1.

Modal Sentences

No subtitle

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Contents

Acknowledgments

Writing this book gave us both enormous intellectual pleasure, and we hope that the readers can extract from the material (at least some part of) the joy and wonderment that we shared as we were working on it. After the long Covid slumber, it seemed that it would be a good time to revisit the area of modality from the perspective of the theory we have been developing in our previous work. Our aim here is to offer a synthesis that can afford considerable and systematic empirical coverage of modal phenomena, as well as a deeper understanding of what speakers do when they choose to modalize.

Modality is a linguistic category of subjectivity that expresses, by definition, absence of veridical commitment therefore some degree of uncertainty. Modal sentences come in different forms and packaging, and we made it our mission to not ignore this variation. We try to bridge empirical breadth with formal semantic theorizing so that our readers can use this book as a manual: an introduction to the tools for analyzing modal sentences, but also a substantial exposure to large sets of data from many languages— within a very inclusive agenda that understands the categories and vocabulary of modality to apply also to evidentiality, imperative mood, and questions. We believe firmly that a unified (empirical and theoretical) vision is necessary if we want to achieve more accurate analyses of modality in human language and of how various phenomena connect with each other, and hope that researchers from diverse paradigms (semantics, syntax, typology, philosophy of language, pragmatics) will find this book useful and exciting.

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Abbreviations

ACC	accusative case
ADV	adverb
CONJ	conjectural marker
COND	conditional mood
CP	complementizer phrase
EV	evidential marker (or EVID), check for consistency
FOC	focus marker
FUT	future marker
GEN	genitive case
IND	indicative mood
IRR	irrealis
DET	determiner
IMPERF	imperfective aspect
ModalP	modality Phrase
MOD	modal expression
NON-PAST	non-past tense
NON-VIS	non-visual sensory evidential
OPT	optative
PERF	perfective aspect
POSS	possessor
PROG	progressive
PRT	particle
PRES	morphological present tense
PAST	past tense
PL	plural
SG	morphological singular
SUBJ	subjunctive mood
TOP	topic marker
TP	Tense Phrase
VP	Verb Phrase

List of Figures

1
Linguistic Modality

In this book, we examine what philosophers and semanticists call *modal* sentences. Such sentences contain linguistic expressions that do not describe what is, or is not, the case in the world, but rather describe ways in which the world could possibly, likely or probably be or could have been. The absence of truth entailment is the hallmark of modality; modal expressions are therefore indicators of nonveridicality, i.e., that the speaker who chooses to modalize is uncertain about whether the propositional content is true. In this chapter we offer a conceptual grounding of modality within the notions of truth, (non)verdiciality, epistemic commitment, and evidential bias— notions that end up being indispensable for a successful understanding of linguistic modality.

1.1 Modal sentences: a definition

We start with a small illustrative sample with sentences containing the well-known class of English modal auxiliaries:

(1) a. Ariadne *might* be at home now.
b. Ariadne is *likely* at home now.
c. Ariadne *should* be at home by now.
d. Ariadne *will* be at home soon.
e. Ariadne is *probably* be at home now.
f. Ariadne *must* be at home now.

Unlike simple episodic (i.e, non-generic) tensed sentences in the past or present– *Ariadne is at home now, Ariadne was at home at 5 pm*– modal sentences contain words that make us think of what is possible, likely or necessary (given a certain body of knowledge, or what follows from certain rules or ex-

pectations), and their interpretation requires a different approach than that of simple tensed sentences for which all we need to know is what is, or is not the case, in the world. Importantly, none of the sentences above entail that the prejacent sentence *Ariadne is at home now* is true, or that the speaker knows or believes that Ariadne is at home now. The absence of truth entailment is the hallmark of modality.

The study of modality has its roots in the Aristotelian logic. While simple tensed sentences are factually and epistemically settled— we can look at the world and establish whether the propositional content is actually true— modal sentences are not settled factually and this recognition is emphasized by Aristotle who offered a first systematic analysis of modal sentences precisely by acknowledging this difference. He writes:

(2) Since 'to apply' is not the same as 'necessarily to apply' or 'possibly to apply' (because there are many predicates which apply, but not necessarily; and others neither apply necessarily nor indeed apply at all, but it is possible that they should apply), it is clear that the syllogism also is different in each of these cases, and that the terms are not related in the same way, but that one type of syllogism is composed of apodeictic, another of assertoric [i.e, factual, clarification ours], and another of problematic [i.e, possible, clarification ours] premises. (*Prior Analytics* 29b, Translation By Hugh Treddenick)

In the Aristotelian system, the concepts of 'necessary' and 'possible' are general, just like affirming and negating; and the theory of modal sentences forms part of Aristotle's general theory of syllogisms developed in *Prior Analytics* and *On Interpretation*. Modal sentences provide arguments that do not rely on factual (which Aristotle calls 'apodeictic', that is, provable) premises. Modality affects the application of the predicate to the subject and thus, admittedly, the type of sentence (see also *On interpretation* 22a 12-15). In the more modern parlance of modal logic and linguistic theories of modality, the modal expression denotes a function F taking scope over the entire sentence S which denotes a (tensed) proposition p: $F(p)$. A modal function creates a complex sentence by embedding the propositional content π of p under possibility or necessity. By Aristotle, this embedding makes $F(p)$ non-factual.

The truth of modal sentences relies, therefore, on establishing conditions under which the sentential content could, would, should or must be true. We can therefore talk about the modal *mode*. In contrast to simple tensed sentences where truth is a matter of fact, in the modal mode truth is a matter of negotiation between a linguistic agent, i.e, the speaker who assesses the propo-

sitional content, and the content itself: it involves a rational quest to find out what the conditions for truth are. Per definition, since modal sentences are not factual, they are *nonveridical*. Nonveridical means that modal sentences convey, to varying degree, uncertainty about the propositional content. This has long been recognized in linguistic semantics, for instance in the form of Nonveridicality axiom for modal verbs propsed in (Giannakidou (1998); Giannakidou and Mari (2018b,a, 2021b,a); see also Beaver and Frazee (2016); Kratzer (1977, 1981), and Karttunen and Peters (1979) who called modal verbs, for this reason, 'weak'). The Nonveridicality Axiom has been proposed as a presupposition of linguistic modality, and it says that when a modal expression is used the speaker entertains two possibilities: p and its negation. We give here an informal characterization of the axiom:

(3) Nonveridicality Axiom for modality
A modal expression F presupposes that when uttering Fp the speaker does not know p, and considers p and $\neg p$ as open possibilities.

In other words, when a speaker chooses to modalize, the hearer is entitled to conclude that the speaker does not know for sure that the prejacent proposition p is true. The axiom provides the definition for what is a modal expression: it is an expression that reflects the speaker's uncertainty between p and its negation, her negotiating among the two options *given some evidence*. Even when a *must* sentence is uttered, the speaker is not certain about the truth of the prejacent (the embedded sentence)— she is, however, *biased* towards it which means, as we detail soon, that she has an inclination to think of the prejacent as a better possibility given the available evidence (Giannakidou and Mari, 2016b,a,c, 2021b,a). *Ariadne might be at home* and *Ariadne must be at home (for all I know)* reveal that the speaker is performing an inferential task, she assesses evidence and draws a conclusion. When a modal verb is used, the evidence is typically weak or perhaps not very reliable; but when a modal verb is used, the speaker has considerable and reliable evidence that supports Ariadne being at home now. The evidence, however, is partial, the speaker does not know all the facts, she knows Ariadne's going back home from school routine, but she doesn't actually know that Ariadne is at home. If she does know that, the speaker will chose to simply assert *Ariadne is at home now*; asserting a modal sentence would amount to saying something less than what she knows.

Nonveridicality is therefore a definitional property of modality, and has appeared is various forms by many authors, including Condoravdi (2002)'s diversity condition, the label 'non-factuality' in the typological literature (Kiefer,

1987, 1997; Narrog, 2005; Declerck, 2011), and in Karttunen (1971)'s assertion that modal sentences are 'weaker' than unmodalized assertions. In Giannakidou and Mari (2021b,a), we characterized modal expressions as *anti-knowledge* markers. Now, of course, it matters whether one reasons with possibility or necessity. Possibility modals express merely the speakers attitude of not excluding either option; necessity modals, on the other hand, convey a certain degree of certainty that the prejacent is likely to be true, as we said. How does the speaker negotiate which of the options— p or its negation— is more likely to be true? The assessment relies on what we called in Giannakidou and Mari (2016b,a,c, 2018b,a, 2021b,a) 'body of evidence', which is the epistemic basis for assessment.

The speaker has knowledge, perhaps sensory evidence, also general and stereotypical rules and expectations that allow them to judge the propositional content as probable or likely, and not merely possible. We will talk more about the nature of the information that is used for the veridicality judgment; dissecting it is key to understanding how modal sentences work— and how they differ from bare unmodalized sentences.

Work on linguistic modality has been quite diverse and from quite different perspectives: typological, descriptive, morphosyntactic and formal semantic. And because cross-linguistically modal expressions manifest themselves in wide variation, modality is often claimed to be a very broad category (a 'supercategory', according to (Nuyts, 2005, 2006), or an 'exceptionally complex' one (Abraham and Leiss, 2012)), in the sense that it encompasses a semantically diverse set of functions centered around the opposition between possibility and necessity (Van der Auwera and Plungian, 1988). While the variation is indeed real, the work done in the past fifty years has shown that it is also quite systematic, and indeed allows one to establish well understood patterns and make predictions given appropriate theorizing.

Our goal in this book is twofold: firstly, we want to familiarize the reader with the key features of the empirical landscape of modality and indeed in the broadest possible sense. This means that (a) we will investigate large sets of data with various modal expressions including non-assertions (imperatives, and questions) which also form nonveridical spaces, and (b) we will include various languages outside English exactly because we want to acknowledge the diversity of linguistic modality. Modal expressions belong to a range of grammatical categories such as modal auxiliaries, verbs, modal particles, mood morphemes, propositional attitude verbs, conditional sentences, and epistemic evidential markers. As the reader has already noticed, the Nonveridicality Axiom also successfully describes the knowledge state of the speaker when asking a question, as well as when making a request or expressing a desire when in

fact the speaker is biased towards a certain outcome. Non-assertive sentences such as imperatives and questions, therefore, fall under the modal umbrella too— while, in contrast to assertions, they lack truth conditions. We will see, crucially, that the operations that are central to the understanding of modal sentences are at work also in the question and the imperative.

Our second goal is to study how the relevant truth or satisfaction conditions are formed for modal sentences depending on what kinds of modalities we have. We want to familiarize the reader with the formal semantic tools necessary in order to study the rich patterns of modality in natural languages, and in so doing we want to build a bold synthetic framework for modal phenomena. While Aristotle's modal system does not employ the notion of a possible world, the concept became a standard tool for modeling modality in modern modal logic in a range of foundational works in the 1960s Carnap (1957); Von Wright (1951); Prior (1957); Kanger (1957); Hintikka (1962), Kripke (1963, 1973) and Lewis (1986), leading to the pioneering work of Angelika Kratzer in the 70s and 80s that proposed an explicit possible worlds analysis of linguistic modals— and which defined the contemporary formal semantic analysis of modality (for a history of the development of possible worlds, see Copeland (2002)).

The notion of a possible world can be traced back to Leibniz, according to whom the 'universe' (the actual world) was one— in fact, the best one— among an infinite number of possible worlds living in God's mind. Kripke and Lewis offer lucid discussions on the concept of a possible world: a possible world is a theoretical construct of a possibility, a way things could have been. Possible worlds, as Kripke emphasizes, do not make any ontological commitments, they are not physical alternatives to the actual world but only conceptual ones. There is an infinite number of ways things could have been and each of these ways represents a different possible world. We assume that humans have the cognitive capacity to imagine and reason with alternative states of affairs— and that this is in fact precisely what language users do when they assess truth with modal sentences. We will present and build on the existing possible world framework for linguistic modality in order to offer an analytical toolkit that can describe and derive the essential features of diverse kinds of linguistic modalities. We will not offer an introduction into formal modal logic or possible worlds semantics— Portner's excellent book does exactly that. In our recent book *Truth and Veridicality in Grammar and Thought* and in a subsequent article that year (Giannakidou and Mari (2021b,a)) we extended the Kratzerian model of modality and proposed a unified *subjective* analysis of propositional attitude verbs and modals as quantifiers over possible worlds anchored to individuals such as the speaker or the attitude holder, i.e. the subject of the

propositional attitude verb. Our emphasis in *Truth and Veridicality* has been on the empirical problem of mood choice — subjunctive versus indicative— in Greek, Italian and French, and we found that the properties of veridicality and nonveridicality capture correctly the choice: the indicative is the mood of knowledge and unqualified certainty and belief, while the subjunctive signals the presence of a nonveridical modal (possible world) space where both p and the possibility of $\neg p$ are entertained. Modal verbs are subjunctive selectors, and in languages that lack mood they are often used in lieu of subjunctive. We will not repeat the mood discussion here unless it is relevant (for instance in the discussion of evidentials in chapter 6 and in questions in chapter 8); instead we will zoom on modal expressions, and extend the empirical scope from verbs to adverbs and many other kinds of modal expressions including evidentials. We will also broaden the scope to include languages beyond the Indo-European domain which we were not able to do before.

We will pay attention to empirical detail, but will not insist on exhaustive typological data (see Nuyts and Van Der Auwera (2016) for papers describing the modal systems of diverse languages, as well as Aikhenvald (2018) for evidentials). We will try to capture as much variation as possible while offering concrete analyses that can have general application. We will formalize the ideas rigorously while also making sure that the tools we will present can be appreciated and used by readers who are not practitioners of formal semantics. We will make sure that we describe the meaning intuitions clearly in the prose so that the analyses can be understood even without following every formal detail.

This book, then, by bridging empirical complexity and breadth with formal analytical theorizing fills what we perceive to be a gap in the existing literature which compartmentalizes the various strands of the analysis and keeps them segregated— hindering, unfortunately, productive conversations and analytical advances. A unified (empirical and theoretical) and broad vision is necessary if we want to have a better and more accurate understanding of what modality in language is, what modal expressions mean, and how various phenomena connect with each other. We want to encourage a more synthetic approach to modality, and hope that researchers from different paradigms (semantics, syntax, typology, philosophy of language, pragmatics) will find this book useful in this direction. Our goal ultimately is to leave the reader confident in her understanding and ability to analyze modal expressions in language.

1.2 Truth, veridicality, and commitment

The study of modality has its roots in the Aristotelian logic, as noted earlier; since then, philosophers and linguistic semanticists have developed numerous theories of what modals are and do. In the formal semantic tradition, Kratzer (1977, 1981, 1991) in her seminal work was the first to develop a theory of linguistic modality the way we understand it today, by enriching the systems of modal logic stemming from Kripke (1963) and Lewis (1986)'s work with modal bases and ordering sources. (Hacquard, 2006; Portner, 2008; Von Fintel and Gillies, 2010) and (Giannakidou and Mari, 2021b,a) (along with many other works mentioned in the references) can be understood as further developments in the Kratzerian system by adding components such as one which is going to become crucial in the discussion is this book, namely the meta-evaluation function that captures the concept of bias we introduced earlier by ranking the likelihood of p with respect to its negation.

Before we delve into our specific studies of linguistic phenomena, we want to offer some thoughts about the concepts of truth and veridicality that are central to linguistic theorizing, and not just about modality.

1.2.1 The objective dimension: truth

Truth has been foundational in the study of linguistic meaning and has also been the foundation of axiomatization in scientific thought. Aristotle gives a well-known definition of truth in his *Metaphysics* (1011b25): "To say of what is that it is not, or of what is not that it is, is false, while to say of what is that it is, and of what is not that it is not, is true." Very similar formulations can be found in Plato (Cratylus 385b2, Sophist 263b). The Aristotelian truth serves as the foundation for the modern approach to truth—advocated by Russell, Moore, and Tarski in the early 20th century—known as the correspondence theory of truth. The semantics we do in linguistics today is *truth-conditional*.

Truth consists in a direct relation of a sentence to reality: the sentence *Snow is white* is true if and only if snow, in the world, is white. The assessment of the actual truth value of a sentence is a proof-like verification process based on empirical evidence: we observe, in the world, if snow is white. This well-motivated understanding is central to natural language semantics, and is associated with metaphysical realism that acknowledges truth and falsity as objective values of sentences.

Objective truth correlates with *fact* but also with *time*: simple positive present and past sentences such as *Ariadne arrived in Paris last night, Ariadne is eating breakfast right now*, are true or false objectively, which means that the

sentences, if true, denote facts of the world. Future sentences, on the other hand, such as *Ariadne will go to Paris next week* are objectively false at the time of utterance (since they have not happened yet), but could or must be true—depending on the strength of prediction—at a future time (see especially Giannakidou and Mari (2018b), a discussion that we will review later).

The foundational observation about modal sentences, since Aristotle, has been that they do not entail truth; they are therefore nonveridical. In important work since the late 90's, veridicality has been defined as the semantic property of linguistic expressions, thought generally as functions F, that are truth-bearing. An function F is veridical if it entails the truth of the propositional content under it. Following (Zwarts, 1995) and (Giannakidou, 1994, 1998, 1999, 2013a), a function F that takes a proposition p as its argument is veridical if Fp entails that p is true, and nonveridical if it doesn't:

(4) Veridicality: A function F is veridical iff Fp entails p.

(5) Nonveridicality: A function F is nonveridical iff Fp does not entail p.

Thus, a function F is veridical if it is truth entailing, and nonveridical if it is not truth entailing. Past and present tense and adverbials, for instance, denote veridical functions: *Yesterday/Two days ago, it rained in Chicago* entails that it rained in Chicago. Veridical sentences are factual— they describe facts of the world. When the truth of a sentence is presupposed and not merely entailed the sentence is called 'factive' (Kiparsky and Kiparsky, 1970), typically the complement of a verb of knowledge: *Bill knows that Mary is pregnant* presupposes that the sentence 'Mary is pregnant' is true, hence the verb *know* is both veridical and factive. Giannakidou (1998, 1999) refers to factivity as strong veridicality in order to capture that truth under a factive verb is not merely entailed but presupposed. Veridicality, overall, understood in reference to truth, is the formal counterpart of the traditional concept of *realis*. Labels such as 'veridicity' Karttunen and Zaenen (2005) and 'veracity' have also been used to refer to veridicality, and the term is used in psychology and cognitive science, somewhat more broadly, but still anchored to the real, external world. [1] Modal expressions, as we said, denote nonveridical functions: *It may be rain-*

[1] In cognitive science, for instance, 'veridicality' can refer to the degree to which an internal representation of the world accurately reflects the external world. In psychology, 'veridical perception' is the direct perception of stimuli as they exist. Veridicality has also been understood in relation to the existence of entities in the world (Montague, 1969). Montague characterized direct perception verbs such as *see* as veridical because *I see a unicorn* entails that a unicorn exists.Giannakidou (2013b) establishes a connection between truth and existence in her study of mood choice in relative clauses.

ing in Chicago and *It must be raining in Chicago* do not entail that it is raining in Chicago. Almost all analyses of modality assume that modal expressions as a class are nonveridical (Kratzer, 1977, 1986, 1991; Giannakidou, 1997, 1998, 1999, 2013b; Condoravdi, 2002; Portner, 2008; Beaver and Frazee, 2016; Giannakidou and Mari, 2016b,a,c, 2018a, 2021b,a; Lassiter, 2016; Von Fintel and Gillies, 2010; Mari, 2015a, 2016).

1.2.2 The subjective dimension: veridical judgment

When it comes to how linguistic agents— speakers and hearers— come to assess the truth of propositional content, the concept of truthfulness becomes relevant. Linguistic agents make assertions or ask questions or assess statements of others not by merely assigning the values true or false to sentences; rather, they form veridicality judgments, and these judgments, crucially, depend on what speakers know or believe to be true, on what kind of evidence they have, on expectations they may have, on how rational they are. The veridical judgment is therefore a complex process of truth assessment that contains also subjective dimensions (see in particular Giannakidou (1998, 1999, 2013b,a); Giannakidou and Mari (2016c, 2021b,a); Mari (2016). Saurí and Pustejovsky (2009); De Marneffe et al. (2012); Laurenti et al. (2022) confirm the complexity of the veridicality judgment the with corpus data.

In addition to the objective dimension of truth, then, speakers are engaged in the more complex task of assessing truthfulness of content, which we call in short the veridicality judgment. The formation of a veridicality judgment is relevant not just for modality; rather, it forms the basis for the satisfaction of co-operativity in the assertion of every sentence in a conversation. Paul Grice in his classic paper *Logic and Conversation* established Quality as one of the foundational principles of cooperative conversation:

(6) Maxim of Quality (Grice, 1975)
a. Do not say that which you know to be false.
b. Do not say that for which you lack adequate evidence.

Gricean Quality is proposed as a filter on co-operative assertion: co-operative speakers enter a conversation with the intent to avoid what they know to be false and what they lack evidence for. In other words, they must be, to their best of their knowledge, truthful. Without truthfulness there can be no real communication, and no sense of achieving a common goal in a conversation. Co-operativity, thus, puts commitment to truth at the center of linguistic interactions that involve informational exchange. We think it is important to note

that it follows from the nature of the human being as a political animal with *logos*, as emphasized in 's *Politics*: we have to assume that human beings by their nature are collaborative, working towards individual as well as common well-being— and this motivates rational behavior (see e.g. Tomasello (2014)). Rational cooperative interlocutors continuously make assumptions about each other's beliefs and intentions (Tomasello et al., 2005; Jacob, 1997).

Building on Grice's seminal work, in Giannakidou and Mari (2021b,a) we formulate the Veridicality Principle as the hallmark of co-operative assertion:

(7) Principle of Veridicality of co-operative assertion (Giannakidou and Mari, 2021a) : (2)
A sentence S is asserted co-operatively 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 (with reasons)* π to be true.

The speaker A is the epistemic authority on the content she asserts, and the authority comes from evidence which produces knowledge and what is called above believe-with-reasons. The Veridicality Principle is proposed as a sincerity condition on assertion, where interlocutors enter the exchange with the goal to communicate and not confuse or deceive each other.[2] It places veridical commitment at the foundation of what it means to co-operatively assert. By uttering the unmodalized sentence sentence *It is raining* the epistemic authority, i.e., the speaker, knows or has grounds to believe because of evidence that it is raining— and shares her knowledge or grounded belief with her audience, which in turn, by the Veridicality principle, acknowledges the speaker's intention to convey truthful content. [3]

When the speaker has knowledge of π, we say that she is veridically committed to π, e.g. the proposition *It is raining*. Veridical commitment in its strictest form is a reflection of knowledge:

(8) Veridical commitment as knowledge

[2] There are, of course, non-cooperative discourses such as advertising, propaganda, bullshit (Frankfurt, 2005), and of course lying. In all these cases the Veridicality Principle is violated or suspended (Meibauer (2019)'s handbook of lying for a collection of recent works). Importantly, non-cooperative discourses are not conversations but tend to be domains of public speaking, where the hearer is a collective, often dislocated audience, and the goal is to persuade or create an impression; see Boscaro et al. (2024) for how the goals of assertion are redefined in on-line discourses.

[3] In the pragmatics literature, similarly, a variety of norms for assertion have been proposed, including: the norm of belief (a speaker must believe in the asserted content see e.g. Davidson (1985); Vanderveken (1990); Lauer (2013); the knowledge norm account (a speaker must know the asserted content e.g Williamson (1996)), or the truth norm (asserting something is recognizing it as true e.g. Grice (1975); Dummett (1981); Wright (1994); Williams (2010).

> A linguistic agent *i* is veridically committed to a proposition *p* iff *i* knows *p*.

In this conception, veridical commitment to truth is a mental state akin to knowing. The speaker has reliable evidence— maybe form her own experience or from credible sources— that the sentence is true. Knowing is totalizing, i.e., if I know *p* I have no doubt, I am not considering it possible for *p* to not be true. This is a very natural way of understanding what it means to be veridically committed, and knowing is realistic and relies on fact.

Yet veridical commitment can also be subjective, arising through the formation of states such as belief, certainty, memory and similar attitudes (see for earlier work Giannakidou (1997, 1998, 1999) and more extensive discussion in Giannakidou and Mari (2021a)). Subjective commitment is veridical commitment even if the belief is objectively false. Consider:

(9) a. Ariadne believes that Milan is the capital of Italy.
b. Ariadne considers Milan to be the capital of Italy.

That Milan is the capital of Italy is objectively false, and the speaker can use this sentence to report Ariadne's false belief. Yet, if Ariadne has that belief, it has to be the case that she is committed to Milan being the capital of Italy. Here is the definition of subjective veridical commitment:

(10) Subjective veridical commitment
A linguistic agent *i* is subjectively committed to a proposition *p* iff *i* believes *p* to be true.

Belief creates veridical commitment as a subjective attitude towards truth; in most cases rational belief is grounded in evidence, and if false, it can be revised. When we assess truth, we typically use a mix of knowledge and rational belief (broadly understood to include perceptions, memory, certainty or even tastes). Veridical commitment purely grounded in belief is highly subjective, and in this case the assertion has weaker evidential force (see McCready (2015) for related discussion). We use the term veridical commitment to refer to this attitude of one's full and complete acceptance that a proposition content π is true.

In Greek and Italian, indicative mood is a reliable sign of veridical commitment (Mari, 2016; Giannakidou and Mari, 2021b,a). [4] In Giannakidou and

[4] The fact that indicative and not subjunctive is used to convey obviously false beliefs indicates that, despite what the speaker knows to be the case and what is objectively the case, when it comes to mood selection, for grammar the only thing that matters is Ariadne's subjectively veridical commitment regardless of relation to truth.

Mari (2021b), we discuss how veridical commitment is formed, and it became clear that our notion of veridical commitment is akin to an epistemic attitude of a linguistic agent towards propositional content that can be subject to grammatical constraints such as mood and tense. Veridical commitment entail knowledge or belief formation, and can even be solipsistic (see Mari (2016) for solipsistic belief with indicative mood) as in the cases of dream and imagination predicates where we lack completely factual grounding— such as *Ariadne dreamt that she was in Paris*. Dream and fiction predicates are by definition counterfactual, and commit the dreamer subjectively to the truth of the dream, while they also select the indicative mood in numerous languages. In the final chapter of this book, we will study the relation between veridical commitment and what we will call deontic authority— which is the authority of the speaker when issuing an directive, i.e., a request or an order or a rule that need to be followed.

Naturally, the term 'commitment' is broadly used in discussions of assertions and questions; the term has been used to convey additional nuances that we want to mention here. Krifka (2015) talks about commitment 'modelled as a set of propositions, containing the propositions that are publicly shared by the participants' [emphasis ours] (Krifka, 2015, 328-329) (see for the initial view, Szabolcsi (1982). Krifka's commitment corresponds to common ground assumptions, and the goal of speech acts is to 'change a commitment state'. Krifka's commitment is close to Farkas and Bruce's notion of *discourse* commitments (Farkas and Bruce, 2010) which are propositions 'publicly endorsed' by the conversation participants as true within a conversational context. It is clear that 'publicly endorsed' does not necessarily mean "known to be true", as endorsement can be done based on belief or some sort of agreement (see also Ducrot (1995); De Brabanter and Dendale (2008); Gunlogson (2008); Northrup (2014); Cornillie (2018); Geurts (2019a); Mari and Portner (2021); hence discourse commitments can be grounded either objectively (based on knowledge) or subjectively (based on belief), as we arguing. In our work, veridical commitment can also be an entirely private attitude of the speaker or the subject of an attitude verb (Giannakidou and Mari, 2016b,a,c, 2018b,a, 2021b,a), it is therefore understood independent of conversation as an attitude towards truth.

Condoravdi and Lauer (2012), on the other hand, talk about 'commitment to act': 'We take the basic effects of many kinds of utterances as being constituted by the commitments they engender for their speakers, constraining their future actions, linguistic and no linguistic. Commitments are always *commitments to act* in a certain way: keeping a commitment means making the right action choices. Action choices are determined by an agent's effective preferences to-

gether with his beliefs, and hence, a speaker can only be committed to beliefs and preferences: being committed to having a certain preference means being committed to choose one's action as if one really has this preference, and similarly for belief.' (Condoravdi and Lauer, 2012, 46). Veridical commitment is a distinct state from commitment to act, which is commitment to make a choice, or to take action to bring about a result. This commitment, we will argue, is highly idealized— and as we will see in chapter 7, in issuing a directive or making a deontic statement, the speaker cannot actually impose on the hearer that the imperative will be followed. In many cases it is not.

Additionally, for all these 'commitments', the level of application is the speech act, not propositional content. In our view, veridical commitment is formed even when one is not engaged in a conversation: veridical commitment happens when a linguistic agent is engaged with information unilaterally, when they read or listen to the news and form beliefs. Veridical commitment thus is what is produced by the epistemic/doxastic foundation of belief and knowledge formation. Engaging in a conversation is not a prerequisite for veridical commitment, as it is for discourse commitments and commitment to act.

When a linguistic agent chooses to modalize, she indicates an epistemic or doxastic state that lacks veridical commitment. The speaker now lacks adequate evidence and cannot form a belief or knowledge of p. She is, in other words, in a state of uncertainty. By entertaining p, the speaker has some indication that p is possible or plausible, she might even have evidence that p is probable or likely, but there is still uncertainty or awareness that not all key facts are there— and this prevents belief or knowledge formation. Modalization is thus the expression of taking a nonveridical stance, as we said in Giannakidou and Mari (2021b,a) towards a content. We characterized modal words as anti-knowledge markers, i.e., indicating that the speaker cannot commit veridically to the propositional content p, they have not formed the belief or knowledge of p. When the speaker does have knowledge of p, she cannot use a modal expression, as illustrated in the well-known cases below:

(11) Context: I am looking through the window and see that it is raining.

a. #It may be raining.
b. #Bori na vrexi.
   may that.SUBJ rain
c. #Può piovere.
   may.3SG rain
d. #It must be raining.
e. #Prepi na vrexi.
   must that.SUBJ rain

f. #Deve piovere.
Must.3SG rain

If I see the rain, I know that it is raining, and knowledge is veridical: if *I know p*, then *p* is true, it is a fact. If I see the rain, I evidence and can commit myself to the truth of the sentence *It is raining*. Modal auxiliaries, even necessity ones, are incompatible with the state of knowledge. In (Giannakidou and Mari, 2016b,a) , we used the continuation "but I am not entirely sure" as a diagnostic for the absence of knowledge or belief (in Italian, the observation is first found (Bertinetto, 1979; Mari, 2009a, 2010a; Giannakidou and Mari, 2013a). Consider:

(12) Deve essere a casa, ma non sono totalmente
must.PRES.3SG be at home, but not be.PRES.3SG entirely
sicuro.
sure
He must be home, but I am not entirely sure.

The use of a modal verb, in other words, weakens the veridical commitment, since now the linguistic anchor reasons with uncertainty which allows both options p and $\neg p$. In the case of possibility modals, the two options are, as we say, in nonveridical equilibrium, which is a 'balanced uncertainty' (Giannakidou, 2013b,a; Giannakidou and Mari, 2021b,a).

(13) Nonveridical equilibrium
p and its negation are open possibilities, and *there is no bias, i.e. the two options are considered equal possibilities.*

The key here is the equalitarian clause that the two options are considered equal possibilities; there are no prior beliefs or expectations or evidence that might turn the scales in favor of the positive or negative possibility. Nonveridical equilibrium characterizes also questions: *Did it rain yesterday?, I wonder whether it rained yesterday*. The question indicates a state of uncertainty that is similar to that of modals of possibility: the two possibilities (rain, not rain) are equal in terms of what the speaker believes or knows to be the case, and there is no ranking between them, no preference of the speaker.

Observe the contrast with the bare positive assertion and the knowledge predicate which do not accept the uncertainty continuation; note that certainty and belief predicates behave like knowledge:

(14) a. #He is at home but I am not entirely sure.
b. #I know that he is at home but I am not entirely sure.

c. #I am certain that he is at home but I am not entirely sure.
d. #I believe that he is at home but I am not entirely sure.

We reiterate that belief and certainty predicates equally convey veridical commitment, albeit subjectively, unlike knowledge which is also objectively veridical. In our recent book (Giannakidou and Mari, 2021b) we offer a detailed explicit semantics of knowledge, belief and certainty predicates, and we also talked about *partial* and *trivial commitment* (see also Giannakidou, 2013b,a): the commitment to a proposition is trivial with possibility modals since no possibility is excluded, and partial with necessity modals which are have evidential bias toward p. Veridicality and commitment thus are understood subjectively not as categorical but as gradable[5], conceptualized as forming a scale:

(15) Veridical commitment strength (Giannakidou, 1998, 1999, 2013b,a; Giannakidou and Mari, 2016b,a,c, 2021b,a)
   a. More committed < unmodalized p, MUST p, POSSIBLY p > less committed
   b. Veridical commitment >> *partial* commitment >> *trivial* commitment;
      >> stands for 'epistemically stronger than'

As expected with logical scalar structure, the higher elements entail the lower ones. We have also used the terms 'epistemic commitment' for veridical commitment, 'counter-commitment' for commitment to negation (which is veridical commitment too), and we have characterized nonveridicality broadly as expressing the state of 'weakened commitment'.

Finally, when we consider actual information conveyed, we observe the following:

(16) Veridical commitment and informativity: (Giannakidou and Mari, 2016b):
   >> means 'informationally stronger than'
   Nonmodalized p (speaker know/believes p, p added to the common ground) >>
   MUST p (speaker does not know p, but is biased toward p) >>
   POSSIBLY p (speaker does not know p, and there is nonveridical equilibrium)

At the discourse level, then, only the veridical fully committed assertion of a proposition p adds this proposition to the common ground as public knowledge. Introducing a modal element creates an informationally weaker sen-

[5] (Liu, 2019) uses the term 'elastic veridicality'.

tence. With a possibility modal, just as with a question, we simply don't know whether there is any evidence to support p; a possibility statement can be mere speculation or guess. Bias toward p, in turn, is informationally stronger than nonveridical equilibrium: there is now some evidence supporting p, thus p is considered a better possibility than its negation. But, in the end, only the bare sentence gives actual information about the world.

Let us now complete this basic outline of the conceptual framework by elaborating a bit more on the notion of modal bias.

1.3 Modal bias

Consider a bit more deeply the difference between possibility and necessity modals.

(17) a. Ariadne might be at the party.
b. Ariadne must be at the party.

In both cases, the speaker is uncertain about Ariadne being at the party, and leaves open the possibility that she might not be. The uncertainty is neutral— or in nonveridical equilibrium, as we just said— with possibility modals: the speaker considers Ariadne being at the party a mere possibility, and has no reason to believe Ariadne being in the party is a better description of what is the case than Ariadne not being at the party. As we will show in chapter 8, possibility modals are very much like information seeking questions (*Is Ariadne going to the party?*) in this regard: in both cases the speaker is in a state of true uncertainty and entertains equally two alternatives.[6] While questions lack truth conditions and are therefore distinct from modal assertions in their discourse function, it is important to understand that the common semantic core between polar (yes/no) information seeking questions and possibility statements is the neutral, unbiased nonveridical state.[7]

On the other hand, when a necessity modal is used, the nonveridical equilibrium is manipulated towards the content of the prejacent (positive or negative) being considered more likely by the speaker. The speaker now has some evidence that allows at least partial committed to the prejacent, in what we call later the Ideal worlds, i.e., the worlds best complying with evidence. We give below an intuitive understanding of bias (to be defined formally later):

[6] (see Liu et al., 2021) for recent discussion and experimental results.
[7] (Giannakidou, 2013b) coined the term *inquisitive assertion* in order to capture precisely the nonveridical semantic core of both modal assertions and questions.

(18) *Evidential bias of necessity modals*
A statement with a necessity modal is biased iff there is evidence that allows the speaker to consider p as a better possibility than $\neg p$.

Giannakidou and Mari coin the term *biased* modals for necessity modals as a class: the speaker is biased in favor of the prejacent proposition, though they still are not veridically committed to it by knowledge, belief, or certainty. Modal bias can be understood as reducing the uncertainty of equilibrium based on some evidence in favor of the prejacent proposition; the statement with a biased modal is therefore a stronger statement informationally than the statement with a possibility modal which seems to convey very little information. Biased modals have a strong inferential character and because they presuppose evidence they often correlate with the class of expressions known as evidentials cross-linguistically. We will discuss the interaction between epistemic modals and evidentials in chapter 6. Crucially, having evidence for the prejacent does not mean that the speaker is in a veridical state of knowing or believing p to be true: the speaker still does not know all the relevant facts or factors. The necessity modal is therefore biased towards the proposition, but it doesn't express veridical commitment to it.

In the theory we will outline in this book, the concept of modal bias will play a key role. Modal expressions in language remain indicators that the speaker reasons with uncertainty and that they leave both options, $p, \neg p$ open. Biased modals, in the epistemic version, rely on evidence that makes the speaker discriminate towards the prejacent. The modal bias is thus evidential in nature, and correlates with the quantificational force of the modal (possibility or necessity) while affecting the apparent strength of the modal statement. We will capture bias, following our earlier work, by means of a metaevaluation function O which we will take to always be present in a modal structure. In a context with strong evidence for the prejacent, O will produce bias; in a context with less, or less reliable evidence or mere speculation, O will establish no preference resulting in a more neutral inference.

With these foundational premises in mind, let us proceed now to outline what we will do in the book.

1.4 Roadmap

In chapter 2, we offer a detailed empirical overview of various modal expressions. Perhaps the most celebrated class of modal words is the one we introduced here of modal auxiliary verbs, often referred to as plain 'modals'. Other

well-known classes are modal adverbs, adjectives, and modal particles— including mood particles such as the subjunctive and the imperative. We will also discuss evidential markers, as these can also be understood as part of the modal landscape. Our goal in this chapter is to expose the reader, in a systematic manner, to the richness of the modality patterns observed in language.

In chapters 3, 4 and 5 we develop in three steps the formal semantic theory of modality as it has been advanced in several key pieces in the literature in the past 50 years. In chapter 3, we present the foundations of possible world semantics for modality, starting with developments in modern modal logic right onto the theory of Kratzer, Portner, and Giannakidou and Mari. Our main languages of illustration will be English, Greek and Italian. We will see that modal force comes in two varieties— possibility and necessity— and modals are existential or universal quantifiers restricted (via the modal bases) over possible worlds of a determined set. We focus on epistemic modality in this chapter.

There are languages outside the Indo-european family that appear to not lexicalize the difference between necessity and possibility and employ 'unitary' modals. In chapter 4, we discuss this type of meaning variation, along with other observable flexibilities which, we will argue, exist even in the more familiar languages such as Italian, Greek and English. We propose that the future modal in Italian and Greek is similarly unspecified, and illustrate that it shows a comparable flexibility to the unitary modal of Salish and Burmese. The concept of non-biased flexible necessity is applicable to other kinds of weaker necessity modals such as *should, ought*, the conditional mood, and similar items— which cross-linguistically often contain a future component.

In chapter 5, our goal is to complete the formal foundations of modality by offering an analysis of the interaction between modal elements and tense morphemes. This is necessary because there are observable patterns of constraints and interpretation that need to be systematized so that they can receive a principled explanation. On the syntactic tree, the modal element typically precedes the tense, and in (Giannakidou and Mari, 2021b,a) we illustrated that there is a three-way correlation between the higher modal element— including propositional attitude verbs— and the embedded tense or the mood exponent below it. In the present chapter, we articulate first explicit syntax-semantics compositions to illustrate how the temporal orientation is derived with embedded tense in Greek and Italian, and then study the interactions between modality and Aktionsart in more detail. We will also pay special attention to different types of future orientations, and the interaction between ability modals and tense as it is manifested in the so-called actuality entailment.

In chapter 6, we study the relation between evidential markers and modality. We revisit some of the core patterns we outlined in chapter 2 and study them

in the light of the modality theory that we have. Now that all the key pieces are explicit, we see that most of the core evidential patterns fall neatly under the category of epistemic modality. Our goal in this chapter is not to provide a full theory of evidentiality— which would present a daunting task that no-one has ever achieved— but to highlight the similarities between evidential markers and epistemic modals and show why the theory of epistemic modality is a useful tool for an insightful understanding of evidential markers. This chapter addresses data from many non-IndoEuropean languages.

In chapter 7, we focus on what we newly call 'directive' modality, which includes deontic, volitional and teleological modality, as well as imperatives. Directive modals as a class can be understood as relying on goals, desires, and rules that must be followed. We think of directive modality as concerning a general attitude of *compliance*: compliance to general rules and laws (God's law, national and international law, professional ethics, tribal custom, classroom etiquette and the like), or compliance to goals set by an individual (teleological modality)— which we call now the deontic authority— based on one's desires, expectations, and hopes. Compliance, we will argue, does not entail performativity, and while it can sometimes take the form of directive for action, the deontic modal remains nonveridical and does not entail action. This becomes particularly visible in the category of imperative which involves the same mechanisms (teleological or volitional modal base, meta-evaluation) with deontic modals, but it may or may not contain bias. The imperative mood, we will argue, is effectively the counterpart of the flexible necessity modal (realized by the future and unitary modals in chapter 4) in the realm of deontic modality.

In chapter 8, finally, we study the epistemic uncertainty that characterizes questions. While questions are different from modal statements in that they lack truth conditions— as they form speech acts that are not assertions— they do share with modal statements the nonveridical state of uncertainty: when one asks a polar question one is considering two options, p and its negation, just like with modal statements, in particular possibility ones. In addition, modal verbs and particles do occur in questions producing specific effects such as further epistemic weakening, which we call *reflection* and rhetorical bias. This chapter explores the similarities in the mechanisms involved in questions and modal assertions— specifically the use of meta-evaluation in producing bias in questions, and a new type of question that we call reflection and which indicates a state of enhanced inquisitiveness which we will call by the Greek word *aporia*.

Questions and further readings

Questions

- It is important to understand that the notion of veridical commitment we use in our work and in this book is epistemic in nature— where epistemic includes knowledge and belief broadly construed to include memories, perceptions and similar attitudes. Veridical commitment is, in our view, the attitude of being truthful and recognizing truthful intent. How do modal sentences differ from non-modal sentences in terms of veridical commitment? Do more subjective elements of belief affect the veridicality judgement, such as tastes aesthetic views, or ideologies?
- When we say that veridical commitment relies on evidence, what kind of evidence, do you think, is good enough to be trustworthy? What kind of evidence is not good enough? How do epistemic authorities make this judgment to trust evidence as reliable?
- The difference between possibility and necessity modals reveals the existence of evidential bias in the latter case. Evidential bias is primarily objective— what the speaker knows— but, like all bias, it can also be grounded in more subjective preferences and attitudes which tend to make us ignore irrelevant or wrong information. Presence of bias can also be detected in phenomena such as genericity (*Lemons are yellow* is true while strictly speaking there are also green or brown lemons), the imperfective paradox, and domain restriction with quantifiers. Can you explore the relation between these phenomena which involve bias based on stereotypicality and modal bias?

Further readings

Giannakidou and Mari (2021b) lay the foundation for a theory of veridicality and veridical commitment and how it is expressed in grammar. The discussion of mood choice with propositional attitude verbs crucially correlates with modality and provides a helpful domain if one wants to understand the extent to which the veridical-nonveridical distinction is encoded in the grammatical systems of languages. In the paper *A Linguistic framework for knowledge, belief, and veridicality judgment* we offer a detailed discussion of the factors determining the veridicality judgment, and it is argued that there are mainly two components in forming it: an informational component that is factual, rational and exogenous, and a preferential (or, as we call it, 'emotive') component that includes subjective preferences, non-rational beliefs, biases and tastes. This is a topic that we revisit in chapter 3, where we give also more philosophical references on the topic.

2

The landscape of modality

With a definition of modality at hand and some foundational concepts introduced in the previous chapter, we are now ready to present and discuss various classes of modality expressions so that we get familiarized empirically with the category 'modal'. What kinds of modal expressions are there? Perhaps the most celebrated class is the one we introduced in chapter 1 of modal auxiliary verbs, often referred to as plain 'modals'. Other well known classes are modal adverbs, adjectives, and modal particles— including mood particles such as the subjunctive and the imperative. We will add in this chapter evidential markers, as these can also be understood as part of the modal landscape. We proceed to illustrate each category in some more detail revealing the major empirical patterns and the questions they raise for the linguistic theory of modality.

2.1 Modal verbs: quantificational force and modal quality

There are some well known taxonomies of linguistic modality such as the one by Portner which distinguishes between sentential, subsentential and discourse modality (Portner, 2008). Sentential modality is, according to Portner, the expression of modal meaning at the level of the whole sentence, and this includes the traditional "core" modal expressions: modal auxiliaries and sentential adverbs like *maybe*" (Portner, 2008). Subsentential modality is "the expression of modal meaning within subconstituents smaller than a full clause, for example within the predicate (e.g., by verbs) or modifying a noun phrase (e.g. by adjectives)" (Portner, 2008, :3). That would include cases like *alleged murderer, potential candidate*.[1] Discourse modality, in turn, is according to Portner "any

[1] Indeed, at the noun phrase level modality seems to be more localized, but it is conceivable to argue that the local modal structure which is predicative can be understood as propositional: an alleged murderer is*a man who is possible a murderer*.

contribution to meaning in discourse which cannot be accounted for in terms of a traditional semantic framework", i.e., any modal meaning that is not part of the sentential truth conditions. Imperatives and questions would fall in this category.

While we agree with the syntactic aspects of this taxonomy, it seems to us that all modal words operate at the sentential level in some way or other, and at the utterance level we may invoke additional structure, as we did in Giannakidou and Mari (2021b,a), and will also do in the last two chapters of this book. We think it is helpful to view modal expressions as a class that creates a modal 'mode', as we said at the beginning in the spirit of the Aristotelian framing.

Another much discussed distinction is that between epistemic and so-called root modals (see also Hoffmann, 1966; Hacquard, 2006). The label 'root' modals typically applies to ability and deontic modals which appear to be closer to propositional attitude verbs in term of being actual verbs and not auxiliaries, interacting also with tense and having a subject that tends to be agentive (*Ariadne can sing pretty well, Flavio is able to sail across the English channel*).It has been observed that epistemic modals tend to be speaker-oriented, but so called root modals are subject-oriented (Bybee and Pagliuca, 1994), and we will come back to this distinction in chapter 8. In chapter 4 we will discuss the interaction of ability modals with tense. Overall, we think the label 'root' modals doesn't offer enough descriptive specificity; rather, it groups together words that do not have the same semantic function. Ability and obligation are not the same thing, hence root modals do not form a semantic natural class the way epistemic modals do, we therefore find it more helpful to use the respective specific labels such as deontic, directive, ability, and the like.

2.1.1 English modal auxiliaries

English modal auxiliaries are well known to have certain syntactic properties that set them apart from regular verbs; one such property is, for example, the absence of inflection (*he must/*musts*) and tense: **he musted*.

Some modals do appear in the past tense (*could/should/might, ought*) but the past is not contentful:

(1) a. Ariadne *might* be at home right now.
b. Ariadne *should* be at home right now.
c. Ariadne *could* text me the results tomorrow.
d. You *ought* to take Lake Shore drive if you want to go to the Chicago loop.

In these cases, the prejacent refers to possible events at present or in the future, not in the semantic past. Modal auxiliaries in other languages do have contentful pasts, e.g. in French, and we have more to say about the modality and tense interaction in chapter 5. We note here that in some cases the use of past correlates with 'weaker' modality, for instance we understand *should* to be a weaker obligation that *Must*, or as Kratzer (1991) calls it, a weaker necessity. We will discuss later in the book what 'weaker' necessity is.

English and German modals (discussed by Kratzer) are famous for being ambiguous in the following way:

(2) a. Ariadne *might* be at home now.
b. Ariadne *may* be at home by now.
c. Ariadne *will* be at home soon.
d. Murderers *should/must* go to jail.
e. We *may* proceed now with the meeting.

In the first two sentences, the interpretation of the modal is epistemic, i.e, it makes us think of what can be known. In (2-c) sentence we have future modality, and in the last two deontic modality which has to do with rules, obligations, and permissions. Kratzer, in her seminal work, studied this apparent ambiguity of modals, and established that natural language modals come in modal 'flavors' and vary along (at least) two dimensions: in terms of quantification force, i.e., whether they express possibility or necessity, but also in terms of what we will call here the modal *quality*. The modal quality (or, flavor as it is sometimes called) can be epistemic, deontic (including what we call in chapter 8 directive modality) or circumstantial. Epistemic modality (from Greek *epistéme* 'knowledge' expresses possibility and necessity that rely on what is known or believed by the speaker or a community, often based on what the available evidence is. The quality of deontic modality (from Greek *déon* 'obligation' characterizes possibility and necessity given a body of laws and rules, permissions and goals. For example, the same English sentence below can illustrate epistemic or deontic quality depending on the context:

(3) a. Roberto must have three children in order to be eligible for this benefit. (deontic)
b. Roberto must have three children, for all I know. (epistemic)

The material in the parenthesis clarifies what kind of criteria are used to determine the quality of the modal *must*– epistemic, having to do with knowledge, belief, evidence, or deontic having to do with goals. Kratzer calls these criteria the *modal base* as we shall see, and the modal base is thought of as a restriction

on the kinds of possible worlds the modal quantifiers over: worlds compatible with knowledge or belief in the epistemic interpretation, or worlds where certain rules or regulations or goals hold in the case of deontic modality, or purely circumstantial worlds (in which case we talk about circumstantial modality). The modal base is typically implicit, but crucially, embedded tense affects the quality of the modal: a past tense only allows epistemic interpretation:

(4) Roberto must have hidden the camera.

This sentence in the past cannot have an obligation reading. Obligations, as well as goals, desires and the like are typically future oriented and rely on the modal complement having a non-past tense (Giannakidou, 2009; Giannakidou and Mari, 2021b,a, and references therin). We will have much to say on these later in the book.

Portner also distinguishes qualities such as bouletic or teleological (called *priority* or *dynamic* modality) as in the cases below:

(5) To get to my house, you must take the ferry. (Portner, 2008) (teleological)

(6) If you want to pass the exam you must study hard (bouletic).

Here the criteria for *must* are a specific goal (to get to the speaker's house) and a desire (the addressee wanting to pass the exam), and we have future orientation. While one can view specific goals and desires as distinct from obligations, it is possible to treat these as a unified class— which we will call 'directive' modality in chapter 8. Directive modality involves some degree of expected compliance and the speaker in this case acts as the deontic *source*.

Ability modality, typically appearing in English with *can, be able to*, appears to be truly distinguished from epistemic and directive modality:

(7) a. Ariadne can solve this problem.
b. Ariadne is able to solve this problem.
c. Ariadne is capable of solving this problem.

Portner (2008, :135) characterizes ability as dynamic modality and considers it a subcase of bouletic modality— thereby distinguishing ability from epistemic or deontic modality. Ability verbs tell us that the subject has the ability to do something, i.e., that if the subject tried to do what the complement sentence says, she would succeed (Thomason, 2005; Mari and Martin, 2007) and more recently (Giannakidou and Staraki, 2013; Giannakidou and Mari, 2021b,a). The subject of the ability modal is typically agentive (see also Hackl, 1998),

in contrast with the subjects of epistemic or deontic modalities. Ability itself is a disposition or precondition for action, though a mere disposition: in the sentences above, Ariadne's ability to solve this problem does not entail that she does, or did solve the problem. Pure ability is thus nonveridical like all modals, and does not entail actual truth of the complement clause. Ability, however, does interact with tense; when in the scope of a past tense the ability modal gives rise to a veridical entailment of actuality [see discussion in (Giannakidou and Mari, 2021b), also chapter 4 here for more details.

Because of their observed flexibility, modal auxiliaries appear to be ambiguous or underspecified. In her pivotal work on German and English modals, Kratzer (1981) posited the concept of the *modal base* as an argument of the modal verb that is responsible for the quality of the modality: an epistemic modal base produces epistemic modality, a deontic modal base is responsible for deontic quality, and so forth. We will discuss Kratzer's theory in chapter 3. Here it is important to note that this systematic underspecification of modal verbs is characteristic of the class cross-linguistically (Fleischman, 1982; Bybee and Pagliuca, 1994; Palmer, 2001; Traugott, 1988). At the same time, while indeed many modals are flexible in modal quality not of all them are: *might*, for instance, is known to only have epistemic quality, and likewise *have to* tends to prefer deontic interpretations. We will observe similar constraints in other modal categories later.

Overall, the key observation is that modal auxiliaries differ in modal force and quality, many are flexible in their quality association— and often, as we observed, there are predictable ways to understand the variation by observing modal and tense interactions: past tense under a modal correlates with epistemic modality, and deontic modality tends to come with a non-past tense below it. Indeed one can generalize that deontic, bouletic and teleological modality come with future orientation— while epistemic modality associates with all tenses. These tense- modality correlations were shown to hold with tense under propositional attitude verbs in (Giannakidou and Mari, 2021b), and we will discuss them further in this book.

2.1.2 The inferential nature of epistemic MUST

The discussion of modals cannot be complete without mentioning the possible evidential character of the necessity modal *must* and its equivalents. [2] As we noted in chapter 1, the MUST type of modal is biased: while nonveridical—

[2] Following standard practice, we will be using in this book upper case (in this case MUST) to designate the family of meanings cross-linguistically; italics refer to specific words.

which means that the speaker does not know or believe the prejacent proposition to be true—, the choice of a MUST expression signifies that the speaker favors the prejacent proposition as a better possibility than its negation. This favoring relies on indications and evidence for *p*, which can be weaker or stronger. Karttunen (1972) held that *must* signifies that the speaker has *indirect* evidence about the prejacent proposition thus ascribing to the modal an evidential component. The motivating data, famously, is that direct visual perception blocks *must*:

(8) *Context: i is standing in front of the window and sees the rain*

a. #It must be raining.
b. #It may be raining.

Must is thus claimed to be 'weak' because it is compatible only with indirect evidence, and this observation has been extended to cross-linguistic MUST expressions. Von Fintel and Gillies (2010, :361) challenge Kartunnen: 'Weakness and indirectness are not two sides of a single coin at all. They are just different'.

Giannakidou and Mari (2016c) agree: weakness has to do with the fact that the MUST modal, like all modals, is non-veridical, hence incompatible with knowledge, but if I see the rain I know it is raining. Possibility and necessity modals are both infelicitous because both are incompatible with the state of knowledge, which is what unhindered visual observation produces. Yet, unlike with possibility, we argued that by choosing the necessity modal the speaker indicates that she is making an inference that it is more likely that it is raining. In other words, what appears as sensitivity to 'indirect' evidence is in fact proof that the MUST modal is incompatible with knowledge. Giannakidou and Mari (2016c, 2021b,a) offer several arguments showing that the concept of indirectness for epistemic MUST modals is best understood as 'not knowing p but inferring that *p* is likely based on reliable premises'. We summarize here some of that discussion.

Consider, first, the contrast between the veridical context where I see the rain, and the following case (9), where I only see a wet umbrella. We include here MUST words from Greek and Italian, including the so-called epistemic future (FUT) that we will soon talk about:

(9) Context: I am in a room and my friend Zoe comes in holding an umbrella that looks wet.

a. It must be raining.
b. Tha/Prepi na vrexi. (Greek)
FUT/Must that.SUBJ rain

c. Deve star piovendo. (Italian)
must be raining
d. Pioverà.
rain.FUT.3SG
e. Deve star piovendo, ma non sono sicura
It must be raining, but I am not sure.
f. Deve probabilmente star piovendo.
It must probably be raining.

Now I see a wet umbrella, but I don't see the rain, therefore I do not *know* that it is raining; but I can infer that it does from the partial premise that the umbrella is wet. Continuation with 'I am not sure' is allowed here, as we see.

Auditory perception is also compatible with MUST, but hearing is as 'direct' as seeing:

(10) Context: I am in a room with no windows, but I hear sounds of what could be rain on the roof.
a. It must be raining.
b. Tha vrexi.
FUT rain
c. Pioverà.
rain.FUT.3SG
d. Prepi na vrexi.
must that.SUBJ rain

If I only hear something that sounds like rain, I do not know that 'it is raining', I only have the sound of something that could be rain. The auditory perception only allows a partial inference. The stimulus is direct, but it does not entail knowledge; what I hear might be caused by something other than the rain. Auditory perception is nonveridical (as we will discuss further in chapter 6), while visual perception, if unhindered, is veridical; it is worth recalling that the first discussions of veridicality in linguistics come from Montague (1969)'s analysis the verb *see* as veridical. Overall, perceptions can of course be deceiving, and just because it *looks like* or *sounds like* it is raining it doesn't follow that it does. Semblance verbs— as will be shown in chapter 6— can be construed also as nonveridical.

Now consider the case where I see, but my vision is hindered. In this case, I can use MUST:

(11) Context: I am looking through the window, and it is foggy and dark. I don't fully trust what I am seeing:

a. Prepi na vrexi. (Greek MUST)
must that.SUBJ rain.3SG
It must be raining.
b. Tha vrexi. (Greek, epistemic future)
future rain.3SG
It must be raining.

Here the existence of obstacles blocks veridical commitment, thus the inference that it is raining. Clearly then, MUST is sensitive to the source of information and evidence, and it is inferential in character. It does not, however, depend on direct perception, but on how reliable I take the sensory information to be in establishing knowledge. If my vision is unclear and it's foggy, I do not trust my senses fully as a source for knowledge, I am therefore not veridically committed to 'It is raining' and I can use epistemic MUST.

As an additional argument, consider the following case, reproducing an example from Smirnova (2013) which we have discussed in Giannakidou and Mari (2016c) Here we see a contrast between MUST and the Bulgarian indirect evidential which is fine in the reportative context.

(12) Reportative context: you and your sister were out of touch for a couple of years. Today she calls you on the phone to catch up. She tells you that her daughter Maria plays the piano. Later, you tell your husband:

a. Maria svirela na piano. (Bulgarian)
Maria play.EV on piano (Smirnova, 2013, :3)
b. #I Maria prepi na pezi piano. (Greek)
c. #Maria deve suonare il piano. (Italian)
d. #Mary must play the piano.

MUST is blocked here because the speaker has knowledge of *p* provided by her sister's utterance. Most of the knowledge we acquire, in fact, comes from hearing and reading sources that we trust. If the speaker trusts the source of the report *Maria plays the piano*, i.e. her sister, and has no reason to doubt her, then upon hearing the information that Maria plays the piano, the speaker knows that Maria plays the piano. MUST words are ruled out, while the indirect evidential is not. This example, therefore, clearly shows that it is not indirect evidence that matters for epistemic necessity; if one has knowledge of *p*, even if this knowledge is indirect, one cannot use a modal.

In Giannakidou and Mari (2016c), we summarized the evidential component of MUST as follows:

(13) *Evidential component of Universal Epistemic Modals* (UEMs)

a. UEMs can only effectively weaken a proposition *p*, if the speaker's knowledge that supports *p* is not complete.
b. Complete knowledge is knowledge of all the relevant facts for *p*. More technically, it is a set of propositions that *entails p*.
c. All other knowledge is partial.

MUST is therefore inferential because it reasons with partial knowledge. We will revisit these ideas again in chapter 6 where we show that many so-called evidential markers in the world's languages have the inferential, partial knowledge character of MUST.

It is indeed possible to show that the same evidence can lead to two different types of statements — bare veridical assertion indicating knowledge, or universal modal statement— depending on the epistemic state of the speaker. Consider a context where I am preparing dinner, and ask my son to switch off the oven when the alarm rings. I know that what is in the oven is all we will eat, but my son doesn't:

(14) Context: the oven alarm rings.
Mom: The dinner is ready.
Son: The dinner must be ready.

Since my son does not know what his mom has in mind, it would be infelicitous for him to utter 'The dinner is ready'. The bare assertion is instead felicitous when uttered by the mom, as she has the dinner plan in mind. Here, direct evidence does not block MUST: the MUST sentence, uttered by the son, is felicitous because his knowledge state is that of only partial knowledge. Note that here the son has direct evidence (the alarm ringing), but he is still in an inferential state, which is compatible with direct evidence, as in the case of the foggy window.

Reversely, as indicated in the earlier reported conversation example, the indirectness does not always trigger MUST. We will use again an example modeled after Smirnova (2013). You and your sister Maria were out of touch for a couple of years. Today you visit her for the first time. As she shows you around her apartment, you see that there is a piano. Later, you tell your husband:

(15) a. I Maria tha pezi/prepi na pezi piano.
the Maria FUT play/must that.SUBJ play piano
b. Maria deve suonare il piano.
Maria must play the piano
c. Maria must play the piano.

Here we have a piano, but we don't actually see Maria playing it, and there is no report that she does. Another way to state this is that MUST relies on an inference *ad peiorem* where several conclusions are possible, only some but not all supporting *p*.

The generalizations that we establish for MUST are very relevant for the discussion of evidentiality. The 'direct' evidential is typically an unmarked past or present, and the marked form is the so-called indirect evidential, which indicates that the source of information is not first hand knowledge of the speaker. The indirect evidential— like MUST in English, Greek and Italian— is a non-veridical marker that marks the reduced commitment of the speaker to *p*. Direct perception and reliable reports, on the other hand, as we discussed, entail full knowledge, and veridical commitment.

Let us proceed now with looking in more detail at modal verbs in other languages. We start with Greek.

2.1.3 Greek modal verbs

Greek has two modal verbs— a possibility modal *bori*, and a necessity modal *prepi*. Staraki (2013, 2017) and Giannakidou and Mari (2021b,a) offer extensive discussions on the Greek modal system including interactions with tenses (see also Giannakidou, 2012; Giannakidou and Mari, 2016c, 2018a, for earlier work). These forms are third person impersonal forms and behave unlike regular verb forms in Greek that are inflected for tense, person and aspect. We will argue later that there is a third lexicalization, consisting in the combination of the future particle *tha* and the past of the necessity modal *tha eprepe* which is equivalent semantically to the so-called weak necessity English modal *should*. All modals require the subjunctive:

(16) Prepi na/*oti vrehi.
must that.SUBJ/*IND rain.PRES.3SG
It must be raining.

(17) Bori na/*oti vrehi.
may that.SUBJ/*IND rain.PRES.3SG
It may be raining.

(18) Bori na/*oti vreksi.
may that.SUBJ/*IND rain.NON-PAST.3SG
It may rain.

(19) Prepi na vreksi.
may that.SUBJ rain.NON-PAST.3SG
It may be raining.

(20) Prepi na/*oti evrekse.
must that.SUBJ/*IND rain.PAST.3SG
It must have rained.

(21) Bori na/*oti evrekse.
may that.SUBJ/*IND rain.PAST.3SG
It may have rained.

Greek only allows finite complements in embedding structures, it thus enables us to see clearly that the modal is a sentence embedding function. In the discussion later of Italian and French, we will treat the subjunctive and infinitive as equivalent. In the examples above we find the two varieties we observe in English: possibility and necessity modals. All modal sentences are nonveridical: in all cases, the sentential complement denotes a proposition in the scope of the modal whose truth is not entailed by the entire modal sentence. This is the hallmark of modality as we noted.

Greek also employs, in more formal registers, a possibility verb *endehete* (from Ancient Greek *endehetai, endehomenon* 'possibility') which expresses epistemic possibility:

(22) Endehete na vreksi.
might that.SUBJ rain.NON-PAST.3SG
It may rain.

(23) Endehetai na evrekse.
might that.SUBJ rain.PAST.3SG
It may have rained.

Endehete seems to be just like English *might*, i.e., it an exclusively epistemic possibility modal. We see below that the verb *boris*' 'can.2SG' which is the personal form of *bori* 'can' receives a deontic interpretation only, but *endexete* only epistemic:

(24) Endehete/boris na fygis tora.
can.2sg that.SUBJ leave.NON-PAST.2sg now
You might leave now. (*endexete*)
You may leave now (*boris*)

It is worth iterating that the deontic reading of possibility which designates permission, arises only in the inflected form of the verb *boro*. We can see here that the impersonal form *bori* is epistemic only. The personal *boro* is, in addition, the ability modal:

(25) Bori/boris na figis tora.
can.3SG/can.2SG that.SUBJ leave.NON-PAST.2sg now
You might leave now. (*bori*)
You are allowed leave now (*boris*)

(26) Bori/boris na figis tora.
can.3SG/can.2SG that.SUBJ leave.NON-PAST.2SG now
You might leave now. (*bori*)
You are allowed leave now. (*boris*)

(27) Ta paidia bori/boroun na odhigisoun.
the children can.3SG/can.3PL that.SUBJ drive.NON-PAST.2SG
The children might drive. (*bori*)
The children have the ability to drive. (*boroun*)

Since *bori* and *prepi* are third person invariant for forms, one could view them as distinct lexical items; and *bori* does not accept past morphology in the epistemic reading— *boruse* past.3SG only has permission or ability reading. The personal, varying form of *prepi, prepo* is possible only in high registers, and does not have a modal meaning but means something like 'deserve' as *Sou prepoun times* 'You deserve honors'. In Greek then, the option of impersonal (third person, invariant) versus personal modal forms appears to lexicalize the epistemic versus non-epistemic distinction. One can argue, then, that in Greek the following modal verbs are distinguished:

(28) a. Epistemic possiblity: third person invariant *bori, endehete*
b. Deontic possibility: personal *boro*
c. Ability: personal *boro*
d. Epistemic necessity: *prepi*
e. Deontic necessity: *prepi*

In Greek, as can be seen in our earlier examples, we find strong correlations between the tense and modality (an observation that holds also for propositional attitude verbs). There are three possibilities for the embedded tense: present, in which case the modality is epistemic, non-past in which case the modality is future oriented and could be epistemic as we argued in Giannakidou and Mari (2018b,a, 2021b,a) or *deontic*, and past where the modality is epistemic in agreement with what we observed for English. Epistemic readings arise in combinations with all tenses [3]

[3] While in Standard Modern Greek, *na* clauses can have temporal independence, some dialects (specifically Griko) is said to feature only non-past. Lekakou and Quer (2016) take this to suggest that there is specialization of morphology in Griko for the marking of subjunctive on the verb. We will not explore the dialects of Greek here.

The non-past form creates a prediction or an interpretation as a deontic statement:

(29) Prepi na vreksi avrio.
must that.SUBJ rain.NON-PAST.3SG tomorrow
For all I know, it must rain tomorrow.
Given what is needed, it has to rain tomorrow.

Deontic readings arise only with the form non-past. Hence we have a dependency of deontic modality to this temporal form—a dependency that doesn't exist for epistemic modals. These correlations were found to be crucial also with propositional attitude verbs (see Giannakidou and Mari (2021b) for discussion). As can be seen in the examples above, both modal verbs require the subjunctive, but, in addition, the epistemic reading is compatible with all tenses. The type of modality doesn't seem to matter for mood choice: it is all subjunctive, which is the mood selected by nonveridical verbs, i.e, modals volitional, directive, ordering, and similar predicates:

(30) Thelo na fas olo to fagito sou!
want that.SUBJ eat.NON-PAST.2SG all the food yours
I want you to eat all your food! (Mother to her child)

(31) Prospathise na apandisis tris erotisis.
try.2SG that.SUBJ answer.NON-PAST.2sg three questions
Try to answer three questions.

(32) Me dietakse na kliso tin porta.
me ordered.3SG that.SUBJ close.NON-PAST.1sg the door
She ordered me to close the door.

We see a clear pattern of future orientation with non-past, volitional propositional attitudes, and the subjunctive. Just as with modals, these verbs also disallow veridical inferencing: none of them entails the truth of their complement. Importantly, the imperative, we will argue, belongs to this pattern too, and we will offer more discussion in our chapter on deontic modality.

We give below more details from Romance languages, French, Italian and Spanish modal verbs where similar observations can be made. In Greek, just like in Romance languages, there is no future modal. In Greek, the future is a particle (to be discussed soon) and in Romance a morphological tense.

2.1.4 Modal verbs in Italian and French

Romance languages, including French and Italian have two modal auxiliaries *pouvoir/potere* (*can/might*) and *devoir/dovere* (*must*). The very extensive literature has disentangled and analyzed in detail the several nuances, uses, and the semantic underpinnings of these auxiliaries in a very large variety of frameworks (see Kronning, 1996; Giorgi and Pianesi, 1997; Squartini, 2004; Hacquard, 2006; Gosselin, 2010; Barbet and De Saussure, 2012; Laca, 2012; De Saussure, 2012; Rocci, 2012; Mari, 2015b, to mention just a few works which are only partially representative of the very lively discussion).

The two modal auxiliaries convey possibility *pouvoir/potere* and necessity *devoir/dovere*, but, in context, they feature the variety of readings observed for other Indo-European languages, including Greek discussed here above, which divide into two main notional groups: epistemic and deontic (at large, including goal-oriented modality, as we discuss in chapter 3).

(33) a. Epistemic possibility: *potere/pouvoir*
b. Deontic possibility: personal *potere/pouvoir*
c. Ability: personal *potere/pouvoir*
d. Epistemic necessity: *dovere/devoir*
e. Deontic necessity: *dovere/devoir*

The divide between the epistemic and the deontic realm is strongly correlated with embedded aktionsart. Epistemic reading arises with embedded statives (34-a)-(35-a) and past (34-b)-(35-b), while deontic reading arises with embedded eventives (37). This is a pervasive phenomenon that we discuss at length in chapter 5.

(34) a. Giacomo deve/può essere stanco. (epistemic)
Giacomo must/can be tired
Giacomo must/might be tired.
b. Giacomo deve/può aver preso un bel voto. (epistemic)
Giacomo must/might have gotten a good grade
Giacomo must/might have gotten a good grade.

(35) a. Giacomo doit/peut être fatigué. (epistemic)
Giacomo must/can be tired
Giacomo must/might be tired.
b. Giacomo doit/peut avoir eu une belle note. (epistemic)
Giacomo must/might have gotten a good grade
Giacomo must/might have gotten a good grade.

(36) Flavio deve/può andare a navigare ora.
Flavio must/can go to sail now
Flavio must/can go sailing now.

(37) Flavio doit/peut aller naviguer maintenant.
Flavio must/can go sail now
Flavio must/can go sailing now.

In Italian, the category of future has also been treated as a modal one since Bertinetto (1979). [4] (Mari, 2009a) further shows that a temporal reading arises when FUT combines with eventives (38) and an epistemic reading when combined with statives (Mari, 2009a, 2010a,b; Giannakidou and Mari, 2016b,a,c, 2018b,a) (39). As we will show, both readings are reducible to an epistemic meaning. The so-called temporal use coveys indeed a prediction, which is inherently an epistemic object, an estimation, as we see below:

(38) La regata finirà alle 17h00. (prediction)
The regatta end.FUT.3SG at-the 5pm
The regatta will end at 5pm.

(39) I tuoi occhiali saranno in camera. (epistemic)
the your glasses be.FUT.3PL in room
Your glasses must/might be in the room.

