

Themes and variations in the expression of modality*

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1. Introduction

This paper explores recurring patterns in the expression of modality across languages, and across time and development, to probe whether there are constraints in how modality can be expressed in natural language, which might guide learners acquiring modal words. The pattern that we focus on, and which can be found in roughly half of the world's languages (van der Auwera & Ammann 2005), is the tendency to use the same modal forms to express both *root* and *epistemic* modality. Epistemic modality involves possibilities given a state of information, such as a body of knowledge, beliefs or assumptions. (1a), for instance, expresses an epistemic necessity based on what we know (including the fact that Al is not in the office). Root modality involves possibilities given a set of circumstances and different 'priorities' (Portner 2009). For instance, (1b) expresses a *deontic* necessity: an obligation given certain circumstances (e.g., Al parked illegally) and a body of laws, and (1c) expresses a *bouletic* necessity: an obligation given certain circumstances (e.g., there is a party) and desires (the wishes of the speaker).

- (1) a. Al **must** be home. He's not in the office. *epistemic*
 b. Al **must** pay a fine. He parked illegally. *deontic*
 c. You **must** go to the party with me! Please! *bouletic*

This meaning distinction between root and epistemic modality seems to have scopal correlates. With an epistemic interpretation, these modals tend to scope high: they tend to outscope tense, aspect, negation and quantifier subjects. With a root interpretation, on the other hand, these modals tend to scope low, below tense, aspect, negation and quantifier subjects (Ross 1969, Perlmutter 1971, Jackendoff 1972, Groenendijk & Stockhof 1975,

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Picallo 1990, Brennan 1993, von Stechow and Iatridou 2003, Stowell 2004, Hacquard 2006, 2011, Borgonovo & Cummins 2007, Laca 2008, a.o.).

As we will see, the interaction of flavor polysemy¹ and scope creates a formidable learnability challenge for children acquiring modals in these languages². Children have to realize not only that a modal word can express different kinds of modal flavors, but also that this modal scopes differently depending on the flavor it expresses. As we will see, this learnability challenge is compounded by fact that these scope interactions are particular to “grammatical” (or “functional”) modals. Epistemic and root modality can also be expressed by verbs, nouns, adverbs or adjectives. Such “lexical” modals³, however do not show the same scope interactions with scope-bearing elements. Hence, in order to master a flavor-polysemous modal, a child must realize (i) that the modal can express different flavors; (ii) that based on the flavor, it interacts differently with scope-bearing elements, but (iii) that this doesn’t follow from the notional meaning involved, since the same modal flavors can be expressed by lexical items that behave uniformly in their scopal interactions. We will articulate this learnability challenge by focusing on the interaction of flavor-polysemous modals with tense and aspect.

Given the learnability challenge that arises from the way flavor polysemy interacts with scope, we ask if there is a principled connection that links modal flavor and modal scope which the learner could use. We turn to modal acquisition and modal change to see whether they can inform this question. Our starting point here is that we find parallel asymmetries between root and epistemic modality in how modals are acquired and evolve over time in those languages that have flavor-polysemous modals. First, children seem to acquire root before epistemic modals. Second, modals tend to evolve from root to epistemic flavors, but not the other way around. Some propose that these two trends are related, either because children’s innovations trigger modal change, or because the kinds of innovations found in both acquisition and language change are natural meaning extensions. There is, however, an important caveat. Here again, the lexical vs. functional distinction seems to matter. As we will see, children’s delay with epistemic modals seems tied to grammatical modals: lexical epistemic words like *maybe* appear very early in child language. Moreover, the unidirectional tendency for modals to develop from root to epistemic flavors is matched by a unidirectional tendency for lexical modals to develop into grammatical modals. Are the flavor-based asymmetries in how modals are learned and evolve over time connected to the flavor-based scopal asymmetries of these modals? We will argue that they are, indirectly. Specifically, we propose that there is something special about the syntactic behavior of

¹ Here we use the term ‘polysemy’ in a pre-theoretical way, to mean that the same modal words can be used to express different flavors of modality. We do not assume that each modal comes with different senses. Instead we will adopt a Kratzerian view that modals come in single lexical entries, with their domain of quantification determined by conversational backgrounds.

² We focus exclusively on languages with flavor-polysemous modals, which are arguably the most difficult to acquire, given the interaction of polysemy and scope. However, it is important to keep in mind when investigating the limits of modal variation, that not all languages show the same flavor-polysemy, though they may still show some flavor-based scope restrictions (see Nauze 2008; Hacquard 2013). Such scope restrictions are arguably easier to acquire in the absence of polysemy. Yet, they may point to something more general and principled, about scope/flavor mappings. Another type of ‘polysemy’ to keep in mind is that in some of the world languages, the same modal word can be used in contexts where an English speaker would either use a possibility or a necessity modal (see Rullmann & Matthewson 2008, Deal 2011, Yanovich 2014, a.o.).

³ The terms lexical vs. grammatical modality come from Traugott (2011).

