{Dox}, \text{speaker}}$ is defined iff $M(\text{speaker})$ is nonveridical (partitioned epistemic modal base). If defined,
 $\llbracket i \text{ SEEM}_{\text{sup}} p \rrbracket^{M, \text{Dox}, \text{speaker}} = 1$ iff
 $\forall w'(w' \in \text{Dox}(\text{speaker}) \rightarrow p(w'))$

Unlike Greek doxastic verbs, SEEM verbs are **underspecified** in the lexicon

Veridical vs. suppositional SEE

- (61) Seeing is believing (veridical SEE, indicative)
 $\llbracket i \text{ SEE}_{\text{belief}} p \rrbracket^{w, \text{Dox}(\text{speaker})} \text{ is } = 1 \text{ iff } \forall w'' \in \text{Dox}(\text{speaker})(p(w''))$.

The Greek *vlepo oti* is understood as a veridical belief verb.

- (62) Suppositional SEE (*vlepo na*):
 $\llbracket i \text{ see}_{\text{sup}} p \rrbracket^{M, \text{Per}, \text{speaker}}$ is defined iff $M(i)$ is nonveridical (partitioned epistemic modal base). If defined,
 $\llbracket i \text{ see}_{\text{sup}} p \rrbracket^{M, \text{Per}, \text{speaker}} = 1 \text{ iff } \forall w'(w' \in \text{Per}(\text{spekaer}) \rightarrow p(w'))$

Veridical, factive, ,and suppositional memory

- (63) Remembering as believing
 $\llbracket i \text{ remember-}oti / \text{that } p \rrbracket^{w, Mem, i}$ is = 1 iff $\forall w'' \in Mem(i)(p(w''))$.
- (64) Remembering as knowing
 $\llbracket i \text{ REMEMBER-}pu / \text{the fact that } p \rrbracket^{w, Mem, i}$ is = 1 iff $p \in w$; if defined, $\forall w'' \in Mem(i)(p(w''))$.
- (65) Suppositional memory:
 $\llbracket i \text{ REMEMBER}_{sup} p \rrbracket^{M, Mem, i}$ is defined iff $M(i)$ is nonveridical (partitioned epistemic modal base). If defined,
 $\llbracket i \text{ REMEMBER}_{sup} p \rrbracket^{M, Mem, i} = 1$ iff $\forall w'(w' \in Mem \rightarrow p(w'))$

Here, the memory is vague and has gaps. It doesn't form a belief or knowledge.

Negation creates a nonveridical lexical entry

Polarity subjunctive

- (66) Dhen pistevo oti/na efije i Ariadne.
not believe.1SG that.IND left.3SG the Ariadne.
I don't that Ariadne left.
- (67) Pistevo oti/*na efije i Ariadne.
believe.1SG that.IND left.3SG the Ariadne.
I believe that Ariadne left.

If I don't believe that Ariadne left, then it is not the case that all world in *Dox* are worlds where Ariadne left.

- (68) $\llbracket i \text{ not BELIEVE } p \rrbracket^{w, \text{Dox}(i)}$ is = 1 iff
 $\neg \forall w'' \in \text{Dox}(i) (p(w''))$.

The effect of negation on the attitude is thus simply a consequence of the fact that *Dox* is no longer veridical, and the subjunctive is fully expected.

Positive bias versus equilibrium

Nonveridical equilibrium (Giannakidou 2013)

- (69) **Nonveridical equilibrium** An epistemic state M is in nonveridical equilibrium iff M is partitioned into p and $\neg p$, and there is no ordering source.

Possibility modals, questions are in nonveridical equilibrium. There is no preference between p and $\neg p$:

- (70) (For all I know) Ariadne **might/may** pass the exam.

Bias manipulates the equilibrium in one or the other direction

Giannakidou and Mari 2016, 2018, 2021

- (71) Informational strength (\gg is 'stronger than')
- Non-modalized p (speaker knows p , added to the common ground) \gg
 - MUST/suppositional doxastic p (speaker does not know or believe p , but is positively biased towards p) \gg
 - POSSIBLY p (speaker does not know p , and there is no bias)

Speaker bias in questions

Bias is a form of **strengthening** that relies of prior expectation of the speaker:

(72) Didn't it rain last night?

(73) It rained last night, didn't it?

The speaker is not in a state of ignorance, has some expectations about what the a better answer will be.

(Sadock 1971; Ladd 1981; BÅring and Gunlogson 2000; Abels 2003; van Rooy and Šafárová 2003; Romero and Han 2004; Reese and Asher 2006; Sudo 2013; Krifka 2015; Malamud and Stephenson 2015; Farkas and Roelofsen 2017; Larivee and Mari 2019/in press; Giannakidou and Mari 2021, 2023, Liu et al 2021, a.o.)

Focus-NEG also contributes bias ranking

Giannakidou and Mari 2023 (to appear):

- (74) $\llbracket \text{QUES Focus-NEG (PRES } (p)) \rrbracket^{\mathcal{O}, M, i}$ is defined only if
- (i) the modal base $M(i)$ is nonveridical and partitioned into $\{p, \neg p\}$ worlds.
 - (ii) p worlds are better possibilities than $\neg p$ worlds
- $\llbracket \text{QUES Focus-NEG (PRES } (p)) \rrbracket^{\mathcal{O}, M, i} = \{p, \neg p\}$

Since a question does not assert $\neg p$ the contribution of Focus-NEG as \mathcal{O} arises as a meaning reanalysis. See Liu, Ritter, and Giannakidou 2021 for experimental evidence in questions and conditionals

Conclusions

- ① The subjunctive is an indicator of the presence of a nonveridical epistemic modal base in the lexical entry of a doxastic attitude and a modal verb. It indicates the absence of belief formation or knowledge.
- ② The indicative is the mood of veridical commitment (objective or subjective). It indicates knowledge or formation of belief.
- ③ Flexible mood does not reveal ambiguity in the lexical meaning of the verb, but underspecification. Lexical entries can be formed with or without the nonveridical epistemic modal base.
- ④ Bias is weaker than veridical belief.

This material was based on:

- Giannakidou, A. and A. Mari. 2018. A unified analysis of the future as epistemic modality: the view from Greek and Italian. *Natural Language and Linguistic Theory*
- Giannakidou, A. and A. Mari. 2021. *Truth and Veridicality in Grammar and Thought*. University of Chicago Press.
- Giannakidou, A. and A. Mari. 2023. Modal bias in questions. To appear in volume *Biased Questions* edited by T. Trinh and M. Krifka.
- Giannakidou, A. and Mari, A. 2023. *Modal Sentences*. To appear with Cambridge University Press