While there is strong stability with respect to modal auxiliaries, languages within the Romance family diverge as far as the status of future is concerned. Spanish features an epistemic future (Rosique, 2015; Rodríguez Rosique, 2019; Rivero and Arregui, 2018; Mihoc et al., 2019; Escandell-Vidal, 2021), while French does not (De Saussure and Morency, 2012; Mari, 2015b). The French example is due to de Saussure and Morency:

(40) Talking about the possible shape of the universe:
a. será esférico. (Spanish)
be.FUT.3SG spherical
b. #Il sera sphérique. (French)
it be.FUT.3SG spherical

[4] We return later to this discussion addressing whether Italian future also has an evidential component. The evidentiality camp inlcudes Squartini (2012); Mari (2010a); Ippolito and Farkas (2021) who argue for a subjective evidential analysis akin to the Tibetan evidential *origo* Garrett (2001). Several arguments have been convincingly raised against this position (see Mari (2021) for discussion). According to some other authors, and most notably Frana and Menéndez-Benito (2019a), the future is an inferential evidential with semantics akin to epistemic modality, as we have been suggesting.

All these modals are nonveridical, none of them entails truth of the prejacent proposition *p*. When it comes to ability modals, a clear pattern about Romance languages is that, when the modal is in the perfect, the sentence gives rise to a veridical inference entialing the truth of *p*. This phenomenon had been first observed by Bhatt (1999) for Hindi, and an impressive amount of research has been dedicated to it (Hacquard, 2006; Mari and Martin, 2007; Laca, 2012; Mari, 2015b; Homer, 2021). The phenomenon is observed in Italian, French and Spanish (as we discuss in chapter 5, it extends of course to Greek but also beyond Indo-European languages and it is for instance found in Palestinian Arabic, see Alxatib (2021). The actuality entailment is made visible by the fact that the continuation denying the truth of *p* is impossible.

(41) a. Jean a pu prendre le train, #mais il ne l'a pas pris.
John has could take the train, #but he not that has NEG taken

b. Gianni ha potuto prendere il treno, #ma non lo ha preso.
John has could take the train, #but not that has taken
John managed to take the train, #but he did not take it.

We will discuss at length the interactions between modality and tense, which are determinant for the disambiguation of the modality.

2.1.5 One 'flexible' modal: Salish

An important point of cross-linguistic variation concerns the fact that while languages distinguish lexically modals of possibility from those of necessity, this appears not to be a universal rule. Some native American languages employ only one modal, such as St'at'imcets Salish which has famously been described as leaving the force underspecified (Matthewson et al., 2007). The modal in question is *k'a* which can express both epistemic possibility and necessity.

The context for the necessity reading (42) is described in Matthewson et al. (2007) as follows. You have a headache that won't go away, so you go to the doctor. All the tests show negative for illness. There is nothing wrong, so it must just be tension.

(42) nilh k'a lh(l)-(t)-en-s-wá(7)-(a)
FOC EVID PREP-DET.1SG.POSS.NOM.IMPF.DET
ptinus-em-su't
think.INTR-OOC

It must be from my worrying.

In this context the test provide evidence that nothing else is going wrong. The context for possibility (43), on the other hand, is more speculative. Here we don't have any specific tests or other kind of evidence at hand; we are merely speculating as to why he's not here.

(43) wa7 k'a s'ena7 qwenúxw
IMPF EVID counter sick
He may be sick.

We see that the same modal word *k'a* is used to convey both necessity and possibility as indicated in the translations. In an evidence based context such as when you have had tests done, the epistemic necessity reading is supported; in a more speculative context, we have a possibility reading. The observation can be crystallized as: more evidence leads to a biased conclusion (MUST), and less evidence leads to a more neutral inference, the appropriate vehicle of which, in English, is a possibility modal. [5]

Similar observations hold for other languages. Birman, which is discussed in Vittrant (2013), features a similar pattern with the modal ya^1 which appears to have both a possibility and a necessity reading (Vittrant, 2013, : 110 examples, (97a-b)).

please, see attached document for correct rendering of the examples

(44) coN^3 pa-$l\epsilon^2$ $=Ka^1$ -ya-Twe^2 $=Ka^1$ coN^3 ye^2 $=Ko^2$ θoN^3
moat circle S. neighborhoods S. moat water OBJ use
ya^1 $=T\epsilon^2$
obtain REALIS
The neighborhoods circled by moats had the possibility to use water.

please, see attached document for correct rendering of the examples

(45) caN^2-yakwϵ-Twe^2 a^3loN^3 $=Ka^1$ $twiN^3$-ye^2 $=Ko^2$ kha
the-remaining-neighborhoods all S well-water OBJ draw
θoN^3 ya^1 $=Ta^2$
use obtain REALIS
All the remaining neighborhoods had to draw water from wells.

Epistemic modality **lϵiN**^{1} is also flexible (Vittrant, 2013, 102).

[5] *K'a* is also discussed in the context of evidentiality in chapter 6, as an *inferential* evidential. The inferential use is by nature indeterminate regarding a biased or a non-biased conclusion.

please, see attached document for correct rendering of the examples

(46) cema^{1} tenϵ^{2}ChiN^{3}. =Ma ne^{2} **lϵiN**^{1} =mϵ^{3}
3SG home LOC be MOD.EPIST IRR
He must/might be at home.

How can this striking variation be captured? At first glance, it seems to defy the basic distinction between possibility and necessity. These data have lead theoreticians to posit that modals can be underspecified for force (Rullmann et al., 2008). In chapter 4, we review this kind of data and identify a new type of necessity: one that doesn't have to convey bias. We will call it 'flexible necessity', rather than 'weak' necessity (lexicalized in English with *should, ought*). The flexible necessity modal will be licensed in more speculative contexts containing little or less reliable evidence. We will offer an analysis of what appears as force variation by building on the idea that the modal structure includes a metaevaluative component. While with necessity modals in the style of MUST the meta-evaluation produces bias, with flexible necessity modals it can produce no bias, resulting in more neutral, thus 'weaker' inferential statements. We will argue that such an analysis is relevant for future modals, as well as weaker necessity modals such as *should*.

Let us move on now to the next category, modal adjectives and adverbs.

2.2 Modal adjectives and nouns

Modal adjectives such as *possible, necessary, probable, likely* in English can also be used to modalize a sentence:

(47) È possibile che sia venuto.
Is possible/necessary that be.SUBJ.3SG come
It is possible that he has come.

(48) È possibile/necessario che venga.
Is possible/necessary that come.SUBJ.3SG
It is possible/necessary that he will come.

In Greek:

(49) Ine pithano na irthe.
is possible that.SUBJ come.3SG
It is possible that he has come.

(50) Ine anagaio na ginoun perikopes.
is necessary that.SUBJ happen.3PL cuts
It is necessary to have budget cuts.

(51) Ine pithano na ginoun perikopes.
is possible that.SUBJ happen.3PL cuts
It is possible that budget cuts will happen.

Interestingly, in Greek the adjective *anagaio* 'necessary' receives only deontic readings, as opposed to *pithano* which can also be epistemic.

There are other adjectives such as *dynaton* and *poly pithano* lit. 'very possible' that are used to convey possibility and probability:

(52) Ine dynaton na ginoun perikopes.
is possible that.SUBJ happen.3PL cuts
It is possible that budget cuts will happen.

(53) Ine poly pithanon na ginoun perikopes.
is very possible that.SUBJ happen.3PL cuts
It is probable/likely/very possible that budget cuts will happen.

The construal 'very possible' is a lexicalization in Greek of 'probable'. Possibility is conceptualized as a gradable property.

There are also noun combinations:

(54) Yparhei (i) pithanotita na ginoun ekloges.
exists (the) possibility that.SUBJ happen.3PL elections
There is a possibility that elections will happen.

(55) #Yparhei (i) dynatotita na ginoun ekloges.
exists (the) possibility that.SUBJ happen.3PL elections
#There is a possibility that elections will happen.

(56) Yparhei (i) dynatotita na dothoun epidomata anergias.
exists (the) possibility that.SUBJ be given.3PL benefits
unemployment.gen
There is the option to offer unemployment benefits.

Dynaton, from *dynamis* 'potential, power' seems to lexicalize deontic possibility, translated above with 'option'.

Deontic possibility also has a nominal lexicalization in French and Italian (we illustrate here the point with French only, the Italian data are parallel).

(57) Il y a une possibilité qu'il vienne.
it there have a possibility that he comes
There is a possibility that he comes.

The corresponding necessity nominalization can only be used with the definite determiner.

(58) Il y a la nécessité qu'il vienne.
it there have the necessity that he comes
There is the necessity that he comes.

Only the possibility nominalization has an epistemic reading.

(59) Il y a une possibilité qu'il soit malade.
it there have a possibility that he be ill
There is a possibility that he is ill.

Possibilité can be also preceded by the definite determiner with deontic reading.

(60) Il existe la possibilité qu'il vienne.
it exists the possibility that he comes
There is the necessity that he comes.

We see that in the realm of adjective and nouns the modal quality tends to be more specific when we compare them to the behavior of verbs.

2.3 Modal adverbs and modal spread

Modal adverbs are a well known class cross-linguistically. In English, they are words like *possibly, maybe, perhaps, necessarily, probably, likely*, but also some more evaluative speaker oriented adverbs such as *definitely, absolutely, certainly* and the like. We will review here the basic patterns in a number of languages.

2.3.1 Modal adverbs on their own

Modal adverbs can exist on own their own without modal verbs, in which case they are the expressors of modality:

(61) a. Ariadne is probably/likely at home right now.
b. Ariadne is maybe/perhaps at home right now.

c. Ariadne is definitely at home right now.

There are potential lexical differences among seemingly equivalent adverbs. For instance, just as we observed with adjectives and nouns, some adverbs prefer one modal quality over another such as *obligatorily, necessarily* which is typically deontic (see Geurts and Huitink (2006)). Here is the Greek too:

(62) #Aposo ksero, ine anankastika spiti tora.
from-how.much know.1SG, be.3SG necessarily home now
#For all I know, he is necessarily at home now.

(63) Exoume anankastika ekloges kathe tessera xronia.
have.1PL obligatorily elections every four years
We have elections obligatorily every four years.

In Italian, the lexicalizations reveal different meaning distributions: *obbligatoriamente* is a deontic adverb, while *necessariamente* (when not combined with a deontic modal) is more of an epistemic.

(64) Ci sono obbligatoriamente delle elezioni ogni quattro anni.
there be obligatorily some elections every four years
There are elections obligatorily every four years.

(65) È necessariamente a casa. (epistemic)
is necessarily at home
He is necessarily at home.

(66) Deve necessariamente andare a casa. (deontic)
must necessarily go at home
He must necessarily go home.

We see that adverbs corresponding to *necessarily*— in Greek there is no lexical difference between necessarily and obligatorily— have limited use in deontic and rule-like contexts. Indeed, this type of adverb tends to prefer contexts of aleithic or analytical necessity such as rules and definitions:

(67) 1+1 anankastika kanei 2.
1+1 necessarily makes 2.
1+1 necessarily equals 2.

On a par with the adjectives, Greek also employs the construal ‘very possibly’ as a lexicalization of ‘probably, likely’.

(68) Poly pithanon/Isos na ginoun perikopes.
very possibly/maybe that.SUBJ happen.3PL cuts

Quite possibly/Probably/Likely/Maybe budget cuts will happen.

Clearly, then, the modal adverb by itself can be the expressor of modality. While we observe some of the ambiguity observed with modal verbs regarding modal quality, it seems that the adverbs tend more to associate with specific modal qualities.

2.3.2 Modal adverbs and verbs: modal spread

Modal adverbs co-exist, crucially, with modal verbs in what has been called *modal concord* (Lyons, 1977; Huitink, 2014; Iatridou and Zeijlstra, 2010) or *modal spread* (Giannakidou and Mari, 2018a, 2021b,a). While this phenomenon received very little attention in the past, in recent years the interest peaked; in our own work we argued that modal spread can in fact be instrumental in revealing additional structure in the modality, and can also explain what has been observed to be positive polarity effect (Ernst, 2009; Nielsen, 2004). As an illustration of modal spread, consider the examples below:

(69) a. John must probably/certainly/definitely be sleeping.
b. John may possibly be a doctor.
c. You must obligatorily submit the application before the end of June.

Here we see *must* and *may* co-occurring with *probably/certainly/obligatorily* and *possibly*, respectively. Lyons (1977) talks about 'modal harmony'— the idea being that there is a concord running through the clause which results in the double realization of a single modality (see also Willer (2013)), on a par with other cases of concord such as negative concord, person or gender agreement. This observation, namely that there is one modality, is stable in most of the analyses of the phenomenon (Geurts and Huitink, 2006; Huitink, 2012, 2014; Grosz, 2010; Iatridou and Zeijlstra, 2010; Giannakidou and Mari, 2018b,a, 2021b,a); *A contrario* Anand and Brasoveanu (2010).

Syntactically, these harmonic structures are different from modal embedding of one modal operator to another such as below:

(70) It may turn out that Ariadne must give her speech this afternoon.

This is a genuine case of *must* embedded under *may*; notice also the clause boundary (*that*). (Embedding can also happen within one clause, of course, as in *Ariadne may have to give her speech this afternoon*).

The question raised by modal spread is the following: if the modal verb is

the modal operator, what is the semantic contribution of the adverb? As we saw in the previous section, the modal adverb, on its own, also contributes modality. How come we only have one modality with multiple exponents? In more philosophical works it has been claimed that "iterating epistemic possibility operators adds no value in the semantics" (Yalcin, 2007, :994), or "embedding an epistemic modal under another epistemic modal does not in general have any interesting semantic effects" (Willer, 2013, :12). These statements suggest that multiple exponents of modality are semantically vacuous. Huitink (2012), Moss (2015), and Giannakidou and Mari (2018b,a), on the other hand, argue that the multiple exponents of modality have a semantic role. Huitink argues that the adverb presents the ordering source of the modal, and Giannakidou and Mari argue that the modal adverb contributes a meta-evaluation function that may or may not produce bias, but is integral to the structure of modality. We will revisit the questions that adverbs pose in chapter 3 where we layout the analytical tools for the modality.[6]

In understanding modal spread, we must also acknowledge that modal adverbs and verb are sometimes incongruent: modal verbs and adverbs with apparently opposing forces can co-occur with a single modality reading, as (71) shows for Italian *dovere* co-occurring with *forse* 'maybe':[7]

(71) Le luci sono accese. Gianni deve forse essere a casa.
The lights are switch-on. Gianni must maybe be at home
The lights are on. John must (#maybe) be at home. (non-harmonic use)

All examples discussed in this section are from Giannakidou and Mari (2018a). Below is an attested example they give (see also Cui, 2015, for a corpus study of modal spread data). The discussion is about an archeological reconstruction of the town Castel Nuovo, near Naples.

(72) Il vaso, che costituisce uno dei premi guadagnati dagli atleti negli agoni panatenaici di Atene, **deve forse** fare parte del corredo di una sepoltura ubicata non lontano dall'area di Castel Nuovo.
The jar, which constitutes one of the prizes earned by the athletes in

[6] Huitink (2012) suggests that conditions on the adverbs "really can only be decided on a case to case basis" Huitink (2012, :30), but our meta-evaluation idea is an overarching theme that allows us to understand the role of adverbs broadly, and why modal spread is generally widely and routinely attested.

[7] We also find attested examples of the combination of epistemic *must* with *maybe* in English: *So there must maybe be some glitch somewhere along the line or something that makes this happen. I am sure is a cache or technical glitchup* ((ex. from Giannakidou and Mari, 2018b,a); Lassiter (see also discussion 2016)).

the pan-athenians olympics of Athens, must maybe belong to the kid of a burial located not far from the area of Castel Nuovo.[8]

Sentences like these challenge the idea of harmony, and this is why we use the neutral term 'modal spread' instead of 'concord". We will see in chapter 4 that incongruent construals can be quite systematic with certain modal verbs such as the future modals, and they result in weakening, or eliminating the bias. Clearly the cases above are not embeddings: they do not say that it is possible that MUST *p*. .

Apparent harmonic uses, of course, seem to be common in Greek and Italian:

(73) a. Prepi malon/oposdhipote na ine giatros.
must probably/definitely that.SUBJ be.3SG doctor
He must probably/definitely be a doctor.

b. Deve probabilmente/sicuramente essere un dottore.
Must.PRES.3SG probably/certainly be a doctor
He must probably/definitely be a doctor.

(74) a. Prepi malon/oposhipote na efije noris.
must probably/definitely that.SUBJ left.3SG early

b. Deve probabilmente/sicuramente essere partito
Must.PRES.3SG probably/certainly be left
presto.
early
He must have probably/definitely left early.

We see here the modal adverbs *malon/probabilmente* (*probably*), *oposdhopote/certamente* (*definitely*), etc. co-occur with the necessity modals *prepi/dovere/must*. In Greek and Italian, modal spread is very common and unmarked. We offered combinations with present and past tenses, to illustrate that the phenomenon is tense independent. We find the co-occurrence also with the future, (75) see (Bertinetto, 1979; Mari, 2009a; Giannakidou, 2012; Giannakidou and Mari, 2012, 2013a,b):

(75) a. Arriverà certamente/probabilmente alle 4.
arrive.FUT.3SG certainly/probably at 4
John will definitely/probably arrive at 4.

b. O Janis tha erthi sigoura/malon stis 4
the John FUT come.3SG certainly/probably at 4 pm

[8] Source:
http://www.comune.napoli.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1425/UT/systemPrint

John will definitely/probably arrive at 4.

In Greek, incongruent construals tend to be avoided, as illustrated below with possibility *bori/may/might* (61-a)-(62-a). Notice the contrast with Italian and English:

(76) a. #Bori malon/opsdhipote na efije noris.
may probably/definitely that.SUBJ left.3SG early
b. Può probabilmente essere partito presto.
Can.PRES.3SG probably/certainly be left early
#He may have probably/definitely left early.

(77) a. #Bori malon na ine giatros.
may probably that.SUBJ be.3SG doctor
b. Può probabilmente essere un dottore.
may.PRES.3SG probably/certainly be a doctor
#He may probably be a doctor.

In Italian, the co-occurrence of a possibility verb with a strong adverb is extremely rare, but it is not impossible to find a few occurrences. In Greek, it is impossible. In (78), we can be certain that the existential modal is epistemic insofar as it embeds a stative which cannot be coerced into an eventive giving rise to the abilitative or circumstantial interpretation of *potere* (*might*). We also see in the second sentence ('no matter how the facts were settled') that the truth is not established and that the first sentence is described as expressing a conjecture. In this attested example, *potere* combines with *probabilmente (probably)*. Notice a similar combination in English:

(78) ... e a questa circostanza **può probabilmente** essere dovuto il fatto che egli fosse arrivato al nono compleanno. Comunque stessero le cose, in ogni modo, era il suo nono compleanno.
and the fact that he reached his ninth birthday might probably be due to these circumstances. No matter how the facts where settled, in any case, it was his ninth birthday.[9]

In other words, in Italian weak modals can co-occur with strong adverbs just as strong modals can co-occur with weak adverbs. The incongruent adverb affects the apparent strength of the modal: a universal modal appears with reduced bias with a possibility adverb, and the possibility modal appears strengthened (with bias) with a strong adverb.

[9] Source: https://books.google.fr/books?isbn=8804536829

On the other hand, the possibility adverb is grammatical only with possibility modals in Greek, Italian and English.

(79) a. Bori isos na efije noris.
may maybe that.SUBJ left.3SG early
b. Può forse essere partito presto.
can.PRES.3SG maybe be left early
He may have possibly left early.

(80) a. Bori isos na ine giatros.
may maybe that.SUBJ be.3SG doctor
b. Può forse essere un dottore.
can.PRES.3SG maybe be a doctor.
He may possibly be a doctor.

We can summarize the facts above in the following three generalizations:

(i) Modal matching appears to be the general case, attested in all three languages (Greek, Italian, English), as well as Dutch (Geurts and Huitink, 2006; Huitink, 2012, 2014) and German (Grosz, 2012).
(ii) Modal spread also allows incongruent combinations. It appears to be a more restricted option but it exists nevertheless.
(iii) Languages are subject to variation with respect to whether, or to what extent, they allow non-matching construals.

Importantly, the modal adverbs that participate in modal spread tend to be positive: *probably, definitely, maybe*. Negative incarnations of necessity(like) epistemic adverbs, like *improbably* and *unlikely* are not used in modal spread:

(81) #Ariadne must/may unlikely/improbably be a doctor.

The reluctance of negative modal adverbs to participate in modal spread is to our knowledge unnoticed in the literature – but in Giannakidou and Mari (2018a) we argued that this distributional restriction is evidence that necessity modals come by default with positive bias. The bias can at best be weakened but it cannot be reversed.

2.4 Modal particles

Mood particles are common devices for modality. German famously possesses a class known as modal particles ((Zimmermann, 2011, and references therein),

sometimes also called discourse particles. Consider the following example from Zimmermann (2011)(with his translation) with *wohl*:

(82) Hat Hans wohl Maria eingeladen?
has Hans PRT Mary invited
What do you reckon: Has Hans invited Mary?

Zimmerman says: "The question above is not about whether or not Hans has invited Mary, but by using *wohl* the speaker indicates her awareness that the addressee may not be fully committed to her answer." Zimmermann (2011, p. 2020). Here are some more examples:

(83) a. Max ist ja auf See.
b. Max ist doch auf See.
c. Max ist wohl auf See.

Zimermann says that *ja* indicates that the speaker takes the hearer to be aware of the fact that Max is at sea, it therefore seems to have a confirming function. *Doch* signals that the speaker takes the hearer not to be aware of this fact at the time of utterance, and *wohl* indicates a 'degree of speaker uncertainty concerning the truth of the proposition expressed', which seems to be akin to MUST. Zimermman claims also that "the discourse particle does not contribute to the descriptive, or propositional, content of the utterance, but to its expressive content, where expressive content refers to the more elusive or ineffable aspects of semantico-pragmatic meaning that link the proposition expressed to the context of utterance" Zimmermann (2011, : 2014). It is conceivable, therefore that a modal analysis is compatible with expressive content. We have proposed a modal analysis of *wohl* as akin to inferential MUST in Giannakidou and Mari (2018b).

The modal category of future is expressed with a particle in Greek, and so does the category of mood. Here is a list with the relevant cases. Let us start with the subjunctive and optative in main clauses:

(84) a. Na/As fiji o Janis.
SUBJ/OPT leave.NON-PAST.3SG the John
John may go.
b. Thelo/Prepi na/*as fiji
want that.SUBJ/OPT leave.NON-PAST.3SG/PAST.3SG
o Janis.
the John

I want John to go
Just must go.

We see here the subjunctive particle *na* appears in main as well as embedded clauses. The optative particle *as* appears only in main clauses. In main clauses, the two particles seem to produce wish or permission, which as deontic possibility. That the default force of *na* appears to be possibility can be seen also in the fact that it combines with modal adverbs of possibility but not necessity (Giannakidou, 2012; Giannakidou and Mari, 2016c):

(85) a. Isos na efije o Janis.
maybe that.SUBJ leave.PAST.3SG the John
Maybe John left.
b. *Mallon na efije o Janis.
probably that.SUBJ leave.PAST.3SG the John
*Probably John might have left.

Na is therefore a possibility modal, as Giannakidou argued (see also Giannakidou and Mari, 2021b,a). In questions, we have a similar use of *na* as epistemic possibility. The data below are from Giannakidou (2009):

(86) Pjos irthe sto party?
who came.3SG to the party
Who came to the party?

(87) Pjos na irthe sto party?
who SUBJ came.3SG to-the party
Who might have come to the party?

(88) Pjos bori/*prepi na irthe sto party?
who might/must that.SUBJ came.3SG to-the party
Who might/#must have come to the party?

Giannakidou (2017) calls the subjunctive here *evaluative subjunctive* (see earlier discussions Giannakidou, 2009; Rouchota, 1994). We see that it is equivalent to the modal *bori* 'may'. It also further combines in a modal spread like fashion with other modal particles such *taxa, mipos, araje* which we will call *reflective* particles in chapter 7:

(89) Na tou milise (araje/mipos/taxa)?
SUBJ him talked.3SG particle
Might she have talked to him?

(90) Tou milise (#araje/#mipos/taxa).
him talked.3SG particle
She talked to him (but I don't believe it).

(91) Tou milise?
him talked.3SG
Did she talk to him?

Here we observe the subjunctive, the possibility modal *bori* and the particles *araje/mipos/taxa* in questions (both polar and wh-questions) but not in assertions. As we can see, the particles can spread in a fashion reminiscent of modal spread with modal verbs and adverbs (*He may possibly be here tonight*). In the declarative context, only *taxa* can be used, which means literally 'as if, allegedly' and casts doubt on the truth of the proposition is attaches to (see Giannakidou, 2022; Ifantidou, 2001, for more details on the Greek particles): *O Janis ine taxa jatros* 'John is allegedly a doctor but I don't believe he is'. The particles in the question correspond to *might*, as indicated in the English translations.

Giannakidou (2017) argues that the particle question differs from the plain one in being open-ended, vague, and primarily self-addressed. It does not require an actual or full answer; for instance, *Pu na evala ta gialia mou?* 'Where might I have put my glasses?' is a question that one poses to herself in a wondering, reflective manner without expectation of an immediate answer or even an answer at all. In other words, questions with modal particles can be monologue-like, but bare questions cannot be used this way, as has also been noted for Japanese and Korean modal particle questions discussed in Kang and Yoon (2018, 2019) and with subjunctive questions in Salish (Matthewson, 2010, calls them conjectural questions).

Kang and Yoon in their discussions of a similar use of the particle *nka* in Korean note that by using *nka*, the speaker "reflects on her own background assumptions and is not simply requesting information from the addressee". *Nka*-questions, they argue, are *feigned monologues*, i.e., the speaker says something as if it were a monologue without expecting an answer necessarily. Because of the monologic nature of the utterance, it does not necessarily obligate the hearer to respond, and while there may be differences between the particles and across languages, these observations hold also for the Greek and English particle questions above.

English data from Ernst (2009), Hacquard and Wellwood (2012) illustrate the same reflective character for English questions with possibility modals:

(92) Is she possibly/*probably a spy?

(93) Might/*must she be a spy?

These have been described as 'weaker' questions. The self-reflective character of particle questions is evidenced further by the fact that directly addressing the hearer is odd.

(94) #Ti *na* efages arage xthes?
what that.SUBJ ate.2SG araje xthes
What might you have eaten yesterday?

(95) Ti efages xthes?
what ate.2SG xthes
What did you eat yesterday?

(96) #Na efages araje xthes?
subj ate.2SG araje xthes
Might you have eaten yesterday?

(97) Efages xthes?
ate.2SG xthes
Did you eat yesterday?

For the Greek particles, we will call this the 'anti-addressee' effect. Cross-linguistically, the effect is observed also in Korean (Kang and Yoon, 2019). The effect is similar in Italian, but the future is used Eckardt and Beltrama (2019); Mari (2021):

(98) Sarà a casa ?
be.FUT.3SG at home ?
Might he be home ?

(99) a. È a casa ?
Is at home ?
Is he at home ?
b. È forse a casa ?
Is maybe at home ?
Is he maybe at home ?

We see therefore that there is a straightforward correlation between the grammatical category 'particle' and a modal verb. Their function appears to be the same in this case. In Greek, even the negation particle *mi(n)* can function as a possibility modal (Chatzopoulou, 2018):

(100) Min eidate ton Jani?
neg saw.2PL the John

Did you maybe see John?

This use of a negative particle, which we will call Modal-NEG, remains productive in literary and other registers. We will analyze the role of these particles in chapter 7. Here we need to note that they appear to be consistently epistemic, and they give rise to a reflective interpretation. In the literature such questions have also been called 'conjectural', (see Littell et al., 2009; Matthewson, 2010; Eckardt and Beltrama, 2019; Frana and Menéndez-Benito, 2019b, a.o.).

Finally, the future is Greek is also expressed with a particle: *tha*:

(101) Tha figi avrio.
FUT leave.3SG tomorrow
He will leave tomorrow.

We discuss the future extensively in chapters 4 and 5.

2.5 Evidential markers

Evidentiality is often discussed in the context of epistemic modality, and it has been claimed in the literature that at least some evidential markers are equivalent to epistemic modals (mostly, though not exclusively, akin to inferential necessity, see however, De Haan (1999) and discussion in Cornillie (2009). In this section we will present some core evidential patterns that have been discussed in the literature, and we will offer an in depth analysis of the relation of epistemic modality and referentiality in chapter 6.

While the precise nature of the category 'evidential' cannot be reduced to one simple generalization, we can say safely that evidentiality is the linguistic marking of the source of information, i.e., how the speaker comes to have evidence to form the basis for their veridicality judgment. The judgment itself is not necessarily one of full veridical commitment to the propositional content, as has been shown, and how committed the speaker is will depend on how strong or reliable the evidence is. For example, one can know that it rained yesterday because one had direct experience of the rain, or because they saw it falling though the window yesterday morning or because someone else that they trust told them that it rained, or because they are drawing a conclusion based on certain known premises (e.g. they see that the streets are wet so they conclude that it must have rained). If a known liar tells them that it is raining, the speaker may report this as *It is raining, John told me* without being veridically committed to this claim.

2.5.1 Grammaticalized evidentiality

First, some descriptive preliminaries. Every language has a way of saying how speakers come to know or believe a certain proposition. For instance, in English we can say:

(102) a. There will be a major recession, they say.
b. The wine tasted good.
c. I saw Flavio cross the street.
d. It looks like/Evidently you lost your keys.

The use of words such as *they say, tasted, saw, looks like, evidently* in the sentences above serves to establish source of information. The evidential marking, in other words, in English comes in the form of sentence embedding or use of parentheticals and predicates of taste, and it is generally optional: I can simply utter *There will be a major recession*, or *The wine was good, Flavio crossed the street* and *You lost your keys* conveying exactly the same commitment to the propositional content. I don't have to indicate the evidential source in English.

In many of the world's languages, however, evidential distinctions are grammaticalized into the linguistic system pretty much the way agreement, tense or mood are. As Boas (1938, :133) put it, 'while for us [English speakers] definiteness, number, and time are obligatory aspects, we find in another language location near the speaker or somewhere else, source of information (whether seen, heard, or inferred) as 'obligatory aspects'. See Aikhenvald (2004); Aikhenvald and Dixon (2014) for further discussion of evidentials in typological perspective, and additional references. Languages such as Tariana (Aikhenvald, 2003, 2004), Cherokee Aikhenvald (2004), Cheyenne (Murray, 2010, 2017), Quechua (Faller, 2002), and Tuyuca (Barnes, 1984) — to mention just a few— have fully grammaticalized evidentiality marking: declarative statements carry mandatory morphological marking that indicates the type of information source upon which the statement is based. Other languages, e.g. Salish can also have bare verb forms as we shall see. About a quarter of the world's languages, according to Aikhenvald (2004) overtly mark every statement for the type of evidence that the statement is based on, they have in other words, grammaticalized evidentiality.

We will offer here some examples from a few languages to get the major empirical patterns. In chapter 6 we will discuss the connection between evidentiality and epistemic modality in more detail. In formal semantic literature on evidentiality, the connection between evidentiality and epistemic modality did not go unnoticed; Izvorski (1997) was a first modal approach, and see sub-

sequent work such as (Ehrich, 2001; Matthewson et al., 2007; Rullmann et al., 2008; Smirnova, 2013, among many others).

Let us look now at some basic patterns.

2.5.2 Tariana

The Northwest Amazonian language Tariana has been among the best known for its evidential marking (Aikhenvald, 2004):

(103) a. t∫inu niwahãka dina.
dog bit.ev.see him
The dog bit him (we have seen it).

b. t∫inu niwahãmahka dina.
dog bit.NON-VIS.sensory him
The dog bit him (we have heard the noise).

c. t∫inu niwahãsika dina.
dog bit.infer him
The dog bit him (he has a scar and I can make an inference).

d. t∫inu niwahãpidaka dina.
dog bit.reported him
The dog bit him (someone told me).

We see here that the verb combines with different morphemes that indicate the source of information. The four major categories appear to be: visual evidence, non-visual evidence, inferential, and reported evidence. These categories are pretty robust cross-linguistically.[10] Evidential markers can be understood to be sentential scope taking elements of the form EVp, where EV is the evidential and p the prejacent. The structure is thus parallel to that of modals. In most descriptions, it is acknowledged that EV operates at the sentential level, that it takes 'wide scope' (see especially McCready and Ogata, 2007, and references there in). We thus have a clear parallel with modals, also structurally.

2.5.3 Quechua

Faller (2002) has studied the evidential system of Cuzco Quechua. This system has several enclitic suffixes that mark evidentiality or the nature of the speaker's justification for making the claim expressed by the sentence. Faller analyzes three suffixes in detail:

[10] On the particular status of reportatives, see AnderBois (see 2014).

(104) a. *Mi*: indicates that the speaker has direct (usually perceptual) evidence for the claim (BGP).
b. *Si*: indicates that the speaker heard the information expressed in the claim from someone else (REP).
c. *Chá*: indicates that the speaker's background knowledge (CONJ), plus inferencing, leads him to believe the information in the sentence true.

Some examples follow (from Faller, 2002).

(105) a. Para-sha-n-mi
rain-PROG-3-BPG
It is raining. + speaker sees that it is raining
b. para-sha-n-si
rain-PROG-3-REP
It is raining. + speaker was told that it is raining
c. para-sha-n-cha?
rain-PROG-3-CONJ
It may/must be raining. + speaker conjectures that it is raining based on some sort of inferential evidence

Faller does acknowledge that some evidentials may be akin to a modal, but she proposes a speech act analysis, using Vanderveken (1990)'s theory which assigns to speech acts preconditions for successful performance; we can think of these as sincerity conditions or presuppositions (see also Murray, 2017, for a non-at-issue view of evidentials). Faller takes evidentials to introduce additional content into the set of preconditions. Izvorski (1997) analysis of the Bulgarian evidential similarly builds the source of information content into a presupposition as we will discuss later.

2.5.4 Cherokee

Cherokee (Aikhenvald, 2004; Murray, 2017) displays an evidentiality system with fewer distinctions than Tariana by distinguishing between firsthand evidence (-2?i) and non-firsthand evidence (-e?i). The examples are borrowed from Asudeh et al. (2017) :

(106) a. wesa u-tlis-2?i
cat it-run.FIRSTHAND.PAST
A cat ran (I saw it running.)
b. uyo ges-2?i
spoiled be.FIRSTHAND.PAST

It was spoiled (I smelled it)

(107) a. u-wonis-e?i
he-speak-NON.FIRSTHAND.PAST
He spoke (someone told me)

b. u-gahnan-ePi
it-rain-NON.FIRSTHAND.PAST
It rained (I woke up, looked out and saw puddles of water)

We see that the Cherokee system makes a binary distinction with direct and non-direct evidence.

2.5.5 Salish

Consider the following from Salish, which makes a three way distinction; the data below are reported in Matthewson et al. (2007); Matthewson (2020):

(108) wá7 *ku7* ku sts'éts'qwaz' l-ta stswáw'cw-a
be REPORT DET trout in-DET creek.DET
[reportedly] There are trout in the creek. (reported information)

(109) plan *k'a* tu7 wa7 tsu7c na máq7-a
already INFER then IMPF melt(INCH) DET snow-DET
The snow must have melted already. (inferential evidential)

(110) pel'p-s-ácw-*an'* nelh neklíh-sw-a
lost.CAUS.2SG.CONJ.PERC.EVID DET.PL key.2SG.POSS.DET
It looks like you've lost your keys. (perceived evidence)

Each of the evidentials in Salish, which are second position clitics, indicates something about the source of the information presented in the proposition: hearsay, MUST inference, or perception. Matthewson (2020) and Matthewson et al. (2007) were the first to propose an analysis of them as epistemic modals. In fact, *k'a* is often cited in the literature as the epistemic modal of Salish—and we analyzed is as a flexible inferential modal in chapter 4.

Willett (1988) offers a categorization of evidentials based on a study of 38 languages, presented in 4.4:

Matthewson et al argue that, based on Willett's categorization, *ku*7 is an indirect reported evidential, covering all reportative cases without specifying whether the report is second-hand, third-hand, or derives from folklore. They call *ku*7 reportative evidential. The marker *ka* is, in turn, an indirect inferring evidential, felicitous in cases involving inference regardless of whether the inference is based on observable results or purely on reasoning. They call *ka*

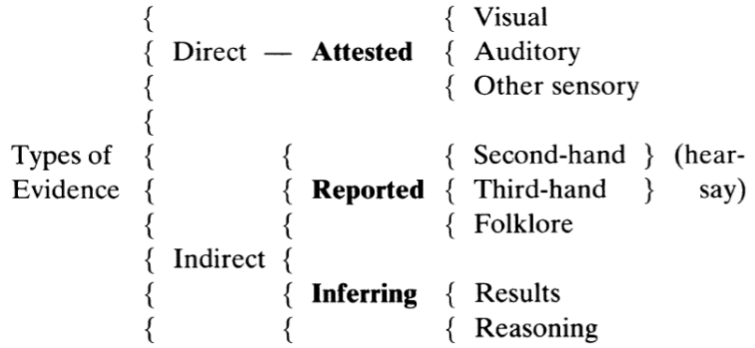


Figure 2.1 Willett 1988 classification of evidence types

'inferential'. Finally, *-an* is characterized as an indirect inferring evidential of results: any claim made using *−an*, Matthewson at all clarify, must be based on perceived evidence, *−an* is thus called perceived evidential.

Matthewson et al. (2007) propose a modal analysis for Salish evidentials that we will discuss later and which will be shown to be very close conceptually to the nonveridicality analysis pursued in Giannakidou and Mari (2016b,c, 2021b,a).

2.5.6 Bulgarian indirect evidential

Bulgarian contains one evidential marker that combines reportative and inferential use. The form is also tensed— it appears with past and future— so here we find an interaction between evidentiality and the tense system. According to Izvorski (1997); Smirnova (2011, 2012); Koev (2011) a single verb form can express either reportative or inferential evidence, depending on the context. The evidential form *pisala* 'write' expresses that the speaker's source of information for her claim that Maria was writing a book is a report. The same form expresses that the speaker's source of information is inference.

Consider the reportative context: Last week Ivan told you that Maria, your former classmate, spent last year writing a book, and that the book has just been published. You believe Ivan. At the class reunion, when someone asks you what Maria was doing last year, you say:

(111) Maria pisala kniga.
Maria write.IMPERF.PAST book

Maria was writing a book, [I heard]

Now consider the inferential context as it is described by Smirnova: Your late aunt Maria spent two months before her death in Paris. After her funeral, you found an unfinished manuscript about Paris in her apartment. You inferred that shortly before her death Maria was writing a book. When one of the relatives wonders what Maria was doing in Paris before she died, you say:

(112) Maria pisala kniga.
Maria write.IMPERF.PAST book
Maria was writing a book, [I inferred].

The marker, as can be seen, recycles tense and aspectual morphology— imperfective and past— and in this sense differs from the other evidential markers we presented. Izvorski presents an analysis of the Bulgarian evidential as an epistemic modal element contributing a presupposition that the evidence that the speaker has is indirect. Izvorski's analysis was the first to embed evidentiality into Kratzer's system of modality, but it was challenged in Smirnova's who noted that in reportative contexts, the evidential can be used even if the speaker believes that the proposition *p* in the scope of the evidential is false. Here is a scenario: You just came from a psychiatric clinic, where you visited your friend Eli. Eli was hospitalized because of severe hallucinations and other psychological problems. When your friend inquires about the things Eli told you, you say:

(113) Izvanzemnite í predlozili rabota v kosmiceska
Aliens her offer.PERF.PAST.PLE job in space
laboratorija.
laboratory
Aliens offered her a job in a space lab, [I heard].

It is clear from the context that the speaker does not believe that Eli was offered a job by aliens. In inferential contexts, on the other hand, the evidential form is infelicitous if the speaker believes that *p* is false.

Inferential context: A month ago Maria applied for a highly competitive position in a NASA laboratory. When Maria announced that she is quitting her current job, you inferred that she got a job offer from NASA. Later, you learned that Maria was not offered a job by NASA. When your friend asks you why Maria is quitting her job, you say:

(114) NASA í predlo˛ili rabota.
NASA her offer.PERF.PAST.PLE job

NASA offered her a job, [I inferred].

Smirnova (2011) notes that this is a problem for Izvorski's uniform analysis which predicts the evidential to be infelicitous if the speaker does not believe *p*. This prediction is not borne out. Moreover, Izvorski's analysis cannot explain why the speaker has to be committed to the truth of the prejacent in inferential contexts but not in reportative contexts. We will revisit these facts in chapter 6. The Turkish evidential *mis* is similar to Bulgarian (Sarigul, 2015).

2.5.7 Japanese

The final language we will consider is Japanese. Ogata (2005) and McCready and Ogata (2007) discuss four distinct inferential evidentials— *mitai, (INF+)soo-da, yoo-da, rashii*, which also can be used as a hearsay evidential— and one pure hearsay evidential, (S+)soo-da. Japanese also has evidential modals, as McCready and Ogata characterize them, but the morphemes they discuss are claimed to have no modal meaning, and to also involve no assertion on the part of the speaker (on a par with what has been argued for Quechua hearsay evidentials as they have been described by Faller). Here are the core examples (translations with 'It seems' are due to McCready and Ogata (2007)):

(115) a. Jon-wa konya-no paatii ni kuru rashii
John-TOP tonight-GEN party to come RASHII
It seems that John will come to the party tonight.

b. Jon-wa konya-no paatii ni kuru soo-da
John-TOP tonight-GEN party to come SOO-COP.PRES
I heard that John will come to the party tonight.

c. Jon-wa konya-no paatii ni kuru mitai (da)
John-TOP tonight-GEN party to come MITAI (COP.PRES)
It seems that John will come to the party tonight.

d. Jon-wa konya-no paatii ni Kuru yoo-da
John-TOP tonight-Gen party to come YOO-COP.PRES
It seems that John will come to the party tonight.

e. Jon-wa konya-no paatii ni ki-soo-da
John-TOP tonight-Gen party to come.Inf-SOO-COP.PRES
It seems that John will come to the party tonight.

Rashii is an inferential evidential: it applies to whole sentences, indicating that the speaker obtained the information via inference, so ti does seem like MUST. According to an earlier source, Aoki (1986), *rashii* is used when the evidence

is circumstantial or gathered through sources other than one's own senses. He provides the following example:

(116) kono kusuri-wa yoku kiku rashii
this medicine-TOP well work RASHII
I infer from what I heard that this medicine works well. (Aoki, 1986, p. 232).

Rashii can reasonably translate with MUST then. *Soo-da* is compatible with several sorts of evidence, according to Ogata (2005) : tactile, visual, auditory, internal sensory, and unknown source evidence. These possibilities are held in common with the other inferential evidentials (except for *rashii* in the case of tactile and visual evidence). Again, the similarity with MUST is striking:

Tactile evidence (Ogata, 2005):

(117) koko-ga mushiba-ni natteiru yoo-da
here-NOM cavity-DAT becoming YOO-COP.PRES
You must have a cavity here (touching tooth).

Visual evidence:

(118) soko-ga mushiba-ni natteiru yoo-da
there-NOM cavity-Dat becoming YOO-COP.PRES
You must have a cavity there (observing blackened tooth).

Yoo-da and mitai behave nearly identically in terms of the sorts of evidence they can accept, and McCready and Ogata treat them together. They are similar to *rashii* in being inferential evidentials, but differ from it and from *Inf+soo-da* in the sources of information they allow. According to Aoki (1986), *yoo-da* is used when the speaker has 'visible, tangible or audible evidence collected through his own senses'.

When we discuss evidentiality in chapter 6, it will be argued that all these sources of information can be encoded as conditions on the modal base if we assume that the Japanese evidentials are indeed modal elements.

2.6 Questions and modality

While categorically different, questions and assertions come closer in the phenomenon of what is often called rhetorical bias. While the utterance of a plain interrogative is a request for information, the biased question is not just seek-

ing information but also conveys the speaker's expectation that a positive or negative answer is more likely:

(119) Is Ernie a vegetarian?

(120) a. Isn't Ernie a vegetarian? (high negation: positive bias)
b. Ernie is a vegetarian, isn't he? (negative tag: positive bias)
c. Is Ernie really a vegetarian? (adverb *really*: negative bias)

A speaker uttering a plain yes/no interrogative is in a state of nonveridical uncertainty: she does not know if Ernie is a vegetarian and poses the question as a request to find out. The polar question is therefore 'information seeking' and does not discriminate towards one answer or the other. This state of neutral uncertainty between p and its negation has been characterized as nonveridical *equilibrium* (Giannakidou, 2013b,a; Giannakidou and Mari, 2016b,c, 2018b,a, 2021b,a) because the two options are entertained by the speaker as equal possibilities upon asking the question:

(121) Nonveridical equilibrium (= 'True uncertainty' in Giannakidou 2013)
A nonveridical sentences expresses equilibrium if p and its negation are considered equal options by the speaker who poses the question.

We will offer later a formal definition of equilibrium; for now intuitively we understand it to mean that the questioner has no preference for one of the two options. Following our earlier work, we take equilibrium to be the default semantic feature of epistemic possibility, questions, and conditionals (for more recent discussion see Liu et al. (2021)), regardless of their discourse function. The egaliatarian state of the nonveridical equilibrium is neutral because when asking a plain polar question the speaker has no preconception of assuming which answer (yes or no) is true, no priors (i.e. previously held beliefs or assumptions) as to the positive or the negative answer being more likely. The proposition *Ernie is a vegetarian* is not challenged in the context prior to asking the question, and the speaker does not have any preference for a positive or negative answer, no expectations that would make them think that Ernie is or is not a vegetarian. Nonveridical equilibrium is, in other words, a state of epistemic neutrality with no preconditions on the context or the speaker's epistemic state regarding the questioned content.

When asking a biased question, on the other hand, the speaker reveals that they actually do have prior expectations that discriminate between the two possible answers. Having prior expectation is not equivalent to believing that *Ernie is a vegetarian*; if the speaker had believed that the content is true they wouldn't have asked the question. Likewise with *really*, the speaker is having

reasons to think that *Ernie is not a vegetarian* is a more likely answer. With biased questions uncertainty still exists about what the true answer is, but the speaker comes to question not from a neutral stance but from a discriminating one.

Biased questions, then, are not mere requests for information but rely on the speaker's prior doxastic and epistemic assumptions and expectations.[11]. In this respect, they lie on a continuum between questions and assertions: they ask whether p but also have reasons to consider p a better possibility. The bias is similar to that observed with MUST. Notice that in the tag question we actually do have a hybrid declarative and interrogative sentence.

Importantly, the bias can also famously be canceled with an answer of the unexpected polarity. Bias is a choice that the speaker makes based on their assumptions and contextual knowledge but it is not a common ground presupposition, as we will emphasize, hence it can be objected to. In the case of positive bias, the speaker seems to rank p as more likely, hence they are more epistemically committed to it; in the negative bias $\neg p$ is considered more likely and there is less epistemic commitment to p.

While we maintain that the categorical difference between modal assertions and questions lays in the first having and the second lacking truth conditions, we also acknowledge that both convey nonveridical states with two alternatives: p and its negation. Nonveridicality thus "allows us to see that the distinction between assertion and question is not as basic as we thought", Giannakidou (2013a) states, and this, she continues, "seems to support an approach to meaning as semantically non-dichotomous" (Giannakidou, 2013a, :117). In the end, what seems to matter is whether a sentence presents the epistemic agent with one or more possibilities about the world, i.e. whether it reflects a homogeneous or non-homogeneous (partitioned) epistemic space. "Superficially, this appears to correspond to the contrast between assertion vs. question. However, the more fundamental distinction is between a partitioned or not epistemic space" (Giannakidou, 2013a, :126).

2.7 Summary

In this chapter, we illustrated the core types of modal sentence we will study in this book. All modal phenomena we presented here share a semantic core:

[11] There is also contextual bias relating to evidence available in the context, i.e., the common ground (*evidential bias*, (Buring and Gunlogson, 2000; Romero and Han, 2004; Sudo, 2013; Northrup, 2014; Domaneschi et al., 2017)), or answer bias Krifka (2015); Malamud and Stephenson (2015). We will not discuss common ground bias here; for more details on factors determining belief formation see Giannakidou and Mari (2021b,a)

they all involve some degree of uncertainty, and therefore denote nonveridical states. We proceed now to offer the core analysis of modalization based on modal verbs and adverbs, and then move on to explore the more specific problems we located here in the rest of the book.

Questions and further readings

Questions

- In the chapter, we presented a very broad empirical domain of modal expressions which includes also evidentials and questions. While we discuss these further in the final two chapters of the book, we want to raise here a very basic question: how do we distinguish modal expressions as a natural class? The unifying criterion, clearly, cannot be morphological— as modal morphology is variable, and certain categories, for example the particles and adverbs, are not morphological modal (e.g. *absolutely, definitely*). Would the criterion then be semantic, namely a modal expression is one that follows the nonveridical axiom, as we suggested in chapter 1? Are modal and non-veridical co-extensive terms? This is a productive question to think about, especially in the context of crosslinguistic comparisons.
- Again in the context of crosslinguistic variation, it would be interesting to see if there are any generalizations about what types of modal expressions occur in languages. What types are lacking and why? Do any of the categories seem more ”basic”? For instance, modal verbs as opposed to nouns, adjectives or adverbs? How do we decide what a basic modal category is?
- Are modal categories universal? If so which ones? Is it possible to express nonveridical uncertainty outside the modal system, for example, with propositional attitude verbs? What if a language lacks those too?
- Finally, regarding the quality variance of modals (different ’flavors’), what do you think this tells us about the role of the context in interpreting modal sentences? Are there potential differences between the modal classes that one can observe? For instance, do verbs tend to be more variant that adjectives or adverbs? Think of various languages. If there are differences between the classes in terms of the available quality variance, what do you think are they due to?

Further readings

In addition to the works mentioned here, detailed typological studies that address modality and evidentiality are offered in Aikhenvald (2018), *The Oxford*

handbook of evidentiality. Oxford University Press. We invite the interested reader to familiarize themselves with the rich patterns, which do show striking systematicity, and which become relevant again in chapter 6.

For modality, the handbook by Nuyts and Van Der Auwera (2016), *The Oxford handbook of modality and mood*, Oxford University Press is a very useful resource.

3

A formal semantic theory for linguistic modality

In this chapter we lay out the foundations of the formal semantic theory of modality as it has been developed in the past fifty years, starting with developments in modern modal logic right onto the very influential theory of linguistic modality developed by Kratzer (1981); Portner (2008); Giannakidou and Mari (2021b). Modality is also central in typological or cognitive approaches, which we discuss in the following chapters, when we consider the parameters of variation cross-linguistically (see most notably Nuyts and Van Der Auwera (2016); Van der Auwera and Plungian (1988) and the relation between modality and evidentiality (see most notably Aikhenvald (2004, 2018)). The formal theory we present in this chapter will be expanded in chapter 4 to include seemingly unexpected patterns of modals involving what we call *flexible* necessity— and which have been the focus of typological approaches. In chapters 5 and 6, we will complete the analytical toolkit by discussing the interaction of modality with tense (see (Condoravdi, 2002; Hacquard, 2006; Mari, 2015b)), and modality with evidentiality.

3.1 Models for modality

The contemporary formal semantic theory of modality is rooted in 20th century modal logic as a method to develop the appropriate metalanguage for the analysis of the linguistic category 'modality'. As Fitting and Mendelsohn (2012) write, "formalization is a fundamental tool for clarifying language, leading to better understanding of thoughts expressed through language" (p. 1). Over the years, and following considerable descriptive and theoretical refinements in modal semantics, formalization turned out to be not only a method for exploring natural language modality but indeed a tool tested against considerable empirical findings; latest developments can be understood as a series of mod-

ifications and revisitations of the logical model, crucially motivated by cross-linguistic observations.

If the history of formal semantics can be understood as the implementation and linguistic adjustment of logical systems, as Montague (1969) recognized, there is no other domain of semantics that better illustrates the dynamic of this enterprise: the framework of modal logic provided the basis for an analytic approach to linguistic modality. The data gathered from a variety of natural languages quickly showed that the framework needed to be revised, augmented, and rethought in order to adapt to the empirical complexity of natural language. At the cross-roads of logic and typology, a proper semantic theory for modals is expected to be able to account for modal universals across languages while remaining both rigorous and flexible enough to accommodate variation and language specificity.

Modal expressions, as we noted at the beginning, are by definition non-veridical: they do not entail actual truth (objective veridicality), and do not entail veridical commitment, i.e., knowledge, belief, or certainty of the speaker that the propositional content is true. Recall the contrast between declarative modalized and unmodalized sentences:

(1) a. It is raining.
b. It rained.
c. It must be raining.
d. It may be raining.

Co-operative conversation follows the Veridicality Principle, as we said in Chapter 1, which requires that the speaker be truthful: in choosing to utter an unmodalized sentence, the speaker knows, or has grounds to believe that it is raining or that it rained, and wants to share her knowledge or belief with her audience. Information flow and sharing information more broadly means, after Stalnaker's influential conception, that the speaker intends the proposition denoted by the bare sentence to be added to the 'common ground' of the conversation. Upon uttering the sentence with this intention, a listener might object if they know or believe otherwise, e.g., if they just came back from outside and it is no longer raining. But insofar as the speaker is concerned, and as long as she reasons sincerely based on *the information or evidence she has at the time of utterance*, when they chose a non-modal sentence in the past or the present tense, they take it to be true that it is raining or that it rained. The speaker has, on other words, veridical intent about the propositional content.[1]

[1] This is why continuations such as *but I don't believe it* are paradoxical: *#It rained last night but I don't believe it.* Such sentences are called Moore-paradoxical in the literature, and the

The linguistic semantic study of modality starts with Angelika Kratzer's pivotal work in the seventies on the German modal auxiliary system (Kratzer, 1977, 1981). Kratzer builds on the Kripkean modal logic with possible worlds (Kripke, 1963, 1973), and illustrates that German modal verbs come in a variety of 'flavors' suggesting that natural language modals are inherently restricted to produce different modal qualities— appearing to be ambiguous and flexible, as we illustrated in chapter 2. In order to capture the flexibility, Kratzer proposed the notions of a modal base and ordering source as covert arguments of modal verbs, and any development in linguistic theorizing about modality since then took Kratzer's framework as the starting point. Paul Portner in his thorough 2009 book (Portner, 2008) develops further the Kratzerian system as an evolution and adjustment of the modal logic perspective to natural language modals. In our own work (Giannakidou and Mari, 2016b,a,c, 2018b,a, 2021b,a) we recasts the insights and mechanisms of the Kratzer/Portner system into a broader framework that capitalizes on the nonveridicality of modal bases and the properties of nonveridical equilibrium (for possibility modals) and evidential bias (for necessity modals). Our system, in addition, more so than Kratzer and Portner emphasizes the similarities between modal expressions and propositional attitude verbs, and in so doing it can explain a number of diverse grammatical phenomena such as mood choice and tense selection. The analytical path from more narrow to broader theories of modality was shaped by the need to capture larger sets of data and the considerable similarities between modal expressions, propositional attitude verbs, and the epistemic state of the speaker in non-assertive domains such as questions, conditionals, and imperatives. It is this broader perspective that we adopt in the book.

In this chapter, we present the key concepts and ideas of modal theory for language tracing the historical trajectory we just outlined. We begin by presenting the foundations of modal logic in Kripke, then move on to the developments that start with Kratzer (1977, 1981, 1991), continue in Portner (2008), and culminate with the modifications and augmentations of Giannakidou and Mari (2016b,a,c, 2018b,a, 2021b,a).

It is fair to state from the outset that possible world semantics is not the only possible framework for modality. There are other frameworks, e.g. the probabilistic one designed by Lassiter (2017); we refer readers to Portner (2008)

infelicity is due to the fact that the second part denies the veridical commitment that the first part of the sentence establishes (see Giannakidou and Mari (2016b) section 5 for more discussion). Notice that modal sentences also give rise to Moore paradoxical effects: *#It may be raining but I don't believe it, #It must be raining but I don't believe it.*. The reason is that by the veridicality principle, in uttering a sentence with the modal, the speaker does convey at least partial commitment to the proposition thus creating a contradiction with the second conjunct that asserts absence of commitment altogether.

for a discussion of probabilistic approaches. These approaches have thus far limited empirical scope (mostly in English), and it is not obvious how they can evolve into theories that can extend easily to capture mood, propositional attitudes and speech acts, leaving therefore still much to be desired. There are also cognitive and typological approaches to modality Nuyts and Van Der Auwera (see for example the papers in the recent Handbook of Modality by 2016) which tend to emphasize the variation of modal expressions cross-linguistically and potential challenges it can pose for formal theories. While acknowledging variation is a *sine qua non* for a formal theory of modality, we are much more optimistic about the prospects of the formal theory being able to handle the variation patterns, and develop tools that can help discover predictable systematicity in the data.

Our goal is not to present an exhaustive historical or analytical overview of possible world semantics. This is already achieved in Portner (2008) and we refer the reader willing to master the technical details of possible world semantics to that work. In the present book, we want to guide readers including— and especially— those with no previous technical background across the possible worlds semantics framework for modality so that they can understand the metalanguage and the purposes it serves. Ultimately, the intuitions and empirical observations we will offer should render the formal theory easy to apply when uncovering new patterns of modality in language.

3.2 Worlds and accessibility relations: Kripke frames

It was Leibniz who invented the notion of possible world, but the modern history of linguistic semantics for modality starts with Lewis' description of what a possible world is. Lewis (1986, 1f) writes:

> The way things are, at its most inclusive, means the way the entire world is. But things might have been different, in ever so many ways. This book of mine might have been finished on schedule. Or, had I not been such a commonsensical chap, I might be defending not only a plurality of possible worlds, but also a plurality of impossible worlds, whereof you speak truly by contradicting yourself. Or I might not have existed at all - neither myself, nor any counterparts of me. Or there might never have been any people. Or the physical constants might have had somewhat different values, incompatible with the emergence of life. Or there might have been altogether different laws of nature; and instead of electrons and quarks, there might have been alien particles, without charge or mass or spin but with alien physical properties that nothing in this world shares. There are ever so many ways that a world might be: and one of these many ways is the way that this world is.

The possible world has been a useful concept across the modern linguistic

and philosophical literature— and proved to be a very fitting tool to model modality and the way things could be or could have been. Kripke (1963) was the first to launch a systematic deployment of possible worlds into the study of linguistic meaning by observing that reference is affected when we reason with proper names in the so-called *opaque* contexts, which are the modal contexts.[2]

Kripke proposes a system of modal logic by defining frames and models. A frame consists of a set of worlds W and an accessibility relation R. A frame is a semantic structure that allows to talk about sets of possible worlds and accessibility relations at once. We have just given a basic description of what a possible world might be. What is an accessibility relation? Saying that a certain world w'' is accessible from another world w' is to say that w'' is an alternative to w'. This is written as $R(w', w'')$. Accessibility relations can be of various types. An epistemic accessibility relation picks alternative worlds that are alike insofar as what a certain individual (let's assume the speaker for simplicity) knows. A deontic accessibility relation picks alternatives that are alike insofar as what the laws state. Accessibility relations can be reflexive, transitive, serial and have formal properties that are not important here (for a formal discussion, see, e.g. Portner (2008); Fitting and Mendelsohn (2012)). It is important to note instead that accessibility relations have as starting world the actual world (which we will designate as w_0) whenever one intends to say that a certain possible world in an alternative to the actual world.[3]

(2) Frame $=< W, R >$

A model in Kripke's theory is a triplet consisting of a set of worlds (which we already know), an accessibility relation (also known) and a valuation function V. A valuation function assigns to any proposition (that we want to take into account) a truth value in every possible world. While logicians manipulate infinite worlds and infinite sets of propositions, speakers do not. My son is sailing in Torrevieja in Spain and I am not certain of what the weather is like. In my representation of the actual world, in one of the alternatives (let's

[2] Opaque contexts are contexts where two correferential terms cannot be replaced *salva veritate*. For example *Bill wants to talk to the winner of this race* is not equivalent (i.e., does not entail) to *Bill wants to talk to Jason* even if Jason is the winner of the race. Opaque contexts are also called intensional and they are the opposite of extensional contexts where *Bill talked to the winner of this race* indeed entails *Bill talked to Jason* if Jason is the winner of the race. Opacity, intensionality and modality are equivalent terms, all nonveridical, while extensionality refers to veridical contexts (see early discussion in Giannakidou (1997, 1999)

[3] This is not a property that holds for every possible modal expression. Dreaming, for example, or hallucinating and imagining, open up possible worlds which are not necessarily alternatives of the actual world (see Giannakidou and Mari, 2021b,a, for discussion that predicates of imagination and dreaming create alternatives that exclude or replace the actual world) and earlier discussions in McCawley (1981); Farkas (1985); Giannakidou (1997, 1998, 1999).

call it w') it is sunny and cold, and in a different one (w'') it is sunny and it is not cold. I thus consider two propositions p = *it is sunny* and q= *it is cold*. The valuation function V assigns 1 to p in w' and w'', 1 to q in w', and 0 to q in w''. There are all sorts of other worlds and propositions, but as speakers, it is very unclear that we take them into account. For the sake of our examples, we certainly do not, and most likely, we also do not take them into account in everyday reasoning. It does not really matter of all other variations of the actual world, we just focus on specific criteria and reason with those.

Here is a so-called Kripke model:

(3) Model $=< W, R, V >$

Modals are quantifiers over possible worlds. Just like *every* and *some* quantify over entities of a given set of individuals, *must* and *can* quantify over possible worlds of a given set. The relevant set is determined by the accessibility relation. *Must* is a universal quantifier, such that, for a given proposition p, p is true in every possible world accessible from the base world. *Can, might, may* are existential quantifiers such that, for a given proposition p, p is true in some of the possible worlds accessible from the base world.

(4) Necessity modals ($\Box$) are universal quantifiers over sets of possible worlds.
$\Box p$ is true iff p is true in all worlds in W accessible from the base world w.

(5) Possibility modals ($\diamond$) are existential quantifiers over sets of possible worlds.
$\Diamond p$ is true iff p is true in some worlds in W accessible from the base world w.

The quantifiers thus end up quantifying over sets of worlds accessible from the base world, but the quantification is otherwise unrestricted. This system describes perfectly analytical (or aleithic necessity), that is, definitional statements such as *Necessarily, a bachelor is an unmarried male, 1 plus 1 is necessarily 2* and similar mathematical and and other analytical statements for which, as we noted in chapter 1, the presence of a modal is not even necessary. The Kripkean necessity validates the veridicality principle T (Chellas, 1980) which say that $T\,p$ entails p and it appropriate for these types of statements.

Let us now see how Kratzer (1981, 1991) builds on this system to derive non-analytical modality, the one we need for nonveridical language modals which are the ones we use in synthetic statements.

3.3 Kratzer's theory: modal bases and ordering sources

Kratzer's point of departure is the grammatical system of German modal verbs such as *sollen, mussen, konnen, durfen*. One of her main observations, as we noted in chapter 2, is that natural language modals seem to vary along two dimensions: modal force (whether they express possibility or necessity), and modal quality, i.e., whether they are epistemic, or deontic, teleological, bouletic and so forth. Rather than considering possibility or necessity with respect to all possible worlds, natural language modals need to be relativized, Kratzer's argument goes, with respect to epistemic worlds, or worlds where laws hold, or worlds compatible with one's goals, etc. depending on the quality of the modality. While worlds can be restricted in the Kripke models by the accessibility relation *R*, there is no intrinsic connection between the modal operator and R in Kripke's system. Kratzer's idea was that modals actually take the accessibility relation as their argument and quantify over a restricted set of worlds that she called the modal base.

Theoreticians have proposed different arrangements and classifications for modals (see extended discussion in Portner and Partee, 2008). Recall the basic qualities of modality that are discussed in the literature; in italics we put the modal quality and the expressions indicating what the modal base is:

(i) Epistemic modality (from Greek *episteme* 'knowledge') expresses possibilities and necessities given what is known or believed by the speaker or a community.

(6) *In view of what I know*, Ariadne must/may/might have Greek citizenship.

(ii) Deontic modality (from Greek *deon*'obligation'): it concerns possibility and necessity in the light of a body of laws or rules, i.e., permissions and obligations. Deontic modality can also be teleological or bouletic if the permissions and obligations concern specific goals set by linguistic agents:

(7) *In view of what the laws are*, John must be eligible for paternity leave. (deontic)

(8) *If you want your coffee to be sweet*, you must/should add sugar. (goal oriented, teleological)

(9) *If you want to enjoy the Greek islands*, you ought to go there in early September. (teleological)

(iii) Ability modality: here we are dealing with abilities and dispositions. Portner understands ability modals under the general category of 'priority'.

(10) *In view of his physical abilities*, Flavio can lift 100 lbs.

The 'in view of' part, Kratzer argues, is an implicit argument of the modal verb which she calls the *modal base*. The modal base determines the modal quality. Modal auxiliaries are lexically underspecified and can vary with respect to the modal bases they take as their argument; they thus appear 'ambiguous', as we noted, in the modal qualities they can express. Overall, the variation in modal quality, is a rather typical feature of a susbtantial number of modal verbs across languages (cf Fleischman, 1982; Traugott, 1988; Bybee and Pagliuca, 1994; Palmer, 2001). In French *pouvoir* ('can') and *devoir* ('must'), in Italian *potere* ('can') and *dovere* ('must'), in Greek *prepei* and *bori* can all express the basic flavors illustrated here, and similarly in many other languages outside the Indoeuropean family (Palmer, 2001; Nuyts and Van Der Auwera, 2016). As we noted, some modals, on the other hand, such as English *might* and Greek *endehete* are lexically specified to be possibilities that only combine with an epistemic modal base, and some others such as the Greek modal adverb *anankastika* 'necessarily/obligatorily' are deontic necessitates only. These can be argued to lexically select epistemic and deontic modal bases respectively. Recall from chapter 2:

(11) Endexete na fygis avrio.
might that.SUBJ leave.NON-PAST.3SG tomorrow
You might leave tomorrow.

(12) #Endexete/boris na fygis tora.
can.2SG that.SUBJ leave.NON-PAST.2sg now
You #might/can leave now.

English *might* and Greek *endehete* are only associated with an epistemic modal base; in other words, their modal quality is fixed. While the accessibility relation of the Kripke system allows discrimination among the various kinds of modal qualities, Kratzer's system goes one step further and builds the accessibility relation into what we have been calling modal quality, which means into the lexical meaning of the modal verb. This is Kratzer's innovation, along with the concept of ordering source. Let us present these two in turn.

3.3.1 Kratzer I: Modal bases

Kratzer proposes that modal verbs are sensitive to what she calls a *conversational background*. Sentences, in general, are always uttered against a conversational background, and Kratzer argues that this background can fill in information that is needed for the interpretation of modals. Essentially, this applies an anaphoric perspective to modal verbs in the sense that they are wired to connect to what is being said in the preceding context in order to get values for their missing arguments— just like anaphors or elliptical elements do (*Ariadne picked the blue jacket and Ilona picked the red one*). The modal, in other words, is a profoundly context sensitive expression.

Formally, a conversational background is represented as a function from worlds to sets of propositions. These propositions correspond to bodies of information, facts, rules, etc., and are responsible for determining the modal quality. Consider the sentence *Bill must be the the murderer* in the context where we are discussing a recent crime. In the course of our conversation, certain facts become known (i.e., common ground) about the crime: for instance, (a) the crime was committed on February 7 at 5:30 pm, (b) Bill and a few others are suspects, (c) among all considered, only Bill has an obvious motive, (d) Bill doesn't haven alibi for that time. This set of facts is the conversational background for our modal, and shape what is known in our world. Of course, the facts are contingent as things could have been otherwise, therefore what is known in this world may be different from what is known in some other world. The conversational background thus assigns a (different) set of propositions to each world of the domain.

In possible world semantics, a proposition itself is a set of worlds (type $< st >$). This set contains all the worlds in which the proposition is true. To express this, we find two notations. Let p be a proposition and w a world. $w \in p$ means that the world w is one of the worlds in which p is true. Similarly, we can also use $p(w)$.

The modal base is designed as a conversational ground. It is a set of propositions which are the knowledge or rules or goals of a given agent (an individual i below or a community), at a given time, in a given world. For the moment, we consider only the world argument here. Formally, this is written, for an epistemic background, as:

(13) $f_{epist}(w) = \{p \mid p$ is a proposition that expresses some knowledge in w – for and individual i, or a group of people or a community $\}$

In the definition we see that the epistemic background can be relative to an individual i, or it represents group knowledge; later, we will propose modal

bases to be relativized always to individuals who come to possess also common knowledge.[4]. Following our earlier work, and basically common sense, knowledge or belief are always anchored to the individual that utters the sentence— the modal base thus contains both individual and commonly held beliefs and rules. Since what we call here is both knowledge and belief, we can reformulate the epistemic background accordingly:

(14) $f_{epist}(w)$ = {p | p is a proposition that expresses knowledge and belief in w – for and individual i, or a group of people or a community }

Giannakidou and Mari (2021b,a) single out the doxastic component specifically only what it is relevant.

Backgrounds can be of different natures, depending on the modal. With a deontic modal, the modal base will be as follows:

(15) $f_{deon}(w)$ = {p | p is a proposition that expresses the laws in a certain context }

A modal base corresponds to the intersection of these propositions. It is written as $\cap f_{epist}(w)$. What does this mean? A proposition p_1 corresponds to a set of worlds. Suppose p_1 is the set w_1, w_2, w_3, w_4, that p_2 is true in w_1, w_2, w_3, w_5 and finally p_3 is true in w_1, w_2, w_3, w_6. The intersection of these three propositions is the set {w_2 and w_3}. These are the two worlds where all three propositions are true.

To summarize, the modal base component of Kratzer's theory is formally equivalent to Kripke's with accessibility relations. The innovation is that Kratzer makes the requirement for accessibility restriction an integral part of the meaning and structure of the modal expression— and in doing so she captures the different modal qualities (epistemic, deontic, dispositional, teleological, etc), or lack thereof.

3.3.2 Kratzer II: Ordering sources

Kratzer suggests that modals be relativized not to one but to two conversational backgrounds. The first is the modal base; the second conversational background is the *ordering source*. The ordering source structures the modal base according to some ideals: moral ideals in case of deontic modality, best or better evidence for epistemic modality, etc. Not all worlds in the modal base are equal, some are 'better' than others, better in that they uphold certain ide-

[4] We are describing here the difference between subjective and objective modality (see Papafragou (2006))

als which, according to Kratzer, impose an ordering in the modal base. Modals end up quantifying not over the entire modal base but only over the *best* worlds of the modal base given the ideal set by the ordering source. This presents a real innovation on Kripke, whose world sets were egalitarian and unordered.

Both modal base and ordering source are functions from worlds to sets of propositions. For the modal base f, these propositions are relevant facts; for the ordering source g, these propositions are ideals. To go to our previous example, if Bill is the murderer, then a world where he is being punished and goes to jail is better than a world where he doesn't, and this captures the deontic *Bill must go to jail*: in the deontic modal base the proposition *Bill goes to jail* is true only in the better worlds which are those that comply with the justice ideal that crime cannot go unpunished, and so murderers go to jail. But in the modal base there are still worlds that do not meet the justice ideal and where crimes go unpunished; in those worlds murderers do not go to jail. The modal proposition *Bill must go to jail* does not hold in these worlds.