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grammatical modals, which explains their quirky flavor/scope interactions: grammatical modals are anaphoric and depend on their syntactic environment for full flavor specification; hence different flavors are tied to different syntactic positions. The anaphoricity of grammatical modals is what differentiates them from lexical modals and derives both their polysemy and flexible scope. We will argue that this plays a crucial role in how grammatical modals change over time and how they are acquired.

This paper is organized as follows. In section 2, we discuss the learnability challenges associated with flavor-polysemous modals. We review Hacquard's (2006, 2010) proposal, which attempts to account for these quirks in a principled manner: what makes grammatical modals special is that they have an anaphoric component, which makes their meaning sensitive to their grammatical environment. Specifically, modals have an event variable, which needs to be bound locally, and which determines the modals' domain of quantification. In section 3, we turn to how modals change across time and development. In section 4, we discuss how the anaphoricity proposal might help explain the types of unidirectionality we find in language change. In section 5, we discuss how children might exploit the link between modal anaphoricity, polysemy and scope, to overcome the learnability challenges of flavor-polysemous modality, and we present data that offer preliminary support for this view.

2. Grammatical modality: syntax, semantics, and learnability

This section outlines the learnability challenges that arise with flavor-polysemous grammatical modals, which argue for a principled connection between modal flavor and scope for these modals. We review Hacquard's (2006, 2010) proposal for such a connection.

2.1 Learnability challenges: polysemy and scope

The first property of grammatical modals we focus on is that they often can be polysemous: the same modal words can express different flavors of modality. As we saw in section 1, English *must*, for instance, can express *epistemic* necessity (i.e., necessity given a body of knowledge), as in (1a); but it can also be used to express different 'root' flavors, such as *deontic* (obligation) or *bouletic* (desire) necessity, as in (1b) and (1c), respectively.

The same modal flavors can also be expressed by lexical modals, which are typically monosemous, such as the verbs *seem*, *order*, *want*, and the adjective *likely*:

- | | | | |
|-----|----|--|------------------|
| (2) | a. | It { seems/is likely } that John is home. | <i>epistemic</i> |
| | b. | Al was ordered to pay a fine. | <i>deontic</i> |
| | c. | I want you to go to the party with me! | <i>bouletic</i> |

The polysemy of grammatical modals presents an initial learnability challenge, above and beyond the usual conceptual and word learning challenges associated with words that express abstract concepts (see e.g., Gleitman *et al.*, 2005). How and when do children figure out when a modal word can express different modal flavors? But the problem gets worse.

Grammatical modals interact differently with tense and aspect, as a function of the flavor they express. First, the same grammatical modals with epistemic flavors tend to outscope tense, while the same modals with root flavors tend to scope below tense

(Groenendijk & Stockhof 1975, Picallo 1990, Hacquard 2006, Borgonovo & Cummins 2007, Laca 2008). Whether epistemic modals *must* outscope **tense** is under debate (see von Stechow & Gillies 2007, Rullmann & Matthewson 2012, Hacquard 2013, *to appear*). Yet it is undeniable that they can, unlike their root counterparts.

To see this, note that the time of evaluation of a *lexical* epistemic modal is set by tense. With past tense on a lexical epistemic like *seem*, we have to evaluate past evidence: *seemed* must report a past necessity, given the evidence available at some past time. Imagine a scenario, where Al has been a prime suspect for a crime that occurred last night in Montreal. Up to now, all of the evidence pointed to him being in Montreal last night. But just now, we receive fresh evidence that proves that Al was in fact in DC last night. We cannot report this state of affairs with (3a); we have to use the present tensed form in (3b):

- (3) a. It seemed that Al was in DC last night/ Al seemed to be in DC last night.
 b. It seems that Al was in DC last night/Al seems to have been in DC last night.

This is not so with the *grammatical* semi-modal *have to*. With an epistemic interpretation, *had to* can be used in our scenario to report a *current* epistemic necessity, based on current evidence, about a past state of affairs:

- (4) Al had to be in DC last night.

Importantly, this temporal quirk of grammatical modals is flavor-sensitive. The same *had to* with a root flavor has to report a past necessity. (5) reports a past obligation (given Al's obligations last night, it was necessary for him to do the dishes then); it cannot report a current obligation to have done the dishes last night.

- (5) Al had to do the dishes last night.

Second, grammatical modals with root flavors combined with perfective **aspect** trigger what Bhatt (1999) calls an “actuality entailment”, that is, an uncancellable inference that the prejacent was actualized. This can be seen in languages that differentiate perfective and imperfective aspect overtly, such as French:

- (6) Al a pu partir ce matin, #mais il est resté.
 Al can-past-perfective leave this morning but he stayed
 ‘Al was able to leave this morning, #but he stayed’

In this respect, root grammatical modals differ from lexical modals like *want* or *have the possibility*, which express similar root meanings, but do not trigger actuality entailments with perfective:

- (7) a. Al a voulu partir, mais il est resté.
 Al want-past-perfective leave but he stayed
 ‘Al wanted to escape, but he stayed’