From the set of propositions $g(w)$, Kratzer proposes an ordering $\leqslant\ g(w)$, which ranks worlds according to how close they come to satisfying the ideal given by g:

(16) For any set of propositions $g(w)$ and any world u, z: $z \leqslant_{g(w)} u$ if and only if, for every $p \in g(w)$, si $u \in p$, then $z \in p$.

The ordering states that for any pair of worlds u, z, u is closer to the ideal set by ⩽g(w) if the set of propositions true in z is a subset of the set of propositions true in u. Imagine two worlds u and z in which Bill committed a murder, and where Bill goes to jail in u, but not in z. Take a deontic ordering source containing two propositions: that murder is a crime and that murderers go to jail. Both worlds violate the first law, but u is closer to the ideal set by the ordering source than z, since in u, the murderer John goes to jail, but not in z: the set of propositions of the ordering source true in u is a superset of the set of propositions true in z. Kratzer's necessity modal structure now looks as follows:

(17) For any world w, modal base f and ordering source g,
$[\![MUST\,p]\!]^{w,f,g} = \forall u \in \cap f(w)$, there is a $v \in \cap f(w)$ such that:
a. $v \leqslant_{g(w)} u$
b. for all $z \in \cap f(w)$: If $z \leqslant_{g(w)} v$, then $z \in [\![p]\!]^{f,g}$

A necessity modal requires that for all worlds u of the modal base, there is a world v that comes closer to the ideal imposed by the ordering source, and in all worlds z closer than v to the ideal, the proposition p expressed by its

complement is true: p is true in all of the most ideal worlds of the modal base. We can simplify this definition by making the so-called 'limit assumption', i.e., by assuming that there always are accessible worlds that come closest to the ideal, call these worlds $\text{Best}_{g(w)}(\cap f(w))$ (for arguments in favor of the limit assumption, see Stalnaker, 1984; Portner, 2008, also for the formulation of the Best operator that captures the ideal ranking).

So, now we have a system where the modal verb says something true not of the entire modal base, but only in the worlds complying with the ideal, the Best worlds.

In Kratzer system, Best is a gradable notion: worlds are more or less good, depending on how steadily they comply with the ordering source (i.e. depending on how many propositions of the ordering sources are true at those worlds. Important for what we discuss later is that the ordering source is responsible for bias, a phenomenon that we are going to discuss at length.

Before we move on explore further the concept of bias, we turn now to the inferentiality of MUST which provides arguments for the nonveridical partition in the modal base, another concept that is key in the framework for modality that we are going to develop here.

3.3.3 Epistemic necessity versus veridicality of knowledge

As we noted in chapter 1, the epistemic necessity modal MUST differs from knowledge, belief and certainty predicates that are veridical. Recall:

(18) Deve essere a casa, ma non sono totalmente
Must.PRES.3SG be at home, but not be.PRES.3SG entirely
sicuro.
sure
He must be home, but I am not entirely sure.

(19) a. #He is at home but I am not entirely sure.
b. #I know that he is at home but I am not entirely sure.
c. #I am certain that he is at home but I am not entirely sure.

Observe the contrast with the bare positive assertion and the knowledge and certainty predicates which do not accept such continuation, and notice that certainty and belief predicates behave like knowledge. The contrast indicates, as we said, that knowledge and certainty predicates convey veridical commitment, albeit subjectively, in the case of certainty or belief. In Giannakidou and Mari (2021b) we offer a detailed semantics of knowledge, belief and cer-

tainty predicates using the framework of possible worlds; the contrast between MUST and these predicates is also corroborated by mood patterns which show that MUST selects the subjunctive but knowledge verbs (as well as belief and imagination ones when construed as private commitment states) select the indicative. We will offer more discussion here as we focus on the issue of MUST and how it contrasts with knowledge.

How does one treat knowledge in the Kripkean framework? In modal semantics, the knowledge predicate is a quantifier over all epistemically accessible worlds, in other words, an aleithic operator:

(20) $\Box_{KNOW} p$ is true iff p is true in all worlds in W accessible from the base world w.

All epistemically accessible worlds are such that what the speaker knows in the base world, is also known there. Now, since p is true in all accessible worlds, compatible with what the speaker knows in w_0, it follows that p is true in w_0. KNOW thus is veridical: KNOW p implies that p is true in the current world. For KNOW, in fact, the veridicality is a presupposition, an observation that goes back to Kiparsky and Kiparsky (1970) who argued that the complement clause of verbs meaning KNOW denotes a fact of the world. Giannakidou (1998, 1999) called knowledge verbs 'strongly veridical' for this reason.

So, KNOW p entails that p is true. If I know that it is raining, it is raining. What about MUST? MUST as an epistemic modal, does not entail that p is true in the actual word, but in the Kripkean framework there is no way to distinguish it from KNOW, as they both are aleithic universals over epistemically accessible worlds. The same reasoning that holds for KNOW holds for MUST: what the speaker knows in the base world, is also known in all epistemically accessible worlds— and since p is true in all accessible worlds, compatible with what the speaker knows in w_0, it follows that p is true in w_0. MUST is therefore veridical (or, as Karttunen called it, *implicative*), as MUST p implies that p is true in the present world. This is the prediction in the Kripke's framework.

However, we showed in chapter 2 that MUST is incompatible with knowledge of the prejacent, and recall the attested examples offered by Lassiter (2016) illustrating that MUST is not veridical:

(21) 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*.

(22) *I don't know for sure*, sweetie, but she *must have been* very depressed. A person doesn't do something like that lightly.

(23) It must have been a Tuesday *(but I don't know for sure*), I can't remember"

(24) I have an injected TB42 turbo and don't like the current setup. There is an extra injected located in the piping from the throttle body... *Must be an old DTS diesel setup but I'm not certain*. Why would they have added this extra injector?

This also holds cross-linguistically, as we illustrated in our Italian example repeated below (see for initial discussion Bertinetto (1979); Mari (2009a,c); Giannakidou and Mari (2013a) see extended discussion in Giannakidou and Mari (2016a) where the following example is drawn from:

(25) Deve essere a casa, ma non sono totalmente
Must.PRES.3SG be at home, but not be.1SG.PRES entirely
sicuro.
sure.
He must be home, but I am not entirely sure.

Epistemic MUST, therefore, unlike definitional aleithic MUST (*1+1 must be 2*)— which does convey inference based on knowledge and is equivalent to the un-modalized version *1+1 is 2*— , does not entail knowledge of p.

The solution in Kratzer consists in designing a new notion of *human necessity*, which, unlike Kripkean necessity uses orderings sources. Human necessity is what we have been calling non-aleithic or synthetic necessity: it is the necessity that does not validate the veridicality principle T of modal logic ($\Box p \rightarrow p$), and for which entailment to p holds only in the Best worlds derived by the ideal of the ordering source (notation: g). The ordering source is a catch-all that includes all kinds of propositions that constitute knowledge, or rule following in deontic and goal oriented directional modality. Generally, the propositions that are reserved for the ordering source are anchored in stereotypical assumptions, in common beliefs or general rules— they present, in other words, a norm for the modality that establishes 'better' worlds.

What is a 'better' world? It can be misleading if one seeks to associate better here with any moral evaluation. Better world simply means more similar to the norm (the ordering source): consider any two worlds in the modal base, and look at how many propositions in the ordering source are true there; the worlds where more propositions are true is a better world according to the ideal established by the ordering. From this point, the notions of necessity and possibility

are relativized to some of the worlds so organized. In this framework, necessity is conceived as *human* necessity, and not a necessity *tout court*, i.e. aleithic or logical necessity.

A proposition p is *human necessity* in a world (the actual one for instance), if the conditions for a human necessity are fulfilled: that any sequence of worlds which are equally good reaches a point where even better worlds are only p worlds. We have instead a *human possibility* when we never reach the point in which we only find $\neg p$ worlds.

(26) A proposition p is **human necessity** in w with respect to a modal base f and an ordering source g iff
for all $u \in \cap f(w)$, there is a $v \in \cap f(w)$ such that:
a. $v \leqslant_{g(w)} u$
b. for all $z \in \cap f(w)$: If $z \leqslant_{g(w)} v$, then $z \in p$

(27) **Human possibility**. A proposition p is a human possibility in w with respect to a modal base f and an ordering source g iff $\neg p$ is not a necessity in w with respect to f and g.

What about MUST in this picture? MUST is a human necessity modal: p is a human necessity if for all worlds u in the modal base, a sequence of worlds is reached where p is true. What does this mean? The idea is to add all pieces of knowledge together and build worlds in which all the stereotypicality conditions are met. Here p is true. If those worlds are reachable from any world in the modal base, then p is a human necessity with respect to the world of evaluation, the modal base and the ordering source. p is thus true in all worlds that satisfy the ideal. Since it is not taken for granted that the actual world satisfies the ideal, this guarantees that p is not necessarily true in the actual world. MUST is a universal modal but, unlike KNOW, p does not come out true in the actual world, in virtue of the presence of an ordering.

Kratzer distinguishes further between strong necessity modals such as *must* and weak necessity modals. She defines a human possibility and a slight possibility.

(28) **Human possibility**.
A proposition is a human possibility in a world w with respect to a modal base f and an ordering source g if, and only if, its negation (that is its complement) is not a human necessity in w with respect to f and g.

(29) **Slight possibility**
A proposition p is a slight possibility in a world w with respect to a

modal base f and an ordering source g if, and only if,
(i) p is compatible with $f(w)$
(ii) the negation of p is a human necessity with respect to f and g.

In her seminal work, Kratzer also distinguishes between more 'objective' and more 'subjective' grounds. In line with Lyons (1977) and explains that German makes this distinction visible in the lexicon. She provides the following context (Kratzer, 1991, : 307) : "Imagine that Lenz, who often has a bad luck, is going to leave the Old World by boat today, on Friday thirteen. On hearing about this, someone might utter one of the following sentences.

(30) a. Es ist wahrscheinlich dass das Schiff sinkt.
It is obvious that the boat sinks
It is obvious that the boat will sink.

b. Das Schiff wird (bestimmt) sinken.
The boat will (certainly) sink
It is probable that the boat will sink.

According to Kratzer, (30-a) expresses a hypothesis that is ground in more subjective evidence of the speaker, whereas (30-b) is ground in more objective evidence. In subsequent literature, subjectivity has often become an evidential category (see e.g. Garrett, 2001; Mari, 2010a,b; Squartini, 2010; Nuyts, 1992). In what follows, we will talk about doxa, without making a difference between pure subjectivity and pure objectivity, as most often than not reasoning and conjectures are grounded in both (see Giannakidou and Mari (2021a)), and are hardly pure.

In the Kratzerian framework, von Fintel and Iatridou treat weak necessity as restricted universal quantification over the best worlds worlds at the intersection of two modal bases. In their words (Von Fintel and Iatridou, 2008, :20):

> Strong necessity modals say that the prejacent is true in all of the favored worlds, while weak necessity modals say that the prejacent is true in all of the very best (by some additional measure) among the favored worlds. While the standard Kratzer framework parametrizes the semantics of modals to two parameters (modal base and ordering source), we introduced a pair of ordering sources: (i) the primary one that is the only one that strong necessity modals are sensitive to and (ii) a secondary one which is the one that weak necessity modals use to refine the ranking of the worlds favored by the primary ordering source. We built that differential sensitivity into the lexical entries of *must/have to* and *ought*.

The important insight here is that in addition to the primary ranking that establishes human necessity— called here strong— as quantifying over the best

worlds, there is an additional ranking, producing *weaker* necessity modals and which is used "to refine the ranking of the worlds". These ideas are reconceptualized in terms of bias and absence thereof in the work of Giannakidou and Mari: weak necessity modals such as *should, ought*, as in *John should be home by now, You ought to try this wine* 'further refine' the necessity in that they devoid of bias. In other words, necessity modals can come without bias too. The next chapter 4 will be devoted to the discussion of this class on non-biased necessity modals.

To sum up, with Kratzer we end up with a framework for language modals which allows us to see some key properties of linguistic modality. In the Kratzerian system, the partition in the modal base between p and $\neg p$ worlds happens with the ordering source. In Giannakidou and Mari, which is the theory we consider next, the partitioning is conceptualized as distinct from ordering and one more element is added to the system: a metaevaluation that creates the ranking of better worlds and which is responsible for bias. We proceed to illustrate the motivations for that theory.

3.4 Veridical commitment and modality

The non-veridicality theory of modality is built in a number of publications most representative of which are Giannakidou and Mari (2013c, 2016b, 2018b,a, 2021b, 2023); we jointly we will refer to these studies as Giannakidou and Mari, and make specific references only to single out specific points in specific places.

The theory capitalizes on the association of a modal expression with a modal base which forms the basis for the veridicality judgment made by the sentence MODAL p. As we noted already, the formation of veridicality judgment is relevant not just for modality: for every sentence in a conversation, speakers and hearers form veridicality judgments about propositional content. Paul Grice in his classic paper *Logic and Conversation* established truthfulness as one of the foundational principles of cooperative conversation: rational cooperative interlocutors continuously make assumptions about each other's knowledge, beliefs and intentions. In making these assumptions, interlocutors form judgments about veridicality and intentions that include one's mental states of knowing, believing, expecting, remembering, and the like. The veridicality judgment, in contrast to truth, is a subjective construct that characterizes how speakers and hearers come to be truthful and assess truth, and while being true

is relatively easy to establish empirically for many sentences, what is meant to be truthful can be more challenging.

Building on Grice's seminal work, in Giannakidou and Mari (2021b,a) we formulate the Veridicality Principle as the hallmark of sincere, co-operative assertion:

(31) Principle of Veridicality of Assertion (Giannakidou and Mari, 2021a, : (2))
A sentence S can be asserted co-operatively 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 is the hallmark of sincere, co-operative conversation where interlocutors enter the exchange solely with the goal to communicate, and do not want confuse or deceive each other or signal other goals.[5] By uttering the unmodalized sentence *It is raining*, the speaker knows or has grounds to believe that it is raining, and wants to share her knowledge or belief with her audience— which in turn, by the Veridicality principle, acknowledges the speaker's intention to convey truthful content.

When the speaker has knowledge of content π, we say that she makes a veridical judgment about π. If the speaker has a veridical judgment towards a propositional content, then she is fully committed to it. Full commitment is absolute and can be a reflection of knowledge:

(32) Veridical commitment as knowledge
A linguistic agent i is veridically committed to a proposition p iff i knows p.

Thus veridical commitment to truth is an attitudinal state akin to knowing. Knowing is realistic and relies on fact, but full veridical commitment can also be subjective, arising through states such as belief, certainty, memory and similar attitudes that enable subjective but not factual commitment to the truth of p. Subjective commitment is veridical commitment even if the belief is objectively false. Recall from earlier discussion:

(33) a. Ariadne believes that Milan is the capital of Italy.

[5] In the pragmatic literature a variety of norms for assertion have been discussed, that most notably include: the norm of belief (a speaker must believe in the asserted content see e.g. Davidson (1985); Vanderveken (1990); Lauer (2013); the Knowledge Norm Account (a speaker must know the asserted content e.g Williamson (1996)), or the truth norm (asserting something is recognizing it as true e.g. Grice (1975); Dummett (1981); Wright (1994); Williams (2010).

b. Ariadne considers Milan to be the capital of Italy.

That Milan is the capital of Italy is objectively false, and the speaker can use this sentence to report Ariadne's contested belief, since Milan is not the capital of Italy. Yet, if Ariadne has that belief, and for the sentences above to be true belief reports, it has to be the case that the subject of belief, namely Ariadne, be subjectively committed to Milan being the capital of Italy:

(34) Subjective veridical commitment
A linguistic agent i is subjectively committed to a proposition p iff i believes p or is certain about p.

Belief and certainty create veridical commitment as a subjective attitude towards truth. When we assess truth, we typically use a mix of knowledge and belief broadly understood to include certainties, perceptions, prior expectations, or tastes; veridical commitment is the term we use to refer this attitude of one's full and complete acceptance that a proposition content π is true. Importantly, in Greek and Italian veridical commitment is expressed with indicative mood (Giannakidou and Mari, 2021b,a). The veridicality judgment is a kind of epistemic/doxastic judgment, and the role of the individual in assessing truth is apparent always (see also Harris and Potts (2009) who postulate that 'all sentences are perspectival').

When a speaker asserts a positive unmodalized sentence in the present or past, unless she is lying, she asserts p because she knows or believes that p is true;[6] What one knows or believes to be true forms the epistemic basis for the veridicality judgment. When the speaker has knowledge or belief of the truthfulness of content π we say that the speaker takes a veridical stance towards it. We think of the veridical stance as the attitude of commitment to truth. The veridical commitment is not commitment to act; veridical commitment is an abstract state of believing (broadly construed) or knowing π to be true, and is independent of action since it relies purely on knowledge, belief, evidence.

There are two types of evidence that contribute to the veridicality judgment: there is (a) declarative informative content, call it C, corresponding to what a linguistic agent knows or believes to be true based on public or private information, and (b) emotive or preferential content, call it $PREF$ that draws on privately held beliefs and attitudes, desires, emotions, expectations, and the like. The latter is entirely subjective, and Giannakidou and Mari (2021a) call

[6] The relation between assertion and belief is complex (Lauer, 2013; Krifka, 2015; Mari, 2017; Giannakidou and Mari, 2021b,a) . We do not enter this debate here, but note that humans typically form veridicality judgment based on both what they know and what they believe, including their biases and expectations that come form religious or political beliefs.

it 'endogenous'. If commitment to truth is sincere, the declarative informative content is evidential, it serves as the body of evidence. Evidence can be public or private, it can be based on prior and experience, studies, and information (both first hand and hearsay from reliable sources, see Boscaro et al. (2024) for discussion of twitter corpus).

The declarative body of evidence *C* is both factual and rational: it contains logical deductive rules, as well as inductive, stereotypical generalizations that guide rational thought. For instance, if the speaker has heard that Ariadne read War and Peace from a reliable source, they will take this hearsay information to be true and convey it as true; but if they hear the same sentence uttered by a pathological liar, rationality should make the speaker reluctant to commit themselves to the sentence. Likewise, if I wake up in the morning and I see that the streets are wet, I can truthfully report this by saying *It rained last night*, because it is rational to infer, by the wetness of the street, that it rained? and less rational to conclude, for example, that it snowed, or that the neighbors left the water running again.

The emotive or preferential component *PREF*, on the other hand, is subjective and private: it contains the set of desires and hopes of the linguistic agent, their political, ideological, religious, or aesthetic beliefs— and it includes biases and preferences that are not always rationally of factually justified. The *PREF* component can be decisive when the sentence contains a so called subjective or evaluative predicate such as in *War and Peace is a masterpiece*, and *This food is delicious*. When a highly subjective predicate is used, the sentence cannot express fact but an opinion. Opinions do not depend on factual evidence *C* alone, and are highly dependent on subjective preferences in *PREF* (which, as we said, need not be rational and could be objectively false).[7]

In the formal theory of veridicality, the epistemic basis for the judgment is captured by the concept of the modal base, which is now viewed as an information state. Giannakidou (1994, 1997)) was among the first to propose a generalization of the veridicality judgment relative to individual anchors *i* and their epistemic states, and called the relevant states 'models of evaluation'. In main clauses, the anchor is by default the speaker, in embedding under propositional attitudes it can be also the main clause subject (see (Farkas, 1985) for earlier work on this with reference also to McCawley (1981).[8]

'Models of evaluation' is the term originally used by Giannakidou (1997, 1998, 1999, 2013b,a). These models are sets of worlds, relative to an individual anchor *i*, corresponding to what *i* believes or knows. Giannakidou (2013b,a,

[7] On the role of emotive content in grammar, see a recent study of Baunaz and Puskás (2022).

[8] Individual anchoring of truth should be seen on a par with other kinds of anchoring of propositional content, i.e. temporal anchoring, or event anchoring (e.g. Hacquard, 2006, 2010).

1999, :(45)) and Giannakidou and Mari (2021b,a) call these models epistemic states in our definition below:

(35) *Epistemic state of an individual anchor i*
An epistemic state M(i) is a set of worlds associated with an individual i representing worlds compatible with what i knows or believes in the context of utterance.

M(i) is a non-trivial set that encompasses i's beliefs and knowledge about the world, i's perspective, so to speak. The veridicality judgment relies on what the anchor knows or believes to be the case.[9] For unembedded sentences, the individual anchor is always the speaker. For an unmodalized assertion of p, p is assertable only if the speaker knows or at least believes p to be true since veridicality is a condition on the speech act of assertion, as we said. Giannakidou and Giannakidou and Mari generalize that all truth judgment is relativized to such epistemic states. With propositional attitude verbs, depending on the lexical meaning of the verb, we have more precise specifications of the states; for instance, we have doxastic states (based on belief only), perception states, memory states, bouletic states (for desire verbs), and the like.

When one utters a positive non-modalized sentence, they utter the sentence from a veridical standpoint which means that the epistemic state is veridical, which means that all the worlds in it are p-words. A state can also be antiveridical if all worlds are $\neg p$ worlds. The veridical and the nonveridical state are homogeneous entailing p and $\neg p$ respectively:

(36) *Veridicality of epistemic states*
   a. An epistemic state M(i) is veridical about p iff it entails p: i.e., $\forall w' \in \mathrm{M}(i) : p(w')$
   b. An epistemic state M(i) is antiveridical about p iff it entails $\neg p$: i.e., $\forall w' \in \mathrm{M}(i) : \neg p(w')$

(37) *Veridical information state as a prerequisite for assertion* (Giannakidou and Mari, 2021b, : 311)
A sentence S is assertable by a speaker i if and only if i's information state is veridical.

A nonveridical state, one the other hand, contains both p and $\neg p$ worlds, it is partitioned state allowing for both possibilities. We have called it a space of uncertainty:

[9] With sentences containing predicates of personal taste (Lasersohn, 2005; Stephenson, 2007; Bylinina, 2017) veridicality is determined not by knowledge but by taste or experience, and the individual anchor is called the *judge*.

(38) *Nonveridical epistemic state*
An epistemic state M(i) is nonveridical about p iff it does not entail p: M(i) contains both p and $\neg p$ worlds.

The nonveridical state allows both options, and modal bases of modal verbs are typically such states in the theories of Kratzer, Portner and Giannakidou and Mari.

Given M(i), we now identify veridicality and nonveridicality *subjectively* as inference to i knowing or believing p:

(39) *Subjective veridicality* (for functions)
A function F that takes a proposition p as its argument is subjectively veridical with respect to an individual anchor i and an epistemic state M(i) iff $F\,p$ entails that i knows or believes p: i.e., iff $\forall w'[w' \in \mathrm{M}(i) \rightarrow p(w')]$.

A subjectively veridical function, in other words, entails p in the information state. Knowledge as well as belief are veridical in this definition, they imply homogeneity of the entire M(i) thus entailment to p in M(i). Subjective veridicality requires that the individual anchor is in an epistemic state that entails (or: supports) p, regardless of whether p is actually (i.e. objectively) true. For instance, *Nicholas believes that Ariadne is a doctor* reflects a veridical epistemic state (with respect to Nicholas = i and Nicholas's belief state = M(i), but the sentence *Ariadne is a doctor* can be objectively false.

(40) [[Nicholas believes that p]] is true in the world of the utterance context w iff: $\forall w'[w' \in \mathrm{Dox}(Nicholas, w) \rightarrow p(w')]$

Here *Dox* (following Giannakidou and Mari, 2021b) is specifically the space of beliefs. The truth condition of *believe* does not entail actual truth. However, (40) renders *believe* subjectively veridical, because the whole M(*Nicholas*) supports p, that it is to say, M(*Nicholas*) entails p. This is a state of full veridical commitment to p, a homogeneous p-space, just like knowledge. Other verbs denoting private epistemic spaces including fiction predicates such as *dream, imagine*[10] are subjectively veridical like *believe*: they entail p in the doxastic or imagination state, but unlike *know* they do not entail actual truth, they are not factive (Giannakidou (1994, 1998, 1999); Giannakidou and Mari (2016b,a)). Veridicality, therefore, is distinct from factivity because it can also be subjective.

[10] See footnote 8 and Mari (2016, 2017) for a refinement of the meaning of fictional attitudes.

Nonveridicality, on the other hand, is a property of a function that does not entail p in the information state, as in (38).

(41) *Subjective nonveridicality* (for functions)
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 p: i.e., iff $\exists w' \in \mathrm{M}(i)\ p(w') \,\&\, \exists w'' \in \mathrm{M}(i)\ \neg p(w')$.

Nonveridical epistemic states M(i) are partitioned, containing p and $\neg p$ worlds. They are therefore, epistemically or doxastically unsettled. Modal verbs are nonveridical functions in the sense above. An advantage of this generalization is that the vocabulary can now be extended to other domains that involve uncertainty, notably inquisitive spaces such as questions which are also nonveridical epistemic states.

Following Giannakidou and Mari (2016a, 2018b,a), we formulate nonveridicality as a precondition on modalities in the form of the axiom below:

(42) *Nonveridicality Axiom of modals*
MODAL (M) (p) can be defined if and only if the modal base M is a nonveridical state, i.e. only if M contains p and $\neg p$ worlds.

The nonveridicality axiom requires that the modal base M(i) be partitioned into worlds where p is true, and worlds where p is not true. This idea, as we mentioned at the beginning of this section, was also present in Condoravdi (2002) diversity condition. We argued that non-aleithic modals (possibility and necessity, epistemic, deontic, bouletic, etc) obey this principle, and therefore come with partitioned modal bases; consequently, epistemic modals do not entail p or knowledge of the speaker that p, and express, as Giannakidou and Mari (2016a) put it (see also Giannakidou, 2013b,a), reduced commitment to p.[11] Unmodalized assertions express full commitment, and are therefore epistemically stronger than modalized sentences which are epistemically weaker. Let us summarize this:

(43) *Veridicality of modal spaces* and *commitment* (Giannakidou, 2013b)

[11] There are two exceptions to the axiom, and both result in trivialization of modality. The first case is the actuality entailment of ability modals, where the modal is trivialized (Mari, 2015b). The second case is aleithic modality, as in *1 + 1 must equal 2*. Giannakidou and Mari (2016a) distinguish this aleithic *must* from the epistemic use. With both aleithic modality and actuality entailment, the distinction between modal and non modal statement is lost. We discuss the actuality entailment later.

a. A *veridical* modal space is fully committed: $\forall w'(w' \in M \rightarrow p(w'))$
b. An *antiveridical* modal space is fully committed: $\forall w'(w' \in M \rightarrow \neg p(w'))$
c. A *nonveridical* modal space is weakly committed: $\exists w', w'' \in M(w' \neq w'' \wedge (p(w') \wedge \neg p(w''))$

A nonveridical space is thus epistemically or doxastically weaker than the veridical space or antiveridical space which entail the prejacent proposition p or $\neg p$, when the prejacent is negated. The nonveridical M conveys weakened commitment of i to p. We say that the commitment is weakened, and not that there is no commitment, because the possibility of p still conveys commitment albeit *trivial*, as we characterized it. Weakened commitment can be trivial, as is the case of possibility, or partial as is the case with necessity modals.

In terms of informative content, a veridical or antiveridical state corresponds to a move by i to add the p or $\neg p$ to the common ground. Following Giannakidou (2013b), we call this 'full informativity'. Positive and negative bare assertions are fully informative in that they allow addition of the prejacent to the common ground:

(44) Fact: *Homogeneity and informativity*
Homogeneous (veridical and antiveridical) information states are fully informative.

Homogeneous states contrast with nonveridical states which are partitioned (p and $\neg p$) thus preventing addition of p to the common ground. Non-indicative assertions— assertions with modals— as well as non-assertions such as questions, optatives, imperatives– all convey nonveridical states and therefore do not add p to the common ground. Assertions with modals are called *inquisitive* by Giannakidou 2013, and it is important to note that they are not weaker assertions, but rather assertions of informationally weaker propositions (MODAL p, rather than p).

Let us now connect veridical commitment and informativity along a continuum. A veridical state commits i to p; MUST p, and MIGHT p, on the other hand, are nonveridical and only partially commit i to p. MUST p is stronger that MIGHT p because it entails partial commitment in Ideal worlds (cf. *infra*), and this creates positive bias towards p. Positive bias is weaker than knowledge or belief of p. Trivial commitment, finally, is simply raising the possibility of p. Let us put it all on a scale:

(45) Scale of Veridical Commitment and Informativity (Giannakidou and

Mari, 2016c))
< $p \gg$ MUST $p \gg$ MIGHT p >;
where '$\gg$' means 'informationally stronger than'
Non-modalized p (speaker knows p, p added to the common ground)
$\gg$
MUST p (speaker does not know p, but is biased towards p) $\gg$
POSSIBLY p (speaker does not know p, and there is nonveridical equilibrium)

Veridical commitment is therefore a gradable property[12], and the three degrees defined here are useful for capturing both the difference between modal and non-modal sentences (which come out as informationally stronger), as well as the difference between a biased modality which expresses partial commitment in the Best worlds, and possibility which only expresses trivial commitment to p by not excluding p as a possibility.

The nonveridicality framework is thus pretty broad, but uses the mechanism of modality— the modal base— as a key component for truth assessment globally. Let us now address the other major components of the theory: equilibrium and bias.

3.5 Equilibrium, metaevaluation, and bias

Consider now again the difference between possibility and necessity modals.

(46) a. Ariadne might be at the party.
b. Ariadne must be at the party.

In both cases, the speaker is uncertain about Ariadne being at the party, and leaves open the possibility that she might not be. The uncertainty is in nonveridical equilibrium with possibility: Ariadne being at the party is considered a mere possibility, and the speaker has no preference, no reason to believe Ariadne being in the party is more likely than Ariadne not being at the party.

(47) Nonveridical equilibrium (= neutral nonveridical state)
A modal space M(i) is in nonveridical equilibrium if it is partitioned into p and $\neg p$ space is, and there is no bias.

Nonveridical equilibrium is an egalitarian state of neutrality: p and $\neg p$ are equal possibilities, none is privileged over the other. Giannakidou and Mari,

[12] Liu (2019) uses the term 'elastic'.

following Giannakidou (2013b), take equilibrium to be the default for epistemic possibility, questions, and conditionals:[13]. in all cases the speaker entertains equally the positive and the negative alternatives. And while questions lack truth conditions and are therefore distinct from modal assertions, it is important to understand that the common semantic core between genuine (that is, non-biased) information questions and possibility statements is the neutral nonveridical state: in both cases, the speaker entertains the positive and negative propositions without ranking them. We will have more to say about the destruction of equilibrium in biased questions in chapter 7.

When bias arises, the nonveridical equilibrium is manipulated towards the content of the prejacent being considered more likely by the speaker. This happens typically with necessity modals like MUST, which the literature calls often 'strong'. The speaker now deems the possibility of p more likely. We give below an intuitive understanding of bias (to be defined formally later):

(48) *Modal bias*
A modal statement MUST p is biased iff the two possibilities — p and $\neg p$– are ranked, and p is considered a better possibility than $\neg p$.

Giannakidou and Mari use the term *biased* modals for MUST modals: the speaker is biased in favor of the prejacent proposition, though they still are not veridically committed to it by knowledge, belief, or certainty.Of course, if the proposition under MUST is negative, bias will be towards $\neg p$ (see Giannakidou and Mari (2018a) for discussion about PPIhood of MUST). Technically, then, if MUST p then bias will be towards the prejacent p whether it is positive or negative.

We will argue that the choice of bias reveals that the speaker has some kind of evidence in favor of the modal prejacent. If the speaker decides to use a biased modal, she does so because she is making an inference based on a number of premises that support p – in the the Ideal worlds, as we will argue next. Biased modals have a strong inferential character for this reason, and because they presuppose evidence they often correlate with the class of expressions known as evidentials crosslinguistically. We will discuss the interaction between epistemic modals and evidentials in chapter 6. Crucially, having evidence for the prejacent does not mean that the speaker is in a veridical state of knowing or believing the prejacent to be true: the speaker still does not know all the relevant facts or factors, with bias she only has *partial* knowledge, as Gi-

[13] On *might* as an alternative generator, from a psychological perspective, see Mascarenhas and Picat (2019)

annakidou and Mari (2016c) take pains to argue. The biased modal, therefore, doesn't express veridical commitment to the prejacent.

In the nonveridicality theory the concept of bias plays a key role. Modal expressions in language remain indicators that the speaker reasons with uncertainty and that they leave both options – p, $\neg p$ – open. With biased modals, in addition, the speaker discriminates towards the prejacent, she appears to have reasons to think of p as a better possibility than $\neg p$. Bias thus reveals that the two possibilities are ranked, and it is the property that produces the apparent strength of the modal statement. The Giannakidou and Mari framework captures bias by means of a metaevaluation function O, as we will show, which introduces the ranking in the modal structure. We remind again that the existence of ranking indicates reasoning with evidence. In a context with reliable evidence (exogenous or preferential, as we mentioned in the previous section) for the prejacent, O will produce bias; in a context with less reliable evidence or mere speculation, O will establish no preference resulting in a more neutral inference of weak necessity modals such as *should, ought*— as well as the future modal, as we will see in chapter 4.

3.5.1 Two modal bases for MUST

We are now ready to put together the analysis of the epistemic necessity MUST modal. The analysis we propose here including its Greek and Italian equivalents that we discussed in chapter 2, as well as other MUST expressions in language that exhibit similar behavior. MUST modals associates with an epistemic modal base M(i) which is the set of propositions known by the speaker i at t_u (the utterance time). w_0 is the world of evaluation, by default the actual world:

(49) M(i) (t_u)(w_0) = $\lambda w'$(w' is compatible with what is known or believed by the speaker i in w_0 at t_u)

The epistemic modality is thus, as we said earlier, by default 'subjective', anchored to an individual. Knowledge changes with time; epistemic modality is therefore parametric to knowledge and evidence at t_u, as is often acknowledged in the literature (see extended discussion in Portner, 2008, and references therein). We also assume that the domain of M(i) is restricted by relevance following the usual assumption of domain restriction with quantifiers.

Given what the speaker knows, the modal base of epistemic MUST is nonveridical, i.e., it does not entail p and contains both p and $\neg p$ worlds. To derive the truth conditions of MUST we assume with the Kratzerian literature

that we described earlier (see e.g. Portner, 2008) that MUST uses a set of propositions $\mathcal{S}$ which impose a norm or an ideal; we think of it as a stereotypicality/normalcy conditions and norms. Let us take note here that such normative conditions are not exclusive modality; they have most notably been discussed also in relation to genericity (see Asher and Morreau, 1995) and progressives (Dowty, 1979; Landman, 1992; Portner, 1998); they appear also as inertia (Dowty, *ibid.*), stereotypicality (Portner, 2008), and reasonability (see Landman, 1992; Portner, 1998; Mari, 2014; Mari et al., 2012), and many other works. They seem to apply well-beyond epistemic modality to linguistic categories that appeal to inferencing, rationality, and causal reasoning more broadly.[14]

Recall that the Kratzer/Portner semantics posits an ordering source called *Best* by Portner) which ranks worlds according to how close they are to the stereotypical ideal. Our account encodes that the modal base is partitioned into stereotypical and non-stereotypical worlds, but we dissociate stereotypicality from ranking. This allows us to capture possibility modals as undergoing the initial partition between stereotypical and non-stereotypical worlds without necessary ordering. So, in the Giannakidou and Mari account we have a partition between worlds following the Ideal and worlds that do not.

In the epistemic modal base $\mathrm{M}(i)(t_u)(w_0)$, we define $\mathrm{Ideal}_{\mathcal{S}}$ as a function over $\mathrm{M}(i)(t_u)(w_0)$, still in the spirit of Portner (2008). The output $\mathrm{Ideal}_{\mathcal{S}}$ is a subset of $\mathrm{M}(i)(t_u)(w_0)$:

(50) $\mathrm{Ideal}_{\mathcal{S}}(\mathrm{M}(i)(t_u)(w_0)) = \{w' \in \mathrm{M}(i)(t_u)(w_0) : \forall q \in \mathcal{S}(w' \in q)\}$

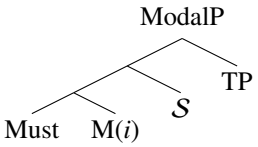
So defined, $\mathrm{Ideal}_{\mathcal{S}}$ is a second modal base for MUST: it delivers the worlds in the epistemic modal base, a subset of $\mathrm{M}(i)$, in which all the propositions in $\mathcal{S}$ are true. $\mathcal{S}$ is a set of propositions that corresponds to common ground norms.[15] The set $\mathrm{Ideal}_{\mathcal{S}}$ is also parametric to time. Unless otherwise stated, we consider that $\mathrm{Ideal}_{\mathcal{S}}$ is determined at the actual world and at the utterance time (this will be indeed always the case in the reminder of this book). As we can see, there is no ranking.

The overall modal structure looks like this:

[14] Stereotypicality as a set of norms for linguistic expressions appears to be related to the concept of stereotype studied in social psychology and also linguistic categorization. In psychology, however, the term "stereotype" can also be use used to refer to beliefs about people's attributes relying on social norms, whereas in modality stereotypicality is about expectations of outcomes based on what is expected *under normal circumstances*. Stereotypically, therefore, the way we understand it in semantic analysis functions as a constraint for rational outcomes.

[15] Since only those worlds are considered in which *all* the propositions in $\mathcal{S}$ are true, the function $\mathrm{Ideal}_{\mathcal{S}}$ determines a cut-off point.

(51)



This structure has the following basic truth condition requiring that p be true in the Ideal set of M(i). Tense comes from below (a semantic present or past ; see Giannakidou and Mari, 2018b, for discussion of tense); recall that t_u is the utterance time. From now on, we assume that, by default, M(i) is projected at the time of utterance in the actual world.

Now, consider the sentences:

(52) a. Ariadne must have been the winner.
b. Ariadne must be talking to Nicholas now.

Given what we said so far, these sentences have the following truth conditions. Given a set $\text{Ideal}_{\mathcal{S}}$ at the utterance time t_u,

(53) (to be completed)
$[\![\text{prepi/devere/must (PAST } (p))]\!]^{M,i,\mathcal{S}}$ is defined only if M(i) is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined, $[\![\text{prepi/devere/must (PAST } (p))]\!]^{M,i,\mathcal{S}} = 1$ iff
$\forall w' \in \text{Ideal}_{\mathcal{S}} : \exists t' \prec t_u \wedge p(w', t')$

(54) (to be completed)
$[\![\text{prepi/devere/must (PRES } (p))]\!]^{M,i,\mathcal{S}}$ is defined only if M(i) is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined, $[\![\text{prepi/devere/must (PRES } (p))]\!]^{M,i,\mathcal{S}} = 1$ iff
$\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

The prejacent is a sentence in the past and at present respectively. The modal base is partitioned into Ideal and non-Ideal worlds, and the assertion of MUST claims p in the Ideal worlds. The tense in both cases is independent of modality and comes from the prejacent itself, not the modal. Echoing Giannakidou and Mari (2016c) and Knobe and Szabó (2013), we can think of $\text{Ideal}_{\mathcal{S}}$ as the 'inner' domain of MUST, and M(i) as the 'outer' domain. The outer domain is a nonveridical epistemic space that does not as a whole support p; but the $\text{Ideal}_{\mathcal{S}}$ space is veridical: all worlds are p worlds. In other words, MUST is nonveridical with respect to M, but veridical with respect to $\text{Ideal}_{\mathcal{S}}$. This accounts for why we say that MUST expresses partial commitment: it expresses commitment to the prejacent in the $\text{Ideal}_{\mathcal{S}}$ subset of M(i). This makes it stronger than

MIGHT, and grants MUST *mixed* veridicality status. We show pictorially the analysis in Figure 3.1.

Because of the nonveridical M(i), MUST satisfies the licensing condition for the subjunctive Giannakidou and Mari (2021b) posit, and this explains why the MUST complement appears in the subjunctive in Greek and Romance languages. While the partition between Ideal and Non-Ideal worlds is not based on ranking, as we show next, the two sets are indeed ranked by a meta-evaluation function. This additional step produces positive bias towards the prejacent.

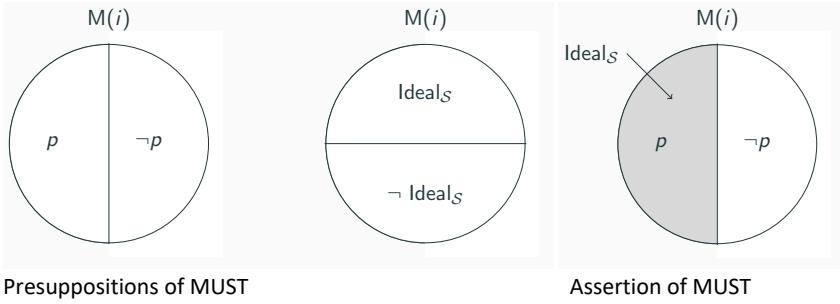


Figure 3.1 Presuppositions and assertion of MUST

3.5.2 Evidence for the metaevaluation: modal spread

Giannakidou and Mari's theory accommodates bias at a higher level than the Kratzer/Portner analysis. Bias is implemented as a metaevaluation function, as an additional layer in the modal structure, and the motivation comes from the phenomenon of modal spread that we identified in chapter 2, and which we will talk more about now.

Modal spread is the label for cases where the modal verbs or auxiliaries are accompanied by a modal adverb. Recall:

(55) a. John must probably/certainly be sleeping.
b. John may possibly be a doctor.
c. You must definitely follow the rules.

Here we see *must* and *may* co-occurring with *probably, certainly, definitely* and *possibly*, respectively. The phenomenon is, in fact, quite common. Lyons (1977) talks about 'harmony', the idea being that there is a concord running through the clause which results in the double realization of a single modal-

ity (Lyons, 1977, :808), on a par with other cases of concord such as negative concord, and person or gender agreement (see also Geurts and Huitink (2006); Huitink (2014); Iatridou and Zeijlstra (2010); Willer (2013)). This observation, namely that there is one modality in these cases, is stable in most of the analyses of the phenomenon, and the situation is distinct from true embeddings:

(56) It may turn out that Ariadne must give her speech this afternoon.

This is a genuine case of *must* embedded under *may*; notice also the clause boundary (*that*). (Embedding can also happen within one clause, of course, as in *Ariadne may have to give her speech this afternoon*).

If the modal verb is the modal operator, what is the semantic contribution of the adverb in modal spread? We offered some discussion in chapter 2, and there is much more in Giannakidou and Mari (2018a, 2019). For our analysis, the adverb, crucially is the overt realization of a metaevaluation function. The existence of such a function is an integral part of the modal structure.

Let us get first an empirical grasp of how the adverb and metaevaluation works. First, as we noted already in chapter 2, it is important to acknowledge that we are not always dealing with concord. Modal verbs and adverbs with apparently opposing forces can also co-occur with a single modality reading, as (57) shows for Italian *dovere* co-occurring with *forse* 'maybe'.

(57) Le luci sono accese. Gianni deve forse essere a casa.
The lights are switch-on. Gianni must maybe be at home.
The lights are on. John must (#maybe) be at home.

Below is an attested example (see also Cui, 2015, for a corpus study of modal concord). The discussion is about an archeological reconstruction of the town Castel Nuovo, near Naples.

(58) Il vaso, che costituisce uno dei premi guadagnati dagli atleti negli agoni panatenaici di Atene, **deve forse** fare parte del corredo di una sepoltura ubicata non lontano dall'area di Castel Nuovo.
The jar, which constitutes one of the prizes earned by the athletes in the pan-athenians olympics of Athens, *must maybe* belong to the kid of a burial located not far from the area of Castel Nuovo.[16]

The same verb-adverb combination with opposing forces can be found in English, as we see above and in (59), but Greek forbids it (60).

[16] Source:
http://www.comune.napoli.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1425/UT/systemPrint

(59) So there **must maybe** be some glitch somewhere along the line or something that makes this happen. I am sure is a cache or technical glitchup.[17]

(60) #Prepi isos na ine giatros.
must maybe that.SUBJ be.3SG doctor
#He must perhaps be a doctor.

Two conclusions must be drawn here: first, to the extent that incongruent forces are possible, this suggests that modal force and whatever the adverbs express can be dissociated within a single modal structure. This results in more flexible modal meanings: the combination of a MUST with *maybe*, for instance, is a weakening of *must*. Secondly, languages do parametrize with respect to the degree to which they allow incongruent forces: Italian allows is more freely, as we see, English allows it too but to a lesser degree, and Greek seems to disallow it with the exception of the future particle, as we shall see in chapter 4. Here are some more examples illustrating the difference in Greek and Italian with possibility modals (61-a)-(62-a):

(61) a. #Bori malon/oposdhipote na efije noris.
may probably/definitely that.SUBJ left.3SG early
b. Può probabilmente essere partito presto.
Can.PRES.3SG probably/certainly be left early
He may have probably/definitely left early.

(62) a. #Bori malon na ine giatros.
may probably that.SUBJ be.3SG doctor.
b. Può probabilmente essere un dottore.
may.PRES.3SG probably/certainly be a doctor.
He may probably be a doctor.

Congruent construals seem to be pervasive in Greek and Italian, just as in English, of course. Recall:

(63) a. Prepi malon/oposdhipote na ine giatros.
must probably/definitely that.SUBJ be.3SG doctor
He must probably/definitely be a doctor.
b. Deve probabilmente/sicuramente essere un dottore.
must.PRES.3SG probably/certainly be a doctor
He must probably/definitely be a doctor.

[17] Source: https://www.blackhatworld.com/seo/ogads-com-mobile-cpa-cpi-incent-network-mobile-content-locker-high-cr.704909/page-26. We thank Paul Portner for pointing this to us.

(64) To these causes conjointly, therefore, must probably be ascribed the very delicate light ring not having been noticed by the observers of the late transit of Venus.[18]

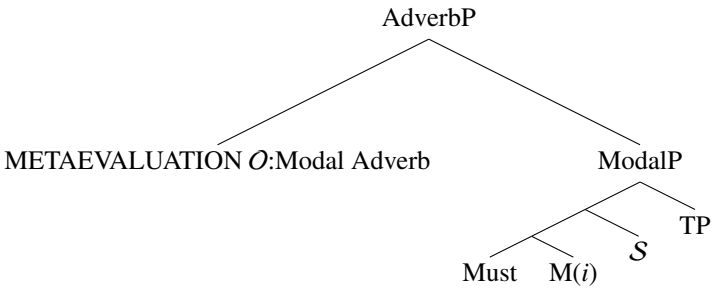
We see here the modal adverbs *malon/probabilmente* (*probably*), *oposdhopote/certamente* (*definitely*), etc. co-occur with *prepi/dovere/must*. In Greek and Italian, modal spread is very common and unmarked. [19]

The observed flexibility, as we said, allows for variable strengths of the modal construals, and this is a desideratum for a successful formal theory of modals. We refer the reader to Giannakidou and Mari (2018a) for more extensive data.

3.5.3 The modal skeleton and the metaevaluation

In the non-veridicality framework, and especially in Giannakidou and Mari (2018a) which we follow closely here, modal spread is taken as evidence for the existence of a metaevaluation in the modal structure:

(65)



This is the structure of 'modal spread', which can be broadly understood now as the case where multiple exponent of modality appear 'absorbed' into a single modality. The role of the modal adverb is important. It appears adjoined to the ModalP, a position consistent with where epistemic adverbs appear (see Rizzi, 1997; Hacquard, 2010; Portner, 2008, for more discussion of the high scoping of epistemic adverbs) .[20] Within ModalP, we find the two arguments

[18] Source: adsabs.harvard.edu/full/

[19] Notice that *probably* cannot be an existential adverb since it expresses bias. We are not aware of any analysis that argues otherwise.

[20] The higher position is motivated, as we said, by the nature of the epistemic modality— and no special composition rule is needed, unlike in e.g. Potts' analysis of evaluative adverbs (Mayol and Castroviejo, 2013; Liu, 2012). As shown in Giannakidou and Mari (2018a), modal adverbs generally disprefer being placed in the left periphery, contrary to purely evaluative adverbs. Some existent theories have defended a view in which the adverbs contribute ancillary

M(i) and $\mathcal{S}$, which are typically covert (unless there is an overt *if* clause to restrict the modal base). In our structure, the adverbs are expected to occupy the Modal Adverb slot. The following are thus equivalent semantically:

(66) a. John is probably sick.
b. John must probably be sick.
c. John must be sick.

When only the adverb is used, we assume that the modal verb is present but silent. If no overt adverb appears, there is a silent adverb. This structure is reminiscent of Huitink (2012) where the modal adverb contributes the ordering source within the classical Kratzerian account.

Let us now consider more concretely how bias is produced. In our semantics, MUST quantifies universally over the Ideal$_{\mathcal{S}}$ worlds. In the specific case of the positive assertion, all Ideal$_{\mathcal{S}}$ worlds are p worlds. With epistemic necessity modals such as MUST, O reveals the speaker's confidence in p by ranking Ideal$_{\mathcal{S}}$ worlds as better possibilities than ¬Ideal$_{\mathcal{S}}$ worlds. We encode this below as *positive bias*:

(67) Positive bias of epistemic necessity modals.
Ideal$_{\mathcal{S}}$ is a better possibility than ¬Ideal$_{\mathcal{S}}$, relative to M(i) and O.

According to (67), there is no ¬Ideal$_{\mathcal{S}}$ world in M(i) which is not outranked by an Ideal$_{\mathcal{S}}$ world. And since, by the truth condition of MUST, all ideal worlds are worlds in which the prejacent is true, O is responsible not just for positive bias towards Ideal$_{\mathcal{S}}$, but also towards the prejacent itself. Crucially, (67) states that worlds that are compatible with what the speaker knows in the actual world w_0 (recall that M(i) is projected from the actual world) are ideal thus better ranked. This means that, according to the speaker, the actual world is more likely to be a world where the prejacent is true.

If there is no overt adverb, we posit a default empty ∅ one that introduces the meta-evaluation O with MUST. In this respect, MUST is lexically specified as a *biased* necessity modal: (i) it introduces universal quantification over Ideal$_{\mathcal{S}}$ and (ii) Ideal$_{\mathcal{S}}$ is ranked as higher by the silent metaevaluative adverb. This is the Giannakidou and Mari version of Kratzer's human necessity.

There are three nuances of strength for the adverbs.

(68) $[\![\text{Probably/mallon/probabilmente}]\!]^{O,\text{M},i,\mathcal{S}}$ =

commitments (Bonami and Danièle, 2008), expressive content (Mayol and Castroviejo, 2013; Giannakidou and Mari, 2017), or sincerity conditions (Nielsen, 2004; Wolf, 2015).

λq. $\text{Ideal}_{\mathcal{S}}$ is a weak necessity with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to M(i) and O & q

(69) $[\![\text{Definitely/oposdhipote/sicuramente}]\!]^{O,\text{M},i,\mathcal{S}}$ =
λq. $\text{Ideal}_{\mathcal{S}}$ is a necessity with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to M(i) and O & q

(70) $[\![\text{Maybe/Forse/Isos}]\!]^{O,\text{M},i,\mathcal{S}} = \lambda q$. O is empty & q

These are not exhaustive, but they are faithful of the range of possibilities observed in the languages we are considering. The input to the adverb is the modal proposition, and the adverb gives the (lack of) bias as part of the modal meaning. With PROBABLY the bias of MUST is maintained, as PROBABLY has the same force as the default covert adverb. With a stronger adverb (DEFINITELY), we have strengthening of the bias to necessity. This means that the adverb strengthens the default preference of MUST. A possibility adverb adds that O is empty. This means that there is no bias, no preference for the $\text{Ideal}_{\mathcal{S}}$ set over the $\neg\text{Ideal}_{\mathcal{S}}$ set. This is the default option with possibility modals, but in the next chapter, we will see that there are necessity modals that can come with an empty meta-evaluation akin to the possibility adverb— and this will be the structure of *weak* necessity modals in this system.

(71) Effect of the adverbs with universal modals.
   a. DEFINITELY (It. *assolutamente*; Gk. *oposdhipote*; Eng. *definitely*): Strengthening the default positive bias.
   b. PROBABLY (It. *probabilmente*; Gk. *mallon*; Eng. *probably*): Maintaining the default.
   c. MAYBE (It. *forse*; Gk. *isos*; Eng. *maybe*): Weakening the default.

Going now to possibility modals, they lack bias. When uttering a modal sentence *Pascal might be home*, the speaker entertains the two alternatives with no preference, and this is the state of non veridical equilibrium as can be recalled. As a result, the default adverb with an existential modal is MAYBE, which produces no bias. But it is conceivable, and indeed observed as we saw in chapter 2, that some possibility modals may be compatible with bias, resulting in stronger possibilities. We expect to find these crosslinguistically.

(72) Effect of the adverbs with existential modals.
   a. DEFINITELY (It. *assolutamente*; Gk. *oposdhipote*; Eng. *definitely*): Introducing positive bias.

b. PROBABLY (It. *probabilmente*; Gk. *mallon*; Eng. *probably*): Introducing positive bias.
c. MAYBE (It. *forse*; Gk. *isos* Eng. *maybe*): Maintaining the default.

As we will see in the rest of the book, the dissociation of modal force (possibility and necessity) from bias allows the theory to capture several facts cross-linguistically and to define graded nuances of modals such as non-biased necessity modals or biased possibility modals.

For the reader interested in the formal implementation, the lexical entry of MUST can now be completed as follows. We see a silent adverb ∅ akin to *probably* in the lexical entries, which provides weak necessity, in the Kratzerian sense. This weak necessity can be strengthened into strong necessity by DEFINITELY, an option attested across Greek and Italian.

(73) $[\![\emptyset\,\text{MUST (PRES }(p))]\!]^{O,\text{M},i,\mathcal{S}}$ is defined only if the modal base M(i) is nonveridical and it is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![\emptyset\,\text{MUST (PRES }(p))]\!]^{O,\text{M},i,\mathcal{S}} = 1$ iff: $\text{Ideal}_{\mathcal{S}}$ is a weak necessity with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to M(i) and O & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

(74) $[\![\text{PROBABLY MUST (PRES }(p))]\!]^{O,\text{M},i,\mathcal{S}}$ is defined only if the modal base M(i) is nonveridical and it is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![\text{PROBABLY MUST (PRES }(p))]\!]^{O,\text{M},i,\mathcal{S}} = 1$ iff: $\text{Ideal}_{\mathcal{S}}$ is a weak necessity with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to M(i) and O & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

(75) $[\![\text{DEFINITELY MUST (PRES }(p))]\!]^{O,\text{M},i,\mathcal{S}}$ is defined only if the modal base M(i) is nonveridical and it is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![\text{DEFINITELY MUST (PRES }(p))]\!]^{O,\text{M},i,\mathcal{S}} = 1$ iff: $\text{Ideal}_{\mathcal{S}}$ is a necessity with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to M(i) and O & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

The default bias can be overwritten by equilibrium in Italian, by MAYBE. Italian, indeed, not only features the combination of MUST and MAYBE, but also has a special modal, *futuro*, that instantiates exactly this configuration: there is quantification over Ideal worlds, but those are not ranked as better with respect to the non-Ideal ones (see ch. 4 for an extended discussion).[21]

[21] For the role of the adverbs with assertion and the notion of gradability of assertion, see Wolf (2015); Greenberg and Wolf (2018).

As for the existential modal, the default is the non-veridical equilibrium. This equilibrium can be maintained (an option that is by default featured by Greek and Italian) or even strengthened (an option that Italian features).

(76) $[\![\emptyset\text{MIGHT (PRES } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined, $[\![\emptyset\text{MIGHT MIGHT (PRES } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff O is empty & $\exists w' \in \mathrm{M}(i) p(w', t_u)$

(77) $[\![\text{MAYBE MIGHT (PRES } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined, $[\![\text{MAYBE MIGHT (PRES } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff O is empty & $\exists w' \in \mathrm{M}(i) p(w', t_u)$

3.6 Conclusion

To conclude, linguistic theorizing about modality in the past 50 leads to a theory that uses modal bases and the logical properties of veridicality and nonveridicality as the foundation for the analysis of modality. In a way of summarizing, we made the following central distinctions:

(i) When the speaker i makes the choice to use a modal expression, she decides to take a nonveridical stance towards a propositional content because she lacks evidence to support knowledge of p. Modals, as Giannakidou and Mari 2021 summarize, as *anti-knowledge* markers, indicators that the speaker does not believe or know p.

(ii) The *Nonveridicality Axiom* is a presupposition that the modal bases of all non-aleithic modals are partitioned sets of worlds, containing both p and $\neg p$ worlds as open possibilities. Nonveridicality imbues the modal base with uncertainty.

(iii) Veridicality and non-veridicality characterize information states of individual anchors that are homogeneous (veridical) or non-homogeneous (nonveridical). The veridical state is the basis for full commitment, and a prerequisite for unmodalized truthful assertion.

(iv) Possibility modals express *nonveridical equilibrium*: p and $\neg p$ are equal options in the modal base, and the speaker has no evidence to prefer one over the other.

(v) The apparent strength of necessity modals comes, we argued, from the presence of a non-empty meta-evaluation O which produces bias, namely that the Ideal worlds are better possibilities than the non-Ideal ones. The bias reflects the existence of reliable evidence in support of the prejacent proposition, we can therefore think of it as *evidential* bias.

(vi) The categories of equilibrium and evidential bias are central to defining the strength of the modal sentence, and are better descriptors of what counts as 'strong' and 'weak' within modality— terms that have been used without precise definition. When reasoning with uncertainty, speakers can take a weaker (possibility) or a stronger (necessity) position depending on how much evidence they have; but the stronger position is at best bias, and never full veridical commitment to the prejacent— since the modal base with both types of modals remains partitioned.

(vii) The use of subjunctive with modal verbs supports the generalization that the subjunctive is sensitive to the nonveridical presupposition of the selecting predicate, as argued in Giannakidou and Mari (2021b).

Building on this framework, we will demonstrate further how this system works and how far it can reach.

Questions and further readings

Questions

- This chapter explains the basic analytical tools for modality. The concept of the possible world is basic, as well as the Nonveridicality Axiom that postulates that the modal base must contain both worlds supporting the prejacent and worlds that do not. There are different kinds of modal bases— epistemic, deontic, ability, for example— and they determine the flavor of the modality. Can you imagine mixed cases, say mixed epistemic-deontic? Can you think of examples?
- Kratzer presents a system for modality with various degrees of strengths for the modals: *must* is stronger than *should* which is stronger than *ought*. This fact, by itself, suggests that the mere possibility versus necessity distinction (parallel to negation versus affirmation) is not enough for the analysis of linguistic modals. Think of the ways weaker or stronger modalities are produced in various languages, the morphological pieces used. Do you find any generalizations?
- If modality is a graded category, could we simply map modal meanings onto probability scales (as is suggested, for instance, by Lassiter)? Such a move would seem prima facie attractive. What would we gain? What would we miss?

Further readings

Portner (2008) is a required reading for those interested in more formal detail of possible world semantics. A more philosophically oriented, amazingly clear book is Fitting and Mendelsohn (2012) introduction to Modal Logic.

4

Unitary modals, the future, and non-biased necessity

In the previous chapter, we offered a detailed formal semantic framework for the analysis of modal sentences by integrating insights from the most influential theories of modality that formal semanticists have developed in the past 50 years. Our main languages of illustration were English, Greek and Italian, and we saw that modal force comes in two varieties— possibility and necessity— the former expressing nonveridical equilibrium and the later evidential bias. Distinct modal verbs tend to lexicalize possibility and necessity in the Indo-European family of languages, but as we mentioned in chapter 2, outside the Indo-European family we also find languages with a single, called here unitary modal, which is translated in some contexts with a MUST and in some others with a possibility modal. In this chapter, we discuss this type of meaning variation, and show that it is found also in the familiar languages Italian, Greek and English. Unitary modals are flexible necessity modals, we will argue— flexible in that they can have, or lack, evidential bias. We will show that the future modal (FUT) in Greek and Italian behaves like the unitary universal of Salish. Overall, a system that allows dissociation of the modal force from ranking (meta-evaluation) such as the one in Giannakidou and Mari (2018b, 2021b,a) is analytically attractive because it captures diversity within a semantic class (necessity modals) without giving up a common semantic core. The concept of non-biased flexible necessity includes other kinds of weaker necessity modals such as *should, would*, the conditional mood, and similar items, which crosslinguistically often contain a future component.

4.1 Unexpected unitary modals in Salish and Birman

As we have demonstrated, data-driven analysis of modality has indeed obliged the theory to move to a more inclusive and refined vision. The distinctions of

'strength' of modal elements must be understood not as a mere binary of possibility versus necessity, but as more nuanced with some apparent 'peculiarities' such as, for example, the fact that St'at'imcets Salish does not mane a lexical distinction between necessity and possibility but employs one modal which appears as underspecified or ambiguous (as observed first in Matthewson et al., 2007). The epistemic modal *k'a*, famously, is said to express both epistemic possibility and necessity.

We read in Matthewson et al. (2007) that the context for the necessity reading (1) is as follows.You have a headache that won't go away, so you go to the doctor. They run a few tests, and the tests show negative for illness. Hence, there is evidence that there is nothing wrong, so the speaker utters the sentence as a conclusion:

(1) nilh k'a lh(l)-(t)-en-s-wá(7)-(a)
FOC EVID PREP-DET.1SG.POSS.NOM.IMPF.DET
ptinus-em-su't
think.INTR.OOC
It must be from my worrying.

The context for possibility (2), on the other hand, is more speculative. Here we don't have any specific tests or hypotheses at hand; the speaker is merely speculating as to why the personal referred to by *he* is not here.

(2) wa7 k'a s'ena7 qwenúxw
IMPF EVID counter sick
He may be sick.

The claim in the original descriptions of the phenomenon is that the same modal word *k'a* is used to convey both necessity and possibility as indicated in the translations. In an evidence based context such is (1) the epistemic necessity reading is supported; in a more speculative context, we have an apparent possibility reading. In terms of the theory as developed so far, the observation can be crystallized as: the Salish modal can be used both when more evidence leads to a biased conclusion, as well as in a context with less evidence. In this case, we have a more neutral inference, the appropriate vehicle of which, in English, is a possibility modal.[1]

Birman, which is discussed in Vittrant (2013), features a similar pattern. Circumstantial modality *ya*[1] appears to have both a possibility and a necessity reading (Vittrant, 2013, : 110 examples (97a-b)).

Please, see attached document

[1] *K'a* is also discussed in the context of evidentiality in chapter 6, as an inferential evidential.

(3) coN^3 pa-lϵ^2 =Ka^1 -ya-Twe^2 =Ka^1 coN^3 ye^2 =Ko^2 θoN^3
moat circle S. neighborhoods S. moat water OBJ use
ya^1 =Tϵ^2
obtain REALIS
The neighborhoods circled by moats had the possibility to use water.

(4) caN^2-yakwϵ-Twe^2 a^{3}loN^3 =Ka^1 twiN^3-ye^2 =Ko^2 kha
the-remaining-neighborhoods all S well-water OBJ draw
θoN^3 *ya*^{1} =Ta^2
use obtain REALIS
All the remaining neighborhoods had to draw water from wells.

Epistemic modality **lϵiN**^{1} is also flexible (Vittrant, 2013, :102)

Please, see attached document

(5) cema^1 tenϵ^2ChiN^3. =Ma ne^2 **lϵiN**^{1} =mϵ^3
3SG home LOC be MOD.EPIST IRR
He must/might be at home.

How can these facts be captured within the formal theory of modals we have? At first glance, they seem to defy the basic distinction (possibility, necessity) the theory relies on.

In this chapter, we identify a new type of necessity: one that can combine with an empty meta-evaluation. This necessity will appear 'weaker', and will be licensed in more speculative contexts containing little evidence. In the epistemic domain, which is the one we focus on in this chapter, the flexible necessity can be understood as a general inferential modal that will or will not produce bias depending on how strong the evidence is. In other words, what appears as force variation, we will argue, is in fact variation in the metaevaluative component: while epistemic necessity modals such as MUST combine only with a non-empty evaluation and produce bias as we illustrated in the previous chapter, there are more flexible necessity modals that can combine with an empty meta-evaluation which is typically associated with possibility modals. In this case, we have more neutral, thus 'weaker' necessity statements that in English will surface also with *should, ought to*.

The apparent ambiguity, in other words, need not be understood as in terms of quantificational force but rather as flexibility in the metaevaluation. Some necessity modals are specified lexically for what kind of metaevaluation they take, for instance MUST modals in English and typically in Indo-European languages; but other necessity modals are not lexically specified for bias. We

will see that the category of future (FUT) is a flexible inferential in the Indo-European family.[2]

We proceed as follows. We present first the data of FUT in section 2 where we establish the variability. Then we offer an analysis of FUT as a flexible necessity in section 3, relying on Giannakidou and Mari (2023). In section 4 we focus on the Salish data from Matthewson et al. (2007). We will present their analysis and then reformulate our own based on the analysis of FUT.

4.2 The flexibility of the future: Italian, Greek, English

The future as a conceptual category in language has puzzled philosophers and semanticists since Aristotle's famous sea battle examples (*De Interpretatione*, Book IX). Aristotle offers what can be thought of as the first nonveridical analysis. He posits that, while the truth or falsity of a future sentence such as *There will be a sea battle tomorrow* will be determined by how things will turn out at some future time, at the speech time both possibilities are open and we do not know if the positive or the negative will be true. This openness of the future is both metaphysical (a future event may or may not happen), and epistemic, in the sense that one cannot *know* a future event because it hasn't happened, in contrast to past or present events.

In the literature on tense, on the other hand, future often features as the dual of past tense (Prior, 1967) ; Kissine (2008) defends a temporal analysis of *will*. But it is not at all obvious that the modal verb *will* is a tense. Huddleston and Pullum (2002) in their comprehensive *Cambridge Grammar of the English Language* argue that: "our knowledge of the future is inevitably much more limited than our knowledge about the past and the present, and what we say about the future will typically be perceived as having the character of *prediction* rather than an unqualified factual assertion." (Huddleston and Pullum, 2002, :190). A prediction is a form of epistemic assessment, inferencing based on premises at the time of utterance; Huddleston and Pullum therefore treat *will* not as a tense but as a modal category, and highlight that *will* is after all a member of the class of English modal verbs. Earlier advocates of modality of *will* are (Coates, 1983; Palmer, 1987; Enç, 1996).

[2] We use FUT to refer to expressions of future cross-linguistically, i.e. English *will*, Italian future called *futuro* in the Italian grammars and literature) and Greek *tha* are FUT. We also use FUT to indicate the semantic function: FUT in various languages are realizations of the meaning FUT in this sense. In the text, it is easy to see which sense is intended, but we also clarify when necessary. Recall that we have been using MUST to refer to expressions of universal epistemic modality cross-linguistically, i.e. English *must*, Italian *dovere* and Greek *prepi* are MUST.

Enç (1996), in addition, points out that regular tenses, present and past, are deictic (Partee, 1984; Heim, 1994, among many others), while the future is not. The past tense in *Ariadne finished her homework*, for instance, denotes a contextually salient time in the past where Ariadne finished her homework, but *Ariadne will finish her homework* does not refer to a time. As Aristotle points out, there may, or *may not*, be a future time t at which Ariadne finishes her work in the actual world. This is a significant asymmetry between past and future that prevents characterization of future as tense; Enç (*ibid.*) offers a number of additional asymmetries in defense of her position that *will* is a modal; see Klecha (2013) and Giannakidou and Mari (2018b) for more recent diagnostics of modality for the future. Cross-linguistically too future expressions are often described as conveying modality (see e.g. Bertinetto, 1979; Copley, 2002; Pietrandrea, 2005; Mari, 2009a, 2015a; Tsangalidis, 2009; Giannakidou, 2012; Giannakidou and Mari, 2013a,b; Broekhuis and Verkuyl, 2014)

Futures sentences are predictions, as we said, and prediction involves inferential modality, i.e., reasoning with evidence (more or less) and expectations about something that may happen in future. FUT p is metaphysically *settled* at the utterance time: p is not true. It remains to be seen if the prejacent p will be true at a future time (see Giannakidou, 1998, 2013b; Giannakidou and Zwarts, 1999; Condoravdi, 2002; Copley, 2002; Kaufmann, 2005; MacFarlane, 2005; Kaufmann et al., 2006a; Bonomi and Del Prete, 2008; Cariani and Santorio, 2015, Todd, forthcoming). On the other hand, the future sentence is epistemically *unsettled*: the speaker does not, and cannot, know whether there will be a future time t at which the prejacent will be true in the actual world, because we can only know things that happened or are happening. Given that prediction relies on evidence a known at the time of utterance, Giannakidou and Mari (2018b) proposed that the modality of prediction is epistemic. At the time of prediction, the speaker has knowledge and beliefs that determine what she predicts, and this knowledge is the foundation (i.e. the modal base) for prediction.

We offered a number of arguments against the metaphysical analysis of FUT, and perhaps the most prominent one came from the category of 'epistemic future' where no prediction is made at all. We will be calling it below non-predictive future for this reason.

4.2.1 Epistemic non-predictive future

FUT morphemes in various languages (Greek, French, English, German, Dutch FUT words) have routine purely epistemic uses (7-b)-(6-b) along with the predictive uses (6-a)-(7-a). In Greek, the prediction reading arises with an embed-

ded non-past, and the non-predictive reading with a present under the future particle *tha* which is external to the verb:

(6) a. Tha figi o Janis. (Greek) (predictive)
FUT leave.PERF.NON-PAST.3SG the John
John will go.

b. O Janis tha ine sto spiti tora. (non-predicitive)
the John FUT be.PRES.3SG at home now
John must/will be at home now (for all I know).

(7) a. Flavio vincerà la ragata. (Italian) (predictive)
Flavio win.FUT.3SG the regatta
Flavio will win the regatta.

b. Gianni sarà a casa. (non-predictive)
Gianni be.FUT.3SG at home
Gianni must be at home.

We label above 'non-predictive' the reading that does not make a prediction, and in this case FUT translates with *must*. The prediction is also epistemic in nature, so we use these distinct labels to make the difference clear to the reader. We proposed an analysis of FUT modals, including *will*, as epistemic necessity modals (see Giannakidou and Mari, 2012, 2013a,a, 2016c, 2018b,a, 2021b, henceforth G&M) see also (Mari, 2009a,b,c, 2010a; Giannakidou, 2012). The observation that the Italian *futuro* has epistemic non-predictive usage goes back to Bertinetto (1979) and Pietrandrea (2005).[3]

The non-predictive reading of FUT arises with present and past orientation, just like epistemic modality. The FUT word combines with an inner PRES or PAST (either overt, as in Greek, or in Aktionsart as in Romance languages, see Giannakidou and Mari (2018b). [4] A combination of FUT and PRES is illustrated in (8). FUT plus PRES does not have a predictive reading, as we noted, but has the flavor of an hypothesis about what is happening now:

(8) a. I Ariadne tha troi tora. (Greek)
the Ariadne FUT eat.IMPERF.NON-PAST.3SG now
Ariadne must be eating now.

[3] In this respect, Italian futuro patterns with Spanish future Laca (2008, 2012); Falaus and Laca (2014); Rodríguez Rosique (2019); Escandell-Vidal and Leonetti (2021), among many others. See Giannakidou and Mari (2018b) and references therein.

[4] The role of Aktionsart in connection with modal interpretation has been studied across languages and categories, see Condoravdi (2002), Laca (2008), Copley (2009), Mari (2015b,a) and we will return to it in the next chapter.

b. Giacomo ora starà mangiando. (Italian)
Giacomo now be.FUT.3SG eat.GERUND
Giacomo must be eating now.

Combinations of FUT with a lower PAST (an aorist in Greek), are only interpreted as hypotheses too, this time about the past:

(9) a. I Ariadne tha itan arrosti xthes. (Greek)
the Ariadne FUT be.PAST.3SG ill yesterday
Ariadne must/#will have been ill yesterday (that's why she didn't come).
b. I Ariadne tha efige xthes.
the Ariadne FUT leave.PERF.PAST.3SG yesterday
Ariadne must have left yesterday.

(10) a. Giovanni sarà stato malato ieri (per questo non
Giovanni be.FUT.3SG been ill yesterday (for this not
è venuto).
has come)
Giovanni must/#will have been ill yesterday (that why he didn't come).
b. Gianni avrà parlato ieri. (Italian)
Gianni have.FUT.3SG spoken yesterday
Gianni must/ #will have spoken yesterday.

Notice that the sentences with past are not counterfactual; they convey genuine reasoning about whether something happened in the past. Greek and Italian FUT, thus, receive epistemic non-predictive readings, and FUT is akin to MUST with PRES and PAST. [5] Yet, unlike *must, prepi, dovere*, FUT appears to be a bit more speculative and some future sentences can be mere guesses, as we noted in Giannakidou and Mari 2018a:

(11) O jos mou tha jini spoudaios giatros kapja mera.
the son mine FUT become.3sg great doctor some day
My son will be a great doctor one day.

When the above sentence is uttered by an enthusiastic mother of a two year old, it sounds more like a wish or an aspiration rather than an actual prediction based on evidence. The future words are completely fine in these cases.

Giannakidou and Mari 2018a discuss the interaction between the FUT and

[5] Notice that the English future modal *will* cannot be used epistemically with a past. We treat the present perfect in English as a past because the modal verb cannot take a tensed form as a complement" **must/may/wlll met, must/may/will have met*. We come back to will in section 3.

the embedded tense (we will say more about this later). The FUT modality associates with an epistemic modal base, we have argued, but it is conceivable that other parameters, more deontic or volitional can go into the evaluation of a future sentence, as will become clear later. In our earlier paper, the evidence we presented for the epistemic analysis of FUT relied heavily on similarities between MUST and FUT in a number of crucial diagnostics including the incompatibility of both with knowledge of the prejacent, and their inferential and potentially evidential character. We will present the analysis in section 3; here we want to illustrate that while MUST and FUT are both epistemic necessities, there are empirical motivations for distinguishing the FUT as a more flexible and potentially non-biased modal (as noted also in Mari, 2010a; Ippolito and Farkas, 2021; Giannakidou and Mari, 2023).

4.2.2 FUT with possibility adverbs

Importantly, there is a use of FUT in Greek with *past.imperfective* that can admit both the possibility adverb *isos* and the stronger one *mallon* 'probably':

(12) I Ariadne tha efevge mallon/isos
the Ariadne FUT leave.IMPERF.PAST.3SG probably/maybe
xthes.
yesterday
As far as I know, Ariadne was probably going to leave yesterday.
As far as I know, Ariadne was perhaps leaving yesterday.

In our earlier work, we noted that Greek FUT is generally more resistant to combinations with *isos*, and with the aorist past this combination is ruled out:

(13) Ta fota one anamena. O Janis tha ine #isos/mallon sto
the lights are on. The John FUT be.3SG #maybe/probably at
spiti.
home
The lights are on. John will perhaps be at home.

While this example is infelicitous, as noted in Giannakidou and Mari (2023), the example with the imperfective past above was good.[6] The imperfective plus *tha* allows the possibility adverb, and appears to be roughly akin to a conditional mood.

Interestingly, we also find the adverb *isos* 'perhaps' in the predictive reading:

[6] We do have observations from native speakers that actually accept *tha* with *isos*, so there appears to be variation in this case too.

(14) pente xiliades lexeis pu isos tha alaksoun
five thousand words that perhaps FUT IMPERF.PAST.3SG
ton kosmo.
yesterday
five thousand words that perhaps will change the world. [7]

(15) To 2022 tha ine isos i kalyteri xronia pou exoume zisi.
the 2022 FUT be.3SG perhaps the best year that have.1pl lived
The year 2022 will be perhaps the best year that we have lived. [8]

We see here a variability comparable to the Salish one we observed at the beginning: the future word in Greek and English gets a necessity reading with the strong adverb, but a weaker reading with the possibility adverb. Recall that we discuss cases with MUST and possibility adverbs in the previous chapter, noting that they are relatively rare, and actually impossible with the Greek modal verb MUST *prepi*:

(16) Ta fota one anamena. O Janis prepi #isos/mallon na
the lights are on. The John must #maybe/probably that.SUBJ
ine sto spiti.
be.3SG at home
The lights are on. John must #perhaps/probably be at home.

Greek is therefore rigid in lexically specifying its MUST modal verb *prepi* as a biased one (i.e., as one where O can never be empty); the new data we offer here show that the Greek future modal particle *tha* is flexible. Even more interestingly, *tha* can modify the MUST modal itself. In this case, we have a clear epistemic weakening that allows the possibility adverb:

(17) Ta fota one anamena. O Janis tha prepi isos/mallon
the lights are on. The John FUT must maybe/probably
na ine sto spiti.
that.SUBJ be.3SG at home
The lights are on. John *should perhaps*/ must probably be at home.

Notice the translation now with *should perhaps* as a rendering of *tha prepi* 'FUT must'. We will come back to these construals, the precise analysis of which has remained a mystery in the Greek literature on the subject (Tsanga-

[7] https://www.efsyn.gr/stiles/dromo-logia/378138-pente-hiliades-lexeis-poy-isos-tha-allaxoyn-ton-kosmo

[8] https://www.newmoney.gr/roh/palmos-oikonomias/ellada/georgiadis-to-2022-tha-ine-isos-i-kaliteri-chronia-pou-echoume-zisi

lidis, 1998; Giannakidou, 2012). The use of *isos* indicates a more speculative context, perhaps even one where I didn't expect John to be home. In the *mallon* 'probably' construal, I do have independent reasons (i.e., other than the lights themselves) that lead me to expect that John must be at home. The contrast reminds us again of the Salish underspecified modal.

It is obvious that the case of the future particle modifying the modal *prepi* is the way Greek produces weak necessity akin to *should*. This becomes obvious also in the deontic domain:

(18) a. Prepi na fas.
must that.SUBJ. eat.2SG
You must eat.
b. Tha prepi na fas.
FUT must that.SUBJ eat.2SG
You should eat.

Tha prepi 'FUT MUST' is the Greek equivalent to the weak necessity modal *should*. The expected compliance with *tha prepi* is weaker just like with *should*, and the compatibility with the possibility adverb suggests absence of bias. This is a reasonable way to understand the *should* type of modal.

The future modal appears to be wildly flexible in Italian (see Bertinetto, 1979; Pietrandrea, 2005; Mari, 2009a,b,c, 2010a, 2021; Giannakidou and Mari, 2023). Consider just this small sample:

(19) a. Gianni sarà forse in piscina.
John be.FUT.3SG maybe in pool
John will perhpas be at the pool.
b. Gianni sarà probabilmente/sicuramente in piscina.
John be.FUT.3SG probably/certainly in pool
John will probably/certainly be at the pool.

We see here that the Italian FUT can combine with strong epistemic modals, like *sicuramente* ('certainly') (47-b) and weak epistemic modals like *forse* ('maybe') (47-a) freely. Again the contrast is one where more evidence supports the *sicuramente* variant, while the *forse* ('maybe') is more speculative. This resonates with the facts that we have observed in chapters 2 and 3 in relation with universal and existential modals *dovere* and *potere* which also appear to be more flexible in Italian. The Greek system, as we saw, does not allow flexibility with the MUST modal *prepi*, but a certain degree of flexibility is indeed allowed when FUT is added to produce *should*, as well as with the future particle *tha* alone.

Let us proceed now with an analysis of the future.

4.3 The future as a flexible necessity epistemic modal

The notion of metaevaluation provides a useful handle to deal with the flexibility and potential weakening of modal readings. We will start with the analysis of FUT in Giannakidou and Mari (2018b) as akin to MUST, and then proceed with the modification in Giannakidou and Mari (2023) which establishes the category of non-biased necessity. We will discuss Italian futuro as a non-biased necessity modal and extend the analysis to explain the effect of Greek future, and other phenomena in Greek, English and French concerning the conditional mood.

4.3.1 The inferential character of epistemic future

A major argument for the role of epistemic modality in the future is the existence of epistemic non-predictive future, as we said, i.e., FUT with lower present or even past tenses in Greek and Italian which do not make a prediction. This purely epistemic reading should not arise if future expressions were simply tenses. Epistemic future is observed in Greek and Italian, but also in Dutch, German, English, and many other languages (see Comrie, 1985; Haegeman, 1983; Palmer, 1987; Kush, 2011; Matthewson, 2012).[9] Here are some well-known English data:

(20) a. That will be the postman.
b. The French will be on holiday this week. (Palmer, 1987)

These sentences do not make predictions. Rather, they seem to convey epistemic modality: given what I know or expect based on general stereotypical assumptions, the French *must* be on holiday this week (see Palmer, 1987, and the references above for more data and nuances). Dutch and German futures have similar use (examples from Broekhuis and Verkuyl (2014) for Dutch, Giannakidou (2014) for Dutch; Lederer (1969) for German; Tasmowski and Dendale (1998); De Saussure and Morency (2012); Mari (2015a) for French). Here are some examples from Giannakidou and Mari (2018b) :

Context: I can't see Hein.

[9] Pietrandrea (2005) uses the term 'epistemic future' for the first time for Italian future, but only for the epistemic use of the future. We thank Fabio Del Prete for bringing this point to our attention.

(21) Hein zal (wel) in de/op zee zijn. (Dutch)
Hein FUT.3SG particle in the/on sea be
Hein must/should be at sea (swimming/on a boat).

(22) Context: the speaker is wondering about the time, there is no watch:

a. Es wird jetzt 5 uur sein. (German)
it FUT.3SG now 5 hour be

b. Het zal nu 5 uur zijn. (Dutch)
it FUT.3SG now 5 hour be
It must/should be now 5 o' clock.

As indicated, the Dutch and German future words *zal, wird* are used as epistemic equivalents to *must, should*. The *must, should* statement is epistemically weaker than an unmodalized assertion (an idea that as we said goes back to Karttunen (1972); Von Fintel and Gillies (2010) call it the *Mantra*). As Huddleston and Pullum (2002) put it, the knowledge grounding the future sentence "is more limited" than knowledge grounding a sentence with a simple present or past.

We believe that in the examples above paraphrases with *should* are also appropriate, as we indicate. If I have strong reasons to trust my assessment of time I would use the *must* variant, if I am assessing a bit more loosely but still with some confidence I would use *should*. In this non-predictive uses, the FUT element is performing an inference based on on implicit (or explicit) evidence, and ultimately forms some sort of hypothesis. In the predictive reading the same inferential path is following, only in this case the consideration is about an event or a situation not of the past or present.

Modal particles such as *wel, wohl*, when alone in German, they have a similar inferential use (Zimmermann, 2011; Giannakidou, 2014):

(23) Max ist wohl auf See. (Zimmermann, 2011)
Max is particle on sea
Max must/should be at sea.

Zimmermann says that with *wohl*, the epistemic commitment of the speaker is *weakened* compared to the plain sentence, while also conveying a confidence that the proposition is likely to hold. This is the typical reading of the *must/should* sentence— and the take-home message is that we find it with the modal particles, MUST, and the future words.

Broekhuis and Verkuyl (2014) treat the Dutch *zal* as an epistemic modal expressing that the prejacent proposition is the result of reasoning based on information judged as 'reliable and well-founded'. This is exactly what we are

saying about the inferential character of the FUT statements, and argues for a tendency to associate with stronger evidence— which may be true of Dutch, and is certainly for part of Greek. Giannakidou (2014) (attributing the example to J. Hoeksema) further shows that *zal* receives purely epistemic reading with past, as in (24), where in the context is that Max is grumpy.

(24) Hij zal wel slecht geslapen hebben! (Dutch)
he FUT.3SG particle bad slept have
He must have slept really bad!

Here the speaker makes a speculation. And below is German future with past:

(25) Ich habe meinem Freund letzte Woche einen Brief geschrieben; er *wird* ihn sicher schon bekommen haben. (German)
I wrote a letter to my friend last week; he must surely have already received it. (Lederer, 1969, p98, ex.584).

Morphologically, a present perfect appears in Dutch and German, just as in English *must have slept*, and not a simple past **must slept*. The simple past is excluded because the modal verb takes an infinitival complement, and this necessitates the use of the auxiliary resulting in the apparent present perfect. **?** notes that in nonfinite contexts, past tense surfaces as the perfect (for recent discussion see Arregi and Klecha (2015). Greek, on the other hand, lacks infinitives and the modal embeds a tensed clause which can be a simple past as we saw. [10] The sentences above, in any case, show that a future morpheme can combine with lower PAST, and when this happens the predictive reading disappears. The above are purely inferential epistemic statements about a past situation the speaker considers likely to have happened.

There appears to be a generalization, then, that future morphemes cross-linguistically are not used just to make predictions, but also as *must/should*-equivalents. For Greek and Italian, epistemic future has been known for quite a while since Bertinetto (1979); Rocci (2000); Squartini (2004); Pietrandrea (2005); Mari (2009a,b,c); for Greek, see Tsangalidis (1998); Giannakidou (2012); Chiou (2014), but the data have unfortunately not featured significantly in formal theories of the future, which tend to focus on *will*. Unlike *will*, which is a modal verb, the future markers in Italian and Greek are a bound morpheme and a particle (*tha*) respectively. In Greek, the future *tha* is followed always by a tensed verbal form (TP), as holds generally for all modal particles including the subjunctive *na*, and others that are not relevant here. The Italian pattern is

[10] The past can be non-relative (Greek), or relative (Italian); see Verkuyl (2011) for more on the notion of relative past, and our discussion in section 5.

not the exact parallel to Greek, but is similar in the relevant respects as we will discuss further in chapter 5 where we concentrate on the interaction between modal elements and tense.

Mari (2009a,b,c); Giannakidou and Mari (2013a,b, 2016a) observe that epistemic futures, like epistemic necessity modals, cannot be used if the speaker knows *p*. Recall from chapter 2 that this has been treated as an evidentiality constraint (Karttunen, 1972; Von Fintel and Gillies, 2010; Giannakidou and Mari, 2016a):

(26) *Context: Direct visual perception of rain, the speaker sees the rain falling*

a. #It must be raining.
b. #Tha vrexi. (Greek)
FUT rain.IMPERF.NON-PAST.3SG
c. #Starà piovendo. (Italian)
be.FUT.3SG rain.GERUND
d. #Tha prepi na vrexi. (Greek)
FUT must that.SUBJ IMPERF.NON-PAST.3SG
e. #Dovrà star piovendo. (Italian)
must.FUT.3SG be rain.GERUND

It is odd to say *It must be raining* when looking outside the window at the rain falling. Eye-sight provides a most reliable evidence for knowledge: when you see that it is raining, you know that it is raining (a point to be further expanded in the evidentiality chapter 6). By uttering *It must be raining* the speaker appears to either question her own knowledge, or simply saying something weaker than what is actually the case, in both cases an odd outcome.

In a context with partial evidence, FUT and MUST are perfectly fine:

(27) I see a wet umbrella.

a. It must be raining.
b. Tha/Prepi na vrexi. (Greek)
FUT/Must that.SUBJ rain.IMPERF.NON-PAST.3SG
c. Deve star piovendo. (Italian)
must.PRES.3SG be rain.GERUND
It must be raining.
d. Starà piovendo. (Italian)
be.FUT.3SG rain.GERUND
It must be raining.

If I see a wet umbrella, I can *assume* that it is raining, but I do not *know* that it is raining. Giannakidou and Mari (2016a) use this difference as an argument that the MUST and future modals reason with evidence which is *partial* only.

Recall finally that both future and lexical MUST modals are compatible with continuations that indicate absence of knowledge:

(28) Deve essere/ Sarà a casa ma non sono
must.PRES.3SG be/ FUT.3SG at home, but not be.PRES.1SG
totalmente sicuro.
entirely sure
He must be home, but I am not entirely sure.

Hence FUT and MUST, as modals, do not entail knowledge of *p*.

4.3.2 Future morphemes and interaction with tense

To understand the patterns, it is helpful to concentrate a bit on Greek because tense and aspect are always reflected morphologically on the Greek verb. The grammars describe Greek as having an morphological opposition between past and non-past, and and aspectual distinction between perfective and imperfective. The morphological combinations create three semantic tenses (Giannakidou, 2009, 2014): a present (PRES), a PAST, and a NON-PAST, which is the tense used for prediction. We illustrate the combinations below:

(29) graf- -o. (semantically PRES)
write.IMPERF NON-PAST.1SG
I am writing (right now).
Write (generally).

The morphological imperfective non-past is semantically the present tense (PRES) in Greek (Giannakidou, 2014), comparable to English simple present and progressive. The combination of this form with FUT is equivalent to MUST PRES *p* in English (Giannakidou and Mari, 2016a).

The perfective non-past is a dependent form, *ungrammatical* by itself as indicated:

(30) *grap- s- o (* on its own, semantic NON-PAST)
write- PERF NON-PAST.1SG

The perfective non-past has no English equivalent, and it is in fact quite rare to find grammatical perfective non-pasts in languages (Giorgi and Pianesi, 1997). Holton D. and Philippaki-Waburton (1997) and Giannakidou (2009). Holton D.

and Philippaki-Waburton (1997) call this form the *verbal dependent*. This is the form used for prediction and future oriented generally, used also with the subjunctive and optatives. We analyze it as a semantic NON-PAST in Giannakidou and Mari (2021b) and Giannakidou (1998), and we can think of it as equivalent to forward shifting aspectual markers that appear in many languages.

The past is marked in Greek with the presence of *e-*, and we have again two options, perfective and imperfective. The imperfective past is the typical preterite as in, e.g., Romance languages. The perfective past, on the other hand, is called the *aorist* and denotes a single (usually completed) event in the past. It is interpreted as a default simple past in English:

(31) e- graf- a. (Greek imperfective past)
PAST- write.IMPERF- PAST.1SG
I used to write.
I was writing.

(32) e- grap- s- a. (Greek perfective past (aorist))
PAST- write- PERF- PAST.1SG
I wrote.

Future *tha* combines with all of the above tenses. Notice first the combinations of FUT with the PRES (imperfective non-past in Greek, gerund plus stative in Italian):

(33) a. I Ariadne tha troi tora. (Greek)
the Ariadne FUT eat.IMPERF.NON-PAST.3SG now
Ariadne must be eating now.
b. Giacomo ora starà mangiando. (Italian)
Giacomo now be.FUT.3SG eat.GERUND
Giacomo must be eating now.

As shown above, FUT plus PRES does not have a predictive reading. We will discuss in the next chapter Italian, and the role of Aktionsart (see Condoravdi, 2002; Laca, 2008; Copley, 2009; Mari, 2015b,a). Combinations of FUT with a lower PAST (an aorist in Greek), also receive epistemic non-predictive readings, as we saw, and here are some more examples:

(34) a. I Ariadne tha itan arrosti xthes (ji'afto dhen
the Ariadne FUT be.PAST.3SG ill yesterday (for-this not
irthe).
came.PERF.PAST.3SG

Ariadne must/#will have been ill yesterday (that's why she didn't come).

b. Giovanni sarà stato malato ieri (per questo non
Giovanni be.FUT.3SG been ill yesterday (for this not
è venuto).
has come)
Giovanni must/#will have been ill yesterday (that why he didn't come).

(35) a. I Ariadne tha efige xthes.
the Ariadne FUT leave.PERF.PAST.3SG yesterday
Ariadne must have left yesterday.

b. Gianni avrà parlato ieri.
Gianni have.FUT.3SG spoken yesterday
Gianni must/#will have spoken yesterday.

With PAST, then, Greek and Italian FUT receive epistemic non-predictive readings, as in Dutch and German. These uses, crucially, are quite common and do not feel in any way marked or exceptional. In English they are excluded because *will* is a ratificational future. [11]

For the sake of completeness, note that with PAST we do not obtain a future of a past reading. To obtain a future of a past, Italian uses the conditional, and Greek the imperfective past (Giannakidou, 2012, : ((21)):

(36) Gianni sarebbe arrivato più tardi.
Gianni be.COND.3SG arrived more late
Gianni would arrive later.

(37) I Ariadne tha efevge argotera.
the Ariadne FUT leave.IMPERF.PAST.3SG later
Ariadne would leave later.

Tha plus imperfective past can be seen as the Greek equivalent to conditional mood (Iatridou, 2000; Giannakidou, 2012). We will adopt this position here, and offer an analysis of the conditional mood later.

The predictive reading emerges with perfective non-past in Greek, and eventives in Italian:

[11] We will talk about this category later. Ratificational futures, according to Giannakidou and Mari (2018b), require that there be a time in the future when the content will be verified (or, ratified), hence such futures rely on even stronger evidence than the ones we find in Greek, Italian, Dutch and German.

(38) O Janis tha ftasi avrio.
the John FUT arrive.PERF.NON-PAST.3SG tomorrow
John will arrive at 5pm/tomorrow.

(39) Gianni arriverà domani.
John arrive.FUT.3SG tomorrow
John will arrive tomorrow.

This form appears with other modal particles such as the subjunctive and the optative, again with future orientation.

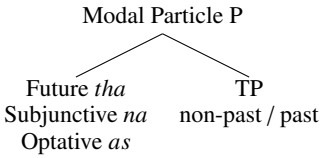
(40) Thelo na ftasi noris o Janis.
I-want that.SUBJ arrive.PERF.NON-PAST.3SG early the John
I want John to arrive early.

(41) As ftasi noris o Janis!
OPT arrive.PERF.NONOPAST.3SG early the John
Let John arrive early!

We see clearly then that the forward shifted reading is not due to the presence of the FUT particle, as there is no FUT in the examples above. Rather, it is the NON-PAST that produces the forward shift, and this is the form used in bouletic and deontic modalities that are inherently future oriented. The perfective non-past is semantically a NON-PAST, and we address its role in the next chapter.

The syntax we adopt, following Giannakidou (2009), and Giannakidou and Mari (2021b) is the following:

(42)



We assume that Italian has the same abstract structure, but relies on Aktionsart below TP. Greek and Italian look similar to languages such as Gitksan (with prospective aspect under their modal; Matthewson (2012), and Hindi (Kush, 2011). We will discuss the interaction with tense in the next chapter more precisely. In the rest of this chapter, our goal is to give an adequate characterization of the meaning of the future markers *tha* and Italian *futuro*. Given the basic sample of data presented here, the following generalizations emerge:

1. *Tha* and *futuro* are epistemic necessity modals, used also for prediction. The predictive reading is also epistemic, triggered by a lower non-past or a prospective, forward shifting form.

2. *Tha* and *futuro* have epistemic non-predicitive readings with present and PAST forms (including present perfects in Germanic languages and past participles in Italian).

3. The lower tense fully determines the type of reading.

In the rest of the chapter, we focus on the fist two points, chapter 5 addresses the third one.

4.3.3 The future as MUST?

Giannakidou and Mari (2018b) propose an analysis of FUT as MUST. They define a secondary modal base $\text{Ideal}_{\mathcal{S}}$ as a function over $\text{M}(i)(t_u)(w_0)$ in the spirit of Portner (2008). The output $\text{Ideal}_{\mathcal{S}}$ is a subset of $\text{M}(i)(t_u)(w_0)$.

(43) $\text{Ideal}_{\mathcal{S}}(\text{M}(i)(t_u)(w_0)) = \{w' \in \text{M}(i)(t_u)(w_0) : \forall q \in \mathcal{S}(w' \in q)\}$

Just like with MUST, $\text{Ideal}_{\mathcal{S}}$ delivers the worlds in the modal base in which all the propositions in $\mathcal{S}$ are true. $\mathcal{S}$ is a set of propositions that correspond to common ground norms and subjective preferences. The truth condition for MUST/FUT says that p is true in the $\text{Ideal}_{\mathcal{S}}$ set of $\text{M}(i)$. Given a set $\text{Ideal}_{\mathcal{S}}$ and the utterance time t_u:

(44) [[prepi/dovere/must/FUT (PRES (p))]]$^{M,i,\mathcal{S}}$ is defined only if $\text{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds.
If defined,
[[prepi/dovere/must (PRES (p))]]$^{M,i,\mathcal{S}} = 1$ iff $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

Recall that at this stage, even if there is universal quantification over $\text{Ideal}_{\mathcal{S}}$ worlds, there is no ranking yet. The typical MUST modal structure, we argued, is a biased one; it contains a default null PROBABLY which ranks the Ideal worlds (where p is true) as better possibilities than the non-p worlds, producing positive bias:

(45) For any $\text{Ideal}_{\mathcal{S}}$, [[Probably/Probabilmente/Mallon]]$^{O,\text{M},i,\mathcal{S}} = \lambda q$. $\text{Ideal}_{\mathcal{S}}$ is a better possibility with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to $\text{M}(i)$ and O & q

(46) [[∅ MUST (PRES (p))]]$^{O,\text{M},i,\mathcal{S}}$ is defined only if the modal base $\text{M}(i)$ is nonveridical and it is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined,
[[∅ MUST (PRES (p))]]$^{O,\text{M},i,\mathcal{S}} = 1$ iff: $\text{Ideal}_{\mathcal{S}}$ is a better possibility with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to $\text{M}(i)$ and O & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

Now, it is important to note that while some predictions tend to indeed be biased— *Elections will/tha/futuro be held in Greece on May 21, 2023, Tomorrow it will be Tuesday*— and indeed favor the outcomes stated by the sentences even aleithically, some predictions can be mere guesses (*My son will be a great heart surgeon some day*). The epistemic non-predictive future shows similar flexibility, and is compatible with both evidence based reasoning as well as merely speculative reasoning. This is where MUST and FUT diverge as epistemic categories: the MUST inference tends to be evidence based and therefore biased, but FUT can also be compatible with less reliable evidence (though not mere credence, as we noted in Mari (2021); Giannakidou and Mari (2023)).

At the same time, the flexibility of FUT morphemes comes in degrees: Greek treats FUT like MUST with some flexibility, as we noted, but Italian futuro seems to be much more flexible.[12] We do not reiterate here the demonstration for Greek *tha*, but concentrate on how the framework can accommodate the difference between a by default biased MUST and a more underspecified FUT within the class of epistemic modality.

4.3.4 Futuro as a non-biased necessity modal

Italian futuro, as we have noted, is freely compatible with a variety of strong and weak adverbs, most notably those meaning POSSIBLY. Let us recall the data:

(47) a. Gianni sarà forse in piscina.
John be.FUT.3SG maybe in pool
John will perhaps be at the pool.

b. Gianni sarà probabilmente/sicuramente in piscina.
John be.FUT.3SG probably/certainly in pool
John will probably/certainly be at the pool.

Ippolito and Farkas (2021) and Giannakidou and Mari (2023) offer further subtle data presenting a number of discrepancies between futuro and *dovere* ('must'). Intra-linguistically, MUST+MAYBE construals are quite restricted, and not every possibility adverb is admitted. For instance *magari* ('maybe') is more rare if not impossible with *dovere*. *Dovere* and futuro differ in that *forse* ('maybe') is much more routinely used with futuro than with *dovere*. As we will show in chapter 7, *magari* is lexically specified for combining with imperatives rather than lexical modality. If force and metaevaluation are dissociated,

[12] Precursors of this idea are Baranzini and Mari (2019), Mari (2010a, 2021)

then manipulations are possible and we may assume that there are different defaults and that would explain the distributions.

Let us consider some examples to see the contrast (48) (judgments from I&F, these are examples (6) in their paper; we have simplified the context):

(48) Maria is at the doctor, who has reviewed her test results. She asks her doctor what is wrong with her. The doctor replies:

a. Deve essere narcolessia.
must.PRES.3SG be narcolepsy
It must be narcolepsy.

b. #Sarà narcolessia.
be.FUT.3SG narcolepsy
It will be narcolepsy.

Ippolito and Farkas comment that FUT is inappropriate in this scenario because it suggests that the doctor is guessing rather than drawing an inference based on the (medical) evidence and information available.[13] We expect from a doctor certainty about a diagnosis, and if a doctor uses an epistemic modal the diagnosis appears less certain, so the MUST sentence already sounds a bit tentative. That being said, we agree that futuro is less felicitous than MUST suggesting, as we are arguing, that futuro disprefers high evidence contexts.

Yet futuro is not equivalent to a possibility modal. Consider:

(49) a. Sono le 5. #Sarà a casa e sarà al lavoro.
be.PRES.3PL the 5. Be.FUT.3SG at home and be.FUT.3SG at the work
It is 5pm. #She will be home and she will be at the office.

b. Sono le 5. Potrebbe essere a casa e potrebbe essere al lavoro.
be.PRES.3PL the 5. Can.COND.PRES.3SG be at home and can.COND.PRES.3SG be at the work
It is 5pm. She might be at home and she might be at the office.

This contrast is explained as follows. Futuro conveys commitment in the Ideal_S set which is the subset of the modal base that complies with common ground norms, beliefs, expectations. MIGHT, on the other hand, is a possibility modal

[13] Ippolito and Farkas translate FUT with *would*, but we use here *will*. The Italian correspondent of *would* is the conditional 'sarebbe', which is not used in (48-b).

and conveys mere equilibrium, lacking the secondary modal base of Ideal. In this respect futuro behaves like *dovere* and MUST:

(50) Sono le 5. #Deve essere a casa e
be.PRES.3PL the 5. Must.PRES.3SG be at home and
deve essere al lavoro.
must.PRES.3SG be at the work
It is 5pm. #She must be at home and she must be at the office.

Futuro, therefore cannot be a mere possibility modal. Giannakidou and Mari (2023) propose that FUT illustrates the category of *flexible necessity* epistemic modal, i.e., a necessity modal without a default bias towards the prejacent. This category, as it turns out, is useful for what appear to be 'weaker' necessities which are not lexically specified for biased metaevalautions, but can be used to express more neutral inferential or speculative statements. We can think of this category of flexible necessity as further weakening from Kratzer's human necessity. In chapter 8, we will identify the imperative as being a flexible necessity in the domain of deontic and volitional modality.

Flexible necessities come in two varieties. They can either be like the Greek future, where the default bias can be overridden, or they can come in the futuro variety where there is no default bias at all. This explains the more liberal flexibility of futuro while the flexibility of Greek *tha* is more constrained. It is conceivable that change pathways, in the long run, will transform an Greek-style FUT into the Italian-style one.

Here is how flexible necessity can be implemented. Futuro, we proposed, comes with a default empty O such as *forse* defined as in (51) (see also Mari, 2021). The lexical entry for futuro is in (76), which is equivalent to (60).

(51) $[\![\text{Maybe/Forse/Isos }]\!]^{O,\mathrm{M},i,\mathcal{S}} = \lambda q.\ O$ is empty & q

(52) $[\![\emptyset \text{ FUT (PRES } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![\emptyset \text{ FUT (PRES } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff O is empty & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

(53) $[\![\text{MAYBE FUT (PRES } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![\text{MAYBE FUT (PRES } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff O is empty & $\forall w' \in \text{Ideal}_{\mathcal{S}}$: $p(w', t_u)$

Bias can, of course be strengthened as illustrated in (54):

(54) $[\![\text{PROBABLY FUT (PRES } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is non-veridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined, $[\![\text{PROBABLY FUT (PRES } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff
$\text{Ideal}_{\mathcal{S}}$ is a weak necessity with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to $\mathrm{M}(i)$ and $O \,\&\, \forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

The strengthenings are systematic and depend on contextual information as well as the presence of stronger modal adverbs. With bias, futuro acquires the stronger flavor of prediction and biased MUST. Hence, futuro is a MUST modal with a ranking that can be empty or non-empty, and this makes it usable in a wider range of situations— including those with less reliable evidence or heightened uncertainty about the prejacent, or even guessing situations where biased MUST cannot be used. This flexibility makes futuro look 'weaker', as we said, but the weakness is not one in terms of force. Flexible necessity is still necessity, but compatible with weaker evidence that does not produce bias. Such a nuanced analysis can only be articulated in a system that allows dissociation of ranking and force such as Giannakidou and Mari (2018a).

4.3.5 More predictions: *should* and Greek FUT with MUST

The relation between the two types of flexibility— overriding the default bias or being entirely unspecified for bias— is of course quite volatile, and changes can happen with time. We revisit now the case when a FUT modifies a modal like MUST where, we suggest, the main modality is MUST and the function of FUT is now shifted to providing an empty metaevaluation. We suggest that this is how the so-called conditional mood works generally in section 5.

In Greek, the future particle *tha* appears with modal verbs too, as we noted, with either deontic or epistemic *should* reading. Let us consider first the epistemic context, where the question under discussion is: what is John's profession? Consider that A has some idea but not really concrete evidence. A states: *I don't know much*. And continues,

(55) a. Tha prepei na ine giatros.
FUT must.3SG that.SUBJ be.3SG doctor
He should be a doctor.

b. #Prepei na ine giatros.
FUT must.3SG that.SUBJ be.3SG doctor
He must be a doctor.

In this context of speculation, *tha prepi* 'FUT must' is fine, but the bare MUST

is not. Recall also that *tha prepi* is compatible with the adverb *isos* 'possibly', unlike the unmodified MUST *prepi*:

(56) Ta fota one anamena. O Janis prepi #isos/mallon
The lights are on. The John must #maybe/probably
na ine sto spiti.
that.SUBJ be.3SG at home
The lights are on. John must #perhpas/probably be at home.

(57) Ta fota one anamena. O Janis tha prepi isos/mallon
The lights are on. The John FUT must maybe/probably
na ine sto spiti.
that.SUBJ be.3SG at home
The lights are on. John *should perhaps* must probably be at home.

Notice our translations now with *should perhaps* as a rendering of *tha prepi* 'FUT must'. The precise analysis of this use of *tha* has remained a mystery in Greek literature on the subject, as we know from the earlier work of Tsangalidis (2009)— but in the system we have now we can explain it as a lexicalization of *should*, as we suggested earlier. The *should* modal comes without bias, and the use of *isos* reveals indeed a more neutral context, perhaps even one where I didn't expect John to be home.

In the *mallon* 'probably' construal, on the other hand, I have independent reasons (i.e., other than the lights themselves) that lead me to believe that John must be at home. The contrast reminds us again of Salish where one modal is used. In Greek the MUST modal is used with the flexible FUT as modifier.

The Italian data are parallel. *Dovere* can combine with futuro, and indeed the result is a weaker epistemic modal that is compatible with mere guesses. Note the concessive particle pur, in Italian.[14]

(58) The speaker has no idea where Giacomo can be, and it is late at night. She asks: Where is Giacomo? Her husband answers:

a. Bo'. Dovrà pur essere a casa a quest'ora !
PART. must.FUT.3SG PART be at home at this-time
No idea, he should nonetheless be home by now !

b. Bo'. (#)Deve essere a casa a quest'ora ! (ok deontic)
PART must be at home at this-time
No idea, he must be home by now!

[14] For the intricate relation between future and concessivity, see Baranzini and Mari (2019) and Mari (2024).

The contrast is very similar to the speculative example from Salish where we don't have any specific tests at hand, but are speculating:

(59) wa7 k'a s'ena7 qwenúxw.
IMPF EVID counter sick
He may be sick.

Matthewson et al. use a possibility modal here, but we want to suggest that the difference can also be understood in the light of the description of the Greek and Italian data. The modal word *k'a* in a speculative context, has a neutral reading, which we want to suggest is akin to *should*.

Going back to Greek FUT, in the deontic reading we have a similar *should* effect. Context: I am telling John, who is the teacher, that he has early meetings with parents tomorrow.

(60) a. #Tha prepei na pas sxolio noris avrio.
FUT must.3SG that.SUBJ go.3SG school early tomorrow
You should go to school early tomorrow.
b. Prepi na pas sxolio noris avrio.
must.3SG that.SUBJ go.3SG school early tomorrow
You must go to school early tomorrow.

We translate *tha prepi* again with *should*, as it appears to be a weaker obligation. The contrast is a bit more diluted than in the epistemic case because the deontic versions are future oriented anyway, so FUT could agree temporally and hence still sound natural. We will discuss more such cases more in chapter 8. For now suffice it to see that in the epistemic FUT plus MUST construals the *should* effect of weakening can be understood as overriding the default MUST bias by FUT itself:

(61) $[\![$tha prepi (PRES $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if M(i) is nonveridical and is partitioned into $\mathrm{Ideal}_{\mathcal{S}}$ and $\neg\mathrm{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![$tha prepi (PRES $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff O is empty & $\forall w' \in \mathrm{Ideal}_{\mathcal{S}}$: $p(w', t_u)$

In other words, in construals when a future modifies MUST such as FUT MUST, the main modality is MUST and the function of FUT is 'demoted' to providing the metaevaluation which is empty. *Tha* in other words, in this case, functions as a possibility adverb. We can view this as a lexicalization process of creating a weaker MUST namely *should*, and it is by itself evidence that the future word *tha* is not simply a variant of *prepi* MUST, but carries the flexibility observed in the seemingly more peculiar cases of Salish. The fact

that two typologically remote languages such as Greek and Salish exhibit this similarity is encouraging for the theory we are developing— as it makes the convergence visible simply by adhering to its basic analytical ingredients.

We want to suggest that this is a helpful way to understand the role of FUT in the so-called conditional construals. The fact that FUT contributes an empty metaevaluation is itself evidence that FUT as a category does associate with this type of weaker ranking.

4.4 Back to Salish: a flexible necessity analysis

We are now ready to discuss the Stat'micets *k'a*, Gitksan *imaa* and similar unitary patterns within an analysis where flexibility of modals is not peculiar but predictable. In the original work on Salish, the contrast has been described as ambiguity in quantificational force, but even in those analyses necessity is postulated as the core meaning, so there is, in the end, no ambiguity in force. We suggest that we have an underspecification of bias, as is revealed in the supporting contexts.

In order to create a manageable typology, it is tempting to divide languages in three main groups as has been done in the literature, based on a force distinction. Let us consider this typology. Languages where flexibility of modals is observed for both epistemic and non epistemic uses (Type 1), languages that have mixed systems (Type 2), and languages that have a dedicated, distinct form for possibility and necessity modals (Type 3).

<table>
<tr><td>Modality</td><td></td><td>Type 1</td><td colspan="2">Type 2</td><td>Type 3</td></tr>
<tr><td rowspan="2">Epistemic</td><td>Possibility</td><td rowspan="2">Form A</td><td rowspan="2">Form E</td><td>A</td><td>A</td></tr>
<tr><td>Necessity</td><td>B</td><td>B</td></tr>
<tr><td rowspan="2">Non epistemic</td><td>Possibility</td><td rowspan="2">Form B</td><td>C</td><td rowspan="2">Form E</td><td>C</td></tr>
<tr><td>Necessity</td><td>D</td><td>D</td></tr>
</table>

Figure 4.1 Modal variation across the force dimension

Stat'micets is a type 1 language. The epistemic modal *k'a* is a unitary inferential modal said to express both epistemic possibility and necessity. In our system, this will be rephrased as *k'a* being underspecified for bias.

Recall our initial descriptions from Matthewson et al. (2007). The context for the biased necessity reading (62) is as follows: You have a headache that won't go away, so you go to the doctor. All the tests show negative. There is nothing wrong, so it must just be tension.

(62) nilh k'a lh(l)-(t)-en-s-wá(7)-(a)
FOC EVID PREP-DET.1SG.POSS.NOM.IMPF.DET
ptinus-em-su't
think.INTR-OOC
It must be from my worrying.

The context for the weaker inference (63) is more speculative. Here we don't have any specific tests at hand, but we are speculating that maybe that's why he's not here.

(63) wa7 k'a s'ena7 qwenúxw
IMPF EVID counter sick
He may be sick.

Notice the translation now with 'should perhaps', but the contrast has been described, as we said, as the same modal word *k'a* conveying both necessity and possibility. In an evidence based context the necessity MUST reading is supported; in a more speculative context, we have a weaker inferential reading. In terms of the theory as developed so far, more evidence leads to a biased conclusion; less evidence leads to an empty metaevaluation (one that has little assumption to base it on), and a more neutral inference is licensed.

Burmese is also a Type1 language (Vittrant (2013) and references therein and in particular Okell and Allott (2001)). Both the circumstantial modal ya^1 and the epistemic modal **lɛiN**^{1} have flexible interpretations according to the context. In (64), *ya* has a possibility reading, whereas in (65), it received as necessity interpretation. In (66), epistemic modal $lɛiN^1$ is ambiguous between a necessity and possibility reading and is fluid. These facts are parallel to what is observed with epistemic future.

Please, see attached document

(64) coN^3 pa-lɛ^2 =Ka^1 -ya-Twe^2 =Ka^1 coN^3 ye^2 =Ko^2 θoN^3
moat circle S. neighborhoods S. moat water OBJ use
ya^1 =Tɛ^2
obtain REALIS
The neighborhoods circled by moats had the possibility to use water.

(65) caN^2-yakwɛ-Twe^2 a^{3}loN^3 =Ka^1 twiN^3-ye^2 =Ko^2 kha
the-remaining-neighborhoods all S well-water OBJ draw
θoN^3 *ya*^{1} =Ta^2
use obtain REALIS
All the remaining neighborhoods had to draw water from wells.

(66) cema[1] tenɛ[2]ChiN[3]. =Ma ne[2] **lɛiN**[1] =mɛ[3]
3SG home LOC be MOD.EPIST IRR
He must/might be at home.

Mixed systems can also be found (Type 2 languages), as in Gitksan. Matthewson (2013) unveils data showing the the epistemic modal *imaa* can have both existential (67) and universal force (68), whereas circumstantial *da'akxw* can only be a weak modal (69), with no universal force (70). The data and glosses are from Matthewson (2013).

Context: Whats that noise?

(67) limx imaa/ima' t Bob
sing EPIS DM Bob
Bob might be singing.

Context: Joe left the meeting looking really green in the face and sweaty. Someone asks you why he left.

(68) yugw imaa hl siipxw-t
IMPF EPIS CN sick-3SG.II
He must have been sick.

Context: Henry has taken a theoretical cooking course, and he is now able to cook, but he never has yet.

(69) da'akxw-i-s Henry #(dim) jam-t, ii ap
CIRC.POSS-TRA-PN Henry #(FUT) cook-3SG.II and EMPH
háwen dii jam-t
not.yet CNTR cook-3SG.II
Henry can cook, but he hasn't yet.

Context: Bob ate bad chicken last night. He should be sick now (given the facts about what he ate).

(70) ??da'akxw-i hl dim sim siipxw-t
CIRC.POSS-TRA CN FUT very sick-3SG.II
He should be very sick.

It is also interesting to note that across Indo-European languages. Danish *ma*, for instance, is claimed to be flexible between a possibility and a necessity reading (Davidsen-Nielsen, 1900, 187).

(71) Nu ma du fortoelle. Van der Auwera and Plungian (1988)
now may/must you tell
Now you must/may tell a story.

The analysis that we have provided for FUT in the previous section can be extended to these modals as well. Apparent ambiguity can now be framed within the category of flexible necessity that can combine with an empty metaevaluation. This weaker necessity will appear to be more speculative in certain contexts, and we have more neutral, 'weaker' inferential statements. Some necessity modals are specified lexically for what kind of metaevaluation they take, for instance MUST modals in English and typically in Indo-European languages. Other necessity modals will be flexible.

If the analysis of futuro is extended to Stat'micets, *k'a* is a flexible modal that can be compatible with empty or non-empty ordering sources.

(72) $[\![\text{MAYBE k'a } (p)]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![\text{MAYBE k'a } (p)]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff O is empty & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

(73) $[\![\text{PROBABLY k'a } (p)]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![\text{PROBABLY k'a } (p)]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff
$\text{Ideal}_{\mathcal{S}}$ is a weak necessity with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to $\mathrm{M}(i)$ and O & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

We are not able to state whether there is a default, and, indeed, this is not even important. What matters is that like futuro, *k'a* (and the other forms that we have encountered in the other languages discussed here above) are flexible necessity modals whose metaevaluation can be manipulated.

It is important to note that the analysis that relies on the manipulations of the metaevaluation holds that there is just one modal skeleton for all modals, no matter whether the metavaluation is fixed or flexible. There is no need to give up on the quantificational analysis, nor to assume two distinct lexical entries for flexible and non-flexible modals.

The original proposal in Matthewson et al. (2007) and Rullmann et al. (2008) takes a different route. *K'a* is analyzed as a necessity modal, but underspecification is encoded in the lexical entry by having the universal modal quantify over subsets of the modal base that can vary by their sizes. They take inspiration form Klinedinst (2007)'s analysis of indefinites and assume that there is a fixed domain of quantification over which the modal operates. The domain of quantification of the modal is determined by a choice function f, that can

be existentially bound. The larger the subset of worlds of the modal base over which the modal quantifies, the stronger the force of the modal. Let c be the context of utterance.

(74) a. $[\![\text{MODAL}]\!]^{c,w}$ is only defined if c provides a modal base B.
b. $[\![\text{MODAL}]\!]^{c,w} = \lambda f \lambda p. \forall w' [w' \in f(B(w)) \rightarrow p(w')]$
Paraphrase: In all the worlds in a contextually determined subset of the modal base, p is true.

Mari (2010a) had suggested this solution for the Italian future data in an earlier analysis. However, there are at least two shortcomings. The first one is conceptual: it is unclear how to fix, even contextually, the size the domain of quantification. The number of worlds in the modal base is potentially infinite, and specifying size is not something that has ever been done mainly because it is hard to understand how to measure that. Second, it appears that unitary modals and those with a lexically specified force have different components, as there is no such f for the latter.

The metaevaluation analysis does not encounter these shortcomings. All modals come with a metaevaluative layer that can produce, or not, bias; what we need to acknowledge is that the type of evidence is important. In a context with strong evidence for the prejacent, the meta-evaluation will be non-empty and will produce bias. In a context with less reliable evidence or mere speculation, the meta-evaluation will establish no preference resulting in a more neutral inference which 'passes' as possibility because it contains the possibility meta-evaluation. Our category of flexible epistemic necessity produces the gradable modal meanings to capture necessities weaker than Kratzer's human necessity such as *should*. A variant of the flexible necessity modal can have the default bias be overridden— often by various clues: prosody, adverbs, particles, and even gestures. These means rely on types of evidence and provide content to feed the metaevaluation, which is an integral layer of the modality that can be manipulated at will.

4.5 The conditional + necessity modal combination

As a final consequence of the analysis we offered here, we will discuss the French 'conditionnel' as a weakener like FUT (see also Celle (2007); Rossari (2011); Rossari et al. (2018)). The discussion reminds us a bit of the Greek FUT plus MUST, but we will take a close look at the conditionnel here separately.

Indeed, it has been recently argued by Agha and Jeretič (2022, 833) that the conditionnel 'enhances' a modal. In our terms here, this means that a unitary inferential is created. French does not have an epistemic future (see chapter 6). To weaken the force of *devoir* (MUST), the conditionnel can be used.

(75) The speaker has no idea where Giacomo can be, and it is late at night. She asks: Where is Giacomo? Her husband answers:

a. Sais pas. Il #devra être à la maison à
not know. must.FUT.3SG be at the home at this
cette heure-ci !
time
No idea, he should be home by now !

b. Sais pas. Il devrait être à la maison à
not know. must.COND.3SG be at the home at this
cette heure-ci !
time
No idea, he should be home by now !

c. Sais pas. Il doit être à la maison à cette heure-ci !
No idea, he must be home by now! (ok deontic)
not know. must be at the home at this time

Is the contribution of the conditionnel in (75-b) the same as the one of future with *dovere, prepi* in Italian and Greek? What type of weakening do we have?

Recall what we proposed for Greek the following: in epistemic FUT plus MUST construals the effect of weakening can be understood as overriding the default MUST bias by FUT itself. Specifically, the main modality is MUST and the function of FUT is now shifted to providing the metaevaluation which is empty.

(76) $[\![\text{FUT MUST (PRES } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined, $[\![\text{FUT MUST (PRES } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff O is empty & $\forall w' \in \text{Ideal}_{\mathcal{S}}$: $p(w', t_u)$

In other words, construals when a future modifies MUST can be viewed as a lexicalization process of creating a weaker, flexible MUST. The fact that FUT contributes an empty metaevaluation is itself evidence that FUT as a category does associate with this type of weaker ranking. Notice that the effect above is with the PRES tense. The conditionnel however contains a PAST.

Italian allows to contrasts the two forms, as both futuro (77-a) and the condizionale (78) can be combined with *dovere*.

(77) The speaker has no idea where Giacomo can be, and it is late at night. She asks: Where is Giacomo ? Her husband answers:

a. Dovrà pur essere a casa a quest'ora !
must.FUT.3SG neonetheless be at home at this-time
No idea. He should be home by now!

b. Dovrebbe essere a casa a quest'ora !
must.COND.3SG be at home at this-time
No idea, he should have been home by now. (He is not).

c. (#)Deve essere a casa a quest'ora ! (ok deontic)
must be at home at this-time
No idea, he must be home by now!

The same difference is in Greek with PRES versus PAST under FUT:

(78) Tha epepre na ine spiti tetia ora
FUT must.PAST.3SG be at home at this-time
No idea, he should have been home by now. (Implicated: he is not).

If, as we argued, the FUT plus past.imperfective construal is the Greek equivalent to conditionnel, then we must say that the reading here is a 'soft' counterfactual. But the FUT MUST Pres, in both Greek and Italian is not counterfactual: *Dovrà pur essere a casa a quest'ora* is compatible with him being at home now; but the conditionel and *tha* plus past.imperfective are not.

Von Fintel and Iatridou (2008) famously argue that the conditionnel introduces a secondary modal base of normalcy conditions that weakens *devoir* into an existential modal. The conditionnel/condizionale is used in counterfactual construals (79) in Romance, and the authors conclude their paper by addressing an important question: why does the counterfactual morphology trigger weakening of the modality?

(79) a. Se avesse potuto, sarebbe venuto.
if have.IMP.SUB.3SG could, be.COND.PRES.3SG come
If he could, he would have come.

b. S'il avait pu, il serait venu.
if he have.IMP.3SG could, he be.COND.PRES.3SG come
If he could, he would have come.

Another notion that has been proposed to understand conditionnel is the notion of 'distance' (see Schlenker (2004) on the conditionnel as a distanc-

ing element). The conditionnel says that according to some source (see e.g. Dendale, 1993)– p is true. The use of the conditionnel in French and the condizionale in Italian extend to uses where the evidence is not necessarily tight to normalcy conditions. No matter what the source is (see (80)) the conditionnel is described as establishing a 'distance' between the speaker and the source (81).

(80) John serait marié, à ce qu'il paraît.
John be.COND.3SG married, to that what-it seems
John is married, apparently.

(81) #Secondo me, sarebbe sposato. (Mari, 2010a)
according to me, be.COND.3SG married
According to me, he would be married.

Important for us is the fact that the information that the conditionnel is anaphoric to is *not* anchored to the speaker, who recognizes that there might be other factors outside the information provided by the source that the speaker has no control upon. In this respect, the conditionnel is not only a distancing element, but it is also an *anti-subjective* one, in the sense that the speaker is not the source of the information. The metaevaluative element accommodates intrinsic subjective evaluation and thus cannot host the conditional.

Our analysis of the bare conditionnel accommodates this effect as shown in (82). We see that the conditionnel leaves the ordering of MUST intact (normal worlds are ranked as better and the default metaevaluation is left unchanged) but weakens the force of the quantification (in spite of the fact that Ideal worlds are better, not all of them are p worlds and indeed the actual world might happen to be one in which something else, unknown to the speaker, happened).[15]

(82) $[\![\emptyset$ MUST+COND (PRES $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is non-veridical and is partitioned into $\mathrm{Ideal}_{\mathcal{S}}$ and $\neg\mathrm{Ideal}_{\mathcal{S}}$ worlds. If defined, $[\![\emptyset$ MUST+COND (PRES $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff $\mathrm{Ideal}_{\mathcal{S}}$ is a weak necessity with respect to $\neg\mathrm{Ideal}_{\mathcal{S}}$ relative to $\mathrm{M}(i)$ and O & $\exists w' \in \mathrm{Ideal}_{\mathcal{S}}$: $p(w', t_u)$

To conclude, although it would be tempting to see the conditionnel as having an effect similar to FUT with the modals, the facts are not entirely parallel. The conditionnel does not touch upon the force of the modal in the metaevaluation, but weakens it quantificational force by introducing worlds in which normalcy

[15] Note that when the conditional/conditional combines with MIGHT, it adds a secondary modal base, normalcy conditions, that modal MIGHT lacks as it conveys pure non-veridical equilibrium.

conditions hold, yet the prejacent is not true. With future, the evidence is anchored to the speaker, but she might be unsure about the evidence and thus not committed to it. Only FUT feeds the metaevaluation, as intrinsically anchored to the speaker and this intrinsically subjective element.[16]

Let us recall here the analysis of FUT+MUST and compare it to (82).

(83) $[\![\text{FUT MUST (PRES } (p))]\!]^{O,\text{M},i,\mathcal{S}}$ is defined only if $\text{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined, $[\![\text{FUT MUST (PRES } (p))]\!]^{O,\text{M},i,\mathcal{S}} = 1$ iff O is empty & $\forall w' \in \text{Ideal}_{\mathcal{S}}$: $p(w', t_u)$

We see that there are (at least) two ways to weaken the force of the universal modal MUST. One is by lowering the ranking via the metaevaluation, as with FUT (83); the other is by weakening the quantification itself, by considering Ideal worlds as ranked higher but as being non-homogeneous (82). These are analytical options that the metaevaluation based theory allows to work with.

4.6 Conclusion

In this chapter, we addressed some apparent challenges to the classical distinction between possibility and necessity motivated by languages that appear to not lexicalize the difference between necessity and possibility, and which employ what we call in the title a unitary modal. We showed that the future modal (at least in Greek and Italian) behaves in a similar way. Structures with this type of modal show flexibility and produce more neutral statements, unlike MUST which is always biased. Overall, the modal system that allows dissociation of the modal force from bias (meta-evaluation) such as the one in Giannakidou and Mari (2018b, 2021b) is the only analysis that can derive diversity within semantic classes without giving up a common semantic core (necessity). The concept of non-biased necessity is, we think, applicable to other kinds of weaker necessity modals such as *should, ought*, the conditional mood, and similar items— which cross-linguistically often contain a future component. The unitary modal, thus, can be seen as an inferential modal which is by its nature indeterminate regarding a biased or a non-biased conclusion.

[16] We are not equating here subjectivity with doxa (see Ippolito and Farkas (2021). Subjectivity can be a mix of knowledge and belief. What matters is the anchor, and, with the conditional the anchor is not the speaker.

Questions and further readings

Questions

- The case of flexible necessity is interesting typologically. Try to identify similar patterns in the languages of your interest. Would it be possible to have a unitary tense morpheme that could refer, say to a past or a future or a present time? One could imagine that this is possible given the dependency of the interpretation on contextual evidence.
- The future is an epistemic category, we argued. Would that be a universal analysis? Is it conceivable that future realizations in languages can also be true tenses? What would potential diagnostics be, given the discussion in the paper?
- Think about the conditional mood a little bit more, and the morphological parts that contain it. Which parts do you identify ? And what is their semantic role ?

Further readings

Van der Auwera and Plungian (1988) is certainly a reference on the notion of 'unitary' modals, even if they do not use this term.

Von Fintel and Iatridou (2008) is certainly a reference on *should* crosslinguistically from a formal perspective. The French literature on discourse and polyphony has produced interesting work on the *conditionnel*, including Kronning (1996); Haillet (2002).

5
Modality and Time

Our goal in this chapter is to complete the formal theory of modality by offering an analysis of the interaction between modal elements and tense morphemes. This is necessary because there are observable patterns that need to be systematized so that they can receive a principled explanation. On the syntactic tree, the modal element typically precedes the tense, and in Giannakidou and Mari (2021b) we illustrated that there is a three-way correlation between the higher modal element— including propositional attitude verbs— and the embedded tense or the mood exponent below it. We will not insist on the issue of mood here, and while we will discuss mood when relevant, we direct the reader to our earlier work for more details on this issue.

Regarding modals specifically, we noted a few key interactions already indicating that the temporal orientation is given by the embedded tense of the prejacent proposition. We saw in the previous chapter that NON-PAST is responsible for the future orientation of modal sentences, including the FUT and deontic modals. We also saw that past and present tense in the prejacent clause produces epistemic modality. In the present chapter, we articulate first an explicit syntax-semantics to illustrate how the temporal orientation is derived with embedded tense in Greek and Italian, and then study the interactions between modality and Aktionsart in more detail. We will also discuss the different types of future orientations, and the interaction between ability modals and tense as it is manifested in the so-called actuality entailment. In addition to temporal orientation, the crucial overarching theme will be that the lower tense affects the quality of the modality, namely whether it will be epistemic or not. Some of the discussion in this chapter will be technical as is needed for the syntax-semantics interface; readers that are not interested in the technical details can skip it, as we will make sure that all key pieces are explained adequately in the prose.

5.1 Introduction: modality, tense, and Aktionsart

Modals rely on modal bases, as we have seen, and modal bases are projected from individual anchors, who function as assessors, or 'judges' of the propositional content based on what they know or believe or remember or expect.[1] In epistemic modality, individual anchors are epistemic authorities that assess truth, while in the case of deontic modals the individual anchor functions as an executive authority setting up the frames of options or compliance (see more in chapter 8). Sometimes the modality is anchored to situations or events (Hacquard, 2006) and not individuals, in which case we think of it as circumstantial or dispositional (ability), and we will discuss this case in this chapter. Individual anchoring means that the modal base is projected based on what the anchor knows or assumes as epistemic authority. In the system we have outlined, individual anchors are the foundational parameters that determine the kinds of worlds in the modal base.

Time also plays a crucial role in determining the modal base, as we saw; it is the other default parameter in the interpretation of modals (Giannakidou and Mari, 2018b,a, 2021b,a). Knowledge and beliefs of an individual change across time; likewise authority relations and circumstances also change with time. Modals must therefore also be evaluated with respect to a time, as we did so far (see Kaufmann et al. (2006b)). A key time, as we saw in the previous chapters, is the time of the prejacent found below the modal, as indicated in the English translations in the examples below. But in French, the modal itself can also be tensed: imperfective past vs. present perfect set the time of evaluation of the modal in the past and in the present, respectively (Mari and Martin, 2007; Mari, 2015b). [2] According to what I knew at the time, I can say:

(1) Le clése pouvaient être dans le tiroir. (past perspective)
the keys might.IMPERF be in the drawer
The keys might have been in the drawer.

According to what I know now, I say:

(2) Les clés ont pu être dans le tiroir. (present
the keys might.PRES.PERF be in the drawer
perspective)

[1] Nuyts distinguishes between subjective and intersubjective modality , as well as objective (based on facts) vs. subjective (based in opinions) epistemic modals. We will comment on these distinctions later.

[2] The reasons why in this specific case the imperfective sets a past modal perspective and the present perfect a present modal perspective, will be discussed later in the chapter.

The keys might have been in the drawer.

In many languages, including English, the tense on the modal verb is not contentful: *might, would, should* are morphological but not semantic pasts, and English modals are well known to have defective tenses as is demonstrated by **musted*. In English, we see that the time of the modal is set in the present in both cases, and the key time is the embedded one.

Condoravdi (2002) suggested that modals are inherently specified for present or past, and distinguishes between what she calls *temporal perspective*, which concerns the time of the modal, and *temporal orientation*, which as we saw is typically expressed by the embedded tense (or Aktionsart, the eventuality type information that comes from the grammatical category of aspect). While there is not much evidence that the temporal perspective affects the type of modality— for instance, in the French versions of the examples above the modality is constantly epistemic regardless of the tense change on the modal verb— we saw in the previous chapters, and is amply demonstrated inGiannakidou and Mari (2021b), that the embedded tense *does* affect the type of the modality. A past triggers epistemic modality and never deontic or future. There is also an aspectual effect: when a modality is combined with a stative past form or present/gerund as embedded tenses, it receives an epistemic reading; when it combines with an eventive or non-past form, it receives a non-epistemic interpretation, as illustrated below:

(3) Epistemic (with embedded present or stative verb form)

a. I Ariadne prepi na troi tora.
the Ariadne must subj eat.PRES.3SG now
Ariadne must be eating.

b. Giacomo deve star mangiando.
Giacomo must be eat.GERUND
Giacomo must be eating now.

c. Flavio deve essere a scuola.
Flavio must be at school
Flavio must be at school.

(4) Epistemic (with embedded past)

a. O Nicholas prepi na efage.
the Nicholas must that.SUBJ eat.PAST.3SG
Nicholas must have eaten.

b. Giacomo deve aver mangiato.
Giacomo must have eaten
Giacomo must have eaten.

(5) Deontic (with eventives and embedded NON-PAST)

a. Flavio deve andare au Havre sabato per navigare.
Flavio must go to-the Havre Saturday to sail
Flavio must go to le Havre to sail, this Saturday.

b. O Nicholas prepi na pai sti Havri gia
the Nicholas must subj go.NON-PAST.3SG to Havre for
istioploia to savato.
sailing the saturday
Nicholas must go to the Havre for sailing this Saturday.

Hungarian follows the same pattern:[3]

(6) a. Itt lehet hortenziát termeszteni.
here lehet hortenzia grow
One can grow hydrangeas here.

b. Peter most lehet, hogy otthon van.
Peter now lehet that home be.PRES.3SG
Peter may be at home now.

The deontic interpretation is sometimes called 'root', but it is more informative to think of the contrast as epistemic versus non-epistemic because this appears to be the main meaning contrast. So-called 'root' refers to both deontic and ability modality, i.e., non-epistemic interpretations.

One of the main questions that the chapter addresses is how embedded tense affects the epistemic vs. non-epistemic interpretation. Some theories argue that time is inherent to the meaning of modals (Condoravdi, 2002) whereas others keep time and modality component distinct (Giannakidou and Mari, 2018b,a, 2021b). The concept of branching time (Thomason, 1984; Dowty, 1979; Kaufmann, 2012) has also been used— and will be useful in the study of so-called *actuality entailments* of ability modals, whereby the modal seems to be, as we argued in Giannakidou and Mari (2021b), is in the scope of a past (see Hacquard, 2006; Mari and Martin, 2007; Homer, 2008; Mari, 2016; Nadathur, 2019, for earlier approaches relying on aspect).

Recall, finally, that future morphemes in Greek and Italian combine with present (gerunds in Italian) or pasts, and in this case FUT receives a non-predictive interpretation.

(7) a. I Ariadne tha troi tora. (Greek)
the Ariadne FUT eat.PRES.3SG now

[3] We thank Marta Abrusan for these data.

Ariadne must be eating now.

b. Giacomo ora starà mangiando. (Italian)
Giacomo now be.FUT.3SG eat.GERUND
Giacomo must be eating now.

c. Giovanni sarà malato (per questo non è qui). (Italian)
Giovanni be.FUT.3SG ill (for this not is here)
Giovanni must be ill (that's why he's not here).

(8) a. I Ariadne tha efige xthes. (Greek)
the Ariadne FUT leave.PERF.PAST.3SG yesterday
Ariadne must have left yesterday.

b. Gianni avrà parlato ieri. (Italian)
Gianni have.FUT.3SG spoken yesterday
Gianni must have spoken yesterday.

When future is combined with NON-PAST or eventive verbs, the time of the event is forward-shifted and this results in prediction:

(9) O Janis tha ftasi avrio. (Greek)
the John FUT arrive.NON-PAST.3SG tomorrow.
John will arrive at 5pm/tomorrow.

(10) Gianni arriverà (domani). (Italian)
John arrive.FUT.3SG (tomorrow)
John will arrive tomorrow.

These facts are already familiar by previous discussions. Let us now make explicit how modals and tense interact. We start with the future.

5.2 Embedded tense and temporal orientation

The basic modal structure we have been assuming has a modality node that embeds a TP, as is very transparently shown in Greek. This will be our foundational structure. In English, the TP appears either as a bare infinitive or a present perfect— and we take it, as noted already, that the bare infinitive corresponds to the semantic present or NON-PAST and the present perfect to a semantic PAST. For the idea that the bare infinitive in English and Germanic more broadly is a NON-PAST, see Abusch (2004) and Wurmbrand (2001).

5.2.1 Morphological and semantic tenses in Greek

We repeat here some key discussion from earlier, in order to help the reader. Tense and aspect are always reflected morphologically on the Greek verb, and Modern Greek lacks infinitives. All modals embed subjunctive clauses, but the future particle *tha* embeds a TP, which allows us to see the structure neatly. We will repeat here some discussion from chapter 3 so that the reader can remember the basic distinctions. The grammars (Holton D. and Philippaki-Waburton, 1997; Tzevelekou, 2012) describe the morphological opposition between past and non-past, and the aspectual distinction is perfective vs. imperfective. The morphological combinations create three semantic tenses (Giannakidou, 2009, 2014) : a present (PRES), a past (PAST), and a NON-PAST, which is the tense used for prediction and future orientation. We remind the reader that, in the prose, we use the uppercase to refer to the semantic tenses, and lowercase to the morphological forms.

Consider first the imperfective non-past.

(11) graf- -o. (imperfective non-past: PRES)PRES.1SG
I am writing (right now).
Write (generally).

The morphological imperfective non-past is semantically the present tense (PRES) in Greek (Giannakidou, 2014), comparable to English present progressive. The Greek form also has a generic, habitual reading as is common in European languages with imperfective aspect.

The perfective non-past is a dependent verb form that does not occur on its own; it needs the subjunctive, future, optative, conditional and other future oriented particles to be grammatical.

(12) *grap- s- o (perfective non-past: *on its own)
write- PERF NON-PAST.1SG

(13) Tha/As/Na grapsi to grama avrio.
FUT/OPT/SUBJ write.PERF.NON-PAST.3SG the letter tomorrow
She will write the letter tomorrow.
Let her write the letter tomorrow.

The perfective non-past has no English equivalent, and it is in fact quite rare to find grammatical perfective non-pasts in languages (Giorgi and Pianesi, 1997); Romance languages only retain the aspectual distinction in the past paradigm. This is the form used for prediction and future orientation, to be analyzed as a semantic NON-PAST in the next subsection. In Russian and other Slavic

languages morphological perfective non-pasts are able to future-shift on their own, unlike the Greek form (see, e.g. Bulatovic, 2002; Todorovic, 2012, for Serbian), suggesting that in Slavic these forms are in fact reanalyzed as semantic futures and not NON-PAST.

The past is marked typically in Greek with the presence of the augment *e-*, and we have again two options, perfective and imperfective. The imperfective past is the equivalent of the preterite in Romance languages: it is a combination of a semantic past plus habitual or progressive aspect, both typical readings with this morphological form:

(14) e- graf- a. (Greek imperfective past)
PAST write.IMPFV 1SG
I used to write.
I was writing.

The perfective past, on the other hand, which is called the *aorist* in Greek grammars, denotes a single (usually completed) event in the past. It is interpreted as a default simple past in English:

(15) e- grap- s- a. (Greek perfective past (aorist))
PAST write- PERF 1SG
I wrote.

This form is a simple semantic PAST. Giannakidou (2003) offers discussion of why this form is not telic, but tends to be interpreted as telic— in the way of implicature since the perfective past instead of the imperfective is used.

For future, Greek has the modal particle *tha* that we are by now familiar with. Italian has a future tense. Greek and Italian FUT combine with all tenses. Recall again the combinations of FUT with the PRES (imperfective non-past in Greek, gerund plus stative in Italian):

(16) a. I Ariadne tha troi tora.
the Ariadne FUT eat.PRES.3SG now
Ariadne must be eating now.
b. Giacomo ora starà mangiando.
Giacomo now be.FUT.3SG eat.GERUND
Giacomo must be eating now.

As shown above, FUT plus PRES does not have a predictive reading and is equivalent to an epistemic modal statement similar (but not always identical, as we discussed in chapter 4), to MUST. In Italian, as we discussed in Giannakidou and Mari (2018b), Aktionsart plays the role that aspect plays in Greek.

The role of Aktionsart in connection with modal interpretation has been studied across languages and categories (Condoravdi, 2002; Laca, 2012; Copley, 2009; Mari, 2015b,a, 2018, see).

Combinations of FUT with a lower PAST (an aorist in Greek) also receive epistemic non-predictive readings:

(17) a. I Ariadne tha itan arrosti xthes.
the Ariadne FUT be.PAST.3SG ill yesterday
Ariadne must/#will have been ill yesterday (that's why she didn't come).

b. Giovanni sarà stato malato ieri (per questo non è venuto).
Giovanni be.FUT.3SG been ill yesterday (for this not has come)
Giovanni must/#will have been ill yesterday (that why he didn't come).

(18) a. I Ariadne tha efige xthes.
the Ariadne FUT leave.PAST.3SG yesterday.
Ariadne must have left yesterday.

b. Gianni avrà parlato ieri.
Gianni have.FUT.3SG spoken yesterday
Gianni must/ #will have spoken yesterday.

These are the epistemic nonpredictive readings. (Note that English *will* does not combine with the past; for differences between Greek/Italian FUT and *will* see Mari (2015a, 2018); Giannakidou and Mari (2018a). French future is similar to *will*; see (Mari, 2015a, 2018; Giannakidou and Mari, 2018b).[4] The combinations of FUT with PAST are quite common and do not feel in any way marked or exceptional. The readings are equivalent to the combinations of MUST with exactly the same tense combinations:

(19) a. I Ariadne prepi na itan arrosti xthes.
the Ariadne must that.SUBJ be.PAST.3SG ill yesterday
Ariadne must have been ill yesterday (that's why she didn't come).

b. Giovanni deve essere stato malato ieri.
Giovanni be.FUT.3SG be been ill yesterday
Giovanni must/#will have been ill yesterday (that's why he didn't come).

[4] Tasmowski and Dendale (see 1998); Dendale (see 2001); De Saussure and Morency (see 2012, on the differences between French MUST and FUT.)

(20) a. I Ariadne prepi na efige xthes.
the Ariadne must that.SUBJ leave.PERF.PAST.3SG yesterday
Ariadne must have left yesterday.
b. Gianni avrà parlato ieri.
Gianni have.FUT.3SG spoken yesterday
Gianni must/ #will have spoken yesterday.

For the sake of completeness recall that we do not obtain a future of a past reading in either language (Giannakidou and Mari, 2018b). To obtain a future of a past, Italian uses the conditional and Greek the past imperfective that we discussed earlier:

(21) Gianni sarebbe arrivato più tardi.
Gianni be.COND.3SG arrived more late
Gianni would arrive later.

(22) I Ariadne tha efevge argotera.
the Ariadne FUT leave.IMPF.PAST.3SG later
Ariadne would leave later.