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- b. Al a eu la possibilité de partir, mais il est resté.
Al had-past-perfective the possibility to leave but he stayed
'Al had the possibility to escape, but he stayed'

Again, this aspectual quirk of grammatical modals is flavor-sensitive: perfective on *pouvoir* with an epistemic interpretation does not yield an actuality entailment (Hacquard 2006, 2009, to appear-b, Borgonovo & Cummins 2007):

- (8) Al a pu partir ce matin, mais il est peut-être resté.
Al can- past-perfective leave this morning but he is maybe stayed
'Al may have left this morning, but maybe he stayed'

Hence we see that grammatical modals differ from lexical modals that express similar flavors in their interactions with tense and aspect. Importantly, however, grammatical modals do not show these quirks across the board: these interactions with tense and aspect are flavor-sensitive. This creates a major learnability challenge. To see this, consider the case of actuality entailments that arise with root, but not epistemic, *pouvoir*.

Children will hear strings involving perfective on *pouvoir* such as '*Al a pu partir*'. Sometimes this string will express epistemic, sometimes root possibilities. Sometimes, this string will express an actualized possibility, sometimes not. When it expresses a *non*-actualized possibility, this possibility has to be epistemic in the adult language. However, what prevents children from hypothesizing that *a pu* can express a non-actualized *root* possibility, given that it can express root possibilities, and that it can express non-actualized possibilities? It can't be that this option is ruled out based on the **notional meaning** expressed. As we see in (7), perfective aspect does not force actuality entailments with lexical modals that express root meanings.

Could it be ruled out by children keeping track of **input frequency**? Recent findings show that children are good at keeping track of statistical frequencies, and that they may be able to infer what is not possible by keeping track of what is and what is not attested (see e.g., Saffran *et al.* 1996, Saffran 2001). Thus, children perhaps refrain from hypothesizing non-actualized root possibilities with *a pu* because they never hear *a pu* with such a meaning.

There are two reasons why this possibility seems unlikely. First, it would require that children are always able to tell what intended flavor was meant. However, even adults do not always know (Coates 1983, Papafragou 1998, Papafragou *et al.* 2007). Second, children's production of modal expressions differs greatly from that of their parents (Cournane 2014, 2015a,b): children do not use the same modal words as their parents with the same frequency, and they sometimes use different words altogether to express similar meanings (for instance, they tend to use *maybe* where their parents tend to use *might*). In comprehension tasks, children also differ from adults in both semantic interpretations and pragmatic inferences (Noveck *et al.* 1996, Papafragou & Ozturk 2006, Cournane 2014).

How then do children figure out how grammatical modals interact with tense and aspect, if they cannot rely on the notional meanings expressed and on statistics? This learnability conundrum suggests that there is something special and principled about the flavor-based interaction with tense and aspect of grammatical modals.

One obvious candidate for this is Cinque’s hierarchy (Cinque 1999), according to which functional elements are organized along a fixed and universal order, with epistemic modals appearing above tense, and root modals below aspect.

- (9) *Cinque’s hierarchy (simplified)*
 Modal_{epis} > Tense > Aspect > Modal_{root} > VP

If this hierarchy is truly universal, and learners are able to use it, they should easily figure out how different flavors interact with tense and aspect differently. Given that functional (“grammatical”) epistemic modals have to scope above **tense**, it follows that they can (and in fact must) outscope tense. This makes sense of the fact that a past tense which, on the surface, seems to modify an epistemic modal, must in fact be interpreted below it, and hence does not backshift the modal’s time of evaluation, as was needed for (4). And given that root modals scope below tense, it follows that their time of evaluation has to be set by tense, as was needed for (5).

Scope can also make sense of the actuality entailment facts with **aspect**, and why they occur with root but not epistemic flavors. Hacquard (2006, 2009) for instance proposes that when the aspect that quantifies over the VP event outscoops the modal (as happens when the modal expresses a root meaning), it anchors this event in the actual world, forcing an actual event. Since epistemics outscope aspect, the VP event is anchored in the modal worlds: no actual event is forced. This is schematized in (10) below (w^* is the actual world):

- (10) Al a pu partir.
 Al can-pst-pfv leave
- a. *Epistemic*: In some world w' compatible with the evidence in w^* , there is an event e of Al leaving in w' .
- b. *Ability*: There is an event e in w^* such that in some world w' compatible with Al’s abilities in w^* e is an event of Al leaving in w' .

Lexical modals differ from grammatical modals in not being functional, and hence not being subject to Cinque’s hierarchy. Hence, once the learner realizes that a modal is functional rather than lexical, Cinque’s hierarchy could help her resolve the challenge of figuring out how this modal, if polysemous, should interact with tense and aspect, by associating epistemic flavors to a high position, and root flavors to a low position. Cinque’s hierarchy can thus resolve our learnability challenge. But this of course comes at the cost of having a built-in, arbitrary, hierarchy of functional projections. Is this ordering really arbitrary, or could it be semantically motivated?