Tha plus imperfective past, we argued earlier, is the Greek equivalent to conditional mood.

Finally, let us remind the reader that the NON-PAST is the form we find in subjunctive clauses:

(23) Thelo na ftasi noris o Janis.
I-want that.SUBJ arrive.PERF.NON-PAST.3SG early the John
I want John to arrive early.

As can be seen, temporal reference shifts to the future with this form.

Giannakidou and Mari (2021b) state that the PRES and PAST are veridical tenses:

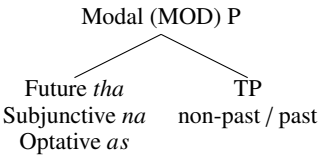
(24) Veridicality of temporal operators:
Let F be temporal function, t an instant or an interval.
F is veridical iff Fp at a time t entails that p is true at a (contextually given) time $t' \leq t$; otherwise F is nonveridical. (Giannakidou, 2002, :23).

PAST/*yesterday* are veridical because (PAST/*yesterday* (p)) at t_u entails that p was true at a time $t' \leq t$. Likewise, PRES/*right now* is veridical because (PRES/*right now* (p)) at t_u entails that p is true at t_u. The future (FUT) and NON-PAST, however, are nonveridical because FUT/*tomorrow* (p)) at t_u does

not entail that p is true at t_u or a time $t' \leq t$; likewise, as we will see next, for the NON-PAST. Temporal veridicality is objective veridicality anchored to t_u, and we discuss next the centrality of t_u in the interpretation of NON-PAST.

As in our earlier work, we will assume that the morphological tense and aspect combinations map onto semantic tenses PRES (imperfective non-past), PAST (perfective past) and NON-PAST (perfective non-past), designated with uppercase. The imperfective past is a compositional combination of PAST and PROGRESSIVE or GEN (Giannakidou, 2009). The syntax we adopt for particles, mood and tense, following Giannakidou (2009), is the following:

(25)



The modal and temporal information are dissociated in the Greek clause. The tensed verb appears in T. Modal particles are MOD heads above TP in what we call Modal P, which is the syntactic space that hosts the nonveridical operators, called by Chatzopoulou (2018) NonveridicalityP. Similarly, in typologically unrelated languages such as Gitksan and other native American languages as well as Hindi (Kush, 2011) we find prospective aspect under a nonveridical head or modal (Matthewson, 2012). It is reasonable to assume that the differentiation of tense and modality/nonveridicality holds universally.[5] In any case, the transparency of modality and tense in the Greek clause allows us to see the clear contribution of each component, and the interaction between mood/modal particle and tense.

5.2.2 The semantic NON-PAST and the *Now* parameter

Giannakidou (2009) defines *semantic* NON-PAST as follows:

(26) Morphological perfective non-past in Greek denotes NON-PAST: (Giannakidou, 2009)
$[\![\text{NON-PAST}]\!] = \lambda P \lambda t \lambda w (P(t, \infty)(w))$

(Following standard practice, we use "(" in the left interval to show that t is excluded from the interval, hence P will be true at a time later than t). NON-PAST introduces a prospective interval, like Abusch (2004) WOLL, a work

[5] Though, interestingly, the reverse pattern is also observed, with Tense higher than MOD, as is recently proposed by Morton and Blanchette (forthcoming) in their discussion of the African language Gisida Anii.

Giannakidou draws on; but unlike WOLL and other morphological non-pasts that can forward shift by default, the left boundary t of the Greek NON-PAST is a *dependent* NPI variable in need of binding. Giannakidou argues that the NON-PAST is a temporal *polarity item* and needs to be licensed. Licensing here means that t must be identified with t_u. The distinctive property of Greek is that t_u (or, n, for Now in Giannakidou and Abusch's original formulations), needs to be introduced in the syntax. The modal particles occupy the higher structure, and because they all have t_u as a parameter of evaluation (as we saw modal operators do in chap. 2), they satisfy the licensing requirement and supply t_u.[6]

Licensing of NON-PAST requires anchoring to t_u, and, following Giannakidou and Mari (2018b), we will call it *Now*-anchoring. There are two possible ways to understand *Now*-anchoring. One way is to say that the modal particle actually adds t_u in the syntax, as suggested by Giannakidou (2009). If we take that view, then t_u is added by every modal element MOD, which explains why the temporal perspective of at least epistemic modals is typically set in the present. On the other hand, *Now*-anchoring can be seen also as a substitution rule for free variables, as was the spirit of Abusch (2004, :39) original rule for WILL: "In the substitution operator, t is a bound variable that corresponds to the tense argument of WILL. For a top-level occurrence of WILL, the effect is to substitute (n, ∞) for n." Giannakidou and Mari (2021b) rephrased this as follows:

(27) *Now*-anchoring rule, triggered at MOD:
Substitute any free variables t in TP with t_u.

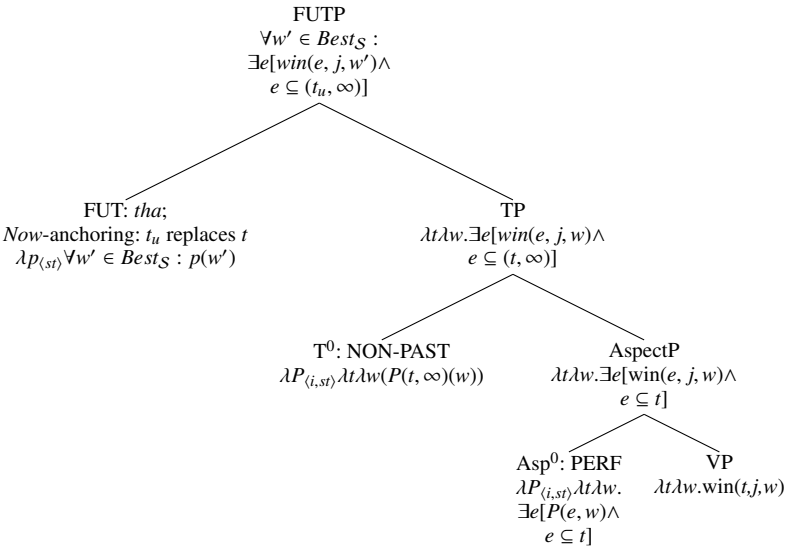
This rule will be in effect only if there are free variables in TP, and it will not apply to lower PAST, for instance, as we will show soon. The rule will enable the free variable t of NON-PAST to be identified with t_u. As a result, the interval provided by NON-PAST will be anchored to t_u, which is what we want. Reliance on t_u appears to be a property of the higher modal structure.

The analysis for the future sentence (28) is provided below (Giannakidou and Mari, 2018b, 2021b, following) :

(28) O Janis tha kerdisi.
the John FUT win.PERF.NON-PAST.3SG
John will win.

[6] Giannakidou (2009) claims that the particles *denote* t_u, thus rendering them temporal operators. In Giannakidou and Mari (2018b), we modified that analysis and argued that t_u is introduced syntactically in Greek in the higher structure by default. It is this formulation that we rely on here.

(29)

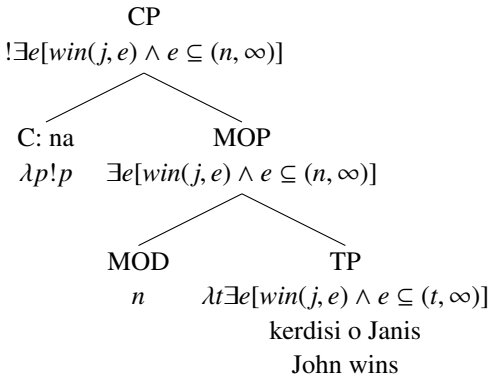


Meaning is represented explicitly at LF, and semantic composition is limited to function application, variable binding, and type raising. Starting from the bottom, perfective aspect applies, yielding a statement that there is a winning event. Following Giannakidou (2009), PERF and NON-PAST are modifiers: their input is a property P and gives back the same property with the addition of the event argument and replacement of t by (t, ∞). PERF introduces the event argument and existentially closes it (as in Giannakidou, 2002; Hacquard, 2009, also). This event has to be located at t, which itself must be placed within the interval provided by NON-PAST. At TP, the t variable remains unbound. At FUT, the *Now*-anchoring rule applies, resulting in identifying the t provided by NON-PAST with t_u. The interval at FUTP is set to (t_u, ∞). The modal meaning can be thus properly computed.

Our analysis of non-past embedded under FUT is very similar to the idea of a prospective marker under FUT, found in recent literature in Kush (2011) for Hindi and Matthewson (2012) for Gitksan (see Giannakidou and Mari (2018b) for extended discussion of these two previous works and comparison).

Overall, the data from Greek, Italian, Gitksan, and Hindi jointly suggest that modality and tense/aspect are dissociated, therefore modals at least in these languages cannot be argued to be mixed modal-temporal operators (Condoravdi, 2002, *pace*). We want to make clear that Greek does not have a prospective aspect, but a morphological and semantic NON-PAST. *Na* is generated in MOD but has moved to C because of its clause typing property (Giannakidou, 2009) :

(30)



Giannakidou and Mari (2021b) assume that *na* is a bouletic or teleological possibility modal:

(31) $[\![\text{na (NON-PAST } (p))]\!]^{M,i,\mathcal{S}}$ is true iff $\exists w' \in M(i) : \exists e[win(j, e, w') \wedge e \subseteq (n, \infty)]$; where $M(i)$ is set of worlds corresponding to what is desired or permitted or set as a goal.

Now-anchoring will be triggered at MOD (also characterized as MoodP in Greek), just as with FUT in the case of the future particle.The modality is understood as teleological or bouletic *na* itself is a possibility modal: *Na kerdisi o Janis!* is equivalent to 'I wish that/Let John win!' [7]

To sum up: the modality and temporal information are dissociated, and the MOD position triggers the *Now*-anchoring rule. The modality of modal particles *na, tha* is always anchored to the present but the temporal orientation and type of modality will depend on the embedded tense. We will see now how this works with an embedded past.

5.2.3 Modality with a Lower PAST

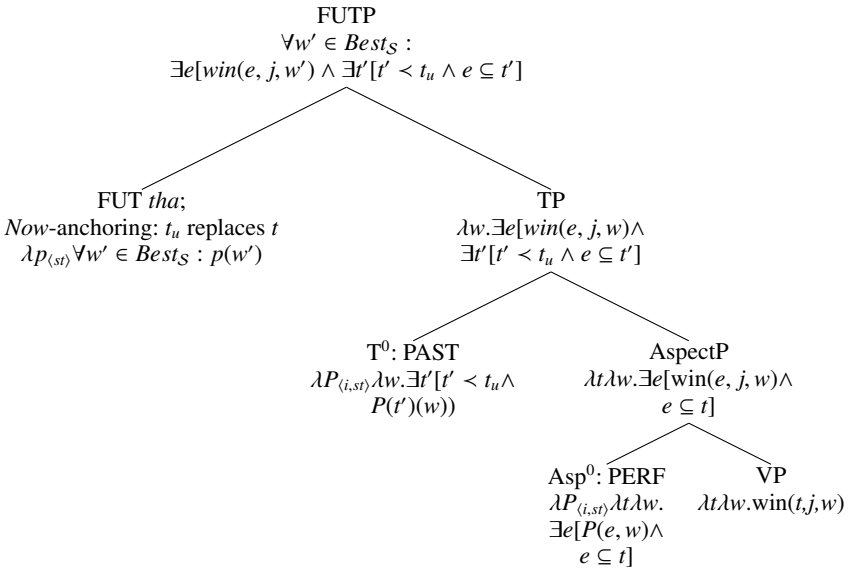
Let us now provide the analysis for modal particle with PAST. We illustrate first with FUT as the simple case without embedding. We distinguish a morphological perfective and a past layer.

(32) O Janis tha kerdise.
the John FUT win.PAST.3SG
John must have won.

[7] Giannakidou (2017) and Giannakidou and Mari (2021b) argue that when *na* is a subordinator, there is no modality of its own since it leaves the Mood phrase and it is in the C position. The main clause C hosts speech acts operators and elements with illocutionary force. We will argue that *na* by itself does not have illocutionary force; see chapter 8 for more discussion.

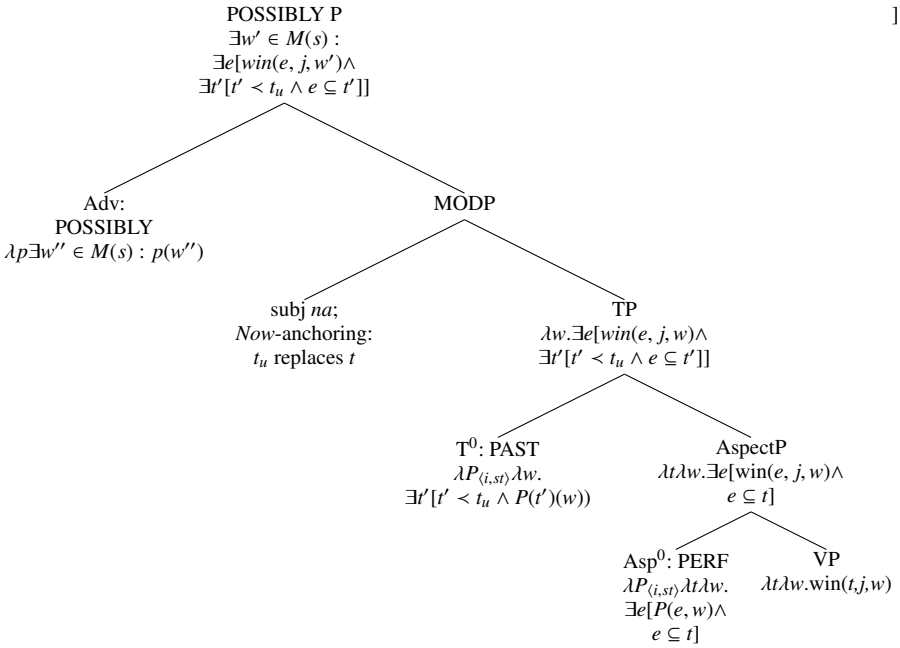
Here, the embedded time is a PAST which is deictic and denotes the anteriority relation with respect to t_u: t' $\prec t_u$. The *Now*-anchoring rule does not apply since there are no free variables.

(33)



With a lower PAST, the FUT sentence is equivalent to a MUST sentence with embedded PAST. The temporal information, in both cases, comes from the past tense below FUT. The same holds for the subjunctive:

(34) O Janis isos na kerdise.
the John maybe that.SUBJ win.PAST.3SG
John must have won.



The past orientation gives an epistemic non-predictive reading, as expected. An embedded present would give:

(35) *na*+ PRES = $\exists w' \in M(s)$:
$\exists e[win(e, j, w') \wedge$
$\exists t'[t_u \subseteq t' \wedge e \subseteq t']]$

Now, $t_u \subseteq t'$ and this derives the possibility reading with present. The FUT plus PRES will be:

(36) FUT + PRES = $\forall w' \in Best_{\mathcal{S}} : \exists e[win(e, j, w') \wedge \exists t'[t_u \subseteq t' \wedge e \subseteq t']]$

The two particles, therefore, correspond to possibility (subjunctive) and necessity (future), and the future statement is always stronger for this reason.

5.2.4 Syntax-Semantics of tense and modality in Italian

In Italian, *futuro* appears as a tense, like morphological present and simple past:

(37) a. Arriv- a.
arrive PRES.3SG
He arrive any moment soon.

b. Arriv- erà.
arrive FUT.3SG
He will arrive.

c. Arriv- ò.
arrive.PAST.3SG
He arrived.

We propose that abstractly the structure is similar to Greek, with FUT being a modal higher than TP. The order of application of the semantic functions is the same as in Greek—and it is merely a morphological fact that future is a Tense, and must therefore stay within the V-form in Italian. In Greek, FUT is a particle and stays outside the V complex. In other words, in Italian there is a mismatch between the function of *futuro* (modal) and its status as a verbal category. The same, by the way, holds for subjunctive, which in Italian, unlike Greek, also appears on V.

The main difference between Italian and Greek is that, in Italian, Aktionsart determines the aspectual information—since in Italian there is no grammatical aspectual distinction. We note with previous literature (Bertinetto, 1979, most notably) that in Italian the eventive/stative distinction plays a role, just as in a variety of other languages (Cipria and Roberts, 2000; Condoravdi, 2002; Copley, 2002; Laca, 2012; Mari, 2015b,a; Frana and Menéndez-Benito, 2019b) . With eventive predicates, the prejacent is forward-shifted, but with with stative predicates (38-a) and (39-a) it is not. The data can be replicated for English:

(38) a. Gianni è malato. (stative, present reading)
John be.PRES.3SG ill
John is ill.

b. Gianni arriva. (eventive, predictive reading)
Gianni arrive.PRES.3SG
John will arrive immediately.

(39) a. Gianni sarà malato. (stative, epistemic reading)
John be.FUT.3SG ill
John must be ill.

b. Gianni arriverà. (eventive, predictive reading)
John arrive.FUT.3SG
Gianni will arrive.

Condoravdi (2002) notes the same interaction for modals with Aktionsart (see (40)). She proposes an account that relies on aspectual differences between statives and eventives, from which it follows that the time of evaluation of the prejacent is forward-shifted only with eventive ones.

(40) a. John might be ill. (stative, present orientation)
b. John might become ill. (eventive, future orientation)

According to Condoravdi, the modal itself bears the temporal information and provides a forward-shifting interval. But what is crucial is the parallelism between grammatical and lexical aspect (Aktionsart), according to which lexical statives are standardly imperfective, whereas eventives are perfective unless they are marked by a progressive verb form (Smith, 1991; Boogaart and Trnavac, 2011). Lexical eventives provide aspectual information—perfectivity; and perfectivity without PAST triggers the NON-PAST reading.

Like Greek, morphological perfectivity gives rise to PERF, NON-PAST, and PERF PAST in Italian resulting in PERF PAST and PERF NON-PAST, as is the case below to produce the predictive reading.[8]

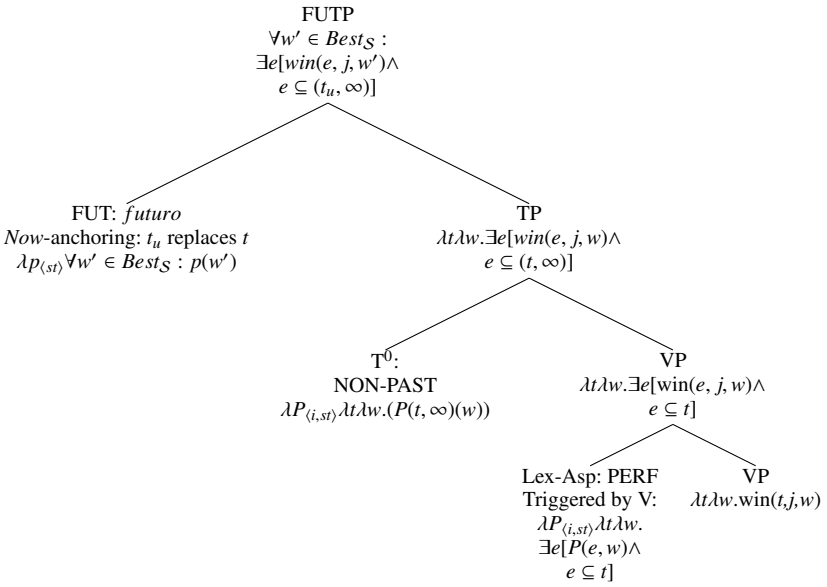
Above the VP, the derivation in Italian is parallel to the one in Greek. FUT provides *Now*-anchoring in Italian as well.[9] Consider (41).

(41) Flavio vincerà.
Flavio win.FUT.3SG
Flavio will win.

[8] As often noted, forward-shifting is observed with statives too, e.g., as in *Domani sarà malato*'(Tomorrow he will be ill), Giannakidou and Mari (see 2018b, for details)

[9] Why the perfective triggers forward shift instead of present has been the object of much study ((Copley, 2009; Mari, 2015b; Boogaart and Trnavac, 2011)). Boogaart and Trnavac (2011) echoes the classical view from Comrie (1976): "a perfective verb form instead presents a situation, "from the outside", as a completed whole, thus including both its starting point and endpoint." Perfectivity in this view establishes a distance between the boundaries of the event and the perspectival point, which in the case of future is t_u. For this reason perfectivity cannot provide PRES, therefore many perfective non-past forms, as mentioned earlier in reference to Slavic languages, are reanalyzed as future or futurates.

(42)



The so called "anterior future"' in Italian is derived as follows.

(43) Gianni sarà andato al cinema ieri.
John be.FUT.3SG gone to-the theater yesterday
John must have gone to the theater, yesterday.

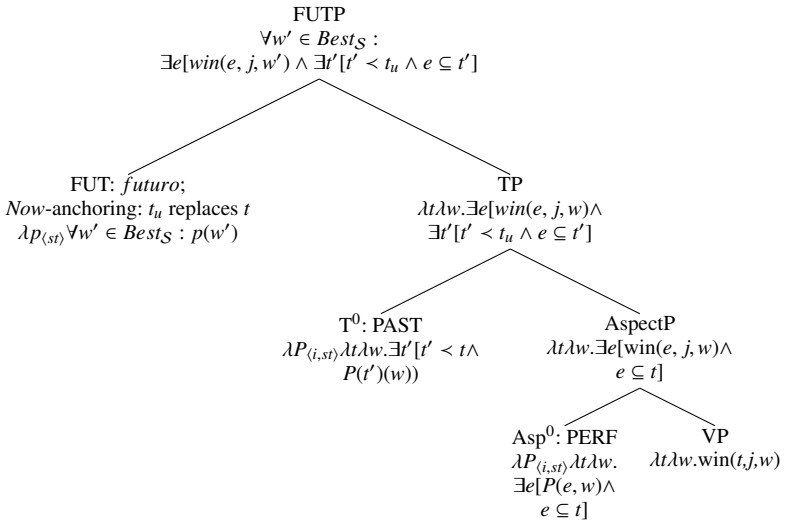
Recall that the corresponding sentence in Greek is a simple past, i.e., past perfective. In Italian, FUT is in complementary distribution with a variety of auxiliaries bearing different tenses (44), thus entering apparent Perfect constructions (De Swart, 2007).

(44) è/fù/sarà andato.
be.PRES/PAST/FUT gone

We decompose the perfect component as a combination of PAST and PERF, as in Greek. PERF provides the temporal boundaries of the eventuality; the PAST expresses anteriority. But given the possibility of combining with a variety of tenses, we must concede that the PAST we are positing is *not* deictic as in Greek but *relative* (Verkuyl, 2011; Broekhuis and Verkuyl, 2014) : it does not express anteriority with respect to t_u but with respect to a time t which is a free variable TP. This triggers the *Now*-anchoring rule. The derivation of (45) follows in (46).

(45) Flavio avrà vinto.
Flavio have.FUT.3SG won
Flavio must have won.

(46)



We can thus generalize that, regardless of whether the embedded PAST under FUT is a simple past or a perfect, what is expressed is the anteriority relation; only with the simple past (Greek) it makes reference to t_u, but in the case of the perfect (Italian, English, Dutch, German) we have relative anteriority and reliance on the *Now*-anchoring rule. What is important is that the anteriority relation is in the scope of FUT. This analysis of Italian can be extended to cover Dutch, German, and English apparent perfects under FUT and MUST.

5.3 More on the future and the nature of prediction

In this section we want to offer some more discussion about the nature of the future and prediction. In chapter 4, we offered an analysis of the future as a potentially non-biased epistemic necessity, and this allows a broad empirical coverage in a number of languages. Here we delve into some more detail about the relation of modality and the future.

5.3.1 Branching time

No matter whether the future is metaphysically settled or not, we must recognize that we cannot know the future. The future is thus epistemically unsettled,

as we have been arguing following the classical Aristotelian analysis. Metaphysically, and more humbly, circumstantially, the future can also be considered unsettled, and indeed, this is how humans behave. We make choices, and our choices and actions make the world change in some way which differs from the unrealized continuation where that particular action is not undertaken and that particular choice is not made. Thinking this way about the future and acting accordingly, as if the future is metaphysically open, is translated in formal terms into the theory of branching time.

Figure (21) represents two worlds w and w' that are identical up and including t'. They differ in what is future to t'. w' and w are an equivalence class of worlds, determined at t'.

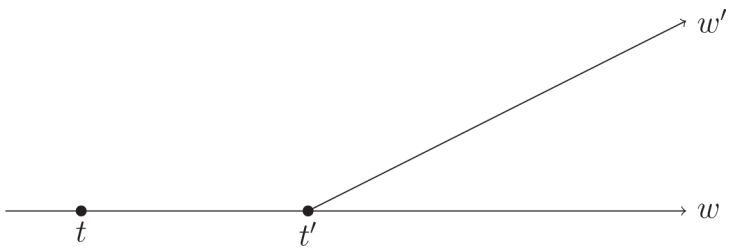


Figure 5.1 Toy branching time

We now restate exactly this in slightly more complex terms. Let us start with the standard $W \times T$ forward-branching structure. A three-place relation $\simeq$ on $T \times W \times W$ is defined such that (i) for all $t \in T$, $\simeq_t$ is an equivalence relation; (ii) for any $w, w' \in W$ and $t, t' \in T$, if $w' \simeq_{t'} w$ and t precedes t', then $w' \simeq_t w$. In words, w and w' are historical alternatives at least up to t' and thus differ only, if at all, in what is future to t'. For any given time, a world belongs to an equivalence class comprising worlds with identical pasts but possibly different futures. Let w_0 be the actual world.

For any time $t \in T$, we define the set of historical alternatives ($\mathcal{I}$) as the set of worlds that are identical to the actual world w_0 at least up to and including t (Thomason, 1984).

(47) $\quad \mathcal{I}(t) := \{w \mid w \simeq_t w_0\}$

In the case depicted in Figure 5.2, the set of historical alternatives at t is the set given in (48).

(48) $\mathcal{I}(t) = \{w_1, w_2, w_0, w_3, w_4\}$

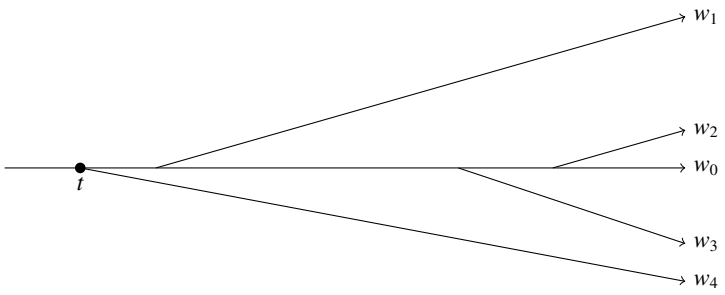


Figure 5.2 $\mathcal{I}(t)$

$\mathcal{I}(t)$ represents the modal base fixed at t.

5.3.2 Epistemic or metaphysical modality?

Aristotle, in his famous sea battle examples, believed that future sentences do have a truth value, we just don't know yet if it is true or false (see also Kissine's analysis). Kush (2011), in his study of the Hindi modal particle *gaa* which, like FUT, shows a flexibility between epistemic and predictive readings uses metaphysical modality for the predictive reading: it arises with the bare verb (no tense or aspect) (49), and the epistemic with perfective (past) (50-a) or progressive aspect (50-b) (examples and glosses are from Kush).

(49) ve bacce do din=mẽ aa-ẽ-gee. (Hindi)
dem.3PL child.M.PL two day=in come.SUBJ.PL
Those children will come in two days.

(50) a. ve log ab^{h}i=tak pahũc^h-ee
dem.3.PL people now=by arrive.PFV.PL
hõ-∅-gee. (Hindi)
aux.SUBJ.PL.MOD.PL
They must have arrived by now.

b. ve log ab^{h}i naac
dem.3PL people now dance.PROF.M.PL
rah-ee hõ-∅-gee.
aux.SUBJ.PL.MOD.PL
They must be dancing now.

Kush analyzes *gaa* as a modal operator just like we do, but posits metaphysical modality for the future reading. Future/metaphysical modal base arises with no tense in Kush's account, and the epistemic reading relies on as aspect: "from the ungrammaticality of auxiliaries in Future constructions we can conclude that Tense is absent." (Kush, 2011, :417). Let us give a shot to this metaphysical analysis of the temporal interpretations, for the sentences:

(51) Gianni arriverà alle 4. (Italian)
John arrive.FUT.3SG at 4
John will arrive at 4.

(52) O Janis tha ftasi stis 4. (Greek)
the John FUT arrive.PERF.NON-PAST.3SG at 4
John will arrive at 4.

Given the branching metaphysical structure, what a speaker knows or believes at the time of prediction still plays a key role for the act of prediction: two different people can make two different predictions, depending on what they know. Let's say a Greek speaking or an Italian speaking Mary utters one of the sentences above. In making the prediction, Mary is using her knowledge. She knows facts as well as generalizations based on personal experience, and rules of thumb about traffic conditions. She knows that around 4 pm it is typically not yet rush hour, that the traffic is easy outside rush hour. She also knows that if you travel outside rush hour the trip from Hyde Park to Lakeview will take 20 minutes. We called the set of propositions below the *future criterion* (after Giannakidou and Mari 2018b), and use $\mathcal{E}$ to refer to it. Mary's future criterion is the following set of propositions:

(53) Mary's future criterion $\mathcal{E}_{Mary}$ = {'around 4 it is not yet rush hour', 'the traffic is easy outside rush hour', 'if you travel outside rush hour the trip from Hyde Park to Lakeview will be take 20 minutes'}

Now, imagine that Susan knows something more. Her future criterion includes the set Mary's does, but also the proposition that there is construction going on that day on the Lake Shore Drive.

(54) Susan's future criterion $\mathcal{E}_{Susan}$ = {'around 4 it is not yet rush hour', 'the traffic is easy outside rush hour', 'if you travel outside rush hour the trip from Hyde park to Lakeview will be take 20 minutes', 'there is construction going on on the Lake Shore Drive', 'when there is construction on the road, traffic slows down'}

Given (54), Susan disagrees with Mary and utters (55).

(55) No. Gianni arriverà alle 5. (Italian)
no John arrive.FUT.3SG at 5
No. John will arrive at 5.

(56) Oxi. O Janis tha ftasi stis 5. (Greek)
no. the John FUT arrive.PERF.NON-PAST.3SG at 5
No. John will arrive at 5.

Because $\mathcal{E}_{Susan}$ contains the construction information, her prediction about Gianni's arrival is for a later time, differing from Mary's. Clearly, then, what one knows affects what one predicts regardless of what will actually be the case. Susan and Mary are in a state of disagreement, reminiscent of disagreement observed with predicates of personal taste (Lasersohn, 2005; Stephenson, 2007; Papafragou, 2006, a.o.). The prediction is therefore a subjective epistemic attitude, anchored to the assessment of the individual making it based on the evidence she has.

The future criterion establishes an epistemic frame that ends up carving the space of metaphysical possibilities into those that are p worlds and those that are not, and FUT would universally quantify over the Best set returned by the future criterion. p would thus be true only in the metaphysical alternatives that are consistent with current knowledge of i. The worlds are metaphysical, i.e. they are versions of reality out there, and we expect that p is true in a non-singleton subset of them.

The main problem with the metaphysical analysis above is that, as we noted in Giannakidou and Mari 2018a, FUT p can be true even if the metaphysical space $\mathcal{I}(t_u)$ is anti-veridical: for example if it turns out that Janis had an accident and is in the hospital, so he is not coming at all. If we do not know that, we are still making a successful prediction, hence prediction seems to rely solely on what the speaker knows or has evidence for at the time of making it. We will extract from our previous work a number of arguments as evidence for why metaphysical modality, while appealing at first glance, is in fact not the appropriate vehicle for prediction.

Predictive future, veridicality A speaker i can make a prediction about p even if there are *no* metaphysical branches that make p true, as we just mentioned. Let us build on this case of an anti-veridical metaphysical modal base. Imagine that, sadly, Susan had a car accident and died on the spot. Mary does not know that Susan died, and utters (57):

(57) Incontrerò Susan domani. (Italian)
meet.FUT.1SG Susan tomorrow
I will meet Susan tomorrow.

(58) Tha dho ti Susan avrio. (Greek)
FUT meet.PERF.NON-PAST.1SG the Susan tomorrow
I will meet Susan tomorrow.

Mary makes a prediction (FUT *p*) based on her state of knowledge at the time of utterance. The fact that objectively the proposition *Susan meets Mary tomorrow* cannot be true appears to be irrelevant for FUT *p*. The prediction FUT *p* solely depends on what Mary knows at t_u, and this holds for all cases of predictions.

A prediction, we argued in Giannakidou and Mari (2018b), is therefore a sentence that is true relative to *i* making it. In this regard, predictive sentences are similar to those containing predicates of personal taste:

(59) a. Mary: Fish is tasty.
b. Susan: No, fish is not tasty.

The proposition *Fish is tasty* is true_i for Mary but false_i for Susan, the two are in a classic case of faultless disagreement. Importantly, with predicates of personal taste this disagreement can never be objectively resolved, since there is no matter of fact that fish is or is not tasty (see Stephenson, *ibid.*). The truth is therefore fully determined by the individual anchor only; and the individual anchor is crucial in determining the basis of knowledge for forming the prediction— but as Aristotle already noted (see also (MacFarlane, 2005), there *will* be a matter of fact for *p*. The predicted sentence *p* will indeed receive a truth value objectively (true_o or false_o), albeit at a later time. Hence, objectively, the complement sentence *p* of FUT, unlike a sentence with a predicate of personal taste, indeed gets resolved, and this is where predicates of personal taste and epistemic modals differ.[10] However, just as with personal taste, the matter is not resolved at the time of the utterance.

Notice also the parallelism with epistemic modals in present and past:

(60) a. For all I know, Mary must be at home right now.
b. For all I know, Mary must have been at home this morning.

Just as with predictions, the individual anchor determines the basis of knowl-

[10] Note that, for MacFarlane (2005) the future sentences cannot be assigned a truth value at the time of utterance. For us, the predictive sentence does have a truth value, it is true/false, parametrically to *i*.

edge for epistemic MUST *p* (Papafragou, 2006, see also). Unlike with predicates of personal taste, with epistemic modals there is also a matter of fact: *p* is/was or is not/was not true. With epistemic modals the matter is settled at t_u— but with predictions it will be settled at a later time. In this respect, prediction stands in between predicates of personal taste and epistemic modals: *p* may be objectively settled (as with epistemic modals), but it is not yet objectively settled at the time of utterance (as with predicates of personal taste).

In the specific case of predictions and antiveridical metaphysics, the matter *is* settled objectively at t_u: given that Susan is dead, the sentence *Susan meets Mary tomorrow* is objectively false at t_u.

To conclude: we distinguish between *p* as a sentence which under FUT will have its truth decided in the future, and FUT *p* as an epistemic modal sentence making a prediction whose truth value is decided at the time of utterance based on what is known at that time by the speaker *i*. The objective value of *p* at the future time does not matter for predictions, just as it does not matter for epistemic modals and for predicates of personal taste. In all cases, truth conditions are assigned independently of the objective status of *p*.

Indeterminate predictions and guesses What we call next *indeterminate* predictions also plead for treating prediction as epistemic in nature. Imagine utterances like the following:

(61) Giacomo will be a famous journalist some day.

Uttered by his mother when Giacomo is 5 years old, this is an indeterminate prediction— a common kind of prediction often reinforced by indefinite adverbs such as *some day* which create temporal distance between the time of prediction and the time of (possible) fact. The indeterminate prediction is a kind of guess, i.e., a mix of aspiration, desire and a little bit of evidence: Giacomo is very charming, talented and communicative, and his mother herself dreams of having a son who is a famous journalist. How the actual world will turn out to be is too far into the future, so current evidence plays little role when making this kind of the prediction— which, as we said, relies more on aspiration (which is a forward looking belief) and less so on actual evidence.

5.3.3 Expectational components in prediction

Now that we just talked about aspiration, it is helpful to ponder on predictions made with a specific goal or plan in mind. Such predictive sentences are often called 'futurates' and may appear with particular forms such as *I am going to*

lose ten pounds this summer. The use of *am going to* makes this a goal-oriented prediction.

Copley (2009) discussed futurates in detail, and starts by asking the question of how the speaker can be confident about her prediction when in fact the future is metaphysically open.[11] She advances the following claim.

"One way is to be confident that someone (the agent of the sentence or some other person) has the ability to determine whether an eventuality will happen or not, and is committed to making it happen. The other is to be confident that non-accidental properties of the world entail that it will happen. These two options were reflected in bouletic and inertial orderings on a metaphysical modal base, with universal quantification over the set of worlds." (Copley, 2002, :59)

Here we have a distinction between so-called bouletic and inertial futures, a difference that Copley traces back to Dahl (1985). The idea is that desires— as we called them earlier, aspirations— and goals are additional criteria that are relevant for future statements. Let us consider an example from Copley, a case where two friends are discussing:

(62) Don't worry, she'll be there at 5:00 p.m. (ex. 124 in Copley, 2002)

Consider now the following example, paying attention to the restriction on the worlds of the modal base, which are p worlds. (63) is an example of bouletic future, according to Copley.

(63) Don't worry, it'll snow tomorrow; it always snows on my birthday. (ex.144, Copley 2002)

The truth conditions Copley provides for (63) are in (64), and are paraphrased as: 'in all situations overlapping with the present, a contextually specified *director* wants [and we add expects] q at some future time.' (Copley, 2002, :69). The notion of director includes those of ability to carry out q or those who expect q because of knowing certain regularities as in the example at hand here.

(64) $\text{ALL}_t(\text{ALL (d)(q)})(\text{w})(\text{t}) = 1$ iff
$\forall t' \supset t$: [$\forall w'$ metaphysically accessible from w at t' and maximally consistent with d's commitments in w at t':
$\exists t'' > t'$: $[q(w')(t'')]]]$
Presupposed: d directs q in w at t'

Positing a director says that at least some predictions involve a calculated estimation that includes agency and expectational patterns— like, we want to add,

[11] Bonomi and Del Prete (2008, see also)

Tomorrow will be Sunday which is aleithic since the pattern is a natural law. It is clear that prediction doesn't have to be a purely epistemic category; but we also want to emphasize that predictions are variable and not all of them involve regularities or commitments to carry out tasks. The guesses that we mentioned earlier do not involve specific tasks, and many predictions are pure estimates based on assessing evidence along with preferences and goals. Regularities and goals are factors that can be understood *in addition to* the epistemic analysis, and we do expect that in a given language— as well as across languages— the difference between a purely epistemic and a mixed-epistemic prediction will be marked, as it in English, for example in the difference between the future modal *will* and the futurate *be going to*. This point deserves considerable exploration.

Aristotle in his *Nichomachean Ethics* posits that *boulesis* (where the word 'bouletic' comes from) which is rational deliberative desire. Rational desire determines action and planning for the future to achieve a certain goal, as opposed to mere desire that can be abstract and concern even improbable things and guesses.[12] The modal base for the future, therefore, may also contain certain priors in the sense of epistemic or bouletic biases towards certain desired outcomes especially in action-oriented cases. If plans are set, a prediction will rely on those too and project expectations accordingly. In a framework such as Giannakidou and Mari 2021, we can view this as a case where the modal associates with two kinds of modal bases, or a mixed epistemic/volitional.

Futurate imperatives illustrate exactly this point. Consider the following example from French:

(65) Tu feras la vaisselle aujourd'hui.
You are washing the dishes today.

The futurate imperative is the use of a future sentence in lieu of an imperative. Here we have a pattern of an alternating order that creates predictability, one day me one day you; or, a pattern arising from me doing the dishes all week, so now it is your turn. In either case, the regularity can be assumed under the future modal criterion which contains also the specific goal. The fact is, predictions are highly context sensitive, and obviously variable in strength, weaker or stronger depending on what we know or expect in any given context.

[12] Likewise, Heim (1992) and Giannakidou (1997, 1998) propose analyses of volitional verbs that contain epistemic presuppositions; see discussion in (Giannakidou and Mari, 2021b), ch.5

5.3.4 Ratificational futures

In this section, we identify indeed a 'stronger' type of prediction that we call, following our earlier work, ratificational. Here we encounter also a point of crosslinguistic variation: while the Spanish future behaves largely like in Italian future (Rivero, 2014; Rodríguez Rosique, 2019; Escandell-Vidal and Leonetti, 2021), the French FUT behaves differently as noted in De Saussure and Morency (2012); Mari (2015a, 2018); Giannakidou and Mari (2018b). These authors propose a notion of 'verification', and Giannakidou and Mari specifically propose that the French future morpheme, as well as English *will* are 'ratificational' which means that they require that there be a verification time in the future. Italian and Greek predictions lack the ratificational component of epistemic future.

To see the contrast, consider English first:

(66) a. He is not at school. #He will be ill.
b. Knock on the door. That will be the mailman.

Palmer's famous sentence *That will be the mailman* is good because there is a regularity or an expectation that mail will be delivered at this time. In the odd example, however, we have a purely epistemic assessment without any expectation, and apparently *will* is bad. In Greek and Italian, this example is absolutely fine; in English, *must* must be used:

(67) a. Dhen ine sto sxolio. Tha ine arrostos. (Greek)
not be at school. FUT be ill
b. Non è a scuola. Sarà malato. (Italian)
not is at school. Be.FUT.3SG ill
He is not at school. He *must* be ill.

Crucially, French future patterns with *will* (Mari, 2015a, see). Observe:

(68) a. La sonnette sonne. Ce sera le facteur.
the doorbell ring.PRES.3SG. That be.FUT.3SG the postman
The doorbell is ringing. It will be the postman.
b. Il n'est pas à l'école. ??Il sera
he not-be.PRES.3SG at the-schoold. He be.3SG.FUT
malade.
ill
He is not at school. ??He will be ill.

(69) a. La sonnette sonne. Ça doit être le
the doorbell ring.PRES.3SG. That must.PRES.3SG be the
facteur.
postman
The doorbell is ringing. That must be the postman.

b. Il n'est pas à l'école. Il doit être
he not be.PRES.3SG at the-school. He must.PRES.3SG be
malade.
ill
He is not at school. He must be ill.

This contrast between *will* and French future (68-b), on the one hand, and Greek/Italian future, on the other, can be understood within the context of the discussion we just had about the role patterns and expectations play as creating predictions that will be narrower empirically than the more general cases of Italian and Greek FUT. Building on work by Mari (2015a), Giannakidou and Mari 2018a identify a subclass of epistemic futures called *ratificational*. A ratificational future is epistemic, but requires further that there be a time of verification (no matter how far into the future), and cannot be used if there is no such time. This case is shown below, with a minimal pair in Italian-French in (70). Here two friends are speculating about the shape of the universe.

(70) a. Sarà sferico. (Italian)
be.FUT.3SG sferical

b. ??Il sera sphérique. (French)
it be.FUT.3SG sferical
It must/#will be spherical.

(Mari 2015 actually presents multiple differences between Italian and French futures and French future and *devoir*, 'must' in French.) Note the translation with *must*, as *will* is odd patterning with French future. According to Mari (Mari, 2015a, 2018), and Giannakidou and Mari (2018b), the oddness is due to the impossibility of the verification of the shape of the universe (see De Saussure and Morency (2012) for the initial discussion). Clearly, ratification is not a constraint for the Greek and Italian FUT, hence there is no oddness. Most importantly, the ratification time must be in the future, and this explains why *will* resists epistemic uses in the past (unlike Greek, Italian, Spanish, German and Dutch futures).

The following further illustrates the same point. Two friends are speculating about the beauty of Tokyo. (71) is acceptable only if at least one of the participants has not seen Tokyo yet and is about to travel there.

(71) Tokyo sera belle.
Tokyo be.FUT.3SG beautiful
Tokyo will be beautiful (I will go there soon and confirm myself).

Devoir (72-a) can be used in scenarios, in which one of the participants is about to travel to Tokyo and in which none of them has scheduled a trip there. The Italian future, again, behaves like *devoir*, see (72-b).

(72) a. Tokyo doit être belle.
Tokyo must be beautiful
b. Tokyo sarà bella.
Tokyo be.FUT.3SG beautiful
Tokyo must/might be (maybe) beautiful.

The necessity for confirmation, for proof at a future time appears to be a factor constraining the particular type of future expressed by *will* and the French future. Giannakidou and Mari (2021b) propose the following lexical entry, where the existence of a future verification time t_{ver} is cast as a presupposition:

(73) Giannakidou and Mari (2021b), relying on Mari (2015a, 2018)
$[\![\text{WILL (NON-PAST}(p))]\!]^{M,i,S,t_u}$ will be defined only if:
(i) the modal base $\text{M}(i)(t_u)$ is epistemic and nonveridical; and (ii) $\exists t_{ver} \in (t_u, \infty)$ such that p will be verified in t_{ver}. If defined,
$[\![\text{WILL (NON-PAST}(p))]\!]^{M,i,S,t_u} = 1$ iff $\forall w' \in \text{Best}_S : \exists t' \in (t_u, \infty) \wedge p(w', t')$

The ratification future does not contain bouletic or agentive elements, but it is creates a prediction that is verifiable, it presupposes that the future statement will be true. The more neutral future of the Greek and Italian type exemplifies the more general case. Regarding *will*, treating is as an epistemic future that depends on the existence of a verification time also resonates with McFarlane's 'time of assessment.'[13] It appears therefore that futures cross-linguistically differ also along the verifiability parameter.

[13] Recall, as we said earlier, that for MacFarlane (2005) no truth conditions can be assigned at the utterance time, but for us the *will* sentence has the truth condition of the MUST modal, though not with bias, as we discusses at length in chapter 4.

5.3.5 On futur antérieur in French and Italian and the mirative effect

The final future case we consider is the futur antérieur (in French) and the futuro anteriore (in Italian). It is immediately necessary to make clear that they never have a future-in-the-past interpretation. To obtain the future-in-the-past interpretation, in both Italian and French, the past conditional is needed, as shown in (74).

(74) a. Pensava che #sarà/sarebbe arrivato prima.
think.IMPERF that be.#FUT/COND arrived earlier

b. Il pensait qu'il #sera/serait arrivé avant.
he think.IMPERF that be.#FUT/COND arrived earlier
He thought that he would arrive earlier.

The futur antérieur in French can have a conjectural interpretation, akin to what is observed with futuro anteriore in Italian (for an extended study of futur antérieur, see Mari (2018)). In (75), the sentence conveys a conjecture, at the time of utterance, about the past. At the time of utterance, the speaker is in a state of lack of knowledge, as expected with the epistemic reading of FUT. The context is one in which I cannot find my scarf. My husband utters:

(75) a. Tu l'auras laissée à Jean Nicod.
you that have.FUT.2SG left at Jean Nicod

b. L'avrai lasciata a Jean Nicod.
that have.FUT.2SG left at Jean Nicod
You must have left it at Jean Nicod.

Starting with the analysis for Italian, everything goes as expected, FUT scopes over PAST, which sets the temporal perspective, that is to say, the time at which the prejacent is evaluated.

(76) Conjectural futuro Anteriore (Italian)
$[\![\emptyset \text{ FUT (PAST } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds.
If defined, $[\![\emptyset \text{ FUT (PAST } (p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff O is empty & $\forall w' \in \text{Ideal}_{\mathcal{S}} : \exists t' \prec t_u p(w', t')$

For French, with the addition of the verificational component in the presupposition, conjectural futur antérieur is analyzed as follows:

(77) Conjectural futur antérieur (French)

$[\![\emptyset$ FUT (PAST $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if (i) M(i) is nonveridical and is partitioned into $\mathrm{Ideal}_{\mathcal{S}}$ and $\neg\mathrm{Ideal}_{\mathcal{S}}$ worlds. (ii) $\exists t_{ver} \in (t_u, \infty)$ such that p will be verified in t_{ver} If defined,
$[\![\emptyset$ FUT (PAST $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff O is empty & $\forall w' \in \mathrm{Ideal}_{\mathcal{S}} : \exists t' \prec t_u p(w', t')$

Surprisingly, futur antérieur in French, and indeed even futuro anteriore in Italian can be used when the speaker knows that p is true at the time of utterance. The context is one in which Nadal wins Roland Garros for the 11th time. Knowing that Nadal has won, the speaker utters:

(78) a. Il aura gagné pour la 11ème fois !
he have.FUT.3SG won for the 11th time !

b. Avrà vinto per la 11esima volta !
have.FUT.3SG won for the 11th time !
Can you believe it! With this, He will have won for the 11th time!

Here FUT is used in a veridical context where the prejacent is true, and according to Mari (2018) this is a *mirative* use as indicated above with the exclamation mark. This use is widespread across languages and in the Romance family, it is well attested in Spanish (see Rodríguez Rosique, 2019; Escandell-Vidal and Leonetti, 2021). It is also attested with FUT plus present perfect:

(79) M' afto, tha exi kedrisi enteka fores!
he have.FUT.3SG won 11th times
With this, he will have won for the 11th time!

As with many other phenomena, the mirative use can be understood as a marked manipulation that builds on the canonical use. According to Mari (2018) the mirative effect is built compositionally. In this case, PAST scopes over FUT and the sentences conveys a past conjecture and a present verification. Note, importantly, that this does not lead to a future-in-the-past interpretation, since, as we extensively saw in our analysis, the prospectivity is not due to FUT. With PAST scoping over FUT, the temporal parameter of FUT is bound by PAST and there is *no forward-shifting* component. FUT only and exclusively conveys the modal meaning.

(80) Mirative-like futur antérieur (French)
$[\![\emptyset$PAST (FUT $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if (i) M(i) is nonveridical and is partitioned into $\mathrm{Ideal}_{\mathcal{S}}$ and $\neg\mathrm{Ideal}_{\mathcal{S}}$ worlds.
If defined, $[\![\emptyset$PAST (FUT $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff O is empty $\&\exists t' \prec t_u \& \forall w' \in \mathrm{Ideal}_{\mathcal{S},\sqcup'} : p(w')$

We see that FUT maintains it non-veridical interpretation, which is now anchored to a past time. Nothing thus prevents that, in the present, the speaker can know that *p* is true. At the time at which FUT is evaluated, she was uncertain whether *p* was, or would become true. The mirative is thus not a predictive interpretation , but an effect obtained by combining past uncertainty (and in fact no bias which is the default with FUT) with present evidence.

We noted that Italian and Greek features the same mirative effect, and since ratification is not a lexical presupposition of Italian future unlike French, the phenomenon seems to be independent of that. If the modal perspective is set to the past as we are proposing, and in the past the speaker lacked adequate evidence (as expected by futuro), nothing prevents that the speaker obtains better evidence in the present. The mirative-like interpretation is thus free to arise as a contextual effect, by the combination of past doubt about *p* and present knowledge that *p* is true.

5.3.6 Conclusion: the nature of prediction

In sum, we identified in the preceding discussion a number of predictive sentences illustrating that the category of prediction, while being a foundationally epistemic attitude— assessing evidence for the future sentence— appears also to be gradable in strength with some predictions being mere guesses and others involve regularities, plans, expectations, or verification times. This diversity is not a surprise, however. It rather indicates that when we make predictions, we make them as rational agents in context; and rationality requires that in our future judgment we take all evidence into consideration including what we know, regularities we observe, expectations that hold given certain plans for action, or even biases (what Giannakidou and Mari 2021 called the endogenous factors). This all goes into the future judgment.

In a framework such as Giannakidou and Mari (2021b), we can model complex predictions where the future modal associates not only with the epistemic modal base but also with a volitional one, or by adding a verification presupposition and mirativity. As we hope we have showed, lexical FUTs will differ crosslinguistically, in predictable ways, in terms of what they combine with.

5.4 Actuality entailment: ability below the PAST

We move on now to examine the phenomenon of actuality entailment (a term coined in Bhatt, 1999), which is the phenomenon whereby a sentence with an ability modal implies that its prejacent was true in the past.

Actuality entailments are a widespread phenomenon across languages, including Indo-European languages such as Hindi (Bhatt, 1999), French (Hacquard, 2006; Mari and Martin, 2007; Homer, 2008; Mari, 2016, a.o.), Italian (Mari, 2015b, 2016) and Greek (Giannakidou and Staraki, 2013), as well as Palestinian Arabic (Alxatib, 2021) and many other languages. The phenomenon, at first glance, appears to challenge the Veridicality Axiom for modals, and for a while it was thought to hinge on perfective aspect. Giannakidou and Mari 2021, however, demonstrate that the actuality entailment actually depends on the past tense, and presents a unique case where the modal actually scopes below tense. Epistemic modals cannot scope below tense, as we have been discussing, hence there is no actuality with epistemic modals. We will consider the temporal approach as well as the previous ones here.

Let us start with some examples, from Hindi (Kush, 2011), French, Italian, Greek and Palestinian Arabic (Alxatib, 2021):

(81) Yusuf havaii-jahaaz uraa sak-taa hai/thaa (lekin vo
Yusuf air-ship fly can.IMPF be.PRES/be.PAST (but he
havaii-jahaaz nahii uraa-taa hai/thaaa).
air-ship neg fly.IMPF be.PRES/be.PAST).
Yusuf was able to fly airplanes (but he doesn't/didn't fly airplanes).

(82) Jean a pu prendre le train, #mais il ne l'a
John has can.PAST.PART to take the train, #but he not that-has
pas pris.
not taken
John managed to take the train, #but he did not do it.

(83) Gianni ha potuto prendere il treno, #ma non lo ha
Gianni has can.PAST.PART to take the train, #but not that has
preso.
taken
Gianni managed to take the train, #but he did not take it.

(84) O Janis borese na
the John can.PERF.PAST.3SG that.SUBJ
apodrasi (#ala dhen apedrase).
escape.PERF.NON-PAST.3SG (but not escaped)
John was able to, and he did escape (#but he did not).

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(85) ∅ Pıdır jrawwıe, (bas maa rawwae)
PRO able.PAST.PFV 3SG.M-go.home, (but neg go.home.past.pfv)

He was able to go home, but he didn't.

In all these examples, we get the veridical entailment that the proposition prejacent to the ability modal is true. The phenomenon typically arises with ability and dispositional modals (often called root modals, as we have mentioned), and a common observation has been that this veridical inference arises when the modal is in the perfective aspect and in the past.

Crucially, the actuality entailment does not arise if the modal is followed by a lower past. As we can see here, if we try to embed a past tense under the ability modal in the present, only the epistemic reading arises regardless of aspect:

(86) I Ariadne bori na odigise (xthes).
the Ariadne can that.SUBJ drive.PERF.PAST.3SG now
Epistemic reading only: Ariadne could have driven yesterday.

(87) I Ariadne bori na odigouse (xthes).
the Ariadne can that.SUBJ drive.IMPF.PAST.3SG
Epistemic reading only: Ariadne could have driven yesterday.
#Ariadne is capable of having driven yesterday.

The pattern here is the familiar one where the embedded past triggers epistemic interpretation on the modal. In addition, the *imparfait* or perfective aspect on the modal cancels the actuality entailment (the examples as above are from Hindi, French, Italian, Greek and Palestinian Arabic):

(88) Yusuf havaii-jahaaz uraa sak-aa (#lakin us-ne havaii-jahaaz nahii uraa-yaa).
Yusuf air-ship fly can-PFV (but he-erg air-ship neg fly-PFV)
Yusuf could fly the airplane (#but he didn't fly the airplane).

(89) John pouvait prendre le train, mais il ne l'a pas pris.
John can.IMPF to take the train, but he not that-has taken
John could have taken the train, but he did not take it.

(90) Gianni poteva prendere il treno, #ma non lo ha preso.
John can.IMPF to take the train, #but not that has taken
John managed to take the train, #but he did not take it.

(91) O Janis boruse na apodrasi (ala dhen apedrase).
the John can.PAST.3SG that.SUBJ escape.NON-PAST.3SG (but not escaped)

John could/was able to escape (but he did not).

please, see document for better fonts for the example here below

(92) ∅ kaan bɪPdar jrawwɪe, bas maa
PRO PAST able.IMP 3SG.M.-go.home, but NEG
rawwae
go.home.PAST.PFV
He was able to go home, but he didn't.

As we can see, the truth of the prejacent is not guaranteed in the examples above with imperfective aspect. People naturally, then, thought, of grammatical aspect as the culprit of actuality with ability modals.

5.4.1 Actuality entailment and aspect

Bhatt (1999) initiates the aspect approach by proposing that the word *can* is ambiguous, and there is an implicative can_2 that behaves just like the implicative verb *manage* thereby licensing the veridical inference.

(93) I Ariadne katafere/borese na
the Ariadne managed.could.PERF.3SG that.SUBJ
ftiaksi to aftokinito.
fix.NON-PAST.3SG the car
Ariadne managed to/was able to fix the car.

(94) a. Mario è riuscito a riparare la macchina.
Mario is managed to repair the car
b. Mario ha potuto riparare la macchina.
Mario has could to repair the car
Mario managed to repair the car.

We see here the parallel with the implicative verbs MANAGE; according to Bhatt, the two readings with perfective past are equivalent. By contrast, Bhatt claims that the imperfective conveys generic information, which prevents the actuality entailment from arising.

Yet Mari and Martin (2007) observe that imperfectivity *cannot* cancel the implication with implicative verbs, and can be seen in the examples below which are replicated for Greek too:

(95) Jean arrivait à prendre le train, #mais il ne l'a pas pris.
John arrive.IMPF to take the train, #but he not it-has taken

(At that time habitually), John managed to take the train, #but he did not take it.

(96) Gianni riusciva a prendere il treno, #ma non lo ha preso.
John arrive.IMPF to take the train, #but not it has taken
(At that time habitually), John managed to take the train, #but he did not take it.

(97) O Janis kataferne na perni to treno, #ala dhen to eperne.
the John managed.IMPF.PAST.3SG SUBJ take the train, #but not it took.IMPF.PAST.3SG
(At the time habitually), John managed to take the train, #but he did not take it.

(98) O Janis boruse na perni to treno, ala dhen to eperne.
the John managed.IMPF.PAST.3SG to take the train, but not it took.IMPF.PAST.3SG
(At the time habitually), John could take the train, but he did not take it.

Since true implicatives like MANAGE do preserve the veridicality inference under imperfective aspect, Mari and Martin argue that there is no such thing as an implicative modal.

Hacquard (2006), following the Bhatt line, claims that the veridical entailment arises when tense is interpreted above aspect. The main idea is that the modals that trigger the actuality entailment are modifiers of event descriptions. The modalized event description denotes a set of events such that there is *at least one world compatible with the circumstances* in the actual world such that John takes the train in this world. Under the scope of aspect, the modal receives a "root" interpretation from being anchored to an event that is introduced by aspect. The world that is introduced by aspect is the actual world. The time of predication of the temporal property is then restricted as past, and the following interpretation is obtained: "There is an event in the actual world that is located in a past interval, and there is a world that is compatible with the circumstances in the actual world in which the event is an event of John taking the train."

The idea of the preservation of event description, however, has been the object of several criticisms, as it is ontologically loaded and also does not derive the intended prediction. The modalized event description denotes a set of

events such that there is at least one world compatible with the circumstances in the actual world, such that John takes the train in this world. There might be other worlds in the modal base in which John does not take the train and this principle does not guarantee that the actual world can turn out to be one in which the event is a $\neg P$-event. The actuality entailment is thus not guaranteed.

Homer (2010) shows that the perfective past on a stative verb also leads to actuality, therefore the phenomenon does not strictly cahracetrize ability modals or implicative verbs. Example (99) entails that the house has been sold.

(99) La maison a coûté 200000 euros.
the house has cost.PAST.PART 200000 euros
The house has costed 200000 euros.

Homer's explanation resorts to an actuality operator ACT for the PERF. But under future, perfective aspect and events cannot license the actualization reading of ability; therefore PERF alone cannot be responsible for the veridical inference:

(100) I Ariadne tha kataferi/boresi na
the Ariadne will manage.PERF.3SG/can.PERF.3SG that.SUBJ
ftiaksi to aftokinito.
fix.PERF.3SG the car
Ariadne will manage/will be able to fix the car.

It appears that the PAST is essential to the derivation of actuality in addition to aspect.

Mari and Martin (2007) build on the clash between the stativity of the modal and the perfective aspect. They propose that the perfective introduces a "boundedness condition," and distinguish two cases: the "bare case," and the cases in which temporal adverbs are used, as in (101).

(101) #Le robot a pu repasser les chemises à un stade
the robot has can.PAST.PART iron the skirts at one stage
bien précis de son développement, mais cette fonction n'a
well precise of his development, but this function not-has
jamais été utilisée.
never been used.
The robot could iron skirts at a precise stage of its development, but this function has never been used.

They propose that the boundedness condition of the perfective aspect can be

satisfied in two different ways. When the adverbs are used, they provide the temporal boundaries within which the possibility holds. In this case, there is no actuality entailment. When there are no adverbs, however, the boundaries of the action itself satisfy the boundedness condition of the perfective. In this case, the action ontologically precedes the attribution of the ability, and thus the actuality entailment arises.

(102) Action Dependent Abilities (ADA):
(i) ADAs require an action to exist: an ADA *ontologically depends* on the corresponding action.
(ii) A unique and nonrepeatable performance suffices to *imply* the corresponding ADA.
(iii) ADAs have the same temporal boundaries as the action on which they depend and are thus bounded.

According to Mari and Martin (2007) the ADA is triggered via a reasoning by abduction spell out as follows:

(103) The attribution to the agent i of the ADAs to do the action a is not typically used as an explanation of the fact that i did α. It is rather because a performs an action α. that we attribute him the ADAs to perform α. ("he did it, so he was able to do it").

In spite of several insights that previous accounts have provided, the role of PAST is systematically underappreciated, and there seems to be an overemphasis on event semantics. The causality-based theory of Giannakidou and Staraki (2013) also relies on event semantics, though it emphasizes the role of ability as a causal factor in bringing about the veridicality entailment. The causality account and its underlying assumptions seem to be better suited for implicatives.

5.4.2 Ability under past

Giannakidou and Mari (2021b) argue that the logical form of actualized ability has PAST above ABLE. This affects immediately the perspective of the ability modal to a time prior to the time of utterance. This is generally impossible with epistemic modals, but ability modals allow it. Unlike previous approaches, in our theory perfective aspect plays a secondary role; notice that English also shows the actuality effect despite the fact that it doesn't employ aspect.

Let us see how the simple effect of the modal being under past produces veridicality. From the perspective of the present, at the time of evaluation of

the modal options were still open. The mechanism (but not the inference) is reminiscent of what happens with conditionals (Ippolito, 2006) :

(104) Jean aurait pu prendre le train, mais il ne l'a pas pris.
Jean have.COND.3SG could take the train, but he not that has taken
John could have taken the train, but he did not take it.

According to Ippolito (2006), with the conditional, the option was open in the past, to take the train. With the imperfective, a similar effect is obtained.

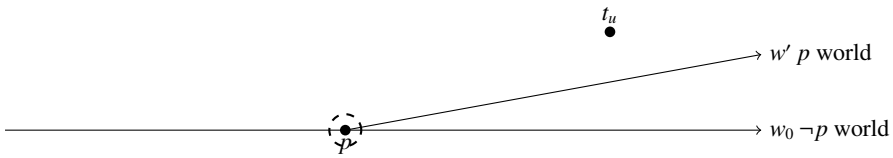


Figure 5.3 Modality + COND

When the modal perspective of a circumstantial modal is set to the past, branches are represented as open in the past. When the counterfactual is used, the anti-actuality inference follows. When the present perfect or a perfective past is used, the actuality inference follows.

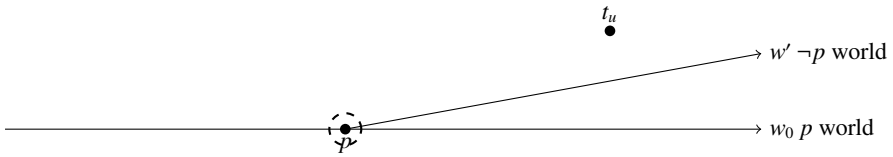


Figure 5.4 Modality + PAST + PERF

With the conditional construction the speaker signals that p could have been the case, but that the actual world is a p world, whereas with the perfect the speaker signals that $\neg p$ could have been the case but that p finally happened. The fact that $\neg p$ could have happened, is thus considered to be informative by the speaker. One of the possible implicit contents, is that p was difficult or unexpected at the time when it became true, or, at least not to be taken for granted.

Consider the following scenario from Mari (2016). As is well known, Usain Bolt is the fastest runner in the world, and can run 100 meters in 9.58 seconds:

(105) Usain Bolt a pu battre le record du monde
Usain Bolt has can.PAST.PART break the record of-the world
du 100 mètres grâce à son entraînement.
of-the 100 meters thanks to his training
Usain Bolt was able to break the 100-meter world record thanks to his training.

Breaking the world record is never taken for granted, and the possibility that even Usain Bolt does not break it is open at a time prior to the race. The sentence is felicitous. Sentence (107), instead, is infelicitous in Context 1 and felicitous in Context 2 described in (106).

(106) a. Context 1: Usain Bolt is in his best shape and at the climax of his career.
b. Context 2: Usain Bolt is recovering from a long cold and is far from his highest standards.

(107) (#)Usain Bolt a pu courir 100 mètres en 15
Usain Bolt has can.PAST.PART run 100 meters in 15
secondes aujourd'hui.
seconds today
Usain Bolt was able to run 100 meters in 15 seconds today.

Consider context 1, (106-a), in which sentence (107) is infelicitous. Since Usain Bolt can run 100 meters in 9.58 seconds, it is taken for granted that, in his best shape, he can run 100 meters in 15 seconds, and the possibility that he does not run 100 meters in 15 seconds was not open. Sentence (107) is instead felicitous in context 2 (106-b), where Usain Bolt is recovering from a very bad cold. In this context, running 100 meters in 15 seconds is not granted; the possibility of $\neg p$ was open before p becomes true.

Future research will determine whether this inference belongs to the so-called class of *post-modal meanings*, that it is to say, it is part of those implicit contents that are cancellable and negotiable, but that hinge on the semantic interpretation and that are on the way of becoming lexicalized.

How does the actuality entailment ultimately arise? Given the modal-temporal setting underlying the choice space of the agents, the answer is straightforward: in the veridical past, the choice space is closed and no choices are possible.

Had a prospective aspect intervened between the modal and the VP, the en-

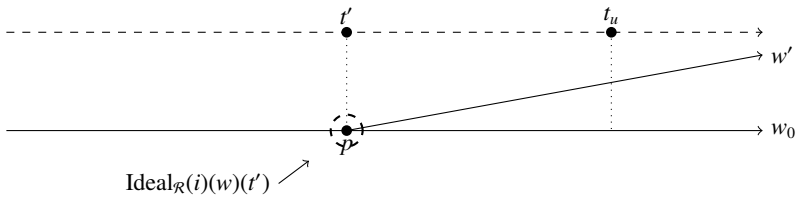


Figure 5.5 Choice space à la Belnap.

tailment would have not arisen, as with the French or Italian "imperfetto" (imperfect).

5.4.3 Epistemic modality cannot scope under past

The specific type of modal base that abilitative modal triggers—given the anchoring to the volitional agent *i*, and the scoping of ABLE below PAST— is crucial: the modal base is a choice space which has the specificity of being closed-past and present-wise. It follows that if a modal cannot embed under PAST, it won't be able to get the actualization entailment. This explains, crucially, why there is no actuality with epistemic modals which cannot occur under PAST. Notice below that the invariant (hence epistemic) form *boruse* (epistemic possibility modal in the third singular, recall discussion in chapter 2) with PAST is simply ungrammatical:

(108) Ta pedia *boruse/bori na odhijisoun.
the children could.3SG/can.3SG that.SUBJ drive.3PL
As far as I know, the children might drive.

In Greek, the invariant *bori* is the epistemic possibility modal (Giannakidou and Mari, 2021b). We see that it cannot occur itself in the past. Past can scope below it, of course:

(109) Ta pedia bori na odhigousan.
the children can.3SG that.SUBJ drove.3PL
The children could have driven.

Given that the epistemic modal *bori* doesn't inflect for tense, aspect and person, we can actually think of it as a particle, since it is invariant just like particles *na, tha,* etc that we have discussed in the book.

Importantly, the ability personal modal *boro* can have a use as a permissive

modal. We can call it deontic use. Deontic *boro* indeed combines with past, and actualization is possible:

(110) Ta pedia borun na pane sto spiti
the children can.3PL that.SUBJ go.IMPERF.3PL to-the home
mona tus.
alone them
Ability: The children are able to go home on their own.
Deontic: The children are allowed to go home by themselves.

(111) Ta pedia borusan na pane sto spiti mona
the children could.3PL that.SUBJ go.IMPF.3PL to-the home alone
tus.
them
Ability: The children were able to go home on their own, and they did.
Deontic: The children could (were allowed to) go home by themselves, and they did.

As we can see, deontic and ability *boro* behave similarly. However, with the permissive reading, actualization is possible but not entailed; the above sentences are nonveridical:

(112) Ta pedia borusan na pane sto spiti mona
the children could.3PL that.SUBJ go.IMPF.3PL to-the home alone
tus, ala dhen pigan.
them, but not went.3PL
Deontic: The children could (were allowed to) go home by themselves, but they didn't.

If we consider deontic MUST, actualization is still cancelable, as expected:

(113) Ta pedia eprepe na pane sto
the children MUST.PAST.3PL that.SUBJ go.IMPF.3PL to-the
spiti mona tus, ala dhen pigan.
home alone them, but not went.3PL
Deontic: The children had to go home by themselves, but they didn't.

Hence, the fact that the ability modal base depends on a volitional agent who has a choice (choice space) is key to explaining the effect of the PAST with ability in a branching-time framework, and why it is either impossible or, at best, weak, with other modals. Actuality entailments are specific to abilita-

tive modals with intentionality and thus choices (on exteneded discussion on intentionality, see Grano (2017, 2021).

5.5 Conclusion

In this chapter, our focus was on the interaction between modality and time. We articulated an explicit syntax-semantics to illustrate how the temporal orientation of modal sentences is derived by the embedded tense. The tense of prediction is the NON-PAST. We also studied the interactions between modality and Aktionsart in more detail. We analyzed the concept of prediction a bit more deeply: prediction is an epistemic category, but the epistemic dimension is not segregated from bouletic factors that create expectational and goal-oriented components, as well as ratificational dimensions of prediction. Finally, we presented the interaction of ability modals with the past tense as it is manifested in the so-called actuality entailment. Crucially, ability can scope under past but epistemic modals cannot.

Questions and further readings

Questions

- In this chapter, we established certain generalizations such as (i) NON-PAST is responsible for the future orientation of modal sentences, and (ii) past and present tense in the prejacent clause produces epistemic modality. These generalizations allow us to discern patterns in data that would otherwise seem random; and they seem to hold also with propositional attitude verbs, as we can see for example in *He persuaded me to go* vs. *He persuaded me that Chris was the best candidate*. Such contrasts bring about different readings on the verb *persuade*, which would otherwise be thought of as ambiguous— but they can possibly related to different lexicalizations. Think of similar patterns in different languages and the overall implications for the theory of modality and propositional attitudes.
- Prediction is an epistemic attitude, as we argued, but predicting can also use preferences, goals, plans or aspirations. Think of different futures and ways of predicting in a given language, say the differences between *Mary will talk to Bill, Mary is going to talk to Bill*, and similarly in other languages. The category futurate ('be going to') seems to be the mixed one. How about the progressive as in *Mary is moving to Paris, We are buying this house*? Where does the futurate reading come from in the progressive?

- Why, do you think, ability can be embedded under time but epistemic modality cannot? Can you think of exceptions this generalization?
- Finally, implicatives (MANAGE) and ability modals do embed NON-PAST in their complements, even when we get the actuality entailment. This renders the complement, in a way, a 'future' with respect to the ability. What does this mean about the veridicality of the implicative class?

Further readings

Tense constraints with propositional attitudes are discussed extensively in Giannakidou and Mari (2021b), and it is worth delving into that discussion to understand better the triple co-relation between modality, tense and mood. The selection patterns of attitude verbs and their tense and mood selection properties affects their meaning, and Grano (2021) is another great resource.

Giannakidou and Mari also discuss the implicative class and offer a non-veridical analysis of MANAGE; see also Nadathur (2019) on this specific topic and more in depth discussion of causality.

Ippolito (2013) is an important reference on the interaction between modality and time in relation with counterfactuality and subjunctive conditionals.

Copley (2009) is the reference in formal approaches for futurates. She also has an interesting notion of Director, which is related to, yet different from the one of epistemic or deontic authority.

6

Epistemic modality, evidentiality, and evidence

Evidentiality, as we mentioned already, is often discussed in the context of epistemic modality. In this chapter we revisit some of the core patterns we outlined in chapter 2 and study them in the light of the modality theory that we developed. Now that all the key pieces are explicit, we will see that most of the core evidential patterns fall neatly under the epistemic modal analysis. Our goal in this chapter is not to provide a full theory of evidentiality— which would be a daunting task that no-one has ever achieved— but to highlight the similarities between evidential markers and epistemic modals and show why the theory of epistemic modality is a useful tool for an insightful understanding of (a substantial part) of evidential phenomena.

6.1 Evidential markers and the questions they raise

The voluminous work on evidentiality of the past 50 years has manifested the richness of the evidential domain. Evidential systems are robust and diverse across languages, and while the phenomenon is not homogeneous crosslinguistically, it is accurate to say that evidentiality encodes the source of information or evidence that the speaker uses when they form their veridicality judgment. Evidentiality, in other words, characterizes the specific ways the epistemic basis for the veridicality judgment is formed, e.g. whether the speaker acquired evidence by directly witnessing the event expressed, or by hearing about it from reliable sources, or by inferring based on certain premises. In many cases, the evidential statement is equivalent to that with an inferential modal.

The following are a few of the definitions that have been used in the literature for evidentiality:

(1) a. Evidentials are devices used by speakers to mark the source and reliability of their knowledge. (Chafe and Nichols, 1986).
b. Evidentiality is a linguistic category whose primary meaning is mark the source of information. (Aikhenvald, 2004).
c. Evidentials are expressions which indicate a speaker's source of justification for the speech act being made. (McCready, 2015)

Chafe and Nichols (1986) offer a general definition according to which the term evidentiality can be used broadly to cover 'any linguistic expression of attitudes toward knowledge', which in fact brings the evidential strategy quite close to modal and propositional attitudes in the more familiar languages of the Indo-European class. The special property of evidential systems is that they encode how speakers come to know, believe, or disbelieve the propositional content.

Evidential markers, like modals, are sentential operators— let us call them EVID— which take *p* as their prejacent in structures similar to modals: EVID *p*. Every language has a way of saying how speakers come to know of believe a certain proposition, or whether they think it is likely. For this function, in the more familiar Indo-European languages, we have MUST modals, the future FUT, perception and semblance verbs. Here are a few examples. Consider a context where I hear a knock on the door and I say:

(2) Tha ine o taxydromos.
FUT be.3SG the mailman
That will be the mailman.

Here I am reasoning with some expectation or regularity, as we said earlier, for examples by knowing that the mailman usually comes at that time and today I am expecting an amazon package. Likewise:

(3) a. Bill seems like he is in a good mood.
b. This car looks like it hasn't been cleaned.
c. The engine sounds like it is broken.
d. The clothes smelled like linen.
e. The pasta tasted delicious.
f. This sweater feels like it's made of cotton.
g. Evidently you lost your mind. I̩ saw you closing the door.

The use of sensory predicates such as *seems like, looks like, smelled, saw, evidently,* etc. in the sentences here serves to establish the source of information, and this is what evidentiality is taken to be about. In the above paradigm

the source of evidence is one's sensory experience. English 'recycles' existing categories such as modal verbs, perception attitudes, and adverbs to express the source of evidence, and this strategy is common among the other Indo-European languages which lack the specific grammatical category 'evidential'. In many of the world's languages, however, evidential distinctions are grammaticalized into the system pretty much like tense, agreement and mood.

Consider one such language, Salish. The data below are reported initially in Matthewson et al. (2007) and Matthewson (2012, 2020):

(4) wá7 *ku7* ku sts'éts'qwaz' l-ta stswáw'cw-a
be REPORT DET trout in-DET creek.DET
[reportedly] There are trout in the creek. (reported information)

(5) plan *k'a* tu7 wa7 tsu7c na máq7-a
already INFER then IMPF melt(INCH) DET snow-DET
The snow must have melted already. (inferential evidential)

(6) pel'p-s-ácw-*an'* nelh neklíh-sw-a
lost.CAUS.2SG.CONJ.PERC.EVID DET.PL key.2SG.POSS.DET
It looks like you've lost your keys. (perceived evidence)

Each of the evidentials in Salish (which are second position clitics) indicate something about the source of the information presented in the proposition: hearsay, MUST inference, or perception. Matthewson et al. (2007), who were the first to describe these patterns in detail, were also the first to propose an analysis of these evidential markers as conveying epistemic modality. One of the markers, *k'a*, is often cited in the literature as the single epistemic modal of Salish— and we recall that we analyzed it as a flexible inferential modal in chapter 4.

In another language, Quechua, Faller (2002, 2006) famously summarizes the core categories of evidentials as follows:

(7) Para-sha-n-*mi/-si/-chá/-chu-sina*.
rain-PROG-3=BPG/REP/CONJ/RES

p=It is raining.
(i) Direct : *mi*: s sees that it is raining.
(ii) Reportative : *si*: s was told that it is raining.
(iii) Conjectural : *chá·*: s conjectures that it is raining.
(iv) Partial evidence/inference from results: *hu* − *sina*/(*chu*) − *suna*: s infers from available evidence that it is raining.

As we said, many other languages grammaticalize evidential distinctions

into the linguistic system. About a quarter of the world's languages, according to Aikhenvald, overtly mark every statement for the type of evidence that the statement is based on. Languages such as Tariana (Aikhenvald, 2003, 2004), Cherokee (Aikhenvald, 2004) , Cheyenne (Murray, 2010, 2017), Quechua (Faller, 2002), and others have fully grammaticalized evidentiality marking: declarative statements carry mandatory morphological marking that indicates the type of information source upon which the statement is based. Other languages, e.g. Salish, Tibetan and Japanese also grammaticalize evidentiality but can also have bare verb forms. Some languages mark evidentials obligatorily in the sentence, but in some other languages one may chose to include an evidential once in a paragraph, thus EVID takes the whole paragraph in its scope. In Tariana and related Eastern Tukanoan languages, Aikhenvald notes, omitting evidentials produces an ungrammatical and unnatural sentence; and likwise, leaving out an evidential in Shipibo-Konibo, a Panoan language from Peru, results in a grammatically 'incomplete' sentence (Valenzuela, 2003, :34). Faller (2002: 23) finally, mentions that a sentence without an evidential in Cuzco Quechua can be understood as having the same evidentiality value as the other sentences in the same text. Speakers of Huallaga Quechua vary in how easily they omit evidentials which are recoverable from the context (Weber, 1989, :324). This variability in grammaticalized evidentiality is not unexpected given that evidentiality correlates with modality and tense.

Aikhenvald offers a lot of information about how evidential markers emerge. In appears that some recycling of morphology happens here too. In many languages, the locus of marking evidentiality is on the verb via a clitic or a particle. This surface realization appears to correlate with typical origins of evidentials, says Aikhenvald: 'verbal' evidentials are more likely to develop out of reinterpretation of tense, aspect, nominalizations and modals (Aikhenvald, 2004, :287), and we do find evidentials often to be fused with tense and aspect (as, for example, in Bulgarian). Evidentials can be expressed by clitics (as in Quechuan and Salish languages), but also with auxiliary and light verb constructions (as in Tukanoan and some Nakh-Daghestanian languages), or copulas (as in Bodic and Tibetic languages). The surface realization of evidentials may correlate with their additional functions; for example, evidential clitics in Quechua attach to a focussed constituent and thus can be used as 'focus markers'. Evidential markers may develop out of independent verbs within serial verbs constructions too.

While the link between evidentials and epistemic modals has been pursued actively since they both involve assessment of evidence, there has been some tension in the earlier literature about the relation of evidentiality and epistemic modality. De Haan (1999) argued that the two categories are distinct because

evidentiality encodes the source of the information, while epistemic modality encodes the degree of commitment on the part of the speaker to the truth of the information. The distinction seems arbitrary. Indeed the notion of commitment is central to the analysis of epistemic modals, as we have shown, but veridical commitment relies on assessing evidence and this is a foundation common to both evidentials and modals. De Haan, however, reaches the unexpected conclusion that information-source is not a modal category. Aikhenvald (2004, :7), in a similar vein, claims that evidentiality and modality are distinct categories, and Faller in her earlier work analyzed some evidentials in Cuzco Quechua as illocutionary rather than sentential operators. In more recent work, Faller (2011) re-analyzes her data in a Kratzerian style epistemic modal analysis.

We believe it is by now uncontroversial that there is enough overlap between evidentiality and epistemic modality— as linguistic categories that rely on assessment of evidence— to warrant an epistemic analysis of many (if not all) evidentials. If some evidentials are illocutionary force operators, then evidential markers, as a class, vary cross- linguistically in terms of their modal status. But even in the illocutionary force analysis, there is arguably assertive content that is modal. It is therefore fair to say that by now there is considerable consensus that large portions of evidential markers are epistemic modals. Matthewson (2012), in fact, proposes that all evidentials are epistemic modals in her strong equivalency hypothesis:

(8) Strong Equivalency Hypothesis
All evidentials contribute epistemic modal semantics, and all epistemic modals contribute evidential semantics.(Matthewson, 2012).

While this hypothesis faces a certain challenge from what we will call 'witness veridical evidentials', it serves as a good illustration of how close the categories— evidentiality and epistemic modality— are understood to be. Representative modal analyses of evidentials have been given in Kratzer (1981), Izvorski (1997), Ehrich (2001), Garrett (2001), Faller (2002, 2003, 2006, 2011), Chung (2005, 2010), McCready and Asher (2006), Portner (2007), Davis et al. (2007), McCready and Ogata (2007), Matthewson et al. (2007), Sauerland and Schenner (2007), Waldie et al. (2009), Murray (2010), Peterson (2010), Speas (2008, 2010), Lee (2011a,b, 2013), Smirnova (2011, 2013), Giannakidou and Mari (2016c, 2021b), among others.

In further support of evidentiality being a modal category, consider that, as we noted, evidential morphology tends to be fused with tense/aspect morphology and even where tense/aspect and evidentials are expressed by entirely distinct morphological systems, there is a clear connection between tense/aspect

and evidence type (see Johanson, 1971; Comrie, 1976; Dahl, 1985; Woodbury, 1986; Smirnova, 2011, 2012, among others). Tense is claimed to be linked to evidence type in that when the time reference of an evidential category differs from that of the proposition with which it occurs, the resulting evidential value will be non-experiential (Woodbury, 1986, :195). The link between aspect, in particular perfect aspect, and evidentiality has to do with the role of results as indirect evidence, as can be seen in the Bulgarian evidential (Izvorski, 1997; Korotkova, 2016). An inference is made based on some traces or results of a previous action or state (Aikhenvald, 2004, :112).[1] An inference from the past into the present will be 'indirect' and will affect likewise the veridicality of the assertion.

The interactions between tense and modality have been well documented in the previous chapters, and in chapter 2, we explored various language systems that grammaticalize evidential marking. Our discussion in this chapter will proceed by centering on the concept of evidence. We start by reminding the reader of some foundational discussion on the nature of evidence and veridicality in section 2. We will then review major evidential patterns in a number of languages, and offer a new analysis of the core types of evidentials— including those that rely on sensory evidence— in the subsequent sections.

6.2 Evidence and veridicality judgment

Evidentiality is the grammatical encoding of 'source of evidence' just like tense is the grammatical encoding of time. The need for evidence itself is a foundational property of modality, especially of MUST and FUT modality, as we saw; and it is encoded in the Veridicality principle of assertion as well as Grice's maxim of Quality which requires that the speaker does not say that for which she lacks adequate evidence. What is special about evidentiality is that it addresses the source of evidence, and it seems that different sources create different degrees of reliability. As a result, when it comes to assessing truth and forming the veridicality judgment, we have gradience regarding the reliability of evidence, and the evidential or modal marker is an indicator of how much we can trust the evidence.

Willett (1988) famously offers a categorization of types of evidence based on a study of 38 languages, presented below:

[1] Speas (2008) mentions **?** who proposed that the meaning of evidential morphemes in Northern Khanty involve equivalence or non-equivalence between events, their results, and speaker's evidence, and showed that tense affects which equivalence relations are possible. Faller (2003) analyzed the Quechua morpheme *-sqa* as a deictic element which locates the eventuality outside of the speaker's perceptual field at topic time.

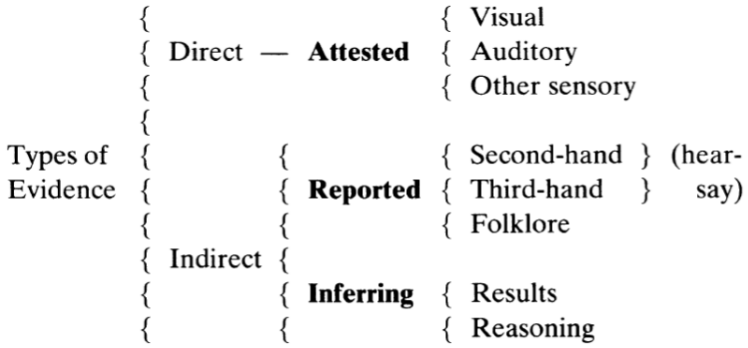


Figure 6.1 Willett's classification of evidentials

We see here a basic division between direct and indirect evidence. Visual and auditory perceptions are kinds of 'direct' evidence, as the speaker witnesses (in the present) or has witnessed (in the past) the event. They would seem to be the most reliable sources when it comes to veridicality because under normal circumstances they establish knowledge: if I see that is raining then I know that it is raining. Yet there are differences in this class, as we shall discuss in terms of reliability. In the indirect evidence branch, on the other hand, we have reported and inferential evidence which is either purely assumption-based or relies on results.

Aikhenvald (2004) gives a similar categorization distinguishing: (i) visual, (ii) non-visual, (iii) inference, (iv) assumption, (v) quotative and (vi) reportative. Languages vary in how they group the recurrent semantic parameters within their evidential systems. The most straightforward groupings provide two main types of evidentials: (a) those relying on sensory first hand experience, which we can call 'direct evidential', and (b) those relying on indirect evidence. In this category, we can think of two subgroups: inferential evidentials which rely on inference and assumption, and reported evidentials relying on hearsay. Numerous languages of Eurasia employ one indirect evidential evidential that covers both reported and indirect evidence (e.g. Bulgarian, Turkish; for an explicit connection between the indirect evidential *mis* in Turkish, mood, and nonveridicality see Sarigul (2015)).

Evidence is the source of knowledge and belief, but as Speas (2018) puts it, "the speaker's level of certainty depends crucially on the reliability of evidence, but neither level of certainty nor reliability is encoded directly as a core

part of an evidential meaning." Reliability of evidence, according to Speas, is 'pragmatically determined', and is not specified as part of the denotation of an evidential; (see also De Haan, 1999; Brugman and Macaulay, 2015, :211). Evidence can be stronger or weaker, but there is no 'weaker' or 'stronger' evidentiality (just like there is no 'weaker' or 'stronger' tense), Aikenvald says. Often we find many fine tuned distinctions: in Tatuyo, an Eastern Tukanoan language, a visual distal evidential or a nonvisual evidential can be used if the speaker can see what they are talking about from a distance or cannot see it properly (Aikhenvald, 2018). Such nuances, in fact, are crucial for the veridical commitment, and demonstrate beyond doubt that evidentials are sensitive to exactly the same factors that epistemic modals are.

Aikhenvald (2004) asserts that "the notion of reliability or truth only marginally applies to information source thus to evidentiality"— but it is very difficult to understand what is meant by that. It is akin to saying that the notion of time only marginally applies to tense. Surely the grammatical system draws certain (principled) distinctions that put distance between the physical, objective dimensions it encodes and the constraints imposed on the speakers on how to express them. But tense and temporal expressions in language make contributions that can only be understood with reference to time— and likewise evidential markers make distinctions that can only be understood in reference to truth and the formation of veridicality judgment. In many ways, and given the parallel with perception and semblance attitudes, it makes sense to treat evidential contributions as akin to the contribution of these— with additional requirements on the source.

Matthewson (2020) offers a helpful distinction based on the following three components:

(9) a. Evidence type: whether the evidence is visual, sensory, reported, etc.
b. Evidence location: whether the speaker witnessed the event itself or merely some of its results.
c. Evidence strength: the trustworthiness/reliability of the evidence.

She argues that each of the three components has direct and indirect values, and that particular evidential morphemes may be semantically complex, encoding information about one, two or all three aspects. Matthewson credits ideas found in Nikolaeva (1999); Faller (2003); Chung (2005, 2012) and Speas (2008, 2010) on the concept of evidence location, which is the idea that some evidentials are sensitive to the location of the speaker at the time of the event, and specifically whether the speaker was in a position to witness

the event itself, or only some results (or precursors) of it. Evidence strength, finally, encodes the speaker's judgment about the trustworthiness or reliability of the evidence and, according to Matthewson, correlates closely (but not completely) with the notion of 'speaker certainty', or what we have called here veridical, or epistemic commitment.

In line with De Haan (1999), several authors including Faller (2002, 2011); Matthewson (2012); Smirnova (2011, 2012) also make the important point that the evidential contribution is separate from the attitude towards truth, i.e., the actual speaker's judgment of the propositional content, namely whether it is true or likely to be true. This second aspect of meaning is, according to many analyses, a modal assertion and it is separate from the source of the evidence, which is the evidential meaning properly speaking. We believe this is an important distinction, and we will rephrase it below. It is also useful to note that it is rooted in the initial picture of De Haan (1999).

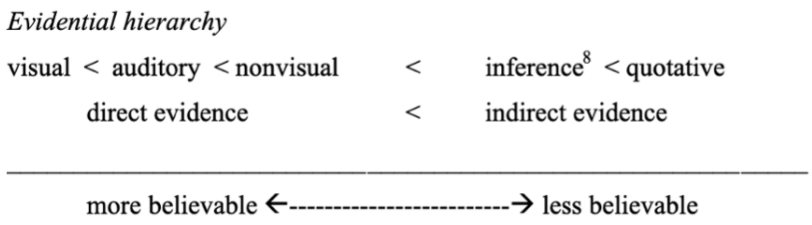


Figure 6.2 Correlation between source of information and belief strength according to De Haan (1999)

Given the body of work done so far, it seems very reasonable to imagine an analysis where that the evidence source characterizes the presupposition– specifically what kind of modal base is used— and the veridicality judgment applies to the assertion. The assertion could be the prejacent *p* itself, or MUST *p*, or MIGHT *p*. We will bring together insights from this previous literature and use this mapping onto presupposition and assertion, which we used for modals, as the basis for our discussion.

The stronger and more reliable the evidence, and stronger the commitment to truth. In other words, evidence quality matters (echoing evidence reliability of Matthewson (2020)). We will use the full picture below— which draws on Mari (2021)'s proposal for the analysis of Italian future that integrates the di-

mensions of evidence variation and reliability as they correlate with the veridicality judgment.

			Reliability	
			Reliable	Non-reliable
Type of evidence	Perceptual	Visual	Seeing clearly	Seeing non clrealy
		Auditory	Listening from an identified source	Hearing from a non identified source
	Non-perceptual	Inferential	Mathematical deduction	Defeasible inference
		Reported	Verified source	Non-verified source
			Veridical committment	Non-veridical commitment

Figure 6.3 Evidence source, evidence quality and veridical commitment (Mari 2021)

With this last picture in mind, let us proceed now to study the major types of evidence source and see how they affect the veridicality judgment they entail. We talk first about perceptual evidence, and distinguish between seeing (section 3) and non-visual perception (section 4). We will conclude that non-reliable evidence, including visual and non-visual creates nonveridical commitment, and for this reason it is compatible with epistemic modals. We will then talk more about inferential evidence (section 5), and finally about reportative evidence (section 6).

6.3 Visual perception as evidence

Let us begin with some data from Floyd (1997) (p. 82, ex. (44)-(45)) on the Wanka Quechua on the so-called direct perception evidential. As you can see in the translations, this evidential conveys that the speaker herself saw or heard the event described.

(10) Akshru-kta-m talpu-la.
papa-ACC-DET sembrar-SIMPLE-PAST
He planted potatoes (the speaker saw him planting).

(11) Taki-va-n-mi.
cantar.IMPF.3.DIR
He is singing (the speaker hears him sing).

Matthewson et al. (2007) mention likewise that the Salish evidential *-an* must be based on first hand perceived evidence, as can be recalled in our earlier example. Speas (2004) says that sentences with sensory or 'direct' evidentials convey that the proposition is to be evaluated with respect to sensory data such as 'seeing or hearing'; Cohen et al. (2010, :42) state that direct knowledge refers to any information 'obtained through sensory devices'. It is generally assumed that when the source is direct sensory experience and specifically seeing, the assertion is veridical: the propositional content is taken to be true, known to the speaker.

For this reason, this type of evidential seems to be outside the realm of modality which, as we have been arguing, requires a nonveridical epistemic state. We can view them as akin to aleithic necessities that come with knowledge. Matthewson (2020) likewise says that direct evidentials pose problems for a modal analysis because typical epistemic modals convey "reduced speaker certainty."

6.3.1 Seeing: direct witness and nonveridical SEE

At this point, it is helpful to recall the earlier discussion of MUST and MIGHT:

(12) Context: I am looking through the window and see that it is raining.

a. #It may be raining.
b. #Bori na vrexi.
may that.SUBJ rain
c. #Può piovere.
may.3sg rain.
d. #It must be raining.
e. #Prepi na vrexi.
must that.SUBJ rain
f. #Deve piovere.
must.3SG rain

If I see the rain, I have reliable evidence to know that it is raining, and knowledge is veridical: if *I know p*, then *p* is true. Natural language modals, even necessity ones, are incompatible with knowledge— recall the Nonveridicality axiom, which states that the modal base must be partitioned into *p* and not-*p* worlds:

(13) *Nonveridicality Axiom of modals*
MODAL (M) (p) can be defined if and only if the modal base M is a nonveridical state, i.e. only if M contains p and $\neg p$ worlds.

The nonveridicality axiom imbues uncertainty, and the modal base M(i) contains two possibilities: worlds where p is true, and worlds where p is not true. Epistemic modals obey this principle, and therefore come with partitioned modal bases— consequently, epistemic modals do not entail p or knowledge of p, and express, as Giannakidou and Mari (2016a) put it (see also Giannakidou, 2013b,a), *reduced* or *weakened* epistemic commitment to p. Possibility modals express trivial commitment, as we said, but necessity modals express also bias towards the prejacent. Modal bias, as we explained in chapter 3, is an evidential preference: the speaker has evidence to consider the p worlds more likely, or better possibilities, than the non-p worlds. For bias to arise, in other worlds, the speaker must have non-trivial evidence supporting p.

In Giannakidou and Mari (2016b,a) we used the continuation "but I am not entirely sure" as a diagnostic for non-veridical commitment. Consider:

(14) Deve essere a casa, ma non sono totalmente
must.PRES.3SG be at home, but not be.PRES.3SG entirely
sicuro.
sure
He must be home, but I am not entirely sure.

So, nonveridical commitment is partial commitment grounded in evidence, yet with uncertainty in it. Observe the contrast with the bare positive assertion and the knowledge, belief and certainty predicates which do not accept such continuation; note that certainty and belief predicates behave like knowledge:

(15) a. #He is at home but I am not entirely sure.
b. #I know that he is at home but I am not entirely sure.
c. #I am certain that he is at home but I am not entirely sure.
d. #I believe that he is at home but I am not entirely sure.

We must thus say that belief and certainty predicates equally convey veridical commitment, albeit subjectively, unlike knowledge which is also objectively veridical. Giannakidou and Mari (2021b, :170) define certainty as a veridical attitude:

(16) Veridical knowledge:
$[\![i \text{ KNOW } p]\!]^{\text{M-epistemic},i} = 1$ iff $\forall w'[w' \in \text{M-epistemic}(i) \rightarrow w' \in \{w'' \mid p(w'')\}]$

(17) Veridical belief:
$[\![i \text{ believe}_{sol}\ p]\!]^{\text{Dox},i} = 1$ iff $\forall w'[w' \in \text{Dox}(i) \rightarrow w' \in \{w'' \mid p(w'')\}]$

(18) Veridical certainty:
$[\![i \text{ CERTAIN}_{sol}\ p]\!]^{\text{Cer},i} = 1$ iff $\forall w'[w' \in \text{Cer}(i) \rightarrow w' \in \{w'' \mid p(w'')\}]$

We put here to use the different modal bases from Giannakidou and Mari (2021b): epistemic M for knowledge, doxastic (Dox) for belief predicates and credence, Cer for certainty predicates. The availability of various modal bases captures the sensitivity of linguistic items to different kinds of information, and indeed it is a tool very well suited for propositional attitude verbs, evidentials and modals. The veridical entries involve entailment to p in the modal base which means that the modal base contains only the possibility of p; the individual anchor (the subject of the attitude) is fully committed to the complement proposition, there is no uncertainty. Belief and certainty express subjective commitment of the individual anchor, i.e., the one who believes or is certain, which could be irrespective of actual truth, as we mentioned— while knowledge is grounded on what is true.

Certainty is like belief but it is a bit more grounded to reality. While doxa includes personal opinions, guesses and consideration of normalcy conditions, certainty involves more tangible evidence (Mari, 2016) . As with belief, certainty does not imply knowledge but, unlike belief, to form a thought that can be qualified as certain, the speaker uses more reliable premises such as factual inferences. With both belief and certainty we have subjective veridical commitment. The definitions above all entail full commitment to the proposition in the modal base.

Yet there is a variant of belief which is nonveridical and implies only partial commitment just like biased MUST Mari (2016). We called these variants of belief in Giannakidou and Mari (2021b) 'suppositional' (in the previous work, these were called 'conjectural' Mari (2016)).

(19) *Suppositional* belief:
$[\![i \text{ believe}_{sup}\ p]\!]^{\text{M,Dox},i}$ is defined iff = 1 iff M(i) is nonveridical (partitioned epistemic modal base). If defined,
$\forall w'[w' \in \text{Dox}(i) \rightarrow w' \in \{w'' \mid p(w'')\}]$

Suppositional belief contains uncertainty: now we have an additional epistemic modal base as a parameter for the verb which is nonveridical. This, which is exactly what MUST has, produces a lexical entry that obeys the Nonveridicality Axiom, a belief meaning with awareness that the speaker doesn't know:

'believe but not know', as we put it Giannakidou and Mari 2021a, chapter 4. This lexicalization of the belief predicate is 'modal' since it involves a non-veridical modal base.[2] Our point in Giannakidou and Mari (2021b) was that many doxastic attitudes can be construed in language in this dual pattern, either as veridical attitudes or as modalized ones that contain a non-veridical epistemic state as an argument. In the modalized variant, the attitudes produce statements equivalent to MUST.

Crucially, SEE predicates behave veridically:

(20) a. #I saw John leaving the house but I am not entirely sure.
b. #I saw that John received the best screenplay award but I don't believe it.

Direct sensory perceptions entail knowledge of p, and we get Moore paradoxical infelicity if we add the uncertainty clause. Evidential markers that require visual source do not obey the Nonveridicality Axiom. Recall Montague (1969)'s analysis of the verb *see* as veridical. Giannakidou and Mari (2021b, :178-181) give the following definition for SEE as veridical:

(21) Seeing is believing ('veridical witness' SEE):
$[\![i\,\mathrm{SEE}_{belief}\ p]\!]^{w,\mathrm{Dox},speaker}$ is = 1 iff $\forall w'[w' \in \mathrm{Dox}(speaker)) \rightarrow w' \in \{w'' \mid p(w'')\}]$

With veridical SEE we have a doxastic modal base that is homogeneous and entails p: seeing, therefore, leads to the belief (or knowledge, or certainty, it really doesn't matter how we characterize it since in all cases we have veridical commitment); denying p produces Moore paradoxical effects.

(22) O Nicholas idhe oti o Flavio eklise ton porta, #ala
the Nicholas saw.3sg that.IND the Flavio closed.3sg. the door, but
i porta den ine klisti.
the door not is closed
#Nicholas saw that Flavio closed the door, #but he is not entirely sure.

We see here that the veridical judgment does not allow an uncertainty clause. This SEE is what one can think of as the prototypical meaning of SEE pred-

[2] Suppositional construals trigger the subjunctive mood in Greek and Italian; and memory, perception, appearance and awareness predicates show similar patterns, as discussed Giannakidou and Mari 2021a. The mood difference is not crucial for the present discussion, but as we will see next belief, memory and perception are not monolithic but can be construed both as veridical commitments as well as modalized attitudes. Just like mood, the presence of an evidential can signal if we are dealing with a veridical or non-veridical construal, as we shall see soon.

icates, and we call it 'veridical witness'. It will be our claim that evidentials that entail the truth of p are veridical witness evidentials, and we can give the basic conditions for the Veridical witness EVID operator as follows:

(23) Veridical witness EVID
(i) Evidential source presupposition: the modal base is epistemic or doxastic, having been determined by visual information.
(ii) Assertion: EVID-veridical witness (p) is true relative to speaker i iff $\forall w'[w' \in \text{M-epistemic}(i) \rightarrow w' \in \{w'' \mid p(w'')\}]$

Evidentials that denote veridical witness assert p relative to the speaker's i knowledge. The evidential contribution is precisely determining that the modal base is epistemic or doxastic. We think that Faller's evidential *mi* is a case in point. The enclitic *mi* indicates that the described event is directly observable or otherwise directly accessible by the speaker, as in (Faller, 2011, :(6)):

(24) Subrina-y-wan-mi tiya-sha-n.
niece-1-COM-BPG live-PROG-3
He is living with my niece.
EVID presupposition: the speaker i has seen that the person is living with the speaker's niece.

Faller says: "*mi* can be used for asserting an immediate entailment of the speaker's direct evidence. By 'immediate' entailment I mean an entailment that is immediately obvious to the speaker without them having to perform conscious calculations or deductions. What is an immediate entailment is context and speaker dependent." (Faller, 2011, :676). Faller (2002) analyzes the morpheme *mi* as changing the sincerity condition to 'speaker believes p and speaker has the best possible grounds for believing p', which is essentially the analysis we just outlined. Seeing is, thus, believing when the evidential is direct witness.

Now, recall that there are evidentials that do rely on visual evidence but do not assert p. Aikhenvald mentions a distinction in Tatuyo, an Eastern Tukanoan language, between a visual 'distal' evidential or a non-visual evidential can be used if the speaker can see what they are talking about from a distance or cannot see it properly. Salish also has one such evidential, *an*, that we have seen before:

(25) pel'p-s-ácw-*an'* nelh neklíh-sw-a
lost.CAUS.2SG.CONJ.PERC.EVID DET.PL key.2SG.POSS.DET
It looks like you've lost your keys. (perceived evidence)

Matthewson et al. state that this sentence is incompatible with the speaker believing p to be true (Matthewson et al., 2007, (39)):

(26) *ts'um'-qs-án'-as kw s-Lémya7 kw
lick-nose-DIR-3ERG-PERC.EVID DET NOM-Lémya7 DET
s-Roger ats'x-en-lkhán wi7 zam'
NOM-Roger see-DIR-1SG.SUBJ EMPH after.all
Lémya apparently kissed Roger; actually I saw it.

According to the authors, *an* requires perceptual evidence but it is also inferential in that it requires gaps, just like MUST. The assertion here cannot be p but MUST p. This amounts to saying that *an* is nonveridical SEE, as below (*Per* is for "perception state"):

(27) Nonveridical suppositional SEE :
$[\![i \text{ see}_{sup}\ p]\!]^{\text{M,Per},speaker}$ is defined iff $\text{M}(i)$ is nonveridical (partitioned epistemic modal base). If defined,
$[\![i \text{ see}_{sup}\ p]\!]^{\text{M,Per},speaker} = 1$ iff $\forall w'[w' \in \text{Per}(speaker)) \rightarrow w' \in \{w'' \mid p(w'')\}]$

(28) Nonveridical-SEE EVID
(i) Source presupposition: the modal base is perception, determined by visual information.
(ii) Assertion: MUST p.

This is a SEE with a nonveridical suppositional perception base. The speaker is aware that there maybe are other factors that prevent knowing, and this explains why *an* can't be used when the speaker knows p to be true. In Greek, the difference surfaces not with an evidential but with the subjunctive mood: the speaker watched Flavio closing the door, but perhaps she was too far away, or she couldn't see clearly for some other reason, she is therefore not absolutely sure that the door is closed. The nonveridical epistemic presupposition is added:

(29) O Nicholas idhe ton Flavio *na*
the Nicholas saw.3sg the Flavio that.SUBJ
klini tin porta, ala i porta dhen ine
close.NON-PAST.IMPERF.3sg. the door, but the door not is
kleisti.
closed
Nicholas saw Flavio closing the door, but he is not entirely sure that the door is closed.

This use of SEE produces uncertainty since the modal base is partitioned, and seeing doesn't produce belief or knowledge of the result. [3]Notice the contrast with English *apparently* which seems to be fine in the translation of the Salish example above. In other words, seeing doesn't always lead to belief or knowledge. This case of seeing-but-not-believing would fall under Matthewson's 'indirect' sensory, as we will have to assume that indirectness in the case of seeing presupposes the existence of some kind of obstacle, internal (not being able to see clearly, being under the influence of drugs, etc.) or external (bad weather conditions, being dark, seeing from a distance, etc.). The mood distinctions we find in Greek and Italian have counterparts in evidential systems that make the difference empirically observable— and ultimately support the unified analysis of modal particles, attitudes and epistemic modals.

To summarize, we will distinguish between two kinds of sensory evidence, direct and indirect witness:

(30) Non-uniformity of sensory evidence

a. Veridical sensory 'direct witness': no obstacles to the visual perception, it leads to belief and knowledge, asserts p.

b. Nonveridical sensory: there are obstacles to the visual experience, produces nonveridical inference, the speaker is at best biased towards p, asserts MUST p.

Only direct witness evidentials entail veridical commitment to p, as only with direct witness, the evidence is a reliable path to knowing. The idea of obstacle captures the fact that sensory perception— even the visual one— cannot always be fully trusted. Indirect witness produces weaker, less reliable evidence, and the assertion will be that of MUST p, as we suggest. This is, we claim, the reading this type of evidential produces.

6.3.2 Semblance evidentials

Semblance evidentials pattern with semblance verbs and give rise to similar behavior. Faller (2011, 665) discusses the enclitic combination =*chu-sina*, which she calls the Perceived Evidence Inferential (PEI) and which is used for inferences based on some kind of observable, partial evidence, often the result of the event described. She reports that consultants agree that *chu-sina* is pre-

[3] In the example here the tense used is the morphological imperfective non-past which in embedded clauses Giannakidou and Mari 2021b have analyzed as zero tense, meaning that it is anaphoric to the tense above it. This is an important point to make so that we don't confuse this non-past with the semantic NONPAST which is perfective and future shifting.

ferred over =*cha*, which is the veridical witness, in a context such as below, where the speaker has direct evidence for the prejacent.

Context: Marya looks very pale.

(31) Unqu-sqa-chu-sina ka-sha-n-man
sick-PRT-PEI be-PROG-3-COND
She appears to be sick (but the speaker is not sure of it, merely states what appears to be the case).

Just because something *looks like* or *sounds like p* doesn't mean that they are *p* (we can think of *p* as a property here). Semblance verbs, according to Giannakidou and Mari (2012), can also be construed as nonveridical. Semblance, like belief, it turns out, can be construed both as commitment as well as supposition in which case it is contrasted with knowledge.

We provide the key facts with Greek verbs and mood— and the prediction is that there will be similar nuances in the evidential domain. We use translations in English to capture accurately the meaning of the Greek sentences which differ minimally only in the use of complementizers. The subjunctive one is *na*, the indicative non-factive *oti*, and the factive one is *pu*:

(32) 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).

(33) Ta paidia fenonde oti ine kourasmena (#ala bori ke
the children seem.3PL that.IND be.3SG tired (but might and
na min ine).
subj not be.3PL).
It is obvious that the children are tired (#but they might not be).

(34) Ta paidia fenonde pu ine kourasmena (#ala bori ke
the children seem.3PL that.IND be.3SG tired (but might and
na min ine).
subj not be.3PL).
The children are tired, and it is apparent.

With the indicative and factive complementizers, as we see, that the children are tired cannot be contradicted. In this case, the speaker *i* has formed a belief that the children are tired, and in the case of factive *pu*, it is even presupposed that they are tired. Hence appearance and semblance are veridical only if they

lead to the formation of belief or if they presuppose knowledge— but they do not inherently do either. It is in the nature of such predicates to show a flexible attitude sometimes as knowledge (using the appearance of p as evidence for p) and sometimes as suppositional belief, in which case they take the subjunctive. The subjunctive complement of a semblance SEEM, APPEAR predicate produces the nonveridical inference: for any p, and individual x, *x seems p* to i (the speaker) does not entail that *x is p* actually. In other words, appearances can be deceiving, and semblance verbs do not entail objective veridicality or knowledge. We call this variant "suppositional SEEM" below to keep in line with our vocabulary so far. We label the modal basis for SEEM attitudes Seem, which we consider as a mix of hearsay, and perceptual evidence.

(35) Suppositional SEEM (with subjunctive in Greek):
$[\![i\,\text{SEEM}_{sup}\ p]\!]^{\text{M,Seem},speaker}$ is defined iff M($speaker$) is nonveridical (partitioned epistemic modal base). If defined,
$[\![i\,\text{SEEM}_{sup}\ p]\!]^{\text{M,Seem},speaker} = 1$ iff $\forall w'[w' \in \text{Seem}(speaker)) \rightarrow w' \in \{w'' \mid p(w'')\}]$

Suppositional SEEM, then is much like suppositional, modalized belief anchored to the speaker. The speaker expresses a bias that i has the property P, but at the same time she is aware that she does not know that for sure.

The indicative complement correlates with veridical commitment, in which case *oti* will be chosen, or with factivity in which case we will have *pu*:

(36) Veridical SEEM (*fenete* with indicative in Greek):
$[\![i\,\text{SEEM}_{veridical}\ p]\!]^{w,\text{Seem},speaker}$ is $= 1$ iff $\forall w'[w' \in \text{Seem}(speaker)) \rightarrow w' \in \{w'' \mid p(w'')\}]$

In Italian we observe indicative/subjunctive alternations, as one would expect. Just as in Greek, the attitude holder is always the speaker. When the speaker does not know, only the subjunctive is possible. In this case, there is epistemic uncertainty and the embedded clause expresses a likelihood judgment about p:

(37) Sembra che sia arrivato.
Seems that be.SUBJ.3SG arrived
It seems that he has arrived, but I am not entirely sure.

So here again with the subjunctive we have the nonveridical inference.

The APPEAR-EVID can be defined as follows:

(38) APPEAR-EVID

(i) Source presupposition: the modal base is determined by visual information.
(ii) Assertion: MUST *p*.

Conceivably, there may be evidentials that assert *p*; those would be equivalent to veridical SEEM, so this flexibility can be expected with evidential meanings cross-linguistically.

To strengthen the support for the conceptual split between veridical and nonveridical modalized sensory experience, we will revisit now arguments from Giannakidou and Mari (2021b, 72-77) which suggest that this difference matters for sensory experiences beyond seeing. It will turn out that there is a hierarchy of evidence that renders some sensory experiences more reliable than others *per se*. Hearing and smelling, for example, may present obstacles inherently and are therefore not as reliable paths to knowledge. In all cases, the key will be what kind of modal base the source presupposition establishes, and whether the assertion is MUST *p*, or weaker than that.

6.4 Non-visual sensory evidence

Let us go back to the discussion of MUST. We will repeat here part of this discussion in order to argue that sensory experience other than vision often counts as unreliable, which means, as we are rephrasing it, 'with obstacles'. We will then raise the issue of why non-visual experience is less reliable than visual one and go back to some thoughts by Aristotle that we find helpful.

6.4.1 Indirect evidentials are fine with non-visual experience

Karttunen (1972) held that the weakness of MUST is intimately related to the weakness of the source of information: only when the speaker has indirect evidence that the prejacent is true, does she use MUST. Giannakidou and Mari (2016c, 2021b) argued that nonveridicality of MUST is not due to the fact that knowledge is indirect, but to the fact that MUST reasons with a nonveridical epistemic modal base. The modal base contains evidence that biases towards *p* but still allows the possibility of *not p*.

Let us proceed to offer arguments showing that it is not indirect evidence that sanctions MUST but lack of knowledge. (We have offered discussion of this before, but it is helpful to remind the reader here). The contrast between unhindered visual perception and hindered one is illustrative; but consider first the context that is famously cited as evidence for need of indirect evidence:

(39) *Context: i is standing in front of the window and sees the rain*

a. #It must be raining.
b. #Tha vrexi.
FUT rain
c. #Piovera.
rain-FUT.3SG
d. #Prepi na vrexi.
must that.SUBJ rain
e. #Dovrà piovere.
must.FUT.3SG rain

Epistemic necessity modals (including FUT) are infelicitous here because, Kartunnen's argument goes, MUST requires indirect evidence, but if see the rain the evidence is direct. However, and this is important, if I see the rain and there are no internal or external obstacles, I *know* that it is raining, and knowledge, as we said, is veridical. MUST is excluded not because the evidence needs to be indirect, as Karttunen argued, but because veridical seeing (what we called direct witness) is a reliable path to knowledge.

Now, consider the case where I see but my vision is hindered. In this case, I can use evidential MUST and FUT as illustrated below (example from Giannakidou and Mari (2021b, 75:(68)) :

(40) Context: I am looking through the window, and it is foggy and dark. I don't fully trust what I am seeing:

a. Prepi na vrexi. (Greek MUST)
must that.SUBJ rain.3SG
It must be raining.
b. Tha vrexi. (Greek, epistemic future, equivalent to MUST)
future rain.3SG
It must be raining.
c. Piovera.
rain-FUT.3SG
d. Dovrà piovere.
must.FUT.3SG rain

Now the necessity modals are fine. While the perception is visual, it contains obstacles and this is crucial for the licensing of MUST. We must therefore concede that the evidential sensitivity of MUST depends on how reliable I take the sensory information to be in establishing knowledge. If my vision is

unclear and it's foggy, I reason with partial assumptions, I can therefore not be veridically committed to 'It is raining' and use MUST.

Consider now auditory perception, which also is compatible with MUST but hearing is as direct as seeing:

(41) Context: I am in a room with no windows, but I hear sounds of rain on the roof.

a. It must be raining.
b. Tha vrexi.
   FUT rain
c. Pioverà.
   rain.FUT.3SG
d. Tha prepi na vrexi.
   FUT must that.SUBJ rain

If I only hear something that sounds like rain, I do not know that it is raining; I only have the sound of something that could (probably) be rain. The stimulus is direct, but inadequate for knowledge: what I hear might be caused by something other than the rain. Auditory perception, by its very nature, is not necessarily veridical. What or who you hear matters: hearing rain will depend on a number of factors, such as how thick the roof is, how good your hearing is. Hearing the voice of a familiar person, on the other hand, will involve less obstacles. But overall, hearing seems more 'indirect' than seeing. In the light of our discussion thus far, the point here is that HEAR is by default suppositional, which means it is modalized— it has the, by now familiar, nonveridical presupposition of lacking knowledge:

(42) Nonveridical suppositional HEAR :
$[\![i\ \text{hear}_{sup}\ p]\!]^{\text{M,Hear},speaker}$ is defined iff $\text{M}(i)$ is nonveridical (partitioned epistemic modal base). If defined,
$[\![i\ \text{hear}_{sup}\ p]\!]^{\text{M,Hear},speaker} = 1$ iff $\forall w'[w' \in \text{Hear}(speaker)) \rightarrow w' \in \{w'' \mid p(w'')\}]$

It is plausible to argue that evidentials that rely on hearing have the denotation above, with the nonveridical epistemic 'do not know' presupposition.

Matthewson (2020) offers some examples with the Salish evidential *l·kw7a* whose use disallows the speaker from having had visual evidence of the eventuality itself. Auditory perception allows the evidential:

(43) áolsem=lhkacw lákw7a
sick=2SG.SUBJ lákw7a

You must be sick.
Rejected if the speaker sees someone is shivering and sweaty.
Accepted if the speaker hears them coughing.

As shown, *lákw7a* is incompatible with the speaker having had visual evidence of the eventuality itself, e.g., if the speaker has seen manifestations of the sickness; but *lákw7a* is acceptable if the speaker merely heard symptoms.

Consider, finally, other types of perception. The data are from Matthewson (2020, (8)-(11)):
Hearing:

(44) wa7 lákw7a ku=ts7ás=a
be lákw7a DET=come=EXIS
Someone's coming. (The speaker can hear them, but not see them.)

Tasting:

(45) wa7 lákw7a ku=sq'áq'pa7 lts7a ti=ts'í7=a
be lákw7a DET=dirt here DET=meat=EXIS
This meat tastes as if there's dirt in it. (Said while trying to eat it.)

Smelling:

(46) tsem-s=kán lákw7a ti=ts'í7=a
burn-CAUS=1SG.SUBJ lákw7a DET=meat=EXIS
I burnt the meat. (Context: you smell it (Davis, 2009).)

Touch:
Context: You are blindfolded. I ask you to tell me which of three cups a stone is in. You feel around and feel the stone and you say:

(47) nilh lákw7aa lts7a
FOC lákw7a here
It's in this one.

The obvious conclusion from this discussion is that Willet's binary division between direct and indirect evidence, with the ensuing categorization of sensory experience as direct or 'first hand' is in need of revision. The senses of hearing, smell, touch, and taste seem to be 'indirect', and they do not license a veridical inference:

(48) a. This sounds like someone is coming, but I am not entirely sure.

b. This meat tastes as if there's dirt in it, but I know Maria is a very thorough chef so there must be something wrong with my taste.
c. It smells like I burnt the meat, but thankfully it is OK.
d. Touching objects blindfolded: This is a bottle— sorry, it is a vase.

But what does it mean for senses to be 'indirect'? In our jargon it means that there are obstacles, therefore the evidence is *not fully reliable* for knowledge or the formaion of veridicla belief. In the end, non-visual sensory experience is inherently modalized, we suggested. In the lexical entries we gave, hearing is more complex since it involves two modal bases, and the data with MUST and *l·kw7a* suggest that the other senses too have a nonveridical presupposition built into them. It turns out that only vision can be veridical by default, and allow the formation of knowledge.

6.4.2 Conclusions about sensory evidence

Aristotle in *De Anima* offers a very through discussion of perception.[4] While the discussion is dense, there are a few ideas that can be extracted from it and which are very useful to linguistic analysis. In *De Anima*: 417b20ff Aristotle treats perceiving like thinking except that the objects of perception are external, while those of thinking are internal representations. Thinking involves just the thinking agent, but perceiving is relational to an external object.

In our discussion above, we found that perceiving is indeed a kind of thinking which may or may not lead to the formation of belief or knowledge of the prejacent proposition. Whether perception has obstacles or not was key to understanding when we have inference and veridical commitment to p (therefore, belief, at least, of p), or merely an inclination towards MUST p. In the later case we talk about modalized perception. We found striking similarities between perception, sensory attitudes and MUST modals that make a unified analysis both plausible and desirable.

6.5 Inferential evidentials

As we noted already, both varieties of epistemic modals (possibility and necessity) are inferential because they rely on inference given certain premises. The premises are the evidence, and there can be much of it, or very little of it or no

[4] We owe to Aristotle the view that there are five and only five senses: sight, hearing, touch, taste, and smell. In the relevant passages, Aristotle talks both about the number and kind of senses that both humans and the animals have. **? missing?** proposes a number of criteria which in conjunction form a fine-grained taxonomy of the senses.

evidence at all in which case the premises are merely speculative or guesses. Inferentiality is not an evidential category by itself since it doesn't have to encode source of information; but inferential reasoning is what characterizes, as we showed, the assertion of sensory evidentials, and it is here where modality and evidentiality most strikingly intersect.

The MUST statement typically illustrates inferencing from reliable premises, it therefore creates evidential bias toward the prejacent proposition, as we have noted several times; the MIGHT statement, on the other hand, reveals inferencing from poor evidence or no evidence at all, or very little information. The MIGHT statement is compatible with mere speculation. The flexible necessity modals (FUT modal), as we showed in chapter 4, can be used with both kinds of evidence: reliable (in which case it will produce bias) or in which case the statement will feel more neutral. Thus, while with all modals the speaker reasons with both options (*p* and its negation), with a necessity modal the prejacent is taken to be more likely than its negation. These two varieties of biased versus non-biased assertions are observed in all evidential systems.

6.5.1 Conjectural evidential and might

Faller (2011) identifies what she calls conjectural evidential *chá* which is felicitous in situations where the speaker is merely speculating or pointing out a possibility. Observe that the evidential is licensed in a situation where B has no idea whether Ines will come or not.

(49) a. A: Inès-cha=qa hamu-nqa?
A: Inès-DIM-TOP come-3.FUT
Will Inès come?

b. B: Ichapas=chá, mana-pas=chá.
B: maybe=CONJ, not=ADD=CONJ
Maybe, maybe not.

Faller concludes that "the Conjectural is quite similar in meaning to English *may*, both in not requiring an ordering source and in being an existential quantifier. The main semantic difference with *may* is that it is not variable with respect to the kinds of conversational backgrounds it combines with, that is, =*chá* does not have deontic or bouletic uses, for example." (Faller, 2011, :673, ex.25). In other words, the conjectural evidential is, for all intents and purposes, an epistemic possibility modal.

6.5.2 MUST like inferentials

The stronger inferential evidential gives rise to an assertion with bias equivalent to MUST. Here are the basic Salish, Quechua and Bulgarian data:

(50) plan *k'a* tu7 wa7 tsu7c na máq7-a (Salish)
already INFER then IMPF melt(INCH) DET snow-DET
The snow must have melted already.

(51) para-sha-n-chá (Quechua)
rain-PROG-3-CHA
It may/must be raining. + speaker conjectures that it is raining based on some sort of inferential evidence

(52) Maria pisala kniga. (Bulgarian)
Maria write.IMPERF.PAST book
Maria must be writing a book, [I inferred].

As we noted in chapter 2, the Bulgarian evidential also interacts with tense, but we will put this aside for now. Regardless of their particular morphosyntactic status, we see here that evidential morphemes, in their inferential meaning make assertions equivalent to those of epistemic MUST, and the first analysis to note this is Izvorski's:

(53) The interpretation of Bulgarian EV *p* (Izvorski, 1997, :226)
a. Assertion: MUST *p* in view of the speaker's knowledge state.
b. Presupposition: Speaker has indirect evidence for *p*.

This is a two tier semantics like the ones we have been giving, where the source is encoded as a presupposition. The assertion is that of MUST plus the presupposition that only indirect evidence be considered in the modal base. According to this entry, the modal base is restricted by the indirect evidence and contains only those worlds in which the available indirect evidence for *p* holds. It remains unclear what indirect evidence is, however. Izvorski in addition utilizes a contextually-determined ordering source, which orders the worlds in the modal base according to how closely they correspond to certain beliefs about the indirect evidence.

Let us consider at this point more data on indirect inference from Salish; we then move on to the analyses of Matthewson et al. (2007) and Rullmann et al. (2008).

6.5.3 More on Salish inferentials

Recall again the two Salish evidentials from Matthewson et al. (2007, :11,12):

(54) plan *k'a* tu7 wa7 tsu7c na máq7-a (Salish)
already INFER then IMPF melt(INCH) DET snow-DET
The snow must have melted already. snow-DET
The snow must have melted already.

(55) pel'p-s-ácw-*an'* nelh neklíh-sw-a
lost.CAUS.2SG.CONJ.PERC.EVID DET.PL key.2SG.POSS.DET
It looks like you've lost your keys.

The authors note that the evidential markers convey how the speaker's epistemic state was achieved, and do not express speaker's commitment to the truth of the assertion. Willett distinguishes between the two sub-types of indirect inferring evidentials Willett (1988, :96) :

(56) Two types of inferentials

a. Inference from results: the speaker infers the situation described from the observable evidence (i.e. from perception of the results of the causing event or action.)
b. Inference from reasoning: the speaker infers the situation described on the basis of intuition, logic, a dream, previous experience, or some other mental construct.

In Salish, Matthewson and Rullmann argue, there is an empirical difference between i and ii type of evidentials: while *k'a* is a general inferring evidential and does not specify whether the inference is based on observable results or solely on mental reasoning, *an* is restricted to inferencing based on perceived results. To see the contrast observe the following contexts. The discussion is from Matthewson et al. (2007).

Context: You had five pieces of *ts'wán* (wind-dried salmon) left when you checked yesterday. Today, you go to get some ts'wán to make soup and you notice they are all gone. You are not sure who took them, but you know that John is the person in your household who really loves ts?wan and usually eats lots whenever he gets a chance.

(57) ts'aqw-an'-ás k'a i ts'wán-a kw
eat-DIR-3ERG INFER DET.PL wind-dried.salmon-DET DET
s-John
NOM-John
John must have eaten the ts'wán.

(58) #ts'aqw-an'-as-an i ts'wán-a kw
eat-DIR-3ERG-PERC.EVID DET.PL wind-dried.salmon-DET DET
s-John
NOM-John
John apparently ate the ts'wán.
Consultant's comment : 'Good if he has bits of ts'wán on his shirt'

Now consider the context same as above, but this time you see skins in John's room.

(59) ts'aqw-an'-ás k'a i ts'wán-a kw
eat-DIR-3ERG INFER DET.PL wind-dried.salmon-DET DET
s-John
NOM-John
John must have eaten the ts'wán.

(60) ts'aqw-an'-as-an i ts'wán-a kw
eat-DIR-3ERG-PERC.EVID DET.PL wind-dried.salmon-DET DET
s-John
NOM-John
John apparently ate the ts'wán.

Both sentences are acceptable indicating that *an* is indeed sensitive to perceived evidence while *k'a* is insensitive to this factor. Salish, thus, has a general inferential and a perception inferential marker. In both cases, inference is made and a biased conclusion is drawn towards the prejacent, though it is not equivalent to veridical commitment to *p*.

English uses the adverbs *apparently, evidently, obviously* which appear to be like *an* in requiring sensory evidence.They can only be used in the context where I see the ts'wa skins. In the previous context of mere inference the adverbs are odd:

(61) You had five cookies left when you checked yesterday. Today, you go to get some and they are all gone. You are not sure who took them, but you know that John really loves cookies, and usually eats lots

whenever he gets a chance.
#John apparently/evidently/obviously ate the cookies.

Hence evidential character is present in these adverbs and depends on their lexical meaning: *apparently, evidently, obviously* do require sensory evidence, and cannot be used if such evidence is lacking.

Crucially, the inferential as well as *an* both are unusable if the speaker is sure that the embedded proposition is true. This is shown below.

(62) *nilh k'a k-Sylvia ku xilh-tal'i; wá7-lhkan t'u7
FOC INFER DET-S. DET do(CAUS)-TOP IMPF-1SB.SUBJ just
áts'x-en
see-DIR
That must have been Sylvia who did it; I saw her. (Matthewson et al., 2007, (38))

(63) *nilh-as-an' k-Sylvia ku wa7 xílh-tal'i;
FOC-3CONJ-PERC.EVID DET-Sylvia DET IMPF do(CAUS)-TOP
wá7-lhkan t'u7 áts'x-en
IMPF-1SB.SUBJ just see-DIR
That was apparently Sylvia who did it; I saw her. (Matthewson et al., 2007, (40)).

This is consistent with the thesis that *k'a* and *an'* are nonveridical MUST modals, and do not assert *p*. Their nonveridicality also prevents them from being used when the proposition is false:

(64) *wa7 k'a kwis, t'u7 aoz t'u7 k-wa-s kwis
IMPF INFER rain but NEG just DET-IMPF-3POSS rain
It may/must be raining, but it's not raining.

(65) *wa7-as-an' kwis, t'u7 aoz t'u7 k-wa-s
IMPF-3CONJ-PERC.EVID rain but NEG just DET-IMPF-3POSS

It's apparently raining, but it's not raining.
Consultant's comment: It's contradictory.

In both cases, knowing that the prejacent is false makes the evidentials infelicitous. Matthewson et al. (2007) and Rullmann et al. (2008) explicitly argue that evidentials in St'á'timcets Salish pattern like MUST modals.(In fact,

the analysis given by Rullman et al. applies to deontic as well as epistemic modals.).[5]

Here are the lexical entries from Matthewson et al. (2007):

(66) a. General inferential.
$[\![$k'a$]\!]^{c,w}$ is only defined if c provides an epistemic modal base B s.t. for all worlds $w', w' \in B(w)$ iff the inferential evidence in w holds in w'

b. Perceived evidence.
$[\![$-an$]\!]^{c,w}$ is only defined if c provides an epistemic modal base B s.t. for all worlds $w', w' \in B(w)$ iff the perceived evidence in w holds in w'

c. Reportative evidential.
$[\![$ku7$]\!]^{c,w}$ is only defined if c provides an epistemic modal base B s.t. for all worlds $w', w' \in B(w)$ iff the relevant report in w holds in w'

d. $[\![$k'a$]\!]^{c,w}$/ $[\![$-an$]\!]^{c,w}$ / $[\![$ku7$]\!]^{c,w} = \lambda f.\lambda p.\forall w'[w' \in f(B(w)) \rightarrow p(w')]$

Crucially, the a, b, c have a veridical modal base which is not partitioned. The d entry has f which is a choice function that selects a subpart of the modal base. But in this part the evidence that holds in the actual world holds, and since p is true in the selected part of the modal base, then, p is true in the actual world. These entries, therefore, give a veridical semantics for the evidentials, despite the fact that the reason advocated for f is to be able to render the force variability of the modal meaning of the evidentials.

Along the discussion in chapter 4, we provide the following improvement. Recall that, in our theory, variability is achieved at the metaevaluation. The modal base is partitioned, which avoids the actuality entailment. The lexical entry allows for adjusting both positive or lack of bias, as shown respectively in (67) and (68).

(67) $[\![$PROBABLY-k'a $(p)]\!]^{O,\mathrm{M},i,S}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into Ideal_S and $\neg\mathrm{Ideal}_S$ worlds. If defined, $[\![$PROBABLY-k'a $(p)]\!]^{O,\mathrm{M},i,S} = 1$ iff

[5] They say further that 'Whereas English modals have a fixed modal force but a varying conversational background, modals in St'á'timcets appear to have varying modal force but a fixed type of conversational background (Rullmann et al., 2008, :218-19). They argue that St'á'timcets modals include a specification of a particular type of modal base: for evidentials, the restriction is to modal bases in which the particular type of evidence holds. This is precisely the analysis we suggested for modalities and attitudes in Giannakidou and Mari (2021b), where modals and attitudes can be lexically specified for what kinds of modal bases they combine with— and it if also the line we have been pursuing here.

$\text{Ideal}_{\mathcal{S}}$ is a weak necessity with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to $\text{M}(i)$ and O & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

(68) $[\![\text{MAYBE-k'a } (p)]\!]^{O,\text{M},i,\mathcal{S}}$ is defined only if $\text{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined, $[\![\text{MAYBE-k'a } (p)]\!]^{O,\text{M},i,\mathcal{S}} = 1$ iff O is empty & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

Let us move on now and complete the discussion with the reportative cases.

6.6 Reportative evidential

In a reportative case, the speaker's evidence for the assertion is the fact that a report was made. Therefore, the accessible worlds in the reportative case are all those worlds in which some *i* other than the speaker *s* said that *p*. Since the actual world is presupposed to be a world in which *i* said *p*, and because we understand that the Veridicality principle of assertion holds, the sentence makes a strong claim about the actual world: unless Mary is not reliable, *p* holds in the actual world. Interestingly, however, reported evidentials are notoriously known for not asserting *p*.

Here are some examples of reported evidentials in Salish (from the works cited earlier):

(69) wa7 ku7 ku sts'éts'qwaz'l-ta stswáw'cw-a (Salish)
be REPORT DET trout in-DET creek-DET
There are trout in the creek, [I heard].)

(70) Maria pisala kniga. (Bulgarian)
Maria write.IMPERF.PAST book
Maria was writing a book, [I heard].

A sentence with *ku7* is felicitous when the speaker relies on a report from some other person. *ku7* may be used regardless of whether the report is second hand, third-hand, or folklore. as illustrated below.

Second-hand context: The speaker is talking about a time during her childhood when a chicken attacked her. The speaker does not remember the occasion, but was told about it by her mother, who witnessed it.

(71) wá7-lhkan ku7 nq' san'k
IMPF-1SG.SUBJ REPORT laugh
[I was told that] I was laughing. (Matthewson and Frank, 2005, :380).

Third-hand context: The speaker is talking about the birthplace of her grand-

mother's mother. She was told about this by one of her relatives, but not by anyone who witnessed the birth.

(72) l-ta cácl'-ep-a ku7 lh-kwís-as ku
in-DET Fountain-DET REPORT HYP-fall-3CONJ DET
skícza7-s
mother-3POSS
Her mother was born at Fountain. (Matthewson and Frank, 2005, :391)

Third-hand context: The speaker is talking about when she heard bells ringing everywhere, and she was told that the bells were ringing because World War II had ended.

(73) nilh ku7 i tsúkw-as k-wa q'eltw'ácw
FOC REPORT when.PAST finish-3CONJ DET-IMPF wage.war
kenkw7ú Europe-a
DEIC Europe-DET
That was when they stopped fighting in Europe. (Matthewson and Frank, 2005, 454)

Folklore context: First line of a legend The Dog Children.

(74) wá7 ku7 láti7 ti pápel7-a smulhats
be REPORT DEIC DET one(HUMAN)-DET woman
There was this woman. (Van Eijk et al., 1981, :32, told by Marina LaRochelle)

Note that Willett's category of 'third-hand' is not restricted literally to third-hand reports. Rather, any case where the speaker has heard about the situation from someone who did not themselves directly witness the situation is classified as third-hand. Folklore cases, Matthewson et al. (2007) argue, are those where the speaker claims that the situation described is part of established oral history.

The class of reportative evidentials includes the German modal verb *sollen*, and the Greek verbs *lei, lene*, literally 'it says, they say' crucially appearing in the right edge of the sentence:

(75) Es soll regnen.
it shall rain
It is raining, I was told.

(76) Vrexi, lei/lene.
rain.3SG say.3SG/3PL

It is raining, they say.

In Greek, the 3rd person forms are particularly telling because they are impersonal and do not refer to a particular person who said the sentence. Reported evidentials are known also as hearsay evidentials.

In a context where it is understood that the hearsay is from an extremely reliable source, the speaker will be inclined to accept the content. For instance, if the source is legend, or folk stories, or some kind of epistemic authority: e.g. *The weather app says it will rain tomorrow* will trigger confidence in the prediction because the weather app is an epistemic authority. In ordinary conversation, however, if reported evidence is used, an implicature can be triggered that the commitment of the speaker is lower, perhaps because they didn't witness the event and can't verify the source. This is an implicature indeed, because, as we just said, it can be canceled by epistemic authority.

The special thing about reported sources is that the report indicates a veridical disengagement from the speaker since another source is explicitly mentioned, and the information it relays can be denied by the speaker without leading to a contradiction.[6] Smirnova (2011, :114) notes, crucially, that in reportative contexts, the evidential can be used even when the speaker believes that the evidential proposition p is false. Here is a scenario from Smirnova 2011: You just came from a psychiatric clinic, where you visited your friend Eli. Eli was hospitalized because of severe hallucinations and other psychological problems. When your friend inquires about the things Eli told you, you say:

(77) Izvanzemnite Ì predlozili rabota v kosmiceska
Aliens her offer.PERF.PAST.PLE job in space
laboratorija.
laboratory
Aliens offered her a job in a space lab, [I heard].

It is clear from the context that the speaker does not believe that Eli was offered a job by aliens. We see this in the inferential contexts where the evidential form is infelicitous if the speaker believes that p is false. Consider the case, Smirnova says, where a month ago Maria applied for a highly competitive position in a NASA laboratory. When Maria announced that she is quitting

[6] The possibility of asserting with an indirect source raises the question of whether the assertion itself becomes weaker. Boscaro et al. (2024), however, argue that veridical commitment remains robust with reportatives, but we must allow for the possibility that the threshold for what counts as adequate or reliable evidence can be lowered— and this can happen when the goals of assertions are redefined as is the case in Twitter.

her current job, you inferred that she got a job offer from NASA. Later, you learned that Maria was not offered a job by NASA. When your friend asks you why Maria is quitting her job, you say:

(78) #NASA Ì predloili rabota.
NASA her offer.PERF.PAST.PLE job
NASA offered her a job, [I inferred].

Smirnova (2011) notes that this is a problem for Izvorski's uniform analysis of the Bulgarian evidential, because it cannot explain why the speaker has to be committed to the truth of *p* in inferential contexts but not in reportative contexts.

Faller also reports that the reportative in Quechua is compatible with the speaker not believing *p*. In the Greek examples above, note:

(79) O Janis efthinete gia to atixima, lene, all dhen to
the John is responsible.3SG for the accident, say.3PL., but not it
pistevo.
believe.1SG
John is responsible for the accident, they say, but I don't believe it.

Here the speaker explicitly claims that she doesn't believe the rumor. It appears, then, that the reportative is compatible with the speaker not believing the propositional content, or having doubts about it, consistent with what we expect from embedding under SAY. Assertion verbs depend crucially on who is making the assertion, and whether it is a reliable source. When a sentence is reported, it also matters that it is reported: the speaker makes a choice to present it as a report, and this produces Gricean reasoning that challenges the content:

(80) a. #John is responsible for the accident, but I don't believe it.
b. John is claimed to be responsible for the accident , but I don't believe it.
c. John's rival says John responsible for the accident , but I don't believe it.

If a speaker chooses to utter a sentence not as a report, they are bound by the Veridicality principle: they believe the sentence to be true (even if it turns out to be false objectively). If a speaker chooses to present the content as a report, the hearer recognizes an intention of veridical disengagement, as we said before.

AnderBois (2014) explores the differences between reportatives and the other evidential categories by keeping track of the commitments of the speaker in

addition to the common ground. What is special about reportatives, according to AnderBois, is not that they are attached at a different level (as in Blain and Déchaine, 2007) or change the illocutionary force (as in Faller, 2002); it is rather that the reportative enables a perspective switch, so that the commitment of the speaker is merely to the existence of a report that p. Whether the report that p leads to the formation of a belief that p or likelihood of p will depend on whether the source is reliable or not, or, as we said earlier, how much epistemic authority it has (see Boscaro et al. (2024) for related discussion).

6.7 Summary

In this chapter, we showed how the theory of modality can incorporate the category of evidentiality in the discussion of epistemic modality. We analyzed three major kinds of evidentials: (a) perception based, (b) inferential evidentials, and (c) reportative evidentials.

Regarding perception based inferentials, we adopted the Aristotelian view that perceiving is a kind of thinking— and we added that while visual perception is veridical and leads to knowledge or belief of p, the other senses are 'indirect' modalized perceptions. Modalized perceptions take a nonveridical modal base as an argument, and create not veridical but biased perceptions. Their assertions are,therefore, akin to those with MUST. Indirect is perception with obstacles we argued.

Regarding inferential evidentials, it was observed that the evidential markers are equivalent to possibility or necessity modals which by default rely on inference given certain premises. The premises are the evidence, and there can be much of it, little of it, or no evidence at all. The evidence can likewise be reliable or unreliable in which case the premises are merely speculative or guesses. Inferentiality is not an evidential category by itself since it doesn't have to encode source of information; but inferential reasoning is what characterizes, as we showed, the assertion of sensory evidentials too, and it inferential reasoning where modality and evidentiality intersect.

The MUST statement typically illustrates inferencing from reliable premises; the MIGHT statement, on the other hand, reveals inferencing from poor evidence or no evidence at all, or very little information. The MIGHT statement can be compatible with mere speculation. Thus, while with all modals the speaker reasons with a nonveridical modal base and both options (p and its negation) are open, with good evidence the prejacent is taken to be more likely than its negation. This dependence on evidence is observed in all evidential systems.

Finally, reportative evidentials may signal, by Gricean reasoning, that the speaker disengages from the proposition– by choosing to attribute it to another source–, and is therefore not committed veridically to it. At the same time, reports credited to an authority are beyond reproach, and can be used to reinforce the truth of the statement as for example in *The doctors say that the mask prevents infections*. Even in such cases, however, challenges can be leveled.

Questions and further readings

Questions

- We saw that the informational source matters for the reliability of evidence, therefore also for the degree of veridical commitment. One question that arises when it comes to evidential systems, then, is the following: if evidentiality as a grammatical category marks veridical commitment, then are epistemic modality and evidentiality interchangeable categories? If so, would marking systematically both be redundant? The existing literature seems to suggest that in evidentiality marked systems we have less modal marking and vice versa; in other words, the two systems are in competition. Reflect on whether this is true and what it tells us about the two categories. Are there independent properties of grammar that would force in the evidential or the modal direction?
- Does reported evidence create weaker assertions? If assertion is governed by the veridicality principle which requires commitment to the propositional content, when a speaker chooses to assert a sentence with a report such as *John is a successful actor, they say*, does that mean that the speaker intends this assertion with weaker commitment? If so, does that make it a weaker assertion? What about cases where citing the source would actually lend more credibility to the assertion?
- Finally, reflect on the natures of the various senses. What makes veridical seeing being unhindered? What makes hearing or smelling be more 'with obstacles'?

Further readings

For more in depth typological patterns see the references cited in this chapter, especially Aikhenvald and Dixon (2014). On the relation between epistemic modality and evidentiality in the functional literature, see Cornillie (2009).

The literature on evidential categories is extremely vast. For further discussion about *origo*, or the self as an evidential category, see the pioneering work

of Garrett (2001). There is a quite representative literature on subjectivity as an evidential, across the work of Nuyts (1992); Squartini (2010).