In the next section, we turn to Hacquard’s (2006, 2010) proposal, which attempts to motivate semantically the scopal interactions of grammatical modals. In a nutshell, the scope of epistemic and root grammatical modals is not an arbitrary fact of syntax, nor is it solely due to the notional meaning expressed. Instead, it follows from a semantic distinction that follows from the syntactic category of the modal: grammatical modals (unlike lexical modals) are *anaphoric*: their domain of quantification is provided anaphorically, via an event variable. In different positions, different event binders are made available, resulting in different modal flavors. Hence, the anaphoricity of grammatical modals is the source of both their polysemy and scope/flavor interactions.

2.2 Proposal: grammatical modals are anaphoric

To capture the flavor ‘polysemy’ of grammatical modals, Kratzer (1981, 1991, 2012) proposes that modals come in a single lexical entry, unspecified for flavor. A necessity modal like *must* or *have to* is a universal quantifier over possible worlds, whose domain of quantification gets determined by context, via a *modal base* (MB), as shown in the simplified entry in (11) (we ignore the ordering source here, which further narrows down the domain of quantification and is responsible for meaning differences amongst root modals):

$$(11) \quad [[\mathbf{have\ to}]]^{w,g, MB} = \lambda q_{\langle s,t \rangle} \forall w' (w' \in MB(w) : q(w'))$$

There are two kinds of modal bases: (i) *informational*⁴ modal bases, which pick out worlds compatible with a body of information, and which are responsible for epistemic flavors (12a); (ii) *circumstantial* modal bases, which pick out worlds compatible with certain circumstances, and are responsible for root flavors (12b).

- (12) a. $[[\mathbf{Al\ has\ to\ be\ home}]]^{w,g, MB_{epis}} = 1$ iff
in all w' compatible with the information we have in w , Al is home in w'
- b. $[[\mathbf{Al\ has\ to\ pay\ a\ fine}]]^{w,g, MB_{circ}} = 1$ iff *in all w' compatible with the circumstances (and that best obey the law) in w , Al pays a fine in w'*

While this captures the polysemy of grammatical modals, it doesn’t yet capture the scopal restrictions in flavor, namely that epistemic flavors are tied to positions above tense, and root flavors to positions below aspect. What we need is a way to restrict informational modal bases to a high position, and circumstantial modal bases to a low position.

To do so, Hacquard (2006, 2010) proposes to alter Kratzer’s system by having the domain of quantification of modals be determined anaphorically rather than purely contextually. While in the standard Kratzerian view, the domain is essentially determined via a free MB variable, in Hacquard (2006, 2010), it is determined by a variable that has to be bound. Specifically, modal bases are determined relative to an event (rather than a world of evaluation): modals have an event variable, which needs to be bound locally by an anchoring event (13). As we will see, two different types of event anchors in different syntactic positions make available two different modal bases, and hence result in different scope/flavor mappings.

$$(13) \quad [[\mathbf{have\ to}]]^{w,g} = \lambda q_{\langle s,t \rangle} \forall w' (w' \in MB(e) : q(w'))$$

For type reasons, there are two positions in which a modal can appear within a clause, irrespective of flavor: either right above TP, or right above VP. When the modal is in the low position, the closest event binder is the aspect that quantifies over the VP event: this

⁴ In the original Kratzerian theory, the modal base responsible for epistemic flavors is called epistemic. This is revised in Kratzer (2012) in view of the fact that ‘epistemic’ modals aren’t always knowledge-based. Aside from this update, this quick summary stays very close to the original theory. Kratzer (2012) makes more substantial revisions, which we cannot get into here for reasons of space.

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flexible scope, and the scope/flavor mappings will follow. Or, the learner might notice that the modal has flexible scope, in which case, she might infer that it is flavor-polysemous. Hence, from realizing that a modal is anaphoric (grammatical), the scope/flavor mappings can be expected. In the next sections, we turn to patterns in acquisition and language change, to see whether we can find evidence for the anaphoricity of grammatical modality.

3. Grammatical modality across time and development

In this discussion of language acquisition and language change, we again focus on languages with flavor-polysemous modals, since their historical and acquisition profiles are the most well documented to date, and since these are arguably the most challenging to learn, given the interaction of polysemy and scope.

3.1. Patterns of change and acquisition and existing proposals

The acquisition literature argues, based mostly on corpus studies, that children acquire root modals before they acquire epistemic ones (Kuczaj & Maratsos 1975; Stephany 1979; Wells 1985; Shatz & Wilcox 1991; Papafragou 1998). Ability modals are the first to emerge, around the 2nd birthday, followed by deontics, and then epistemics, around the 3rd birthday:

- (16) a. I **can** write. (referring to ability to write his name, 2;03,04)
b. You **must** have pencil. (urging mom to take pencil, 2;11,28)
c. He **must** be ready for his lunch. (about a baby crying, 3;05,01)
(“Adam”, Brown 1973)

The language change literature argues that modals tend to evolve along systematic paths. First, grammatical modals tend to develop from lexical modals, such as verbs, but not the other way around. Second, modals tend to start out with root meanings, and then acquire epistemic meanings, but not the other way around (Bybee *et al.* 1994, Roberts & Roussou 2003, van Gelderen 2004, Traugott 2011, Narrog 2012, a.o.). For instance, the English modal *can* started out as a verb in Germanic with the modal meaning ‘to know how’; it then appears as a functional modal after the erosion of agreement (among other factors, see Roberts 1985), meaning intellectual and then physical ability in Middle English, and evolves into a more general possibility meaning in Early Modern English; *can* finally occurs with deontic and epistemic meanings in Late Modern English (OED, Bybee *et al.* 1994; see also Traugott 1989, Traugott & Dasher 2002):

- (17) Typical path (e.g., *can* from Old English *cunnan*)
root verb ➡ root modal auxiliary ➡ epistemic modal auxiliary
cunnan (know how) ➡ *can* (ability) ➡ *can* (circumstantial) ➡ *can* (epistemic)

We thus find parallel trends in both acquisition and language change: (i) children seem to acquire *root* before *epistemic* modals; (ii) modals tend to develop from *root* into *epistemic* modals, in diachrony. What drives this unidirectionality in language change and acquisition, and are these trends related? Two main types of proposals can be found in the literature to explain these parallel trends: conceptual proposals, where the evolution from root to

epistemic is a natural meaning extension, and syntactic proposals, where the evolution is due to a natural syntactic reanalysis process.

There are several variants of the **conceptual** approach. All have in common that the meaning extension from root to epistemic modality is deemed somehow natural. It is argued to arise either via *metaphorical extension*, from the more concrete domain of physical possibilities to the more abstract domain of intellectual possibilities (Sweetser 1990, Diessel 2011, 2012), or via ‘*subjectivity*’, that is, with more and more speaker-orientation (Narrog 2012); or via an *implicature* process: if ‘John had the obligation to do something’, then ‘he must (epistemically) have done it’ (Traugott 1989, Traugott & Dasher 2002). According to this kind of approach, the trends in child language and language change are parallel—as they both involve a natural meaning extension—but independent. Children start with root modality, and then move on to acquire the conceptually more abstract epistemic modality, as their own conceptual capacities and “theory of mind” (i.e., ability to attribute mental states to themselves and others) develop.

It is not entirely clear that the conceptual approaches are truly explanatory, however. First, why should the extension from root to epistemic modality count as natural, but not one from epistemic to root? Are root possibilities not also abstract? And couldn’t the implicature go in the opposite direction? Wouldn’t it be as natural to infer from ‘he must (epistemically) have done it’ that ‘he had the obligation, or strong desire, to do it’? As for the tendency of children to acquire root before epistemic modality, it is not clear either that an appeal to conceptual development is truly warranted. For one, there is mounting evidence from infant developmental studies that children have an understanding of sophisticated epistemic concepts early on (Onishi & Baillargeon 2005, a.o.). Second, a closer look at children’s production of modals shows that children as young as two produce lexical epistemic words like *maybe* (O’Neill & Atance 2000, Cournane 2015a,b, a.o). Children may thus start *producing* polysemous grammatical modals with root meanings before epistemic ones, but this could be due to a host of reasons, such as not realizing that these words are polysemous, or choosing to use words like *maybe*, because it is unambiguous, or because it appears in syntactically simpler structures (Cournane 2015a,b). Whatever the reason, children’s production of lexical epistemics casts doubt on the idea that they lack conceptual access to epistemic modality.

Syntactic approaches appeal to syntactic economy principles to explain an “upward” reanalysis (from $V > v > INFL > C$) (Roberts & Roussou 2003, van Gelderen 2004, 2011). Generally in these approaches, upwards reanalysis is directly the source of form changes (lexical to grammatical), and indirectly the source of meaning changes (root to epistemic). The assumption is that the innovative forms (grammatical, epistemic) are higher in the tree than the conservative forms (lexical, root), in accordance with, for example, Cinque’s hierarchy (see Roberts 2010, cf. van Gelderen 2004). What drives this upward reanalysis is a built-in preference in children for simpler structures. According to this kind of approach, the link between the acquisition and change trends is causal; children are the agents of change and their (syntactically-driven) innovations can result in language change.

The syntactic approaches also have shortcomings. Syntactic approaches derive unidirectionality from syntactic reanalyses. But while syntactic economy principles can explain *syntactic* reanalyses, it is not clear that they can explain *semantic* reanalyses. It is indeed quite unclear what meanings children are supposed to be assigning to the modals that they are syntactically reanalyzing.

4. Modal anaphoricity & modal change

Recall that a typical path for modal change starts with a lexical modal, often a verb, which expresses some kind of root meaning.⁶ This verb undergoes two kinds of changes: (i) a syntactic one, from lexical to functional (losing, for instance, agreement morphology); (ii) a semantic one, by acquiring epistemic meanings. What is not attested are lexical modals that derive from grammatical modals, nor epistemic modals later acquiring root meanings.