A more recent literature is focusing on generic knowledge (see Kittilä (2019) for a comprehensive view) as an evidential category, and more generally the evidential category of mutual knowledge Hintz and Hintz (2017). As far as we are aware, there is no attempt to bridge the vast literature on the notion of common ground Stalnaker (1978) – including the one on the strength of the assertion and commitment Krifka (2017); Geurts (2019b) – with the evidential literature on common knowledge.

Finally, aspect has been studied in connection with evidentiality, most notably by Izvorski (1997); Korotkova (2016).

7

Directive modality: deontic and imperative sentences

In this chapter we examine what we call 'directive' modality, which includes deontic, bouletic modals and imperatives as a class of modal expressions that can be understood as relying on goals, desires, and rules that must be followed. We think of directive modality as concerning a general attitude of *potential compliance*: to general rules and laws (God's law, national and international law, professional ethics, tribal custom, classroom etiquette and the like), or compliance to goals set by an individual (teleological modality) based on one's desires, expectations, and plans. Compliance, we will argue, does not entail performativity , and while it can sometimes take the form of directive for action, the directive modal remains nonveridical and does not entail action. This becomes particularly visible in the category of imperative which we study here as an instance of directive modality: it involves the same mechanisms (teleological or bouletic modal base, meta-evaluation), but it may or may not contain bias. The imperative mood, we will argue, is effectively the counterpart of the flexible necessity modal (realized by the future and unitary modals discussed in chapter 4) in the realm of directive modality.

7.1 Deontic modal sentences and imperatives: core questions

Modalities can be distinguished along two major quality types (or flavors) as we know: epistemic and non-epistemic judgment types, as Portner and Rubinstein (2016) call them, the later including deontic and teleological modality, as well as ability (which we discussed in chapter 5). Portner talks about priority and dynamic modality (Portner, 2008, :135) in this case. We give some examples below:

(1) Priority/deontic

a. Criminals *must* be punished. (deontic)
b. With no exception, finals *must* be submitted by Friday 5 pm. (deontic)
c. You *should* try this chocolate, it's really good. (volitional/bouletic)
d. If you want to enjoy the trip, you *ought* to take the scenic route even if it takes a bit longer (preferential).
e. You *could/must* add some more salt to the soup if you want it to be tasty. (teleological)
f. You *may* go now. (permission)

(2) Dynamic volitional
a. John *can* swim (ability)
b. You *can* see the ocean from here (opportunity)

We focus on priority modals of the three kinds singled out above: deontic, volitional/preferential, and teleological. Priority modals, which we call as a class *deontic* here, have to do with choices and obligations, but differ in (a) where the choices and obligations come from (general rules, one's own desires or goals), and (b) how strong the compliance conditions are. We think of the former as the deontic source, which can be exogenous (general rules imposes by outside sources), or endogenous (one's own goals). As we can see, in some cases, we are dealing with law-like obligation or class rules that must be adhered to and cannot be violated, while in some other cases the deontic modals *should, ought to* issue softer directives that reveal preferences, therefore creating a choice for the subject that comes with looser compliance. The deontic statement can be a mere suggestion, as in the case of *You could add some more salt in the soup*, or permission as in *You may go now*. The variability we observe is due to the force of the modal, as expected (*must* versus *may*); but it can also be understood as reflecting a difference in bias between stronger necessity modals such as MUST and more moderate variants such as *should, ought to* which— as we argued for its epistemic counterpart— confer no bias.

Once we articulate our analysis of deontic sentences and the role of the deontic source in establishing bias and conditions for compliance, we will move on to the category of the imperative. While traditional grammars and classical speech act analyses associate imperatives with the force of command, substantial work done in the past 20 years has illustrated that imperatives are actually quite flexible and come in three varieties which, following the parallel with deontic modals, we will call strong, moderate, and indifferent. Some illustrative cases are given below:

(3) Strong imperatives: commands, requests, warning

a. Master to slave: Open the door!
b. Teacher to students: Submit your finals no later than Friday 5 pm.
c. Don't move! The bomb will explode.
d. Please help me.

The deontic source with imperatives, unless they are self-directed, is always external. In the command class, the deontic source is some kind of hard authority that issues a command or a rule to be followed as in the master (from Lewis, 1979, 's work) and the teacher examples. In the warning, we again have an external authority with the addressee's interest in mind. These imperatives seem quite normative and require that the addressee take action to comply.

In the class of moderate imperatives, on the other hand, the addressee is simply presented with a choice:

(4) Moderate, choice imperatives: suggestions, advice, concessions
a. A: How do I go to Harlem? B: Take the A-train. (advice)
b. A: Can I open the window? B: Sure, go ahead. (acquiescence)
c. Exasperated parent: Sure, then go to your damn party! (concession)
d. Have a seat (invitation)

The deontic source here is offering a choice and the addressee can take action or not without consequence.

In the next case of indifferent imperatives, finally, there may not even the possibility for action:

(5) Indifferent imperatives: wishes
a. Get well soon!
b. Waiting for the blind date to arrive: Be handsome!

Imperatives, then, as can be seen, can be used for a much wider range of speech acts (Schmerling, 1982; Davies, 1986; Wilson and Sperber, 1988; Han, 1999), a phenomenon that Schwager (2006) labels 'functional inhomogeneity' and Condoravdi and Lauer (2012) call 'functional diversity'. All uses fall into Searle's class of directive speech acts (Searle, 1969). The flexibility reminds us of the similar variation found with deontic modals— paraphrases are readily available, for example:

(6) Strong imperatives: necessity modals
a. Master to slave: You must open the door!

b. Teacher to students: You must submit your finals no later than Friday 5 pm.
c. You must not move! The bomb will explode.
d. You must help me.

(7) Moderate imperatives: non-biased necessity modals, or possibility modals
a. A: How do I go to Harlem? B: You should/ought to take the the A-train. (advice)
b. Exasperated parent: Sure, you can go to your damn party! (concession)
c. You may take a seat. (invitation)

(8) Indifferent imperatives: wishes
a. You should get well soon!

In classical speech act theory (developed by Austin (1962); Searle (1969)), imperative sentences, just like interrogative ones, are thought to have a distinct illocutionary force, separate from assertion— while modal sentences remain assertions, even if *inquisitive* Giannakidou (2013b) as we suggest in our chapter on questions. Some of the issues that were relevant for questions are also relevant for imperatives since in this case too we are dealing with non-veridical spaces that connect to responses that can go in the positive or negative direction.[1] In the speech act framework the question is: if declarative sentences make assertions and interrogatives have the force of question, what is the illocutionary force of the imperative? It seems that if the imperative has its own illocutionary force it must be considerably varied, as indicated by the data above. This variation poses a challenge for the idea that there is one illocutionary force for the imperative.

On the other hand, the observed variation seems to be supportive of the parallel with deontic modals suggesting that the same mechanisms that we find in modality are at play with imperatives too (modal bases, bias). This didn't go unnoticed, and Kaufmann (2012); Eckardt (2011); Oikonomou (2016); Tahar and Mari (2023) are recent theories that explore this parallel. All three argue that imperative sentences are modal, but Kaufmann (2012); Eckardt (2011); Tahar and Mari (2023) opt for a universal analysis (although with differences regarding the modal base either deontic for Kaufmann or metaphysical with future reference for Eckardt), while Oikonomou (2016) suggests an existential analysis. We will consider these theories later and argue that the imperative is an umbrella directive modal akin to the unitary epistemic modal we observed in chapter 4. Apparent differences, we will argue, are due to the working of

[1] Kaufmann (2012) actually poses non-veridicality as a presupposition of imperatives.

the metaevaluation that may or may not produce bias. As with questions later, we will claim that, in addition to the modal structure, there exists the discourse function layer that involves the syntactic C position— and we will rely on a parallel with subjunctive main directive clauses that we discussed briefly in Giannakidou and Mari (2021b). The comparison between imperatives and main subjunctives will be very informative.

Searle talks about 'directive' speech acts, and he means speech acts by which the speaker intends that the addressee act in a particular way. But directiveness does not always have this intention to act, as can be seen in the cases of advice, concession or indifferent imperatives and wishes. We will offer a framework for directiveness that comprises higher and lower commitment to comply, and we will derive it from the function of bias. There are two kinds of directives we will argue: those that require compliance, and those that offer mere choice.

The chapter is organized as follows. In section 2 we present our analysis of deontic modals based on the concept of a teleological directive modal base. We also emphasize the role of the subject in anchoring the modal base, and discuss the questions of compliance and possible commitment to act. In section 3, we discuss hybrid directive sentences that appear with subjunctives in Greek. These are very interesting as they allow us to see that a modal analysis does not preclude the speech act component. We turn to the imperatives in section 4. We conclude in section 5 by comparing directive modality with epistemic modality and demonstrating the richer notion of commitment that emerges. With epistemic commitment, the individual anchor is an epistemic agent, but with directive commitment the individual anchor (the speaker, the subject, or the addressee) is engaged in a choice: to take action or not in order to make the propositional content true. In some cases no action can be taken (*Get well soon!*) and in these cases the choice is void. But when action can be taken, the choice can be biased or not, and it is only in the former case that directiveness will likely result in action.

7.2 Deontic modal sentences

7.2.1 Recalling epistemic modality

Remember that the core of the Kratzerian system is the *conversational background*. Sentences, in general, are always uttered against a conversational background, and Kratzer argues that this background can fill in information that is needed for the interpretation of modals. As we said, this renders modal expres-

sions highly context sensitive in the sense that they are wired to connect to the context of use in order to get values for their missing argument, most notably the modal base.

Formally, a conversational background is represented as a function from worlds to sets of propositions. These propositions correspond to bodies of information, facts, rules, etc., and are responsible for determining the modal quality. Consider the sentence *Bill must be the the murderer* in the context where we are discussing a recent crime. In the course of our conversation, certain facts become known (i.e., common ground) about the crime: for instance, (a) the crime was committed on February 7 at 5:30 pm, (b) Bill and a few others are suspects, (c) among all considered, only Bill has an obvious motive, (d) Bill doesn't have an alibi for that time. This set of facts is the conversational background for our modal, and shape what is known in our world. Of course, the facts are contingent as things could have been otherwise, therefore what is known in this world may be different from what is known in some other world. The conversational background thus assigns a (different) set of propositions to each world of the domain.

The modal base is designed as a conversational ground. In the case of epistemic modality, it is a set of propositions which are the knowledge/goals of a given agent (an individual, for simplicity, here), at a given time, in a given world. In Kratzer's notation this is written as follows:

(9) $f_{epist}(w) = \{p \mid p$ is a proposition that expresses some knowledge in w – for and individual i, or a group of people or a community $\}$

We see that the epistemic background can be relative to an individual *i*, or it represents group knowledge. In the Giannakidou and Mari system, modal bases are relativized always to individual anchors who come to possess also common knowledge, and are epistemic authorities on what they know or believe Giannakidou (1998, 1999, : (45)) and Giannakidou and Mari (2021b) call these models epistemic states, as can be recalled:

(10) *Epistemic state of an individual anchor i*
An epistemic state M(*i*) is a set of worlds associated with an individual *i* representing worlds compatible with what *i* knows or believes in the context of utterance.

In epistemic modality, the veridicality judgment relies on what the anchor, which is the epistemic authority of their own assertion, knows or believes to be the case; and the epistemic state can be further narrowed down to refer to states of memory, awareness, expectations, and the like as it becomes partic-

ularly visible with attitude verbs (Giannakidou, 1998; Giannakidou and Mari, 2021b). For unembedded sentences, the default epistemic authority is always the speaker. For an unmodalized assertion of p, p is assertable only if the speaker knows or at least believes p to be true. In other terms, veridicality is a condition on the speech act of assertion, as we said.

Let us now see how this model applies in the deontic domain.

7.2.2 Deontic sources, deontic authorities and deontic subjects

Summarizing from the opening of the chapter, by deontic, we mean the following three kinds of modals:

(11) Deontic modals – obligation

a. Criminals *must* be punished. (deontic)
b. Students *must* submit their finals by Friday 5 pm. (deontic)

(12) Volitional/preferential modals (goals, choice)

a. You *should* try this chocolate, it's really good. (volitional)
b. You *must* add some more salt to the soup if you want it to be tasty. (teleological)
c. You ought to take the scenic route. (preferential)

(13) Permission

a. You *may* go now.
b. John is allowed to enter.

We distinguish two main patterns: the deontic cases which involve obligation, and the patterns that involve choice with respect to a goal (including permission). In deontic modal sentences the deontic source can be *external* or *exogenous*, as in the case of obligation and permission, or *internal* or *endogenous* when there is a goal set by the address or the deontic subject. Depending on the source then, we have different modal bases M(i) at t_u (the utterance time). w_0 is the world of evaluation, by default the actual world.

While the notion of evidentiality applies to epistemic modality and serves to provide the content that fills in the modal base (facts, observations, internal thoughts etc ...), in the deontic domain one can distinguish the *deontic source* from the *deontic authority* (see for the first suggestion in this direction Raulet (2022)). If Macron utters (14), he will act as the deontic authority, but not as the deontic source. In this case, the source are the doctors or the experts who issued the recommendation. The default deontic source is the law. However,

the spectrum of sources can be much wider and very much context dependent, as in the epistemic case. Just as epistemics have evidential presuppositions, deontics/volitional and permissives presuppose a source.

(14) Vous devez tous porter un masque !
You must all wear a mask !

Rules, goals and preferences are the counterparts of evidence in the realm of the deontic. We also assume, as we did with epistemic modals, that the domain of M(i) is restricted by relevance following the usual assumption of domain restriction with quantifiers.

Furthermore, the deontic modality can also be 'subjective', and parametric to rules, goals and preferences of i at t_u. In (15), instead, the authority issuing the order and the source of the recommendation is one and the same and is the speaker.

(15) Close the window, I am cold !

Subjective preferences also fall in the realm of directive modality.

Continuing with identification of parameters in the deontic domain, the addressee is the *deontic subject*. Speaker anchoring which is epistemic is also in place since the speaker continues to be the assessor of the truth of the statement. The speaker however is not the one who needs to comply (unless it is a first person obligation *I must go to school now*).

To summarize then, here are the relevant individual parameters for deontic and directive modal statements (for a first proposal see **?**):

(16) Individual parameters in directive modality
   a. Deontic source: the law, expert group, the speaker i
   b. Deontic authority: the speaker i who issues the directive
   c. Deontic subject: the addressee, present (in second or third person), or implicit.

For an imperative like *You must all wear a mask!*, the deontic source is the doctors, the deontic authority is Macron— who is the speaker issuing the directive—, and the deontic subject is the population that the addressee *you* refers to. On a par with the epistemic modal base of i which is grounded in evidence, the deontic modal base is grounded in the deontic source. For deontics, M(i) is the set of the worlds compatible with the source that are relevant for the deontic subject (which is also the syntactic addressee subject) in the imperative. A deontic subject need not be present, and it is not in in first or

third person non-imperative directive statements (*I must do to the bank, Bill must give me the keys tonight*).

The following are examples of types of deontic modal bases:

(17) M(i) (t_u)(w_0) = $\lambda w'$(w' is compatible with what the law that i appeals to in w_0 at t_u t)

(18) M(i) (t_u)(w_0) = $\lambda w'$(w' is compatible with what the class professor i sets as class rules in in w_0 at t_u)

(19) M(i) (t_u)(w_0) = $\lambda w'$(w' is compatible with i desires in in w_0 at t_u)

(20) M(i) (t_u)(w_0) = $\lambda w'$(w' is compatible with i goals in in w_0 at t_u) (teleo)

The flexibility of our system allows to disentangle the role of the addressee (which is the deontic subject) and the deontic authority. The deontic authority, instead, will play a role at the level of the metaevaluation where the strength of the directive is evaluated.

7.2.3 Implementation

In our system, the deontic source delivers the modal base. Recall that the deontic source can be external to the deontic authority, or coincide with it. It can be subjective or objective, depending on whether it encodes more objective facts or more subjective preferences. A stereotypicality function delivers those worlds that better comply with the modal base as in the case of epistemics. The Kratzer/Portner semantics posits an ordering source which ranks worlds according to how close they are to the stereotypical ideal. Our framework, as can be recalled from chapter 3, encodes that the modal base is partitioned into stereotypical and non-stereotypical worlds, but we dissociate stereotypicality from ranking which is done by the meta-evaluation and results in bias if the metaevaluation is non-empty.

A reviewer raises the question of what happens if one of the rules is inconsistent with the norms in the world. For instance, if an irrational rule rewards driving above the speed limit, but the regular rule (through custom and utility) is respecting the speed limit. We consider such cases abnormal, insofar as the irrational rule ranks higher than non-regular-rule worlds. A norm (or the regular rule: do not exceed speed limit), just like in the epistemic case, captures a regularity which creates an expectation; and if speed limits are generally set, it is irrational to have a law that necessitates or allows exceeding them. Any directives that would be based on such inconsistencies would be ruled

out as pragmatically infelicitous, just like *Mary came so fast, she must have teleported here* is ill-formed.

The regular rule (do not over-exceed speed-limit) holds even if the world turns out to be abnormal. The directive is not sensitive to what turns out to be the case, just as an epistemic modal statement does not turn out false if the speaker makes a hypothesis that turns out to be wrong. The modal statements are intrinsically subjectively anchored to the epistemic or the directive authority, and are not falsified by how the actual world turns out to be, normal or abnormal.

The deontic modal base is non-veridical and does not entail that p is true. This holds also for addressee oriented modals, including imperatives and general rules:

In the deontic modal base $\mathrm{M}(i)(t_u)(w_0)$, we define $\mathrm{Ideal}_{\mathcal{S}}$ as a function over $\mathrm{M}(i)(t_u)(w_0)$. The output $\mathrm{Ideal}_{\mathcal{S}}$ is a subset of $\mathrm{M}(i)(t_u)(w_0)$:

(21) $\mathrm{Ideal}_{\mathcal{S}}(\mathrm{M}(i)(t_u)(w_0)) = \{w' \in \mathrm{M}(i)(t_u)(w_0) : \forall q \in \mathcal{S}(w' \in q)\}$

So defined, $\mathrm{Ideal}_{\mathcal{S}}$ is a second modal base for the modality: it delivers the worlds in the deontic, teleological or volitional modal base, a subset of $\mathrm{M}(i)$, in which all the propositions in $\mathcal{S}$ are true. $\mathcal{S}$ is a set of propositions that corresponds to common ground norms.[2] The set $\mathrm{Ideal}_{\mathcal{S}}$ is also parametric to time. Unless otherwise stated, we consider that $\mathrm{Ideal}_{\mathcal{S}}$ is determined at the actual world and at the utterance time. As we can see, there is no ranking.

The deontic modal base is non-veridical and does not entail that p is true. This is always the case with addressee oriented direct modals (22-a) on which we focus, leaving generic deontic modality (see Hacquard, 2006; Mari, 2015b) for later (22-b). Unless otherwise stated, by 'deontic modality' we refer to 'addressee oriented deontic modals'.

(22) a. You must go to school!
b. One must be a child to use this restroom.

Deontic modality is future oriented, just like bouletic modality (Condoravdi, 2002; Giannakidou and Mari, 2021b). In our book, we posited an anti-factivity presupposition of directive predicates. Issuing an order only makes sense if the speaker knows or believes that p has not been executed. Being future oriented is not a temporal property encoded in the meaning of the modal itself (*pace* Condoravdi, 2002), but it is grounded in what it means to issue a directive. We

[2] Since only those worlds are considered in which *all* the propositions in $\mathcal{S}$ are true, the function $\mathrm{Ideal}_{\mathcal{S}}$ determines a cut-off point, just like with epistemic modals.

treat this entailment as a lexical presupposition and derive future orientation from this component.

Like epistemic modality, deontic modality features different strengths: baseline which is possiblity, flexible necessity which is MUST without bias, and biased necessity. Key to our analysis is the individual parameter *i* that stands for 'deontic authority' and to which the force of the modality is parametrized in the metaevaluation.

The baseline for deontic modality is permission (ALLOW) which is nonveridical equilibrium. When a permission is issued, the deontic subject can or can not bring *p* about. When a permission is issued, the deontic subject can chose to take action to bring *p* about or not. The embedded non-past tense, as we explained just here above, capture the default future oriented reading

(23) $[\![\emptyset$ ALLOW (NON-PAST $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if the deontic $\mathrm{M}(i)$ is nonveridical and is partitioned into $\mathrm{Ideal}_{\mathcal{S}}$ and $\neg\mathrm{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![\emptyset$ ALLOW (NON-PAST $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff O is empty as per $a \wedge \exists w \in \mathrm{M}(i)$ $p(w) \wedge \exists w' \in \mathrm{M}(i)$ $p(w')$

With ALLOW, the metaevaluation is empty, both options are equally possible. It is the base directive. Modals like *should/ought* and the corresponding modal in the conditional in Romance (Von Fintel and Iatridou, 2008), the metaevaluation sets the $\mathrm{Ideal}_{\mathcal{S}}$ have been called in the literature *modals of normality* (Copley, 2006; Yalcin, 2016) that emphasize that *p* will come true if the normalcy conditions are satisfied. In our account, normalcy conditions enhance quantification over the $\mathrm{Ideal}_{\mathcal{S}}$.

In English, epistemic *should* is weaker than epistemic *must*, and this is reflected in the absence of the ordering source (but still universal quantification in the $\mathrm{Ideal}_{\mathcal{S}}$ set). We assume that the same analysis applies to deontic *should*, as follows. Romance MUST+COND is similar to *should* and we assume that the conditional is the overt counterpart of $\mathrm{Ideal}_{\mathcal{S}}$ and introduces the normalcy conditions (as already pointed in the literature).

(24) $[\![\emptyset$ SHOULD (NON-PAST $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into $\mathrm{Ideal}_{\mathcal{S}}$ and $\neg\mathrm{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![\emptyset$ SHOULD (NON-PAST $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff O is empty as per i & $\forall w' \in \mathrm{Ideal}_{\mathcal{S}} \exists t' \succ t_u p(w', t')$

Note that the entry in (24) is parallel to the entry for FUT, where we had universal quantification over $\mathrm{Ideal}_{\mathcal{S}}$ with no ranking. We called this non-biased necessity.

Recall that FUT can convey a mere guess (25-a), whereas the modal plus conditional *dovrebbe* cannot do that. *Dovrebbe* remains nonetheless weaker than *dovere* (MUST) and in our theory, it does not feature ranking. The non-biased necessity FUT however, can go down to non-veridical equilibrium, whereas *dovrebbe* cannot be weaker than non-biased necessity.

(25) a. Bo'. Sarà a casa. (FUT lowered to equilibrium)
No idea. He might be home.
b. #Bo'. Dovrebbe essere a casa. (non-biased necessity)
No idea. He should be home.
c. Deve essere a casa. (biased necessity)
He must be home.

Deontic MUST, just as epistemic MUST, features an ordering that ranks Ideal_S worlds as better possibilities.

(26) $[\![\emptyset \text{ MUST (NON-PAST } (p))]\!]^{O,\text{M},i,S}$ is defined only if the modal base $\text{M}(i)$ is nonveridical and it is partitioned into Ideal_S and $\neg\text{Ideal}_S$ worlds. If defined,
$[\![\emptyset \text{ MUST (NON-PAST } (p))]\!]^{O,\text{M},i,S} = 1$ iff: Ideal_S is a better possibility with respect to $\neg\text{Ideal}_S$ relative to $\text{M}(i)$ and O as per i & $\forall w' \in \text{Ideal}_S : \exists t' \succ_{t_u} p(w', t')$

The stronger the bias, the closer the modal gets to obligations; the weaker the bias, the closer the modal gets to choices. Choice is always possible since it is the baseline; however, with obligations the authority's preference is very strong for action to be undertaken, but the result is never veridicality. When my child does not eat generally vegetables, saying *You must eat your vegetables* still implies that the ideal worlds are worlds where my child eats vegetables. In our system, then, normalcy and Ideal are indistinguishable form one another.

What counts as better possibility for directives? Consider *Murderers must go to jail*. In the Kratzer/Portner system we have an ordering source: for any pair of worlds u, z, u is closer to the ideal set by $g(w)$ if the set of propositions that are true in z is a subset of the set of propositions true in u. Take two worlds u and z in which John committed a murder; if u is a world where John goes to jail and z is a world where he does not, u is a better world, i.e., closer to the ideal', than z. In our system, better possibility is a world where the preferences in the metaevalaution are true. If the metavaluation contains that murderers must be punished, then a world where a murderer goes to jail is does not. Hence better possibility for deontic modality should be understood as better *compliance* with the rules/norms/goals.

7.2.4 Biased and non-biased deontic necessities

Just as with epistemic modals, with deontic modals, adverbs manipulate the bias issuing an obligation when they are strong modals, or simply presenting choices when they are weaker.

(27) Prepi opsodhipote na ipovalis aitisi.
must definitely that.SUBJ submit.2SG application
You must definitely submit an application.

(28) Devi assolutamente mandare un CV.
must.IMP.2SG absolutely send a CV.
You must absolutely send a CV.

With weaker modals, a choice reading is obtained. Here the modal base provides worlds that better comply with what is in the interest of the addressee, and the commitment of the deontic authority is weak. Recall that the modal base is anchored to the deontic subject 'you' here. The metaevaluation encodes the commitment of the person issuing the order. When a suggestion is issued, the commitment to comply is weak, and the metaevaluation can host a weak adverb.

(29) Tha eprepe isos na ipovalis aitisi.
FUT must.PAST perhaps that.SUBJ submit.2SG application
You should perhaps submit an application.

(30) Dovresti forse mandare un CV.
must.COND.2SG maybe send a CV
You should maybe send a CV.

Recall that *tha eprepe* lexicalizes *should* in Greek, as we said in chapter 4. Here the bias is removed, and the effect is parallel with what we observed with epistemic modals.

Our analysis copes well with the observations in Portner and Rubinstein (2016). Consider (31) ((43) in Portner and Rubinstein, ibid.):

(31) a. Our uninsured citizens should get insurance.
b. Our uninsured citizens must get insurance.

The sentence in (31-a) is appropriate in a context in which the speaker is contributing to a negotiation about health care reform, while (31-b) is appropriate when the speaker wants to rule out further debate. Combining these ideas with the semantics from Von Fintel and Iatridou (2008), the prediction is that [must (p)] conveys that p follows from non-negotiable requirements, while

[should (*p*)] conveys that *p* follows taking into account requirements about which the speaker allows negotiation. This can be rephrased in our analysis as follows: with deontic *should* the modal sentence conveys non-biased necessity; deontic-*must* conveys biased necessity. Bias follows from ranking in the metaevaluation, as we have now repeatedly noted.

For the interpretation of deontic and volitional modals, Lassiter (2011) proposes a scale that measures the expected utility of a proposition. According to Lassiter, both weak necessity *should/ought* and strong necessity *must*, as priority modals, are interpreted relative to a very high contextual standard in the positive form. Given that Lassiter's treatment of epistemic modality is distinct, the account will have to posit a lexical ambiguity for modals like *must*, which is an undesirable result (see also discussion in Portner and Partee, 2008).

7.3 Directive unembedded subjunctives

In this section, we will consider the divide between obligation and choice. In Giannakidou and Mari (2021b) we observed that the Greek optative particle *as* and the subjunctive particle *na* appear in main clauses:

(32) a. Na/ As fiji o Janis.
SUBJ/ OPT leave.NON-PAST.3SG the John
John may go. Let John go.

b. Thelo na/*as fiji o Janis.
I want that.SUBJ/ OPT leave.NON-PAST.3SG the John
John may go/Let John go.

(33) a. Fige Jani!.
leave.IMP.2SG John
John, go!

b. *Thelo fige Jani!
want.1SG leave.IMP.2SG John
I want John, go!

In main clauses, the subjunctive *na* appears equivalent to *as* and the imperative in producing permissions, requests, or wishes. *As*, unlike *na*, cannot embed. We can think of these unembedded subjunctive directive clauses as akin to, or 'hybrid' imperatives. It is often assumed that in imperatives there is an illocutionary force operator in C that encodes the specific discourse function. It can be argued that the subjunctive particle *na* moves to this position, as the imperative morpheme has been argued to do (Rivero and Terzi, 1994; Giannakidou, 1997, 1998). One can also hypothesize that the subjunctive remains

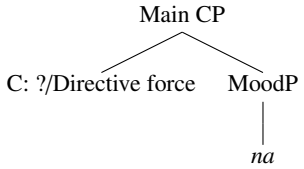
in Mood phrase and that it behaves as a possibility modal— a position that receives support from the fact that *na* itself appears with other illocutionary forces, e.g. in questions, as we seen:

(34) Pjos na kerdise?
who that.SUBJ win.PERF.PAST.3SG
Who might have won?

Here we have a question, and the presence of the subjunctive particle does not turn the question into a command or a wish. It must then be understood that the subjunctive *na* does not have illocutionary force by itself, but as a modal it appears in the scope of various illocutionary forces. In this case, the subjunctive is equivalent to a possibility modal (Giannakidou, 2017). Oikonomou (2021) also argues that the subjunctive particle has modal content in her discussion of prioritizing predicates such as *simboulevo* 'advise'. Our thesis in Giannakidou and Mari (2021b), following Giannakidou (2017), is that in embedded clauses *na* has no modal meaning but in main clauses or when optional, *na* is akin to a possibility modal.

We schematize this discussion below:

(35)



In a main *na* permission or request, we assume that there is a covert Directive operator in C, and that *na* associates with a deontic modal base. The *na*-directive case is therefore very interesting as, first, it allows us to see that a modal analysis does not preclude the speech act component, and second it makes visible that there is matching in the quality of modality. The default force of *na* appears to be possibilit: *Na* appears with modal adverbs of possibility, but not necessity (Giannakidou, 2012, 2017) :

(36) a. Isos na efije o Janis.
maybe that.SUBJ leave.PAST.3SG the John
Maybe John left.
b. *Mallon na efije o Janis.
probably that.SUBJ leave.PAST.3SG the John
#Probably John might have left.

The subjunctive mood morpheme *na* is therefore a possibility modal, as Giannakidou (2017) has argued.

(37) $[\![\text{Na}_{main}\ (\text{NON-PAST}\ (p))]\!]^{M,i,S}$ is true iff $\exists w' \in M(i) \exists t' \in [t_u, \infty : p(w', t')$

In our theory in Giannakidou and Mari (2021b), the subjunctive *na* indeed is the modal head, with the modal adverb of possibility appearing in the meta-evaluation position *O*. A necessity modal is at odds with *na* because in Greek we only have agreement patterns, i.e. the modality needs to be matched, as we illustrated in chapter 2. Hence, though a particle, the Greek subjunctive behaves on a par with a modal verb in main clauses. Crucially, when co-occurring with modal adverbs, Greek *na* cannot be argued to be higher than Mood, obviously. In embedded clauses, on the other hand, *na* has a life as a subordinator, and for this reason it is often characterized as a complementizer.

The important point is that the subjunctive directive sentence allows us to see that unembedded morphological mood in Greek functions as a modal element. If this is true for the subjunctive, it is plausible to think that it will be true of the imperative too. And if the subjunctive is akin to possibility, then it is also plausible to assume that the imperative cannot be exactly identical.

We will propose in this chapter that the imperative, given its flexibility, can be understood as a modal element, just like the subjunctive *na*, coupled with an illocutionary force operator in C. We will adopt that structure above from Greek where the illocutionary force Directive resides in C (see Portner et al., 2019, for a Jussive Phrase which also licenses the subject of imperative, i.e., the addressee). Just like the subjunctive, the imperative is generated in Mood, which we can see easily in languages like Greek and Italian where it is a morphological mood. But unlike the subjunctive, the imperative moves to C where it acquires directive illocutionary force. Before we go to the specifics of this analysis, we will consider the main strands of literature for the imperative, and the theories they have produced.

7.4 Theories of imperatives

During the past four decades of research, the imperative has received a lot of attention (see Von Fintel and Iatridou, 2008; Jary and Kissine, 2014, for overviews). Generally, the literature makes a dichotomy between the so-called minimal approaches which assume that imperative sentences are not propositions, and the modal approaches which argue in favor of a modal operator in

the semantics (as we just did with the subjunctive). Our framing on the subjunctive relates to both types of approaches and allows a conceptualization of the imperative structure as containing both modality and illocutionary force as two distinct components.

7.4.1 Non modal approaches

The minimal approach to imperatives says that there is no modal operator in the semantics of an imperative clause (Hausser, 1980; Portner, 2004, 2007; Pak et al., 2008; Mastop, 2005; Starr, 2020; Von Fintel and Iatridou, 2017; Roberts, 2018; Oikonomou, 2021). Portner (2007), following Hausser (1980), proposes a rather minimal denotational semantics, according to which imperatives denote a property that is restricted to the addressee:

(38) $[\![\textit{read this book}]\!] = \lambda x[x \text{ is the addressee and } x \text{ reads this book}]$

The directive discourse function of imperatives comes from the pragmatics. This type of analysis is typically accompanied by a theory of the dynamic pragmatics that addresses how imperatives change the context, and there is a variety of proposals, all positing a separate discourse component that the imperative clause type specializes in updating. Specific proposals about what the discourse component include the to-do-lists (TDLs) of Portner (2007), plan sets of Han (2000), permissibility spheres of Lewis (1979), or the effective preference structures of Condoravdi and Lauer (2012).

Portner (2004, 2007) suggests that the imperative is a different clause type along with declaratives and interrogatives. Following the Stalnakerian picture, declaratives update the information in the common ground by addition; Portner suggests a parallel function for imperatives to add properties to the so-called To-Do-List for the addressee (similar to the plan set in Han, 2000).

The problem with this approach is the flexibility of the imperative— the fact that it adds not only something that is to do, but also something that is merely to consider, a choice as we said (see also Von Fintel and Iatridou, 2017) and Condoravdi and Lauer (2012). Condoravdi and Lauer identify a series of uses of imperatives, just as we did earlier in the chapter; the list includes directives (subdivided into command, warning, requests, advice, pleas), wish-type uses (sub-divided into well-wish, curse, addressee-less wish), permissions and invitations, and disinterested advice. The following examples are from Condoravdi and Lauer (2012, p. 38sqq).

(39) *Directives*

a. Stand at attention ! (command)

b. Don't touch the plate! (warning)
c. Hand me the salt, please. (request)
d. Take these pills for a week. (advice)
e. Please, lend me the money! (plea)

(40) *Wish-type uses*

a. Get well soon ! (well-wish)
b. Drop dead ! (curse)
c. Please, don't rain ! (addressee-less wish)
d. Be blond ! (absent wish)

(41) *Permissions and invitations*

a. Ok, go out and play. (permission/concession)
b. Have a cookie(,if you like). (offer)
c. Come to dinner tonight(, if you like) (invitation)

(42) *Disinterested advice*

A: Excuse me, how do I get to San Francisco ?
B: Take the train that leaves fro over there in 10 minutes.

The observations here are parallel to those discussed at the beginning of the chapter, and indeed hold for both imperatives and directive modals. There are basically two kinds of imperatives: imperatives of compliance (commands, recommendations, requests), and imperatives of choice (the softer ones, where no strict compliance is expected). One can view the relation between the two as the weakening of the former in the later.

According to Condoravdi and Lauer (2012), imperatives are intimately tight to preferences of what we call deontic authority, and use a set of 'effective' preferences, which are maximal sets of consistent propositions that best reveal the preferences of this authority. The goal of the imperative is for the addressee to adopt these preferences and become an agent that carries out action in accordance to the effective preference. While their system envisions a representation whereby choices can be made (and ultimately the action might not be carried out), there remains a strong requirement that the effective preference is endorsed by the addressee. In their terms: an imperative is true "iff the speaker *S p* is committed to a preference for the addressee *Ad* to effectively prefer that *Ad* be at the airport at noon" Condoravdi and Lauer (2012, :47).

Condoravdi and Lauer are aware that the requirement that the preferences be endorsed by the addressee is too demanding; in simple choice cases, the effective preference is a mere suggestion and not a directive for adopting the preference (let alone carry out action). There is also always the possibility,

even if adopting the preference, of not carrying out p for independent reasons. Conversely, when I am asking my neighbor to stop his loud music, I am not asking them to adopt my preferences either; it would be fine for them to stop the music even if they prefer not to. Of course, if the addressee does not to endorse the effective preference, they will also not carry out action.

The idea that the deontic authority is committed to the addressee adopting a preference is not itself commitment to act but rather commitment to impose a preferential attitude, and the step of how adopting the preference guarantees taking action is missing. In simpler terms, the requirement that the speaker imposes a preference to the addressee is both too strong and too weak: it doesn't capture the softer mere choice cases, while also not connecting the strength of potential endorsement to conditions of compliance.

What Condoravdi and Lauer propose is an underspecified semantics where imperatives convey an effective preference of the speaker that the addressee carries about p. let PEP_w is the effective preference set:

(43) a. Close the window!
b. $\lambda w[PEP_w(S\,p, \lambda u[Ad\,\text{closes the window in}\,u])]$

With this semantics, context determines the force of the imperative uniquely in each case. The semantics of the imperative is rather vague, and the context will provide the necessary specifications to make it work. This theory, then, is quite minimal. All minimal approaches fail to capture the parallel between imperatives, directive modals and the subjunctive that we have pointed out; they single out imperatives as special creatures with minimal semantics.

7.4.2 Modal approaches

On the modal approach of imperatives, the common denominator among various analyses is that they incorporate a modal operator into the semantics of an imperative clause (Han, 2000; Schwager, 2006; Kaufmann, 2012; Crnič and Trinh, 2009; Grosz, 2011; Oikonomou, 2016). The exact nature of this operator varies across the different approaches. Kaufmann (2012) proposes a rich denotational semantics, according to which imperatives denote modal propositions. *Open the door!* gets a semantics very close to *You should/must open the door*. A is the addressee.

(44) $[\![\text{Open the window !}]\!]^w = \forall w' \in \cap f(w)[\text{A opens the window in}\,w']$

We see here a universal quantifier that renders the imperative equivalent to a necessity modal.

In addition, there are presuppositions that ensure that imperatives are not used as statements about what is required but only as performatives that (attempt to) change what's required. The fact that there is a modal operator in the semantics allows Kaufmann to use all the machinery introduced by Kratzer in order to account for the variety of interpretations in imperatives, by employing different conversational backgrounds for the ordering source. Kaufmann derives wishes (g = what the speaker wants), requests/commands (g = what the speaker orders) and advice (g = preferences, or what is considered to be generally preferred) (see Kaufmann, 2012, section 4.1). For the weaker readings, some extra machinery needs to be involved to weaken the universal force, and in some cases the results are derived on a case by case basis.

Oikonomou (2016), on the other hand, starts with a weaker analysis of the imperative as a deontic possibility, and uses exhaustification to derive the stronger readings. An exhaustive possibility amounts to a necessity. Kaufmann (2012, 2019) also assumes that covert exhaustivity combined with possibility constitute together the imperative operator. Under her view, when we get a possibility reading there is some mechanism which removes exhaustivity; but in Oikonomou's system the possibility is the default.

One argument in favor of the existential analysis is that free choice items (FCIs) appear in the imperative with permission readings only (Giannakidou, 1997, 1998, 2001; Schwager, 2006; Aloni, 2007; Kaufmann, 2012, a.o.).

(45) a. Pick any flower!
b. Pick any press!

If you actually pick every dress, Giannakidou (2001) argues, you have not understood what imperative was about. Giannakidou also posits an existential quantifier as a default for these imperatives, and points out that necessity modals do license FCIs:

(46) a. Any minors must be accompanied by their parents (Giannakidou, 2001, 126).
b. Any pilot must be out flying planes today. (Dayal, 1998, 457).

Therefore the argument for existential analysis relying on FCIs is not fully waterproof.

7.5 Strengthening and weakening of imperatives

Here we discuss the occurrence of strengthening or attenuating particles with imperatives, and we take them to suggest that the imperative has a default unspecified for bias. Important in the argument is also the fact that the subjunctive directive which we examined earlier has a possibility default.

In Greek, the imperative is compatible with the particle *ja* which seems to strengthen it:

(47) Ja ela edo!
ja come.IMP.2SG here
Come here, won't you!

(48) Ja katse fronima!
ja sit.IMP.2SG quite
Be quite, won't you!

As indicated, *ja* appears to function as a bias inducing adverb, and creates an imperative that is incompatible with the polite form *parakalo/please*, as we see:

(49) #Ja ela edo parakalo!
ja come.IMP.2SG here please
Intended: Come here, please!

(50) #Ja katse fronima parakalo!
ja sit.IMP.2SG quite please
Intended: Be quite, please!

If we add *ja* to the PLEASE imperative we get an odd or funny effect, exactly because of the contrast between the immediacy of *ja* and the weakening of *parakalo/please*. *Ja* does not seem to be a good vehicle for a mild request. (We thank Despoina Oikonomou for discussion on this point.).

Likewise, *ja* is infelicitous with the optative and subjunctive because they are weaker directives, merely choice offering:

(51) Na grapseis edo to onoma sou.
SUBJ write.IMP.2SG here the name yours
You should write your name here.

(52) As grapseis edo to onoma sou.
as write.IMP.2SG here the name yours
You can write your name here.

(53) #Ja na/as grapseis edo to onoma sou.
ja SUBJ/OPT write.IMP.2SG here the name yours

You should write your name here.

The pattern we observe here is reminiscent of modal spread, indicating that the *ja* particle strengthens the imperative default like an adverb, i.e., by introducing bias. Conceivably, then, the imperative can be conceptualized as a non-biased necessity, like FUT.

McCready (2009) notes a similar pattern with Japanese *jo* which is claimed to strengthen a request, as in (54), where the speaker insists that the addressee buys a new skirt.[3]

(54) atarasii sukaato kat-te (yo)
new skirt buy.IMP (YO)
(Come on,) Buy me a new skirt!

The translation *come on* seems appropriate for *ja* too.

By contrast, attenuating particles are also common cross-linguistically. D'Antuono (2020) recalls the German *bloss*, as in (55).

(55) Ruf bloss die Polizei!
Call PRT the police!
Call the police (You may call the police, Call the police if you please)

The adverb *magari* in Italian has a similar effect. "Magari makes an imperative more of a suggestion than an order, or even an invitation. A *magari* imperative, like a pure imperative, apparently sounds more polite in offering a possibility rather than an order." (D'Antuono (2020, :86), see also Manzini (2015)).

(56) (Magari) prova (magari) in questo modo (magari)
magari try magari in this way magari
You may try this way.

Hence, we have strengthening and weakening going both ways, as we observed with flexibl necessity. D'Antuono notes further that the epistemic *forse* is infelicitous with imperatives— and we want to suggest that this may be due to blocking by *magari*, indicating that the two particles *forse, magari* may be semantic allomorphs in Italian, one for the epistemic and the other for the deontic domain.

Another interesting manipulation of imperative meaning that is found across languages is in interaction with space and time. The default strong force of imperatives can be strengthened (recall that the default strong force of MUST

[3] See also Davis (2009) for an implementation in dynamic semantics.

with a default *probably* can also be strengthened by *definitely*), most notably by a temporal adverb of immediacy:

(57) Na grapseis edo to onoma sou amesos!
SUBJ write.IMP.2SG here the name yours immediately
You must write your name here immediately!

Here we have an intensity parallel to the one observed earlier with *ja*. We can imagine a context where the addressee has refused or is reluctant to comply with the directive and write her name, and the use of IMMEDIATELY strengthens the subjunctive directive to a command.

Across languages, and most notably in Tariana, imperatives combine with deictic elements of proximity or distance. These are reinterpreted as indicating rudeness or politeness and ultimately as force manipulators, with polite imperatives ending up weaker than rude imperatives. The examples are from Alcázar and Saltarelli (2014) citing Aikhenvald (2010).

(58) pi-*ñ*ha-si
2SG.proximal.IMP.eat
Eat here ! (close to the speaker)

(59) pi-ñha-kada
2SG.distal.IMP.eat
Eat over there ! (away from the speaker)

We consider all these effects as metaevaluative, with the function of manipulating the commitment of the deontic authority, namely the speaker, as we will now show. The fact that imperative structures show empirically the effects of metaevaluation is in itself a good argument that imperatives, as a grammatical category, belong to the modal family.

7.6 Imperatives as flexible necessity modals

We propose that the imperative sentence contains a modal element akin to FUT and the Salish flexible necessity modal. In addition, there is illocutionary force operator in C (recall the Greek structure where there is both a Mood phrase and a distinct illocutionary force in C; (see Portner et al., 2019, for a Jussive Phrase which also licenses the subject of imperative, i.e., the addressee). Just like the subjunctive, the imperative is generated in Mood, since they are both morphological moods; the imperative moves to C where it acquires directive illocutionary force.

Recall that there are basically two kinds of imperatives: imperatives where compliance is expected (commands, recommendations, formal requests), and imperatives of choice (the softer ones, where no strict compliance is expected.). This flexibility is the what we expect with flexible necessity modals, universal in force but without default bias. Previous modal approaches assume a performative effect which they derive as a separate pragmatic component, most often rooted in the authority relation between the speaker and the addressee. We nonetheless believe that most of the imperatives do not need any hierarchy: when I tell my neighbor to stop his loud music, I have no specific authority, I am just issuing a request based on my preferences and rights to a peaceful rest. We thus use the term ' deontic authority' in a broader manner.

Recall the building blocks: the modal base encodes the deontic source. The modal authority issues the imperative, and it is by default the speaker. (On a sign, it can be the writer of the sign). An important point and difference between us and previous approaches is the distinction between knowledge at t_u and future expectations. Indeed, while Kaufmann (2012) assumes that the modal base of the speaker upon issuing the imperative is nonveridical (containing both p and $\neg p$ worlds), we assume that the speaker knows that p is not true at the time of utterance. M(i) thus contains only $\neg p$ worlds at t_u. Relatively to a future time t', instead, the modal base is nonveridical: the speaker is aware that p might not turn out to be true, that is to say, the addressee (or a third party in case of wishes) remains free not to carry out p. M(i), relatively to t' projects worlds in which p becomes true and worlds in which it does not.

As for $\text{Ideal}_{\mathcal{S}}$, this function delivers the worlds in the deontic, teleological or volitional modal base, a subset of M(i), in which all the propositions in $\mathcal{S}$ are true and where $\mathcal{S}$ is a set of propositions that corresponds to the deontic authorities expectations.

We will distinguish two versions of imperatives: those without bias (we will call them SHOULD imperatives), and those with bias (MUST imperatives). The former are the default:

(60) $[\![\emptyset$ SHOULD-Imperative (NON-PAST $(p))]\!]^{O,\text{M},i,\mathcal{S}}$ is defined only if the modal base M(i) is antiveridical at t_u and it is nonveridical relatively to a time t' future w.r.t. the utterance time. Relatively to t', M(a) is partitioned between $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds.
If defined,
$[\![\emptyset$ SHOULD-Imperative (NON-PAST $(p))]\!]^{O,\text{M},i,\mathcal{S}} = 1$ iff O is empty as per i & $\forall w' \in \text{Ideal}_{\mathcal{S}} \exists t' \succ t_u p(w', t')$

The imperative is a necessity modal without bias by default. As we noted, the

modal base is anchored to i: the preferences, the goals, the expectations are all anchored to the speaker as the deontic authority. The worlds in which p becomes true are those in which the preferences of the speaker becomes true in virtue of the addressee or a third party action (as in the modal approach), but the addressee is not a parameter of the interpretation function.

As we observed, the meta-evaluation can be strengthened to bring bias, in which case we have the MUST-imperative with bias:

(61) $[\![\emptyset$ IMPERATIVE-MUST (NON-PAST $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}}$ is defined only if the modal base $\mathrm{M}(i)$ is antiveridical at t_u and it is nonveridical relatively to a time t' future w.r.t. the utterance time. Relatively to t', $\mathrm{M}(a)$ is partitioned between $\mathrm{Ideal}_{\mathcal{S}}$ and $\neg\mathrm{Ideal}_{\mathcal{S}}$ worlds. If defined, $[\![\emptyset$ IMP-MUST (NON-PAST $(p))]\!]^{O,\mathrm{M},i,\mathcal{S}} = 1$ iff: $\mathrm{Ideal}_{\mathcal{S}}$ is a better possibility with respect to $\neg\mathrm{Ideal}_{\mathcal{S}}$ relative to $\mathrm{M}(i)$ and O as per i & $\forall w' \in \mathrm{Ideal}_{\mathcal{S}} : \exists t' \succ t_u\ p(w', t')$

Greek and Japanese *ja, jo* mentioned earlier are bias bringing elements, only now bias is not rooted in evidence but derives from the deontic source— and the very fact that the speaker is the deontic source, giving us the performative effect. Ultimately, as with epistemic necessity, the type of source (in the case of the epistemic modal: the evidence) determines the force of the metaevaluation: if the source is a volition or a goal the metaevaluation will deliver a quite strong preference and ultimately, we will have a command and the performative expectation will be strong. But if the deontic source is a hopeless preference, then the metaevaluation will deliver an empty ranking resulting in a mere wish. Metaevaluation manipulates the bias as with epistemic modals. Wishes and advices are therefore deontic *SHOULD* as non-biased necessity modals. In other words, when the imperative contains bias it becomes a strong directive, and when it doesn't it become a choice imperative.

As we demonstrated in section 3, imperatives, unlike modals, also feature a speech act operator in the pragmatics: imperative sentences becomes a command or a choice imperative depending on the strength of the metaevaluation that, as we have just mentioned, is ultimately grounded in the deontic source and authority. All these parameters are, for the imperatives, anchored to the speaker and $\mathrm{Ideal}_{\mathcal{S}}$ worlds are those in which the expectations of the speaker are fulfilled. We view the deontic authority as the directive counterpart to evidence that grounds epistemic authority with the speaker. The deontic source creates conditions for full compliance (as in command), partial compliance (as in directive but non-commanding deontics and imperatives), or trivial compliance as in the case of simple wishes (*Get well soon! Go left, go right; I*

don't care). This analysis, we feel, naturally extends to optatives (Grosz, 2012), which can be understood as choice SHOULD imperatives.

7.7 Summary

In this chapter we focused on directive or priority modality, which includes deontic, bouletic modals and imperatives as a class of modal expressions that can be understood as relying on goals, desires, and rules that must be followed. Imperatives and directive modals involve the same mechanisms: teleological or bouletic modal base, meta-evaluation. The imperative mood, we argued, is effectively the counterpart of the flexible necessity modal (realized by the future and unitary modals we discussed in chapter 4) in the realm of directive modality.

Imperatives, we argued come in two varieties: those that express high priority directives (commands), and those that simply present a choice. The later, we argued, is the default. This analysis captures very easily what appears to be "force" flexibility in the imperative sentence which is used in a wide array of cases, from mere wishes to commands.

In the end, directive modality, while differing in the type of modal base used, doesn't differ much in terms of anchoring to an individual authority. The authority is always the speaker who, in the epistemic case, assesses evidence and commits to the truth of the propositional content she asserts; but in the directive case, the speaker functions as the deontic authority relying on what she needs to be done or an external deonitc source. With strong directive modals, in addition, the goals of the addressee (the deontic subject) also play a role in shaping the authority's motivation for issuing a directive: for instance, when I utter *My daughter needs to submit her college application by Tuesday*, I consider my daughter's needs. Likewise if I utter *If you are hungry, order a pizza* I offer a choice that considers the addressee's needs.

Questions and further readings

Questions

- In this chapter we developed the concept of deontic authority. Think of how this authority differs from the epistemic authority which is the speaker when assessing truth in epistemic modality. What kind of commitment is determined or required in the deontic case? Are compliance and veridical commitment unrelated?

- An important portion of imperatives is characterized, as we said, by speaker's priorities and preferences that present the addressee with a choice rather than a command. Think of this difference and possible morphological marking of it crossliguistically. Would it be possible to actually find a language that has two types of imperatives, one for command one for choice? This distinction seems to be central in directive sentences, and it is fruitful to ponder on how it lexicalizes in the modal systems generally.
- The attenuating or strengthening particles, we argued, are evidence for the existence of modal spread in the directive structures. Think of examples various languages. Can we have just the particles barring the modal head? Why, or why not?
- In our approach, asserting a sentence with a deontic modal and issuing an imperative amount to very similar speech acts, i.e., issuing a directive. Issuing a directive is a form of assertion. What are the implications of this analysis for speech act theory? Do we need a special speech act for the imperative? We showed that there are many advantages for treating imperatives and deontic modals on a par— in terms of common structures and ingredients, as well as crosslinguistic generalizations. Can you think of arguments for a need to keep imperatives as a distinct category?

Further readings

The introductory book Jary and Kissine (2014) is a very useful reference. The foundational pieces Portner (2007); Kaufmann (2012); Condoravdi and Lauer (2012); Von Fintel and Iatridou (2017) are also highly recommended. For a famous criticism of imperatives as modals, see Ross (1944).

8

Modal structure in questions: reflection, *aporia*, and bias

In this final chapter, we study the epistemic uncertainty that characterizes questions. While questions are different from modal statements— in that they lack truth conditions, and they are typically requests for information rather than assertions— questions and modal statements share the nonveridical state of uncertainty as their foundational semantic core. When one asks a polar question one is considering two options, p and its negation, just like with modal statements. Nonveridical equilibrium characterizes the neutral information seeking question, and modal verbs and particles do occur in questions producing further epistemic weakening, which we call *reflection* in the title. Reflection is a stance of *aporia*, an enhanced inquisitiveness in the Socratic sense, i.e., in order to introspect rather than seek a definitive answer. We show a number of empirical similarities between modal expressions and questions, including the robust use of aporetic particles in questions crosslinguistically. The well known phenomenon of rhetorical bias in questions, on the other hand, is evidential in nature just like modal bias. This chapter explores an analysis that allows us to unify the two hitherto unconnected phenomena of bias and reflection— and by exploring the purely semantic properties of epistemic modals to derive the effects, we render appeal to a speech act operator for questions unnecessary.

8.1 Manipulation of the nonveridical partition

The literature on interrogative sentences and their denotations, i.e., questions, is extremely vast and it is by no means our goal here to provide an overview. While in natural language semantics and in speech act theory the distinction between an assertion and a question is taken as basic (Groenendijk and Roelofsen, 2009; Ciardelli et al., 2013), when we look at modal sentences and questions together we find them to form a natural class as they both convey non-

veridical epistemic states of uncertainty that allow p and $\neg p$ as open possibilities. In a recent paper, Giannakidou 2013 emphasized that the prerequisite for asserting with a modal and for questioning is that the speaker is in a state of uncertainty in both cases, i.e., she is in an nonveridical information state where p is not settled: p and its negation being open possibilities. Therefore, in terms of what the speakers knows or can commit epistemically to, the difference between a question and modalized assertion is not categorical: both raise the possibility of the prejacent p being true, but do not commit the speaker to p, they do not assert p.

Inquisitiveness and modal uncertainty, in other words amount to the same epistemic state— and Giannakidou (2013a) argued that given that allowing p and $\neg p$ is the hallmark of inquisitive sentences (questions), we can think of nonveridical assertions as *inquisitive assertions*. Thus, Giannakidou argues, if we take the definitional property of modals— nonveridicality— into consideration, the distinction between assertion and question is not categorical: assertions do not form a natural class because nonveridical assertions pattern epistemically with questions. This means that the difference between questions and assertions as a division of labor between informativity and inquisitiveness cannot be categorical either.

In view of our discussion of modal sentences thus far, and specifically the concepts of nonveridical equilibrium and modal bias— which is evidential in epistemic modality or preferential with directive modality, as we saw— it can be argued that bias creates partial informativity in necessity modal assertions, and when present also in questions. Let us start by considering, then, how bias is manifested in questions.[1] We then move to present the phenomenon of reflection. These are the two main kinds of manipulation observed in questions.

8.1.1 Rhetorical bias in questions

While the denotation of a plain interrogative such as (1) is a question as request for information, the biased questions in (2) also convey the speaker's assessment that a positive or negative answer is more likely. This has been called in the literature rhetorical bias, and it can be positive or negative. Observe the contrast below:

(1) Is Ernie a vegetarian?

(2) a. Isn't Ernie a vegetarian? ('high' negation: positive bias)
b. Ernie is a vegetarian, isn't he? (negative tag: positive bias)

[1] For clarification: interrogative and declarative are labels that apply to sentences; the denotation of an interrogative sentence is a question.

c. Is Ernie really a vegetarian? (adverb *really*: negative bias)

The question in (1) is a neutral information seeking yes/no, or polar, question; the other two questions are often called rhetorical and the rhetorical effect is that the speaker has prior assumptions that establish a preference in the positive or negative direction, hence the terms positive and negative answer.

A speaker uttering a plain yes/no question is in a state of 'true' uncertainty: she does not know if Ernie is a vegetarian and poses the question as a request to find out. The polar question is therefore 'information seeking' and does not discriminate towards one answer or the other. This state of neutral uncertainty between p and its negation has been characterized as nonveridical *equilibrium* as we said: the two options are entertained by the speaker as equal possibilities upon asking the question. Recall:

(3) Nonveridical equilibrium
A partitioned (p and $\neg p$) epistemic or doxastic space M(i) is in nonveridical equilibrium if p and $\neg p$ are equal options, i.e., they are not ranked; i is the individual anchor, by default in questions the speaker.

The egalitarian state of the nonveridical equilibrium is neutral because when deciding to ask an unqualified question the speaker has no priors (i.e. previously held beliefs or assumptions) as to the positive or the negative answer being more likely. The proposition *Ernie is a vegetarian* is not challenged in the context prior to asking the question, and the speaker who asks the question does not have any particular or reliable evidence that would make them think, before asking the question, that Ernie is or is not a vegetarian. Nonveridical equilibrium in questions is, in other worlds, the state of epistemic neutrality we found with possibility modals, with no preconditions on the context or the speaker's epistemic state regarding the questioned content.

The biased question, on the other hand, is discriminatory. When asking it, the speaker reveals that they actually do have some prior assumptions that create expectations— maybe some reliable evidence, as in the case of epistemic modals— which preempts preference of one possibility while both options are still entertained. For instance, the speaker would choose to qualify the question (with negation, with *really*) and asks (2-a)-(2-b) only if she is considering, prior to asking the question, that *Ernie is a vegetarian* is a more likely answer (see Ladd (1981) for the initial observation). The similarity with modal bias in necessity statements (*Ernie must be a vegetarian*) is straightforward (see Larrivée and Mari (2022) for the parallelisms between high-negation biased questions and necessity modals). In both cases, the speaker is not in a state of

complete ignorance, but possesses some indication that preempts them to favor one answer over the other.

Importantly, as emphasized i more recent work by Giannakidou and Mari (2019) evidential bias is not equivalent to believing or knowing that *Ernie is a vegetarian*; if the speaker had formed that belief or knew that Ernie is a vegetarian, they wouldn't have asked the question. This is an important point to note, again in similarity with the MUST modal statement.

In (2-c) with *really*, the speaker is having reasons to think that *Ernie is not a vegetarian* is a more likely answer. Here we have negative bias.[2] Again, this is not a belief that Ernie is a vegetarian; if the speaker believed that already, there would be no need to ask a question. With biased questions uncertainty still exists about what the true answer is, just like with MUST statements, but the speaker comes to question not from a neutral stance but from a discriminating one: she ranks the two possible answers, and has prior assumptions that favor the one or the other. Those assumptions need not be hard core evidence, for instance having seen Ernie eating meat. Any kind of suspicion, or rumor would be enough to make the questioner ask with bias.

Bias thus manipulates the neutrality of equilibrium in a positive or negative direction by the speaker's epistemic state which contains suggestive evidence in support of the positive or negative answer. The speaker chooses to add certain devices to theList.pdf question, such as high negation (2-a), a negative tag (2-b), or the adverb *really* (2-c) to indicate asking with bias. The choice to add these devices reveals to the audience that the speaker abandons neutrality and questions with preference towards a (positive or negative) answer (Sadock, 1971; Ladd, 1981; Abels, 2003; Van Rooij et al., 2003; Romero and Han, 2004; Reese, 2007; Asher and Reese, 2007; Krifka, 2015; Malamud and Stephenson, 2015; Farkas and Roelofsen, 2017; Larrivée and Mari, 2022; Giannakidou and Mari, 2021b, 2019; Matthewson, 2023, a.o.). In (2-a)-(2-b) the speaker has a positive bias and seems to believe it more likely that Ernie is a vegetarian; in (2-c), by adding *really*, the speaker intends to show that they doubt that Ernie is a vegetarian.

Biased questions, then, are not mere requests for information; just like asser-

[2] Negative bias is also famously observed with negative polarity items (NPIs) (Borkin, 1971; Giannakidou, 1997, 2007; Van Rooij et al., 2003; Guerzoni, 2004; Guerzoni and Sharvit, 2007, a.o.) :

(i) a. Have you spoken to Mary even once? (NPI: negative bias)
b. Did Mary lift a finger to help? (NPI: negative bias)

The speaker here has a negative expectation that the addressee has not spoken to Mary or that Mary did not help. In both cases, bias arises because the speaker decided to augment the questions with a focused NPI.

tions, they rely on the speaker's prior doxastic and epistemic assumptions and expectations.[3] In this respect, they lie on a continuum between questions and assertions: they ask whether *p* but also discriminate towards *p*, or its negation. Notice that in the tag question (2-b) we actually do have a hybrid declarative and interrogative sentence. Importantly, the bias can also famously be canceled by the addressee with an answer of the unexpected polarity. Bias is a choice that the speaker makes based on their assumptions and contextual evidence but it is not a common ground presupposition, as we emphasized in Giannakidou and Mari (2019); Liu et al. (2021), hence it can be objected to by another speaker.

The phenomenon of bias is, therefore, a good testing ground to establish a parallel between the structure of questions and the structure of modality. Questions and possibility modals share an important piece of meaning: they express nonveridical equilibrium. When a bias device is used, the device manipulates the equilibrium by introducing a ranking function. This is grammaticalized in modality with necessity modals such as MUST and their equivalents (Giannakidou and Mari, 2016c, 2018a, 2021b,a)— and the expressor of the ranking function can be an overt adverb as we said earlier, or a covert one. Bias inducing devices in questions contribute or manipulate a ranking. The different effects, positive or negative, are due to the lexical contribution of the bias inducing device.

8.1.2 Reflective questions and enhanced inquisitiveness as *aporia*

We will now consider the pragmatic dual of rhetorical bias: the use of modal particles and verbs in questions, resulting in the question now becoming 'weaker'. Weaker means that it is now harder to see what the answer to the question will be to the extent that the question might even be unanswerable. Since Giannakidou and Mari (2019), we call such questions *reflective*; in recent literature other labels have been used such as 'conjectural' (see a.o. Littell et al. (2009); Giannakidou (2017); Matthewson (2010); Eckardt and Beltrama (2019); Eckardt (2020); Mari (2021)) and 'unasked' (Von Fintel and Iatridou, 2019).[4]

The term 'unasked' in particular suggests— in agreement with what we have argued and will further pursue here— that this type of question is so non-canonical that is not even asked. We chose the word 'reflective' for a similar

[3] There is also bias relating to evidence available in the common ground (*evidential bias*, Buring and Gunlogson (2000); Romero and Han (2004); Northrup (2014); Domaneschi et al. (2017), or answer bias (Krifka, 2015; Malamud and Stephenson, 2015). We will not discuss common ground bias here; recall our earlier discussion in chapter 6 on evidentials.

[4] Farkas (2022) studies 'non-intrusive' questions. It is debatable whether these are equivalent to conjectural questions, a delicate matter that we do not address here.

reason, namely to indicate that what the speaker is doing with this type of question is not asking for information, but rather he takes the stance of introspective reflecting, which is, we newly claim, akin to Socratic *aporia*: a characteristic state of puzzlement and perplexed inquisitiveness that figures prominently in the Platonic dialogues. Aporia is an attitude of enhanced inquisitiveness where one raises the question in an open-ended manner, entertaining multiple options without expecting a definitive specific answer. Many Platonic dialogues end in a state of aporia, masterfully, in order for Socrates to illustrate that certain questions are had to answer.

The reflective question is well documented for a number of languages including English, Greek, Salish, Romanian, Japanese and Korean (Kang and Yoon, 2018, 2019). Let us consider first some data with possibility modal verbs in English:

(4) a. Might/*must she be a spy?
b. Where might/*must I have put my glasses?
c. Is Ariadne at home, I wonder.

The reflective question is qualified with a possibility verb, or *I wonder* has been added. In this case, in fact, the sentence sounds more like an embedded question. Notice the unacceptability of the MUST modal, which seems to be a general phenomenon. In Italian, for instance, we find the modal *potere* and the necessity modal *dovere* is likewise banned; the unbiased future modal is OK (Mari, 2021).

(5) Dove possono/*devono essere i miei occhiali ?
where might/*must be the my glasses
Where might my glasses be ?

(6) Dove saranno i miei occhiali ?
where be.FUT.3PL the my glasses
Where might my glasses be ?

In Greek, we have the subjunctive and modal particles like *araje*:

(7) Ti na kanei araje i Ariadne tora teleftea?
what subj do.3SG PRT the Ariadne now lately
What might Ariadne be doing nowadays?

(8) Pu *na* evala (araje) ta gialia mou?
where subj put.past.1SG PRT the glasses mine
Where might I have put my glasses?

This type of question can also be understood as being monologic in character, as it can be addressed to oneself. For instance an absent-minded speaker is looking around, a bit puzzled perhaps as she can't find her glasses; and a speaker who hasn't seen Ariadne in some time is wondering what might have happened to her. But the reflective question doesn't have to be self-addressed— it can also be a question that I address to someone else, but with reduced expectation that the addressee will know the answer.

The question does seem unanswerable at the time of asking:

(9) Na perase araje to test odijisis i Ariadne?
subj passed.3SG araje the test drigin the Ariadne
Could Ariadne have passed the driving test, I wonder.
Might Ariadne have passed the driving test?

Given that Ariadne is not here to give us an answer and that the reflective question doesn't an authoritative addressee, formulating it in this manner reveals less of a desire, on the part of the speaker, to receive a specific answer and more a desire to reflect on whether Ariadne passed the test, or what Ariadne is up to.

Lyons, in the passage below, describes a difference between asking a question and what he calls merely 'posing' a question (Lyons (1977); Von Fintel and Iatridou (2019)):

(10) a distinction between asking a question of someone and simply posing the question (without necessarily addressing it to anyone). When we pose a question, we *merely give expression to, or externalize, our doubt* [emphasis ours]; and we can pose questions which we do not merely expect to remain unanswered, but which we know, or believe, to be unanswerable. To ask a question of someone is both to pose the question and, in doing so, to give some indication to one's addressee that he is expected to respond by answering the question that is posed (quoted from Gärtner and Gyuris (2012)).

We will interpret the above text as saying that merely posing a question is akin to taking a stance of *aporia*, i.e, she adopts an introspective reflective state of enhanced inquisitiveness. We find aporia in platonic dialogues where a question is posed— e.g. what might the nature of knowledge be? What might be the nature of justice?— in order to introspect knowing that at best we can produce tentative or partial answers, or perhaps no answers at all. Importantly, philosophical questions of the Socratic kind manifest themselves as reflections very naturally, with the subjunctive and particles:

(11) Pja na ine araje/taxa i fysi tis dikaiosynis?
what sub be.3SG PRT/PRT the nature the.GEN justice.GEN
What might the nature of justice be?

Asking this question, which can be done with an audience present opens a theme for introspection, which itself suggests that such questions are not monologues. Both speaker and audience enter the discussion with open mind and awareness that they are not looking for a definitive answer. Formulating the question without the particles deprives it from its philosophical, open-ended character:

(12) Pja ine i fysi tis dikaiosynis?
what be.3SG the nature the.gen justice.GEN
What might the nature of justice be?

The question now is posed specifically, with the expectation of a specific answer; but for a question on this broad and complex topic, asking it this way deprives it of its aporetic character. We will use the word reflection to capture what the speaker is doing with these aporetic questions. A reflection is an attitude or aporia namely enhanced inquisitiveness— and while it is expressed with an interrogative sentence, the perlocutionary effect is not to give an answer but entertain and negotiate possibilities. This is why reflecting is not, strictly speaking, request for information— and why we must conclude that the interrogative sentence is not categorically associated with information seeking.

The aporetic effect of reflection is clearly distinct from rhetorical bias:

(13) Didn't Ariadne pass the driving test?

As we noted earlier, negation is known to create positive bias, and a biased question is asked by a speaker who has prior assumptions about what would be a better answer. Reflection creates *anti-bias*, in the sense that while a biased speaker has a narrower epistemic horizon (tilted in one or another direction), the reflective speaker has a more open answer horizon. This is why we think reflection is the pragmatic dual of bias.

The aporetic effect of reflection is, we will argue here, enhanced inquisitivenss, and we will suggest that this is done with a meta-evaluation that produces epistemic widening by engaging with assumptions *not* previously entertained by the speaker. Farkas (2022) claims that with with reflective questions in Romanian (she calls non-intrusive) the speaker does not assume that the issue raised will be resolved in a future state of the conversation. Reflec-

tive questions have also been characterized as 'feigned monologues': Kang and Yoon (2018, 2019) in their discussion of questions with the particle *nka* in Korean note that by using *nka*, the speaker "reflects on her own background assumptions and is not simply requesting information from the addressee". *Nka*-questions, they argue, are *feigned monologues*, i.e., the speaker says something as if it were a monologue without expecting an answer. Because of the monologic nature of the question, it does not obligate the hearer to respond, hence these questions can often be self- addressed. While there may be differences across languages, these basic observations hold for the Korean, Greek, Italian, and English questions with epistemic modals and *I wonder*.[5]

The first analysis we know that addresses the use of possibility modals in questions is Giannakidou (2017) who discusses the subjunctive in questions. She argued that, in Greek, possibility modals and the subjunctive are equivalent, and that the MIGHT question's answer set contains modalized propositions. We will consider this analysis later and suggest that it indeed captures the case of asking a question where the issue is not p but the possibility of p. Aporetic reflection, on the other hand, can also feature a meta-evaluative layer manipulating the bias and thereby the speaker's assumptions towards one of the two possible answers, or any answer at all. We will develop this idea by focusing on *really* positive questions (section 3), on high negated positive questions (section 4), and we will address in section 5 the analysis of reflective questions.

8.2 Background on questions and their relation to assertions

The voluminous literature on questions and their varieties is built upon the foundational insight of Hamblin (1973): unlike assertions, questions do not have truth conditions, but denote sets, the sets of possible answers to the questions. There is thus a profound categorical distinction between an assertion and question— and this distinction reflects the general assumption of speech act theory that different syntactic sentence types of declarative, interrogative and imperative map onto distinct speech acts such as assertions, questions and commands respectively (Searle, 1969; Portner, 2018, for a recent discussion). When it comes to assertions and questions, most formal analyses assume a logical language that reflects a clear-cut syntactic distinction between declaratives and interrogatives often containing a designated speech act operator such as ASSERT and ? respectively (Krifka et al., 1995). Ciardelli et al. (2013) call those analyses *syntactically dichotomous*, and propose further that they are also

[5] On widening with exclamatives, see Villalba (2008) and discussion in Zanuttini and Portner (2003).

semantically dichotomous in assigning different semantic values to assertions (propositions) and interrogatives which are taken to denote questions, i.e., sets of propositions, as we just said.