Modal change is slow, and must happen incrementally, with very minimal changes from one stage of evolution to the next (Bybee *et al.* 1994, Roberts 2010). In this section, we show how the anaphoricity proposal can explain why such small changes should proceed in the lexical to grammatical direction, and from the root to epistemic direction, but not vice versa.

Recall that the difference between lexical and grammatical modality is that the latter is anaphoric. Lexical modals such as verbs and adjectives are predicates of events; grammatical modals are not, but they are nonetheless event-relative: they have an event variable that needs to be bound. Now, a lexical verb could easily transform into a grammatical modal by having its event argument converted into a ‘dependent’ event variable (Giannakidou 1998). Grano (2008) proposes something similar for the restructuring of verbs like *try*, whereby the individual argument gets converted into a dependent individual variable. This initial syntactic reanalysis from a lexical to a grammatical modal would be barely noticeable meaning-wise, as the concept expressed would remain the same.⁷ But this is where asymmetries in flavor come into play. A grammatical *root* modal scopes low (right above the VP), whereas a grammatical *epistemic* modal scopes high (above tense). Because a grammatical *root* modal appears in the same region of the tree as a lexical *root* modal, it might be possible to syntactically reanalyze one for the other. At least, there should be more confusability between lexical and grammatical *root* modals than between lexical and grammatical epistemics, since *lexical* epistemic modals, being predicates of events, have to appear inside the VP, while a corresponding grammatical epistemic scopes above tense.

Hacquard (2013) argues that this asymmetry in potential confusability might be the source of the unidirectionality in modal change patterns. Specifically, what might trigger modal change is an initial syntactic reanalysis of a lexical verb into a functional modal with the same meaning. A lexical verb like *want* is a predicate of events, fully specified for meaning; a functional modal like *must* is not a predicate of events, but it is event-relative: its full flavor specification arises via the binding of its event variable. Event-relativity allows a straightforward conversion from lexical to functional modality. All that needs to happen is for the lexical modal’s event argument to be converted into an event variable, which then needs to be bound:

- (18) a. $[[\mathbf{want}]]^w = \lambda e \lambda q_{st}. \mathbf{want}'(e) \ \& \ \text{in } \forall w'(w' \in \text{DESIRE}(e)): q(w')$
 b. $[[\mathbf{must}]]^w = \lambda q_{st}. \quad \forall w'(w' \in \text{MB}(e)): \quad q(w')$

⁶These verbs are often called premodals (Lightfoot 1979, a.o.). They typically denote mental states or states of obligation, desire or potential acting on the subject (see also Bybee *et al.* 1994, Tollan 2013:9).

⁷This is in line with von Stechow’s (1995) conjecture that “grammaticalization is a **re-arrangement** of meaning, not a change of meaning”; emphasis ours. See also Tollan (2013).

Hence the process would start with an initial syntactic category change: a verb's argument gets converted into an event variable, which then has to be bound by a local event binder (the VP event). This first step (from (19a) to (19b)) is primarily type-theoretic: there is no change in the concept expressed, only in how the relations entailed by that concept are associated with arguments (or contextual variables). The modal might then acquire a more general meaning by allowing any circumstantial modal base (19c). Once it loses its restriction to circumstantial modal bases (19d), and given that it is now functional, it is free to merge in different positions.⁸ When it merges in a high position, its event argument can no longer be bound by the VP: it will either be bound by the speech event or an attitude event, when embedded, and receive epistemic interpretations:

- (19) a. $[[\mathbf{cunnan}(\textit{know how})]] = \lambda q \lambda e. \textit{know-how}'(e) \ \& \ \exists w(w \in \textit{know-how}(e): q(w))$
 b. $[[\mathbf{cunnan}(\textit{know how})]] = \lambda q. \exists w(w \in \textit{know-how}(e): q(w))$
 c. $[[\mathbf{can}(\textit{root})]] = \lambda p. \exists w(w \in \mathbf{MB}_{\textit{circ}}(e): q(w))$
 d. $[[\mathbf{can}(\textit{root or epistemic})]] = \lambda p. \exists w(w \in \mathbf{MB}(e): q(w))$

This accounts for the naturalness of the common path from lexical to functional, and from root to epistemic. But what about non-attested patterns?

First, why couldn't a lexical verb that expresses an epistemic meaning become functional, and, over time acquire root meanings? What makes the initial syntactic reanalysis possible for the root case is that it is relatively easy to misanalyze a *lexical* root modal as a *functional* root modal given that they occupy close positions in the tree (since root modals appear right above the VP). Furthermore, lexical root modals tend to take complements (in English, nonfinite), which resemble prejacent of functional modals. A lexical epistemic like *think*, on the other hand, is much more obviously different from a functional epistemic modal, given that (i) functional epistemics scope high in the tree, and (ii) lexical epistemics take complements (in English, finite) that are much more different than the prejacent of functional modals (in English, non finite).

Second, why do functional modals never seem to transform into lexical verbs?⁹ It could be that scope flexibility and polysemy provide evidence that prevents reanalysis into a lexical word. Or, the explanation could be more syntactic in nature: perhaps it's easier to ignore agreement markers than it is to hallucinate them, a general principle of the historical comparative method.

In sum, we propose that what might explain the unidirectionality of modal change over time is the asymmetry in syntactic similarity between lexical and grammatical root modals, as compared to lexical and grammatical epistemic modals. If this is correct, we might expect children to fall prey to such confusability: they should be more likely to confuse a lexical root modal for a grammatical one than to confuse a lexical epistemic for a grammatical one. As we will see in the next section, preliminary evidence suggests that this might be the case.

⁸ Whether a modal takes this extra step or remains a grammatical modal with root meanings exclusively depends on several factors, for instance, whether there might be functional pressure to recruit new words to express meanings that were expressed by words that become obsolete (see van Gelderen 2004, 'cyclic renewal').

⁹ When a functional modal does evolve further, it typically transforms into a mood marker (Narrog 2012, a.o.).

5. Modal anaphoricity & modal acquisition

Recall the learnability challenge that flavor-polysemous modals create for children: children have to figure out that a modal like *pouvoir* can express both epistemic and root modality, and that when it combines with perfective aspect and expresses root modality, it must describe an actualized possibility, but not necessarily when it expresses epistemic modality. As we have argued in section 2, this learnability challenge cannot be resolved by simply appealing to notional meaning, since lexical modals with root meanings do not force such actuality entailments. We proposed that there has to be a principled connection between scope and flavor for polysemous grammatical modals, which children could exploit.

According to our proposal, the lexical status of a modal (functional or lexical, as possibly given away by morpho-syntactic cues) could help the child determine whether the modal is anaphoric and therefore a candidate for polysemy and scope flexibility: the child should more readily expect *grammatical* modals to show polysemy and scope flexibility than *lexical* modals. We briefly discuss preliminary evidence for this in section 5.1.

Second, we saw that we might be able to explain unidirectionality in modal change trends by invoking the anaphoricization of a modal, which we argued was more likely to start out from root than epistemic lexical modals, due to the ease of confusability between lexical and grammatical modality for root flavors. In section 5.2, we review preliminary evidence that these language change tendencies can also be found in child language.

5.1. Evidence for exploitation of grammaticality and anaphoricity in modal learning

Our current understanding of young children's modal comprehension is still very spotty. For one, the majority of studies that have probed for asymmetries in the acquisition of root vs. epistemic modals have focused on production data. This could well underestimate children's comprehension of modals. Children may not produce certain modals with certain flavors because they may not want to talk about these kinds of possibilities. Or they may choose to use other words to express these meanings. Hence, lack of production does not entail lack of comprehension. Moreover, as we saw in section 3, children as young as two do produce lexical modals like *maybe*, suggesting that they may have access to epistemic modality, even if their first uses of grammatical modals are with root meanings.

To date, only three studies have specifically tested children's comprehension of a polysemous modal (*must* and its Spanish and German counterparts). These studies show that children understand that *must* can be used to express both root and epistemic flavors as early as age 3 (Fond 2003, Heizmann 2006, Cournane 2015). We expect that, if learners exploit the connection between anaphoricity and polysemy and scope when acquiring modals, children who show awareness of *must*'s polysemy, should also show awareness that this modal interacts differently with tense and aspect.

Cournane (2015b) and Cournane & Pérez-Leroux (*in prep*) tested whether children paid attention to the presence of aspectual markers in the prejacent of *must* sentences when deciding whether *must* was intended with a deontic or an epistemic interpretation. Specifically, they tested children's interpretations of *must*-sentences with bare complements (*Michael must wear his boots*) and with both perfect and progressive aspect-marked complements (*Michael must {be wearing/have worn} his boots*) using a picture-choice task.

In the task, participants heard a test sentence in the context of a story and then selected between two pictures to illustrate the sentence, one depicting an epistemic interpretation and one a root interpretation.

Results show that adults behaved as expected, choosing epistemic pictures for modal-aspect sentences and primarily deontic pictures for bare complement sentences. Child results show that three year olds likely interpret most sentences as deontic, but when they select epistemic interpretations it is significantly for aspect-marked sentences, though this may initially only be true in the perfect condition (but see Heizmann 2006 for evidence that with progressive *-ing* three year olds understand that both root and epistemic interpretations are possible). Children become increasingly adult-like for aspect-marked sentences, showing very strong epistemic interpretations by age 5. Children become less adult-like for the bare complement sentences, progressing by age 5 to an input-divergent epistemic-bias. While these results should be taken with a grain of salt because of the older children's responses to the bare complement sentences (see Cournane 2015b for an analysis suggesting these represent overextensions in line with language change), they tentatively suggest that when children are aware of a modal's polysemy, they are also sensitive to flavor/scope differences.

To see whether children pay attention to the lexical status of a modal, and exploit it when deciding whether it is a candidate for polysemy and flexible scope, we now turn to their comprehension of the lexical verb *want*. *Want* is a lexical root (bouletic) modal that is often involved in grammaticalization processes, by typically evolving into a future modal auxiliary. It is currently polysemous in various languages (e.g., Brazilian Portuguese; Mendes 2015).