Another clear example of dichotomous approach is the partition semantics of Groenendijk and Stokhof (1984), where a logical language is assumed to contain sentences of the form *?p* (interrogative), and *!p* (declarative), and every sentence in the language is either declarative or interrogative. The system is thus syntactically dichotomous; it is also semantically dichotomous in that declarative and interrogative sentences denote difference semantic objects. Declaratives denote *propositions* (sets of worlds): in uttering *Ariadne ate breakfast* the speaker provides information that the actual world is located in the p region given by *Ariadne ate breakfast*. But interrogatives denote questions in the technical sense: i.e. equivalence relations over the set of possible worlds. A polar question *Did Ariadne eat breakfast?* partitions the worlds into those where Ariadne ate breakfast and worlds where she did not, and the speaker asks which partition to place the actual world in. [6]

It is not our intention to reconsider this categorical distinction, but to shed light on a long-standing issue. To present the issue, assume the following equivalences:

(14) open = not close; close = not open

On the background of this equivalence, all the following questions have the same meaning, as illustrated in the set of the possible answers.

(15) a. Is the door open? {*open, not open*}
b. Is the door closed? {*open, not open*}
c. Is the door open or not? {*open, not open*}
d. Is the door closed or not ? {*open, not open*}
e. Is the door open or closed? {*open, not open*}

To account for the pragmatic differences among those questions (Bolinger, 1978; Biezma, 2009), a variety of revisions have been proposed. On the semantic side, notion such "highlighting" have been introduced (Roelofsen and Van Gool, 2010), whereby questions, while introducing alternatives, allow

[6] These quite popular distinctions are currently re-thought in the light of *inquisitive semantics*. Groenendijk originally envisioned a logical system where sentences are not distinguished syntactically as declaratives or interrogatives, and where sentences have both inquisitive and informative content. In a recent paper Ciardelli et al. (2013), claim that 'inquisitive semantics, as a general approach to meaning, does not require a clearcut syntactic distinction between declaratives and interrogatives." And Giannakidou (2013a) proposes that modal assertions, by being nonveridical, have inquisitive content and are thus not fully informative as veridical assertions.

highlighting one of them. The meanings of (15-a)-(17) would thus be respectively as (16-a)-(16-b):

(16) a. Is the door open ? {{open, not open}, {open}}
b. Is the door closed ? {{open, not open}, {not open}}

According to Biezma (2009) and further developed by Biezma and Rawlins (2017), these questions differ semantically in that the *or not* question, "exhaustifies" the alternatives.[7]

(17) a. Is the door open ? {open}
b. Is the door not open ? {not open}
c. Is the door open or not ? {open, not open}

If a question can denote a singleton alternative, it becomes hard to distinguish it from assertions (e.g. *The door is open*), on the assumption that both, in this case, denote the set of possible worlds where the door is open.

Pragmatic theories have thus posited two step mechanisms, where the notion of alternative answers is cast in terms of possible discourse continuations.[8] In Krifka (2015) commitment space semantics, when a positive alternative is highlighted as in (15-a), the speaker offers "open" for uptake, modifying the conversational context in such a way that acceptance of the addressee will definitely add it the common ground. If the addressee chooses "closed", some extra work to resume the overshadowed alternative is required. A similar mechanism was envisioned in Farkas and Bruce (2010), who resort to the notion of "table" as a preliminary limbo state where the proposition lies before making it to the common ground once the approval of the addressee is obtained.[9] With (15-a), the speaker proposes that "open" be added to the common ground (they use the technical notion of "push"), still leaving open both options {open, not open}. With the speaker proposes that "not open" be added to the common ground, again leaving open the possibility that either one of the options {*open, not open*} be finally added to the common ground (in technical terms, two common grounds are projected, one in which "open" is added, and one in which 'not open" is added). In these approaches, while categorically distinct, questions and assertions share a same mechanism (see Ginzburg, 1996): they raise an issue. For Ginzburg, adding a proposition is to raise an issue and the addressee need not reject it in order for the proposition to make it to the

[7] For further developments, see Beltrama et al. (2020).
[8] Van Rooij et al. (2003) the solution is in terms of Utility in terms of agent's goals: in (15-a), p being true would bring the speaker closer to their goals.
[9] Farkas and Bruce (2010) specifically work on reaction to questions.

common ground. What categorically distinguishes propositions and questions is that the latter add alternatives besides raising an issue. Modal sentences, as inquisitive assertions, also add alternatives as we saw, and this is a core similarity with questions.

Note that this idea is later developed in the inquisitive semantic frameworks, where both assertions and questions denotes sets of possibilities, that is to say, sets of sets worlds. The difference between assertions and questions emerges as one between informativeness and inquisitivity, defined as follows (see discussion in Groenendijk, 2007; Mascarenhas, 2008; Groenendijk and Roelofsen, 2009, a.o.) :

(18) Inquisitiveness in terms of possibilities Groenendijk and Roelofsen (2009), definition 9:

a. ϕ is inquisitive in σ iff there are at least two possibilities of ϕ in σ;

b. ϕ is informative in σ iff there is a possibility for ϕ in σ and ϕ excludes a possibility in σ.

Consider also the following fact, from Ciardelli et al. (2015):

(19) Inquisitiveness in terms of possibilities
ϕ is inquisitive iff there are at least two possibilities for ϕ.
ϕ is an assertion iff there there is exactly one possibility for ϕ.

In other words, an inquisitive sentence $?p$ expresses a partitioned epistemic state (two possibilities for p) but an assertion of p comes only with one possibility: p. This is true, however, only for veridical, i.e.past and present assertions. Nonveridical assertions such as modal sentences, on the other hand, as we have shown, also come with two possibilities and so they need to be thought of as inquisitive as Giannakidou (2013a) suggests. Hence, if we take veridicality into consideration, the difference between questions and assertions cannot be categorical, since assertions do not form a uniform class in presenting only one proposition. Nonveridicality allows us to see that the distinction between assertion and question is, epistemically, not as basic as we thought.

The division of labor between inquisitiveness and informativity, on the other hand, is argued to be categorical: in the case of declarative sentences, inquisitive content will always be trivial, while in the case of interrogative sentences, informative content will always be trivial (Ciardelli et al. (2013)):

(20) Inquisitiveness and Informativity

a. A question $?\phi$ has trivial informative content.

b. An assertion *Assert* ϕ has trivial inquisitive content.

Again, given that modal assertions do have inquisitive (nonveridical) content, one of the consequences of nonveridicality is that the division of labor between informativity and inquisitiveness cannot be categorical either. It is important to understand that full informativity cannot be the basis of assertion, as assertions differ in their veridical commitment, as we noted:

(21) Veridical commitment and informativity: (Giannakidou and Mari, 2016c):
>> means 'informationally stronger than'
Nonmodalized *p* (speaker know/believes *p*, *p* added to the common ground) >>
MUST *p* (speaker does not know *p*, but is biased towards *p*)>>
POSSIBLY *p* (speaker does not know *p*, and there is nonveridical equilibrium)

At the discourse level, then, only the veridical, fully committed assertion of a proposition *p* is a proposal to add this proposition to the common ground as public knowledge. Introducing a modal element creates an informationally weaker sentence from the perspective of the speaker. With a possibility modal, just as with a question, we simply don't know whether there is any evidence to support *p*; a possibility statement can be mere speculation or guess. Bias toward *p*, in turn, is informationally stronger than nonveridical equilibrium since now there is some evidence supporting *p* that renders it a better possibility, in the assessment of speaker, than its negation. But, in the end, only the bare sentence gives actual information about the world.

Our discussion in this book therefore has shown, echoing Giannakidou (2013a), that nonveridical assertions can be understood as having non-trivial inquisitive content since they entertain two options; and they are informationally weaker than past or present positive and negative assertions. So, from the point of view of nonveridicality, assertions do not behave as a uniform class, therefore a categorical distinction between assertion (trivial inquisitive content) and question (trivial informative content) is not desirable. Biased questions, at the same time, convey substantial background information; hence, though inquisitive, their informative presuppositional content is non-trivial. This suggests that the divide between inquisitiveness and informativity does not map straightforwardly onto assertion vs. question— lending support for the original conception of meaning as being semantically non-dichotomous.

Putting these issues aside, on the empirical side, the variety of questions cross-linguistically is impressive. Krifka (2021b) has proposed a baseline for questions in English that we reproduce here:

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Example	Short	Terminology
Is it raning?	PQ	positive question
Is it not raining?	NQ	negated question
Isn't it raining?	HPQ or HPQ/NQ	high negated positive question
Isn't it not raining? *Aren't there no restaurants here?*	HNQ	high negated negated question
Is it really raining?	reallyPQ or RPQ	*really* positive question
Is it really not raining?	RNQ	*really* negated question
IS it raining?	FPQ	focused positive question
IS it not raining?	FNQ	focused negated question
Is it REALLY raining?	FRPQ	focused *really* positive question
Is it REALLY not raining?	FRNQ	focused *really* negated question
It is raining?	DPQ	declarative positive question
Is it raining??	IPQ	incredulity positive question
Is it raining or not?	APNQ	alternative question w negation
Is the bridge open or closed?	AAntQ	alternative question w antonyms
Do you have any potatoes?	npiPQ	positive question with polarity item

Figure 8.1 Krifka (2021a) list of variety of English questions

With this background, let us now take a closer look on biased questions.

8.3 REALLY-questions and negative bias

Questions with the adverb *really* are known in the literature to express negative bias. We give below the English example and its Greek and Italian equivalents:

(22) Is Ernie really a communist?

(23) Ine o Ernie *pragmati/st' alithia* kommunistis?

(24) Ernie è *davvero* un comunista ?

By using REALLY (*really, pragmati, st'alithia, davvero*) the speaker seems to be genuinely interested in knowing if Ernie is a communist, like when one utters *I want to know whether Ernie is really a communist*. In addition, as we said at the beginning, in choosing to use REALLY the speaker intends to show that she has some doubt that Ernie is a communist (see also a recent discussion of the *really* effect in Cory and Todor (2020) and more references therein). With a REALLY question, the speaker acts as if she raises the stakes for the

addressee to give a truthful answer because her doubt indicates some clue that supports a negative answer. The adverb *wirklich* (the German counterpart of *really*) gives rise similarly to the same negative bias effect, as is experimentally confirmed in Liu et al. (2021) in questions and conditionals; and it was one of the most solid experimental findings in that work.

Romero and Han (2004) proposed an influential account of the adverb *really* as VERUM which we consider after we first lay out our modal analysis. The really effect occurs also in constituent questions, as in *Who did really go to Berlin?*, alternative questions (e.g. *Did he really go to Berlin, or not?*) and in declarative questions e.g. *He really went to Berlin?*.

Bias, as we said earlier, is the destruction of the egalitarian state of equilibrium in a positive or negative direction because the speaker has, prior to asking the question, some evidence that make them think that *Ernie is not a communist* is a better possibility than *Ernie is a communist*. For this reason, the stakes are higher for the answerer to show that he is not. Importantly, negative bias is not a belief that the prejacent is not true; it is rather, as with MUST, an indication that the speaker is considering a nonveridical partition and compares the likelihoods of p and $\neg p$. Unlike with MUST, the favored proposition now seems to be the negative one.

Bias is anchored to the speaker who ranks the two possibilities prior to asking a question, just like with MUST; it can thus best be understood— as suggested already by Liu et al. (2021), as a speaker-anchored definedness condition on asking the question. For Stalnaker (1978), and this is important to note, speaker presuppositions are preconditions that need to be satisfied before the common ground can be updated; hence they are requirements on the speaker's knowledge, not on the common ground.[10] We ask here how bias comes about with REALLY expressions. Part of the puzzle is also that REALLY expressions, while positive, they bias towards a negative answer.

Let us observe further that the negative bias of REALLY holds across nonveridical constructions, including conditionals (25-a) and imperatives (25-b). In the later case, we observe a similarity with the Greek *ja*-imperatives we discussed in chapter 7, where we argued that they bring bias:

(25) a. If John really studied very hard, he will pass the exam easily.

[10] Von Fintel (2008) and subsequent literature in the context change potential tradition think of the presuppositional component of the meaning of a sentence as being a requirement on the information state it is used to update. "Since the information state a sentence is used to update in the ideal case is the common ground, the presuppositional requirements are imposed on the common ground" (Von Fintel, 2008, :5). In effect then, definedness conditions can be understood as common ground presuppositions, or as in the Stalnakerian sense which effectively makes no distinction between felicity conditions of the speaker and common ground.

Speaker's assumption prior to the question: John most likely did not study very hard.

b. Really, close the door!
Speaker's assumption prior to the question: the addressee resists closing the door.

c. Ja klise tin porta! (Greek)
Do close the door!

The conditional protasis is another sentence where we find nonveridical equilibrium: the speaker entertains equally the possibilities of studying and not studying hard— Liu et al. (see 2021) for experimental parallels of the two environments. In imperatives, while the positive alternative is favored, the addition of REALLY and *ja* creates a context where there is evidence for some resistance. This generalized bias demonstrates that evidential bias is not something special about questions, as much of literature on questions seems to assume. In the unified perspective of the nonveridicality theory with the centrality of equilibrium and bias, the generalization seems natural and indeed can be used as evidence that the same mechanisms are at play.

The prior assumptions could be the speaker's private assumptions but they could also be contextual, as the two types of information intersect. In some cases, it could be merely a contextual challenge prior to assertion, as in the following example from Liu et al. (2021):

(26) A: I know, John told you that he will study very hard for the exam, but I am still worried.
B: If John really studied very hard, he will pass the exam easily. And if he says he studies hard, I believe him.

In this example, B is entertaining A's uncertainty about whether John studied hard, while also asserting his own position favoring the positive answer. As with MUST modals, the biased speaker has some evidence that establishes a preference in one direction or another.

In positive veridical assertions, REALLY again relies on prior assumptions that establish preference, but now in a positive direction. Observe the following example from Romero and Han (2004):

(27) a. ?I am sure I am tired.
b. I really am tired.

Here the speaker makes a positive statement against a background assumption that the speaker is not tired. As Romero and Han observe, 'other epistemic

certainty expressions' don't have this property, as can be seen. In our view, the contrast here is further evidence that REALLY is not an epistemic attitude, unlike *I am sure* (cf. *infra*). Rather, as a focus adverb, even in positive sentences REALLY depends on background assumptions, and it contrasts in polarity with the assertion of the REALLY statement. *I am not really tired* presupposes a context where the background assumption is that the speaker likely is tired (see Liu et al., 2021, for discussion and references).

8.3.1 The REALLY bias as metaevaluative ranking

The new analysis we will propose goes as follows. REALLY words (*really, truly, actually* etc.) are focus adverbials, and as such they are anaphoric to alternative assumptions prior to the assertion or question. In the positive assertion, the alternative contextual assumption seems to be that I am not tired. In the question, it seems to be that Ernie is likely a communist. Liu et al. (2021) call it *contextual* positive bias:

(28) Is Ernie really/truly/actually a communist?

a. Contextual positive bias: Whether Ernie is a communist is under discussion, and the contextual assumption is that it likely that he is.

b. Speaker negative bias: Ernie not being a communist is more likely that Ernie being a communist.

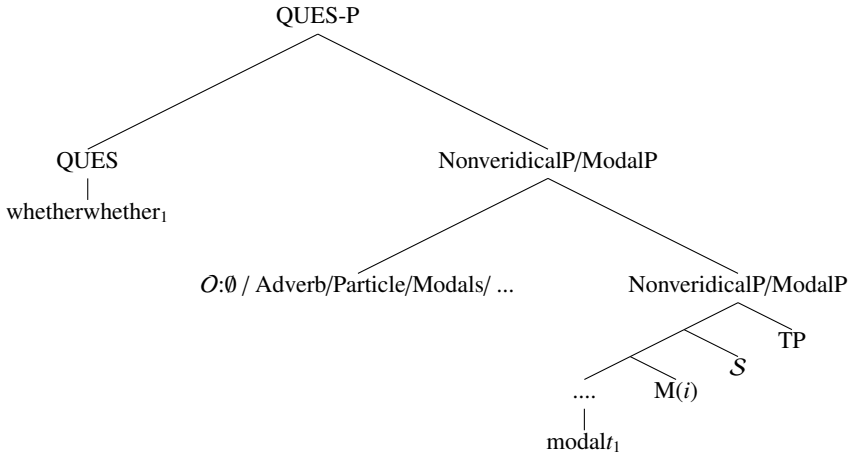
We thus have a contrast between the contextual assumption of REALLY words, which is positive, and the stance of the speaker who challenges it. The positive adverbs thus have an adversative function— which also follows from the fact that, being focus adverbs, they need to associate with a novel alternative will have to be the negative one.

? propose the following. They start with the basic equilibrium partition for questions which is that of possibility modals:

(29) $[\![\emptyset\,\text{MIGHT (PRES }(p))]\!]^{O,\mathrm{M},i}$ is defined only if
(i) $\mathrm{M}(i)$ is nonveridical and partitioned into $\{p, \neg p\}$ worlds, and if
(ii) O is empty
$[\![\emptyset\,\text{MIGHT (PRES }(p))]\!]^{O,\mathrm{M},i} = 1$ iff $\exists w'[w' \in \mathrm{M}(i) \wedge p(w')]$

This gives equilibrium, and as we see the meta-evaluative ranking is empty. Now, the syntactic tree for questions is as follows.

(30)



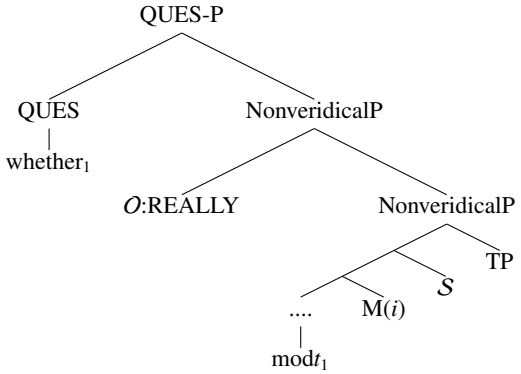
We see here the additional of the NonveridicalP/ModalP (see also Chatzopoulou (2018)) which will host the REALLY adverbial. The modal and question structure are distinguished in that the former has quantificational force and truth conditions, but the question does not have truth conditions.

(31) $[\![\text{QUES}\ \emptyset\ (\text{PRES}\ (p))]\!]^{O,\text{M},i}$ is defined only if
(i) M(i) is nonveridical and partitioned into $\{p, \neg p\}$ worlds, and if
(ii) O is empty
$[\![\text{QUES}\ \emptyset\ (\text{PRES}\ (p))]\!]^{O,\text{M},i} = \{p, \neg p\}$

REALLY only has presuppositional content: it introduces the ranking function O which now says that $\neg p$ is a better possibility than p:

(32) Is Ernie really a communist ?

(33)



(34) $[\![\text{QUES REALLY (PRES}\ (p))]\!]^{O,\text{M},i}$ is defined only if

(i) the modal base M(i) is nonveridical and partitioned into $\{p, \neg p\}$ worlds.
(ii) $\neg p$ worlds are better possibilities than p worlds
$[\![\text{QUES REALLY (PRES } (p))]\!]^{O,\text{M},i} = \{p, \neg p\}$

The assumption is made that the structure above is for both main and embedded questions, and in main clauses the QUES position can host a speech act operator. Modal sentences lack this additional layer. The question still denotes the nonveridical partition p and $\neg p$— but the worlds are now ranked by the speaker, and the negative worlds are judged to be better possibilities by the speaker upon asking the question. That the negative worlds are better possibilities means that the answer to the question will more likely fall in the negative space of the partition. In other words, the speaker prior to the question considers $\neg p$ more likely. This captures the negative bias accurately both in terms of it being a precondition on using REALLY and in terms of the contribution of REALLY being speaker driven.

The ranking is driven by the speaker's assumptions which counts as evidence for the preference, as we said. The REALLY bias, then, is akin to the evidential source with evidential markers that we observed in chapter 6: it is a contribution at the presuppositional level, driving the preference encoded in the metaevaluation.

The evidence could include beliefs, but REALLY is not itself an attitude of belief. REALLY does not have truth conditional (assertive) contribution in questions because questions do not have truth conditions and do not assert. It is unclear to us whether REALLY has assertive content even in assertions: *I am really tired* seems to just settle the statement (contested in the prior context, we we noted earlier, hence again adversative) in the positive, but whether there is additional contribution in the assertion, e.g., a degree reading, is an open question that we will not address here. The important proposal is that REALLY words function as modal adverbs that contribute a non-empty metaevaluation, hence the same mechanism of bias is involved in both modals and questions.

We move on next to consider the VERUM analysis of the REALLY effect.

8.3.2 VERUM

Romero and Han (2004)'s paper offered a view on REALLY as a VERUM operator, and this has set a benchmark in the literature on bias. We will address this influential analysis here.

VERUM is treated initially as a veridical operator akin to knowing or believing; Romero and Han call it "the run-of-the-mill epistemic operator denotation

[...], where x is a free variable whose value is contextually identified with the addressee (or with the individual sum of the addressee and the speaker)":

(35) $[\![\text{VERUM}_i]\!]^{g^{x/i}} = [\![\text{really}_i]\!]^{g^{x/i}} = [\![\text{be sure}]\!]([\![i]\!]^{g^{x/i}}) =$
$\lambda p_{<s,t>}\lambda w.\forall w' \in \text{Epi}_x(w)[p(w') = 1]$ ((40) in Romero and Han (2004))

The function defined here is "the correct denotation for straightforward epistemic expressions like *be sure, be certain*. But note that, though *really* or VERUM is often epistemically flavored, it is not interchangeable with pure epistemic expressions like *be sure*" (Romero and Han, 2004, :626). This is because REALLY is not an epistemic or doxastic attitude, as we have noted. Had VERUM conveyed the certainty or knowledge of p, it should have been unusable in questions which by definition presuppose uncertainty: if the speaker knows or believes that p is true, why bother asking the question? [11] VERUM cannot be a veridical operator as above, it cannot entail p.

Romero and Han acknowledge the problem and advance that "the intuition is that *really* or VERUM is used not to assert that the speaker is entirely certain about the truth of p, but to assert that the speaker is certain that p should be added to the Common Ground (CG). [...] REALLY/VERUM is a *conversational epistemic operator* [emphasis ours]." (Romero and Han, 2004, :627). They then offer definition FOR-SURE-CGx in their 43, where "$\text{Epi}_x(w)$ is the set of worlds that conform to x's knowledge in w, $\text{Conv}_x(w')$ is the set of worlds where all the conversational goals of x in w are fulfilled $\text{CG}_{w''}$ is the Common Ground or set of propositions that the speakers assume in w'' to be true (Stalnaker, 1978; Roberts, 1996)".

(36) $[\![\text{VERUM}_i]\!]^{g^{x/i}} = [\![\text{really}_i]\!]^{g^{x/i}} =$
$\lambda p_{<s,t>}\lambda w.\forall w' \in \text{Epi}_x(w)[\forall w'' \in \text{Conv}_x(w')[p \in \text{CG}_{w''}]] =$
FOR-SURE-CG_x ((43) in Romero and Han)

However, VERUM is now driven by common ground assumptions; but the REALLY bias (and bias more broadly, as we showed) is tied to the speaker. The speaker may be making assumptions about Ernie being a communist that could be entirely at odds with the hearer's assumptions, thereby raising the stakes for the latter as we mentioned earlier. More importantly, VERUM in this new definition continues to be an attitude (now that the speaker is certain that p should be added to the Common Ground), and as such the problem of conflicting with the question remains. There is no evidence that REALLY has any assertive

[11] Even if questions 'flip' epistemics to the addressee (Eckardt and Beltrama, 2019) as in *Are you sure that Ernie is a communist?*, without an explicit signal to the addressee, the question remains anchored to the speaker.

content in questions— and in an actual assertion (*I am really tired*) REALLY contributes only a degree meaning and no 'epistemic implicature'.

The most important problem with the VERUM analysis of REALLY is, in our view, that the VERUM meaning is akin to the assertion with a veridical attitude itself, but the bias is, as we argued, at the non-at-issue level (see also Liu, 2012; Liu et al., 2021). In our analysis both VERUM and REALLY are presuppositional, affecting the ranking, REALLY thus turns out to be the dual of MUST— and the same can be said for VERUM focus which responds to the nonveridical partition and is indeed adversative like really:

(37) Ernie did vote/really voted for Trump.

Both require contextual bias in favor of Ernie not having voted for Trump, and both presuppose that the speaker has evidence to assert otherwise. 'Modalization' then is the application of meta-evaluative ranking and this is common to both VERUM focus and adverbs meaning REALLY.

In other words, we are proposing that the modal ranking can be realized by expressions that are *not* strictly speaking modal, such as the adverbs meaning REALLY, VERUM focus and, as we argue next, negation. The possibility of ranking exists as long as we have a nonveridical structure which presents two propositional alternatives that can be ranked and have bias, or be left unranked in the egalitarian state of equilibrium.

8.4 Focus negation and positive bias

Positive bias in questions arises with what has been called 'high' negation question. Here we will reinterpret the well known data in the light of the idea that bias in this case too, because of focus, relies on prior assumptions that establish a metaevaluative preference. The use of focus negation, as we will call it, is an indication that the speaker reasons with prior evidence, just like with *really* and evidentials.

Since Ladd (1981), the observation has been that the bias is due to so-called 'high' negation which indicates that the questioner believes p to be true or more likely:

(38) a. Isn't he home ?
I thought he was / #I did not think he was.
b. N'est-il pas à la maison ?
Je pensais qu'il l'était / #Je ne pensais pas qu'il l'était.
c. Dhen ine spiti? (Greek)

d. No has telefonat? (Catalan, (Espinal, 1997))
Haven't you called?

This type of high negation question is widespread cross-linguistically. The following is an example from Sudo (2013, 28b).

(39) a. A: We are all here now. Shall we begin the meeting?
b. B: dare-ka hokani ko-nai no?
B: who-KA else come-neg Q
Isn't someone else coming ?

The bias here is described as leaning towards a confirmatory answer, and this is why such question are often also called rhetorical (see also Buring and Gunlogson, 2000; Romero and Han, 2004; Goodhue, 2018). Krifka (2015) states that with negated questions, the speaker checks whether the addressee is ready to express lack of commitment towards the proposition, which is compatible with expecting a positive answer.

The term 'high' refers to the fact that syntactically high negation can be interpreted in a high or low position, as illustrated below for English:

(40) Isn't John at home?
a. High negation: Isn't John at home? (NEG > QUES)
b. Low negation: Is John not at home? (QUES > NEG)

Across languages the ambiguity does not always arise, and high negation can only be interpreted in a high position. The two readings have different intonational patterns, and only high negation bears focus:

(41) Il n'est pas venu?
He not is come?
Hasn't he arrived?
a. Intended interpretation: It is not true that he has arrived?
b. Impossible interpretation: Is it true that he has not arrived?

This data can be replicated for Greek, with focused negation *dhen*:

(42) DHEN irthe?
not came.3SG?
Hasn't he arrived?
a. Intended interpretation: It is not true that he has arrived?
b. Impossible interpretation: Is it true that he has not arrived?

Current accounts agree on a number of facts that hold uniformly across languages. High negation is focus sensitive (we will call it Focus-NEG for this reason from now on), and (i) triggers the speaker's expectation that *p* is true (43); and in the question (ii) it renders the positive answer more likely:

(43) a. N'est-il pas à la maison ? Je pensais qu'il l'était / #Je ne pensais pas qu'il l'était.
b. Isn't he home ? I thought he was / #I did not think he was.
c. Dhen ine spiti? Isn't he at home? I thought he was.

A variety of approaches have been developed to account for bias with what we will call here Focus-NEG (=high negation) in questions: (i) VERUM operator accounts (Romero and Han, 2004; Repp, 2012, for FALSUM), (ii) double speech-act accounts (Reese, 2007), (iii) commitment (Krifka, 2015) and (iv) decision based accounts (Van Rooij et al., 2003); (v) evidence-based accounts (Buring and Gunlogson, 2000; Sudo, 2013; Roelofsen and Farkas, 2015; Goodhue, 2018) and (vi) implicature-based accounts (Goodhue, 2022). It would be impossible to render justice to the whole literature, and for the purpose of this chapter we only focus on the interrelations between MUST, Focus-NEG and bias; for a review, see Krifka (2017); Larrivée and Mari (2022).

Larrivée and Mari (2022) establish a series of correlations between high Focus-NEG in questions and MUST, pretty much in the spirit we outlined for REALLY. They argue that Focus-NEG and MUST share important similarities, most importantly (a) they are nonveridical (rather than anti-veridical like logical negation), and they convey the speaker's preference that *p* is more likely. However, they are in complementary distribution in evidential contexts. MUST is felicitous in contexts that are compatible with *p*, whereas negative questions are felicitous in contexts that are *in*compatible with *p* (called 'negative evidence' by Buring and Gunlogson (2000), see also Sudo (2013)). The following examples are from Larrivée and Mari (2022).

(44) John looked pretty happy coming back from school.
a. – Il doit avoir réussi son examen de math. / He must have passed the big maths test.
b. – #N'a-t-il pas réussi son examen de math ? / #Didn't he pass the big maths test?

(45) John looked pretty down coming back from school.
a. – #Il doit avoir réussi son examen de math. / #He must have passed the big maths test.

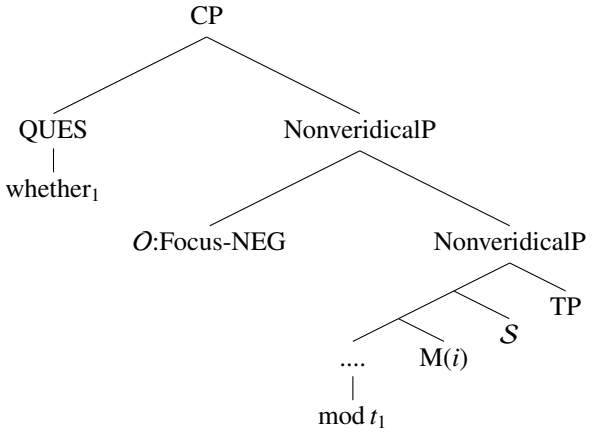
b. – N'a-t-il pas réussi son examen de math ? / Didn't he pass the big maths test?

The contrast shows that MUST builds on the evidence existing at the utterance time, while focus NEG depends on contextual evidence prior to the utterance. Given that he passed the exam, John should look quite happy in the later example. Looking at these data, one can safely suggest that Focus-NEG introduces a metaevaluation which, like MUST, produces positive bias. The bias is positive because the negation particle cannot function as canonical negation; low negation, by contrast, is de-accented and functions normally as the expected proposition negating function. Since it cannot function as regular negation, Focus-NEG is forced to work as meta-evaluation:

(46) $[\![$QUES Focus-NEG (PRES (p))$]\!]^{O,\mathrm{M},i}$ is defined only if
(i) the modal base M(i) is nonveridical and partitioned into $\{p, \neg p\}$ worlds.
(ii) p worlds are more preferable than $\neg p$ worlds
$[\![$ QUES Focus-NEG (PRES (p))$]\!]^{O,\mathrm{M},i} = \{p, \neg p\}$

Since a question does not assert $\neg p$ the contribution of Focus-NEG as O arises as a meaning reanalysis. Just like with REALLY, we can assume that NEG is in the O position in the question skeleton:

(47)



Putting the effect of REALLY, VERUM and Focus-NEG together, then, we must say that their content is only presuppositional, i.e. the metaevaluation O. In this way, we can explain both the bias and the polarity reversal by acknowledging the function of negation as focus operator— and allowing an extended syntactic structure in questions to parallel the (independently motivated) one

for modality with a position for O. No other account that we know of offers an explanation of these facts with such simplicity and no additional *ad hoc* assumptions.[12]

Before closing, we want to go back to the strength of veridical commitment, and note that modals and questions mirror each other in terms of strength. In our theory, commitment with modals proceeds according to the following scale:

(48) Veridical commitment strength (see chapter 1).
   a. More committed < unmodalized p, MUST p, POSSIBLY p, * > less committed
   b. Veridical commitment >> *partial* commitment >> *trivial* commitment;
   >> stands for 'epistemically stronger than'

The asterisk * in (48) indicates that no epistemic modal can convey negative commitment (see Ernst, 2009; Homer, 2015; Giannakidou and Mari, 2018a, as for how this relates to the neg-raising property of universal epistemic modals).[13]

With REALLY and Focus-NEG the commitment, which is a presupposition rather than assertion, proceeds as a mirror image:

(49) Scale of commitment in question presuppositions:
   < p, FOCUS-NEG p, MIGHT p, REALLY p >;
   where i is the speaker, p conveys full commitment of i to p; FOCUS-NEG p conveys *partial* commitment of i to p, MIGHT p conveys *trivial* commitment and REALLY conveys *negative* commitment of i to p.

Like MUST and MIGHT, Focus-NEG and REALLY questions are non-veridical. Focus-NEG and MUST are equivalent in terms of function and commitment in questions, and likewise REALLY contributed ranking but is negatively biased for the reasons we explained earlier. Why modal assertions and questions are mirror images of commitment is a question that we cannot an-

[12] This account copes well with the proposals according to which there is some contextual evidence that provides $\neg p$ (the source of the evidence can be the Other (using Larrivée and Mari (2022)'s terminology, see also Goodhue (2022) on the role of interlocutors in the calculation of the implicature, in a pragmatic perspective) thus making salient the available alternatives. In languages like Japanese, the particles disentangle the evidence bias and the speaker's bias. According to Sudo (2013), both biases are at the non-at-issue level. In our view, the speaker's bias is part of the meaning of the question, and can be neutral.

[13] Cross-linguistically, attitudes like 'doubt' can instead convey negative commitment. As far as we are aware, at least in Indo-European languages, there is no modal verb/auxiliary equivalent.

swer fully; but within the Giannakidou and Mari (2018a, 2021b) system the contrast can be simply due to the fact that, in questions, REALLY and negation are forced to function in an alternative way given their opposite polarity anaphoric property due to focus.

We now complete our exploration of the relation between questions and modality by considering the reflective question.

8.5 Reflective questions: the mechanisms of aporia

The reflective question, as we noted in the introduction, is produced typically with modalization, i.e. when a modal particle or verb is added to the interrogative sentence. In order to refresh our memory, we give below some basic examples with a possibility modal in English, the future in Italian, and the subjunctive plus other modal particles in Greek:

(50) Ti na kanei araje i Ariadne tora teleftea?
what subj do.3SG PRT the Ariadne now lately
What might Ariadne be doing nowadays?

(51) Dove saranno i miei occhiali ?
where be.FUT.3PL the my glasses
Where might my glasses be ?

(52) Pu *na* evala (araje) ta gialia mou?
where subj put.past.1SG PRT the glasses mine
Where might I have put my glasses?

This type of question can also be addressed to oneself, as can be recalled, for instance an absent-minded speaker is looking around, a bit puzzled perhaps as she can't find her glasses; or a speaker who hasn't seen Ariadne in some time is wondering what might have happened to her. The question seems unanswerable at the time of asking:

(53) Na perase araje to test odijisis i Ariadne?
subj passed.3SG araje the test driving the Ariadne
Could Ariadne have passed the driving test, I wonder.

The interrogative expresses, as we said, a desire to reflect on the issue rather to get a full and complete set of answers. We will argue that the reflective question expresses the state of *aporia*. Aporia is the characteristic state of puzzlement and enhanced inquisitiveness, and the question is merely an invitation

to reflect knowing before hand that there will be many possible answers, or no answer at all— rather than expecting a precise and definitive "correct" answer. Aporetic reflection is thus an attitude of introspection rather than requesting information, or seeking confirmation as seems to be the case with rhetorical bias.

Recall that philosophical questions of this kind manifest themselves as reflections very naturally, with the subjunctive and particles, as we have noted:

(54) Pja na ine araje/taxa i fysi tis dikaiosynis?
what sub be.3SG PRT/PRT the nature the.GEN justice.gen
What might the nature of justice be?

Without the particles, we have a regular information seeking question:

(55) Pja ine i fysi tis dikaiosynis?
what be.3SG the nature the.GEN justice.GEN
What might the nature of justice be?

The aporetic effect of reflection is that the speaker formulates the question with augmented uncertainty which, we will suggest, reveals a meta-evaluation that produces epistemic widening by engaging with assumptions *not* previously entertained by the speaker.

The question becomes reflective when modal particles and verbs are used– roughly expressing possibility. We will focus on Greek and Italian patterns mostly, and will ask the following questions. What is the nature of the elements that produce reflection? Are there different strategies for reflection? We will argue that reflective questions illustrate very clearly the presence of a modal element in the question, and indeed the presence of a non-biased modal (possibility or FUT). We will then single out three strategies: (a) the possibility strategy— where the question is about the possibility of *p*—, (b) the enhanced modal base strategy illustrated with Greek particles where the meta-evaluation function creates epistemic widening, and (c) the Italian strategy of FUT scoping above the question. In all cases the result is increased inquisitiveness, but there are subtle differences between the reflection types produced which we hope to make clear in the discussion. We proceed as follows. We offer a more detailed discussion of the Greek data next, along with some data from Korean that give us an accurate picture of reflection as a monologic introspective strategy. We then offer the analysis of the two strategies we outlined.

8.6 Basic characteristics of reflective questions

The reflective question contains an epistemic modal adverb, particle or verb. For a long time, it was thought that epistemic modals do not occur in questions (Coates, 1983; Drubig, 2001; Jackendoff, 1972; Leech, 1971; McDowell, 1987). Jackendoff, specifically, claimed that while *may* can either be interpreted deontically or epistemically in a declarative sentence (*John may leave early tonight*), it can only be interpreted deontically in a question (*May John leave early tonight?*). Ernst (2009), on the other hand, presented examples with modal adverbs in questions (*Is she possibly the murderer?*), and Hacquard and Wellwood (2012) offer corpus data with possibility modals in questions. Here are some examples:

(56) a. With the owners and the players on opposite sides philosophically and economically, what might they talk about at the next bargaining session?
b. Might he be blackballed by all institutions of higher learning?

These questions with *might* appear to be reflective; since they contain the modal verb they are plausibly questions about the possibility of *p*, as Giannakidou (2007) proposed. This appears to be the strategy of English.

Let us turn now to Greek where a wealth of particles are used.

8.6.1 Greek aporetic particles in questions

In Greek, as noted in Giannakidou (2009, 2017) already, we find possibility modal particles, adverbs, and of course also possibility verbs in questions. Some of the particles are not strictly speaking modal words— they are rather speaker oriented expressing some form of doubt or wonderment, and we can call them 'aporetic'. We give below examples with the the so-called *evaluative subjunctive* (Giannakidou, 2017), the possibility adverb *mipos* 'maybe', and the particles *taha,araje*.

Consider first the unmodalized question:

(57) Kimate i Ariadne?
sleep.3SG the Ariadne
Is Ariadne sleeping?

The unmodalized polar question is a genuine request for information where— regardless of the exact implementation— the speaker 'raises the issue' of whether Ariadne is sleeping or not, and presumes that the addressee has epistemic authority on the matter, i.e. they can give a correct answer to it namely that Ari-

adne is or is not sleeping. The context for information seeking is a neutral one in the sense that the speaker has no prior assumptions about whether Ariadne should or should not be asleep (contrary to biased questions, for example).

This bare question can be augmented with aporetic or modal particles:

(58) *Na* kimate (*araje*) i Ariadne?
SUBJ sleep.3SG (araje) the Ariadne
Might Ariadne be sleeping?
Is Ariadne perhaps sleeping?
Ariadne is sleeping, I wonder?

(59) *Araje* kimate i Ariadne?
araje sleep.3SG the Ariadne
Maybe Ariadne is sleeping?

(60) Mipos kimate i Ariadne?
maybe sleep.3SG the Ariadne
Maybe Ariadne is sleeping?

(61) (Na) Kimate taha i Ariadne?
subj sleep.3SG taha the Ariadne
Maybe Ariadne is sleeping, I wonder?

The occurrence of the subjunctive in questions has been observed first in Rouchota (1994), who called the questions 'dubitative'. Eckardt (2020) makes a similar observation for German questions with the particle *wohl*, namely that *wohl* creates a conjectural question (63) unlike bare questions that are information requests (62).

(62) Wo ist der Schlüssel?
where is the key?
Where is the key ?

(63) Wo wohl der Schlüssel ist?
where WOHL the key is?
Where might the key be, I wonder.

Descriptively, in Greek we find either the subjunctive on its own or accompanied by particles such as *araje, taha*, the modal adverb *mipos* 'possibly, and can occur in the fashion of modal spread. Here are some more examples, including a case of embedded clause:

(64) Mipos araje kimithike i Ariadne?
possibly araje slept.3SG the Ariadne
Ariadne slept maybe?

(65) Anarotieme an (araje)/mipos (taha) kimithike i Ariadne.
wonder.1SG if PART PART slept the Ariadne
I am wondering if maybe Ariadne slept.

Mipos and *na*, however do not co-occur:

(66) *Mipos na kimithike i Ariadne?
possibly SUBJ slept.3SG the Ariadne
Ariadne slept maybe?

Mipos is an actual possibility adverb licensed in questions, the dual of *isos* 'possibly' in assertions Giannakidou (2009); Giannakidou and Mari (2021a). *Mipos* cannot be used in an assertion:

(67) Isos/*Mipos kimithike i Ariadne
possibly slept.3SG the Ariadne
Ariadne possibly slept.

It is interesting that Greek makes this distinction in possibility adverbs. *Isos* can also be used in questions:[14].

(68) Isos (na) kimithike i Ariadne?
possibly SUBJ slept.3SG the Ariadne
Ariadne slept maybe?

As we noted already, some of the particles can be treated as possibility modals (*mipos*), but *taha* means literally 'as if, allegedly'; when added, in a declarative sentence, it casts doubt on the truth of the proposition is attaches to (see Ifantidou, 2001) :

(69) O Pavlos ine taha giatros.
the Paul is *taha* doctor
Paul is allegedly a doctor (but he is not, or I doubt it).

(70) Kani taha oti niazete.
do.3SG *taha* that care.3SG
He acts as if he cares (but he does not, or I have increased doubt that he does).

(71) Tis yposxethike oti taha tha tin pandrefti.
her promised.3SG that *taha* FUT her marry.3SG
He promised her that he will marry her (but I doubt he will).

[14] See Giannakidou and Mari (2021b) for more discussion on *mipos, isos*.

Unlike *allegedly* which is neutral as to the truth of the prejacent, the addition of *taha* in a declarative clause expresses increased doubt or falsifies the prejacent, even with the verb like *promise* which is used above as a mere verb of saying. In the question, *taha* acts as a reflective marker signaling doubt. We observe, therefore, a meaning reanalysis that is motivated— as in the case of Focus-NEG— by the fact that the particle is used in an interrogative sentences. The effect that the particles achieve in Greek is covered jointly by *might, maybe* or the addition of 'I wonder', as indicated in the English translations.[15] The particle *mipos* emerges from a historical path that fused the negation *mi(n)* with the indicative complementizer *pos*.

The aporetic effect of reflecting is manifested in two ways: firstly, the reflective question can be self-addressed, and second it seems to lack the urgency to receive an answer. For instance:

(72) Pu na evala (araje) ta gialia mou?
where SUBJ put.1SG araje the glasses mine
Where might I have put my glasses?

Here I am looking for my glasses and I am posing this question to myself. Being in a state of ignorance, I cannot presume (as I should in a canonical information seeking question) that I am an epistemic authority on the matter— and asking this question merely expresses my aporetic state. The lack of urgency is also revealed by the fact that that the question can be continued by "Who knows?", unlike regular information questions:

(73) Pu na evala (araje) ta gialia mou? Pjos kseri!
where SUBJ put.1SG araje the glasses mine. who knows
Where might have I put my glasses? Who knows.

Yet, lacking the urgency to answer does not mean that the reflective question cannot be answered or that it posed without the intend of answer. The sentence below is a fine answer to the question:

[15] The Greek negative particle *mi(n)* can also be used in questions with the same open ended reflective flavor (Chatzopoulou, 2018), (Giannakidou and Mari, 2023) interestingly here being addressed to a generic audience (while appearing in the second person plural:

(i) Min eidate ton Jani?
NEG saw.2PL the John
Did you maybe see John?

In Giannakidou and Mari 2023 we called the particle Modal-NEG and this use is found in literary and similar registers. The context for these questions is that Janis is hard to find and perhaps will not be seen. *Mi(n)* is the negation of non-indicative contexts in Greek (Giannakidou, 1997; Veloudis, 1980).

(74) Ston pago tis kouzinas.
in-the counter the.gen kitchen
On the kitchen counter.

My daughter who hears me talking to myself, can indeed volunteer this answer. Likewise:

(75) A:Ti na kani i Miranda tora araje?
what SUBJ does the Miranda now araje
What might Miranda be doing now, I wonder.

(76) B:Spudhazei iatriki.
study.3SG medicine
She's studying medicine.

In the above example, from von Fintel and Iatridou 2024, we see again that the reflective question receives a factual answer. Yet, as von Fintel and Iatridou note, volunteering a response doesn't necessitate posing a question:

(77) A: We will recruit a few more players.
B: Indeed, five more to be precise.

Speakers respond to questions as well as assertions; thus receiving a response is not necessarily an indication that one poses a genuine question. Let us concentrate below on the two points of self-addressing and less urgency to answer constitute, as we said, the essence of aporia.

8.6.2 Anti-addressee effect: no second person questions

Directly addressing the hearer in the second person is odd with a reflective question:

(78) #Ti *na* efages arage xthes?
what SUBJ ate.2SG araje xthes
What might you have eaten yesterday?

(79) Ti efages xthes?
what ate.2SG xthes
What did you eat yesterday?

(80) #Na efages araje xthes?
SUBJ ate.2SG araje xthes
Might you have eaten yesterday?

(81) Efages xthes?
SUBJ ate.2SG xthes
Did you eat yesterday?

We will dub this, following Giannakidou and Mari (2019) the 'anti-addressee' effect. [16]

In Italian, note likewise the infelicity of (82):[17].

(82) #Quanti anni avrai ?
How many years have.FUT.2SG
How old might you be?

We claim here that the anti-addressee effect arises because, upon asking the aporetic question, the speaker would have to ascribe to the addressee a contradictory epistemic state that grants her both (a) the epistemic authority to answer since they are asked a question, and (b) inability to answer because the question contains aporia. The addressee is indeed an epistemic authority on matters that concern their own actions or their own age; the oddity of the reflective question, on the other hand, presupposes that the addressee cannot be a definitive authority since no specific or complete answer is expected. Stated otherwise, by choosing the indeterminacy of aporia, the knowledge of the addressee would be at stake— but of course, the addressee has complete knowledge about their own age, contrary to what the use of aporetic form indicates.

(83) #Quanti anni puoi avere ?
How many years can.FUT.2SG have
How old might you be?

Such questions can only be 'fixed' in a guess game-like context, where the addressee pretends not to know so that the speaker can guess the age.

Reflective questions, by the same reasoning, cannot be asked by teachers to students in tests:

(84) #Pjos na egrapse (araje/taxa) tis Syntaktikes Domes?
who SUBJ wrote the Syntactic Structures
Who, do you reckon, wrote Syntactic Structures?

[16] The literature from the evidentiality studies sometimes talks about 'interrogative flip', claiming that(i) a question containing an evidential expects that the hearer has the relevant type of evidence (interrogative flip e.g. Speas and Tenny (2003), Aikhenvald (2004), Murray (2016); San Roque et al. (2017), Bhadra (2020) a.o.) (ii) an anti-addressee arises if the addressee does not have the correct type of evidence. This is a proposal that has been defended for the Italian future.

[17] For extended discussion on future in questions Mari (2021, 2024))

The test context is anti-aporetic: it is the typical context where it can be presumed that there is a specific and correct answer, and it checks the addressee's ability to give the correct answer as epistemic authority. With a test question we expect that, if the student studied, they are an epistemic authority in giving the expected correct answer. Aporetic questions are therefore not appropriate in this context.

As we noted in footnote 16, similar observations have been advanced for questions with evidentials: a question with an indirect evidential is not felicitous when the addressee has complete knowledge (see Bhadra (2017); San Roque et al. (2017) among many others). This has been been presented, in fact, as an argument in order to disentangle epistemic modals from evidentials Frana and Menéndez-Benito (2019b); Ippolito and Farkas (2021) (see Mari (2021, 2024) for a detailed discussion of the arguments). We have newly shown here that questions with epistemic modals are also infelicitous when the addressee is not in a state of aporia and lack of knowledge as the modal requires.

8.6.3 Monologic nature

We will digress here a bit to consider the Korean facts with *nka* questions of Kang and Yoon (2019, 2020) who argue that reflective questions are feigned monologues. According to Kang and Yoon, textitnka questions are used not for requesting information from an addressee but in order to express "a speaker's epistemic uncertainty or conjecture on the propositional content." We will expand on the similarity of their core case with the Greek reflective question.

Korean employs the disjunctive particle *nka* with the Q-marker *ni*. *Nka* questions, according to Kang and Yoon, contrast with the regular factual question marker *ni* in the following way. Imagine a context where Mary, a reporter, was waiting for John and Bill, who were competing with each other for the win in the finals of the chess competition. She was ready to interview Bill, because Mary was told from her boss that Bill was the strong front-runner of the competition. After the match, John and Bill came out of the room. John had a very subtle smile and Bill had a poker face. Given their facial expressions, she infers that John might have won. But at the same time, John is unlikely to be the winner given her boss's comment. In complete uncertainty about her inference, facing evidence that was unlikely given her initial assumptions, Mary says:

(85) Con-i wusungca-i-nka? (Korean)
John-NOM winner-be-NKA
Maybe John is the winner, maybe not?

(86) Con-i wusungca-i-ni?
John-NOM winner-be-Q
Is John the winner?

The meaning carried by *nka* is not simply an extension of a question, Kang and Yoon argue. Rather, the *nka* question is claimed to be a non-factual question (Seo, 1987; Jang, 1999; Park, 2005; Kim, 2010; Lee, 2015; Kang, 2015). By using *nka*, the speaker questions her own background assumptions on whether John might have won the game or not— and is not simply requesting information from the addressee.

In exactly the same context, the Greek reflective question can be posed:

(87) Na edosan araje ston Jani ti thesi? [Greek]
SUBJ gave.3PL araje to-the John the position
Could they have possibly given the position to John?

This is a context where my information prior to asking the question was that John's rival would get the job. My reflective question expresses incredulity, a state of wondering disbelief, questioning my own background assumptions. In opting to formulate a reflective question, I need to widen my assumptions and add what I previously thought an unlikely possibility.

Nka-questions, Kang and Yoon conclude, are *feigned monologues*, i.e., the speaker says something as if it were a monologue without expecting an answer necessarily. Because of the monologic nature of the utterance, it does not necessarily obligate the hearer to respond, though of course a response can be given, as we noted earlier.

What is interesting about the monologue claim here is that, as is obvious in the context above, the speaker who asks the question is incredulous because the evidence appears to be in conflict with her own beliefs prior to the question. She has to question her own assumptions by considering something quite far fetched (in fact, the opposite of what was expected). This insight clearly suggests that some aporia patterns indeed involve epistemic widening and disbelief.

8.6.4 Reflective questions in Italian

Mari (2021) shows that questions with epistemic modals in Italian (88) — which include Italian future questions (89), (90) – are by default self addressed (see also Eckardt and Beltrama (2019), *pace* Ippolito and Farkas (2021)).

(88) Dove possono essere i miei occhiali ?
where might be the my glasses
Where might my glasses be ?

(89) Dove saranno i miei occhiali ?
where be.FUT.3PL the my glasses
Where might my glasses be ?

(90) Sarà a casa ?
be.FUT.3SG at home ?
Might he be home ?[18]

Such questions are akin to questions with *forse* which is the possibility adverb 'maybe' in Italian:

(91) a. È a casa ?
Is at home ?
Is he at home ?
b. È forse a casa ?
Is maybe at home ?
Is he maybe at home ?

In Italian, the reflection is obtained not only with possibility modals and future, but is also enhanced by temporal particles like *mai* ('never'):

(92) Dove saranno mai i ragazzi ?
where be.FUT.3SG never the boys ?
Where might the boys be ?

Far-fetched possibilities can also be triggered by elements indicating dispreference like *cavolo* (litt: cauliflower) in Italian (93), *fichtre* (exclamation adverb in French (94)), or *the hell* in English.

(93) Dove cavolo sono ragazzi?
where cauliflower are the boys ?
Where the hell are the boys ?

(94) Où fichtre sont les garçons ?
where the-hell are the boys ?
Where the hell are the boys ?

(95) Where the hell are the boys ?

[18] Greek FUT cannot be used in reflective questions: Tha ine spiti tora? 'Might he be at home now' is quite odd. We assume that Greek FUT is prohibited as a blocking effect, since Greek has a variety of particles in its disposal to do the job.

The hell and equivalent expressions do create a reflective effect, and their addition is consistent with the observation just made in the context of Korean that the speaker is entertaining assumptions not established by her current knowledge.

Like in Greek, 'who knows' further evidences the open-endedness of these questions:

(96) Sarà a casa? Chi lo sa!
be.FUT.3SG at home? Who that knows!
Might he be home ? Who knows !

We can thus see that we are dealing here with an aporetic question, just like in Greek and Korean. The intent of the speaker is not to seek information from an addressee but rather to signal that she is open minded and negotiating her own assumptions by extending the realm of possibilities.

8.7 Reflection as aporia: three strategies

In this section we will make precise how the aporetic effect is achieved, and we will narrow down in three ways.

A reflective question— whether via a modal verb, or a particle or by adding things such as *I wonder*—, though it appears syntactically as an interrogative sentence, it does not have the discourse function of the information question which is to request an authoritative answer from an addressee. The categorical barrier between an assertion and a question in this case seems to be relaxed. When asking with aporia, the speaker does not presume that the hearer is an epistemic authority, and there is no expectation of authoritative answer.

An obvious question then is: what is the illocutionary force of a reflective question? If we go back to Lyons' distinction between a asking a question and posing a question, what is the force of posing a question? Given that reflective questions need no authoritative addressee (recall the anti-addressee effect), it becomes clear that reflections and requesting information cannot have the same illoctionary force, and they do not incite similar perlocutionary effects. If asked with an audience, the perlocutionary effect of an aporetic question is to reflect, not to give an answer, as can be recalled from the genuine philosophical aporetic questions and by the questions with disbelief— which are invitations for reflection, issuing a topic and invite introspection on it.

If a reflection, then, does not have the illocutionary force of a question while appearing in the form of a question, we must concede that there can be no speech act operator in the structure of interrogative sentences *in general*; for

if there had been one, it would have to have variable. Relaxing the illocutionary force, however, and here we will echo our earlier work, "cannot be stated meaningfully if we assume that a speech act operator is present in the question. If such an operator existed, manipulation would entail either that the operator is flexible in force— which is another way of saying that it is 'ambiguous'; or it would entail that another operator is used. Either option would be stipulatory because it does not predict when and why this happens. We will provide, instead, a semantic explanation for the relaxing of of the illocutionary force. The apparent force manipulation can more plausibly be understood as suggesting that there is no illocutionary operator in the sentence." (Giannakidou and Mari, 2019).

Reflection is a polymorphic notion that mobilizes different strategies depending on the nature of the trigger, and in what follows, we will suggest three strategies: (a) the possibility strategy where the question is about the possibility of *p*—, (b) the enhanced modal base strategy illustrated with Greek particles where the meta-evaluation function creates epistemic widening, and (c) the Italian strategy of FUT scoping above the question (Mari (2021, 2024))[19]. In all cases the result is increasing inquisitiveness, but there are subtle differences between the reflection types produced.

8.7.1 Strategy 1: Asking about the possibility of *p*

The first analysis of the reflective effect capitalizes on the use of possibility modals in questions and is formulated in Giannakidou (2017). Giannakidou says that the reflective question contains a possibility modal, and that in Greek possibility modals and the subjunctive are equivalent. In both cases, we have a question with MIGHT hence the answer set, in contrast to the plain question, contains MIGHT propositions:

(97) ⟦Who came to the party?⟧ = {Bill came to the party, Marina came to the party, Ariadne came to the party, Nicholas came to the party,...}

(98) ⟦Who might have came to the party?⟧ = {it is possible that Bill came to the party, it is possible that Marina came to the party, it is possible that Ariadne came to the party, it is possible that Nicholas came to the party,...}

[19] Eckardt (2020) envisions a scope strategy for german *wohl* in questions, whereby *wohl* triggers a QUD at the semantic-pragmatic interface The strategy envisioned here lies at the syntax-semantic interface, with no QUD triggered by FUT.

This analysis says that the possibility question, instead of asking about *p*, it asks about the possibility of *p*:

(99) a. Is it possible that Ariadne won the race?
b. Might Ariadne be the winner of the race?

(100) Bori i Ariadne na kerdise ton agona?
may the Ariadne SUBJ won.3SG the race
Is it possible that Ariadne won the race?

Clearly, such question ask about the possibility of Ariadne having won the race. They could (but don't have to) be posed to someone, but because they are asking about the possibility of *p* they are speculative. If we include this option in the reflective family— as we think we should— the reflective effect seems to be due simply to the fact that the modalized questions invite speculation and not, strictly speaking, answering.

8.7.2 Strategy 2: epistemic widening of the modal base

We will follow here the thread from Giannakidou and Mari (2019) and propose another strategy involves epistemic widening. This seems to be an analysis appropriate for some of the particles that do not seen to have overtly modal force.

Recall that the primary characteristic of the particle question is that it calls the speaker to entertain possibilities beyond what is currently known or assumed, and sometimes in conflict with it. In a framework which uses metaevaluation, we will argue that the reflective effect is due to the function of the modal element of enlarging the spectrum of the possibilities. The particles create *epistemic widening*: the set of the possibilities considered attract attention to *p*, but seeking *p* in a larger set.

Recall the Korean and Greek examples we discuss earlier, where the speaker is facing evidence that was unlikely given her initial assumptions which were that John would not be the winner. We give below the Greek version of the Korean example:

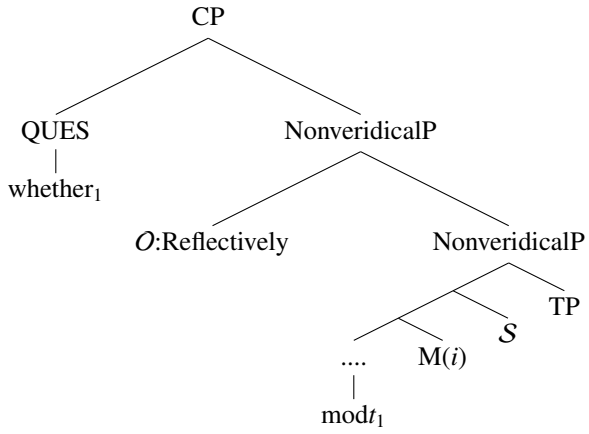
(101) Con-i wusungca-i-nka? [Korean]
John-NOM winner-be-NKA
Maybe John is the winner, maybe not?

(102) Na edosan araje ston Jani ti thesi? [Greek]
SUBJ gave.3PL araje to-the John the position
Could they have possibly given the position to John?

Recall that this is a context where my information prior to asking the question was that John's rival would get the job. My reflective question expresses incredulity, a state of wondering disbelief, questioning my own background assumptions. In opting to formulate a reflective question, I need to widen my assumptions and add the previously unlikely one.

Here is how we suggest to go about that: we add the adverb *reflectively*, as an umbrella for all the elements that can be hosted for reflection.

(103)



(104) $[\![$QUES Reflectively (PRES (p))$]\!]^{O,\mathrm{M},i}$ is defined only if
(i) M(i) is nonveridical and partitioned into $\{p, \neg p\}$ worlds.
(ii) $\cap O \supset$M(i)
$[\![$QUES Reflectively (PRES (p))$]\!]^{O,\mathrm{M},i} = \{p, \neg p\}$

With the reflective function, the set of possibilities extends beyond the modal base — $\cap O \supset$ M(i) — thus making it harder to think of what would be a 'correct' answer. The epistemic state of the speaker entertains a broader set of potential answers, not a narrower one as in the case of bias where a potential answer is favored by the speaker's prior assumptions. The effect of widening the modal base $\cap O \supset$M(i) is presuppositional.

In both this and the possibility analysis analysis, the effect of reflection is thus semantic/pragmatic, and we do not pose a special speech act operator. Since the effect concerns the modal base, it can be hypothesized that the difference between a possibility assertion and a question does not necessarily reflect the presence of a speech act operator in the syntax. The question denotation remains that of a noveridical modal space. Our analysis, finally, seems to be more in like with Eckardt and Beltrama (2019); Von Fintel and Iatridou

(2019)— both accounts also challenging the status of the reflective question as a question— and contrasts with Farkas (2022) who argues that by marking an interrogative with a reflective marker (in Romanian: *oare*) the speaker "signals that she does not assume that the issue she raises will be resolved in a future state of the conversation." In the examples we discussed, take the most recent one we discuss here, it is clear that the speaker does believe that the issue will be resolved. The reflective marking rather signals that the resolution will require epistemic expanding, which means a revision of the speaker's current epistemic state. The monologue-like flavor follows from this property.

Reflection thus, in this analysis, is an epistemic manipulation of a nonveridical space. When there is a specific unexpected alternative, epistemic widening will result in belief revision as is the case in the incredulity examples. In other cases, epistemic widening will result in vagueness because it enhances the possibilities in an open-ended manner. It may turn out that, crosslinguistically, there is variation along this dimension, and certainly more work is needed to establish that. What we can say for sure, however, is that the apparent harder-to-answer property of reflective questions can be nicely captured by epistemic widening, and that having an actual answer or not is not crucial to reflection. Certainly, it can't be presupposed that no answer can be given; only that be expanding the options getting to the naswer is a harder task.

8.7.3 Strategy 3: FUT > QUES, the scope strategy

Italian future, as we saw, is a unbiased epistemic universal modal. Our analysis –discarding the empty ordering source– is as follows.

(105) $[\![\text{FUT (PRES (} p \text{))}]\!]^{\text{M,Ideal},i,\mathcal{S}}$ is defined only if (i) M(i) is nonveridical and (ii) M(i) is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds, and (iii) i has potentially no clues.
If defined,
$[\![\text{FUT (PRES } (p))]\!]^{\text{M,Ideal},i,\mathcal{S}} = 1$ iff $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$
Paraphrase: (presupposition) The modal base M(i) is partitioned into p and $\neg p$ worlds as well as into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. i has potentially no clues for p. (assertion). All Ideal worlds are p worlds.

The following picture summarizes our analysis of future as a non-veridical and unbiased universal epistemic modal. Note, indeed, that there is no notion of ordering at play, an issue discussed at length in Giannakidou and Mari (2023) and earlier in chapter 4.

We propose that the type of reflection that the universal modal enhances in

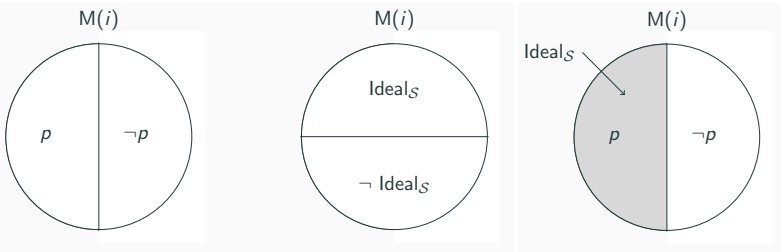


Figure 8.2 Presuppositions and assertion of Italian FUT as non-biased epistemic necessity

questions derives from a scope taking strategy, whereby the modal FUT scopes over QUES and thus over a set of propositions rather than a proposition.

(106) $[\![\text{FUT (QUES } (p))]\!]^{O,\text{M},i,\mathcal{S}}$ is defined only if:
M(i) is nonveridical and is partitioned into Ideal$_\mathcal{S}$ and ¬Ideal$_\mathcal{S}$ worlds.
$[\![\text{FUT (QUES } (p))]\!]^{O,\text{M},i,\mathcal{S}} = \forall w' \in \text{Ideal}_\mathcal{S} : p(w', t_u) \vee \neg p(w', t_u)$

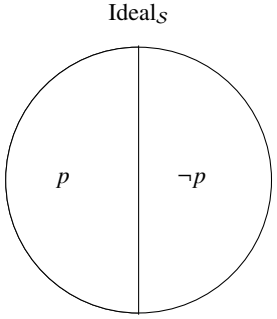


Figure 8.3 FUT > QUES

The scope of the modal over the QUES operator accounts for the observed nuances of the readings. First, QUES is not a speech act operator, and second, reflection is derived insofar as the inner mental state is represented as partitioned. Third, the question is unaddressed: the question is relativized to a state of mind. Finally, the question is considered as potentially unanswerable by the speaker: adding information through Ideal$_\mathcal{S}$ does not resolve the issue.

The analysis also predicts that biased universal modals cannot appear in

reflective questions, as in this case one option would have to be favored over the other, with a resulting biased questions.[20]

8.8 Conclusion

In this chapter, we explored how the modal concepts of nonveridical equilibrium, evidential bias, and metaevaluation apply to questions. The motivation was that while polar questions and modal assertions are deeply similar in denoting nonveridical spaces, partitioned into p and its negation. The partition can be indiscriminate, in which case we have nonveridical equilibrium; but the option of bias (via metaevaluative (O) ranking) exists in all nonveridical spaces. Both questions and modals start with a core partition between p and $\neg p$, and a ranking is always available depending on background assumptions, evidence, and expectations. Focus adverbials such as REALLY, modal adverbials, and negation are overt lexicalizations of biased ranking. The overall analysis offers a novel way of understanding what bias is and how it is derived, capitalizing on a number of independently motivated assumptions about focus, and the structure of the nonveridical space.

We also contributed to a deeper understanding of the phenomenon of reflection which is, as we argued, posing a question with the intent to introspect rather than seek information. The reflective question is not a variant of the information seeking question, but rather expresses the enhanced inquisitiveness of aporia: it invites the addressee to introspect with the speaker— and when self addressed, to even expand the speaker's own background assumptions. We proposed three strategies to achieve the reflective effect, including epistemic widening, which means a revision of the speaker's current epistemic state with previously unconsidered, or even unlikely, possibilities. Epistemic widening is what underlies the apparent (but not exclusive) monologic characetr of some reflective questions.

Our analysis offers, as far as we know, the first unified framework for questions and modal sentences. Overall, the framework of modality we developed in this book— by dissociating modal force from ranking— offers a flexible way to understand the deeper relation between asking a question and modalizing, as well as how seemingly un-modal expressions can undertake functions typically associated with modality. As we approached the end of our exploration of modal sentences, our hope is that the book succeeded in demonstrating how broad, empirically, the linguistic phenomena are that can be under-

[20] For extended discussion of why MUST cannot appear even in biased questions, see Giannakidou and Mari (2019)

stood as modal— and how useful flexible the concept of nonveridicality is in capturing them.

Questions and further readings

Questions

- If an interrogative and a modal sentence denote the same thing— a nonveridical space in equilibrium or with bias— how do they still differ? If inquisitiveness is entertaining both options, how do we distinguish between a question and a modal assertion ? Do we need a speech act operator? Or can we derive the fact that an information seeking question seeks an answer from other, independent factors?
- This question can also be posed in the context of deontic modality and imperatives. How does the deontic modal sentence differ from the imperative one in this regard?
- We suggested a number of strategies for aporia. How about rhetorical bias? As we saw, it can be derived in various ways: with negation, tags, REALLY, negative polarity items, and other means. Is it conceivable that there are multiple strategies involved? Think of examples in various languages— and the meaning of the specific words that are responsible for bias. With negative polarity items, for examples, bias is often attributed to an scalar component in the NPI meaning EVEN.

Further readings

Ginzburg (2012) is a useful resource if one wants to know more about the possibility of developing a grammatically rooted theory of conversation motivated by data from real conversations. Ginzurg's work draws on extensive corpus studies of the British National Corpus, and uses also evidence from language acquisition, and computer simulations of language evolution. Ginzburg and Sag (2000) is also a major work.

Ciardelli Ivano and Roelofsen (2018) is the latest most comprehensive exposition of the paradigm of inquisitive semantics.

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Glossary

Actual World The way things are in the most comprehensive way.. 313

Actuality entailment Veridicality entailment that arises with certain uses of modal expressions, and most notably when the modal is in the perfective aspect and past tense.. 313

Commitment to act Commitment to make a choice, or to take action to bring about a result.. 313

Compliance Attitude of the addressee revealing their willingness of performing the action triggered by the issuing of an imperative.. 313

Deontic Modal Base Set of propositions that correspond to norms. In the deontic domain teleological modality can be distinguished from moral modality. In the teleological domain the modal base will be a set of propositions compatible with the goals of an individual or a group and in the moral domain the modal base will be a set of propositions compatible with the moral norms of an individual or a group.. 313

Epistemic Modal Base Set of propositions that correspond to what an individual anchor (or as is sometimes also called a judge; an individual or a group) knows or believes. In the latter case, the term *doxastic modal base* can be used.. 313

Evidential bias of necessity modals A statement with a necessity modal is biased iff there is evidence that allows the speaker to consider p as a better possibility than $\neg p$.. 313

Evidentiality The study of the grammatical encoding of the information about the sources through which the content conveyed is acquired.. 313

Kripke Frame A pair $=< W, R >$ where W is a set of worlds and R an accessibility relation.. 313

Kripke Model A triple $=< W, R, V >$ where W is a set of worlds, R an acces-

sibility relation and V a valuation function that assigns a truth value to propositions at worlds.. 313

Metaevaluation The metaevaluation is the expression of a preference (or lack-thereof) of one of the options in a nonveridical state. The metaevaluation can be manifested by the presence of modal adverbs, but can also be silent and be encoded as a default in the meaning of the modals.. 313

Modal Base Set of propositions that are chosen in view of a certain criterion. They can be epistemic or deontic.. 313

Modal bias In a non-homogeneous epistemic state M(i) either p or $\neg p$ is the preferred option.. 313

Modal spread The combination of a modal verb and adverb of different or equal forces, sometimes multiple adverbs as in questions.. 313

Necessity Modal Universal quantifier that operates on a set of possible worlds.. 313

Nonveridical equilibrium In a non-homogeneous epistemic state neither p nor $\neg p$ is the preferred option.. 313

Nonveridicality of epistemic states An epistemic state is nonveridical about a content p if it is not-homogeneous and only contains both worlds in which p is true and worlds in which p is false.. 313

Possibility Modal Existential quantifier that operates on a set of possible worlds.. 313

Possible World The way things can or could have been in the most comprehensive way.. 313

Ratificational future A specific type of epistemic future that presupposes the existence of a time at which the content can be evaluated as true or false.. 313

Unitary modal A modal that does not lexicalize the difference between necessity and possibility.. 313

Veridical commitment as belief A linguistic agent i is subjectively committed to a proposition p iff i believes p to be true.. 313

Veridical commitment as knowledge A linguistic agent i is veridically committed to a proposition p iff i knows p.. 313

Veridicality of epistemic states An epistemic state M(i) is a set of worlds associated with an individual i representing worlds compatible with what i knows or believes in the context of utterance... 313

Veridicality of epistemic states An epistemic state is veridical about a content p if it is homogeneous and only contains worlds in which p is true. 313

Index