English-learning children understand early on that *want* expresses desire. However, they seem to be willing to entertain **polysemy** with *want*, depending on the *syntax* in which it appears. Evidence for this comes from naturalistic production data (Cournane 2015b, *submitted*), where children sometimes produce *want* with modal auxiliary syntax (dropping *to* for instance; Cournane, *submitted*). Interestingly, when they do, they seem to sometimes attribute to *want* more of a future or circumstantial meaning than a purely bouletic one:

- (20) Looking at carriage, wondering if it's big enough: "I *want* fit in there?"
("Sarah", 2;08, Brown 1973)

Further evidence comes from Becker (2006, 2009), who probed children's understanding of raising vs. control predicates. In particular, Becker tested whether children would accept *want* sentences in a raising frame, as in (21):

- (21) It wants to be raining.

Becker found that young children were willing to accept *want* with raising syntax. Interestingly, when they did, they seemed to attribute to it a future, rather than a bouletic meaning, as the following dialogue between a child and the experimenter seems to show:

- (22) Exp: Does it want to be raining today?
Child: No, because it *IS* raining.
Exp: What if it was sunny, could it want to be raining?

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Child: No because it's sunny.

Exp: What if it was cloudy, could it want to be raining?

Child: Yes, if it was a dark cloud.

Hence, we see that the meanings that children assign to modals, and whether they entertain polysemy, correlate with the syntactic frames in which these modals occur. Young children are sensitive to the presence of aspect in the preadjacent of *must* when deciding whether *must* was intended with a deontic or an epistemic interpretation. They are further willing to extend the meaning of *want*, in the presence of morpho-syntactic cues of functional modality.

5.2. Evidence for upward reanalysis in modal learning

There is an ongoing debate as to the role of children in language change. Some argue that they play a crucial role in introducing new forms that eventually result in language change (e.g., Lightfoot 1979, Roberts & Roussou 2003, van Gelderen 2004, Kroch 2006). Others argue that they play no role, though their errors may be reminiscent of language change patterns, if these are natural changes (e.g., natural meaning extensions) (Traugott & Dasher 2002, Diessel 2011, 2012, a.o.). We may thus expect children's errors to mimic the kinds of innovations that happen diachronically (see Cournane, *to appear*). Given the unidirectionality of modal change over time, we may expect similar trends in child modal use. In particular, we expect both a tendency for "upward" reanalysis, where lexical modals get treated like functional modals, and for modal meaning extensions from root to epistemic, but not vice versa. Cournane (2015b) provides evidence for both of these trends in child language.

With respect to syntactic reanalysis, Cournane (2015b, *submitted*) presents evidence for an upward reanalysis of the *semi-modals* (*have to*, *be going to*, *be supposed to*), through a corpus analysis investigating children's production of various lexical and grammatical modals. Cournane notes that child output strings containing verbal modals have omitted functional morphemes, most notably infinitival *to* and *be* (27a). These omissions cause verbal modal syntax to pattern, at least on the surface, with target syntax for auxiliary modals like *must* or *can* (27b): *subject + modal + bare verb complement*.

- (27) a. Utterances with verbal modals ("Sarah"; Brown, 1973)
- | | | |
|------|----------------------------------|--|
| i. | I goin touch it. | Omitted <i>am</i> and <i>to</i> ; 3;00 |
| ii. | I had do it. | Omitted <i>to</i> ; 3;06 |
| iii. | No you supposed to go like that. | Omitted <i>are</i> ; 5;0 |
- b. Utterances with auxiliary modals ("Sarah"; Brown, 1973)
- | | | |
|------|---------------------|--------------|
| i. | I can come get you. | Target; 2;08 |
| ii. | You must go to bed. | Target; 3;01 |
| iii. | That would hurt. | Target; 3;09 |

Cournane shows that with these semi-modals, children tend to omit functional elements like *to* and *be* into their 6th year, compatible with an analysis as full modal auxiliaries. Interestingly, these omissions persist for much longer than similar omissions with lexical modals, such as *try to* and *want to*. If we take it at face value that omissions reveal a higher

analysis for the set of v modals, this result suggests that the child may have competing grammars while in the optional omission stage (i.e., she posits both v *going* and INFL *going*), like we see in diachrony (Yang 2000, i.a.).

Cournane (2014) also shows that children tend to regularly accept epistemic interpretations for modals that adults use only or predominantly with root meanings. For instance, adults tend to use *can* and *have to* to express root modality; however, children accept these modals to express epistemic modality as well, differing from adult controls. This was shown experimentally via a Sentence Preference Task, where children were told a story, and had to pick which one of two puppets best described what happened. An epistemic scenario would go as follows: ‘The little girl was playing on the swing, and look, what happened? [picture of a girl on the ground crying, with a cut on her knee]. Puppet A: “*She might have hurt herself on the swing*”. Puppet B: “*She can have hurt herself on the swing*”. Children chose the *can* sentence significantly more than adults in such scenarios. In deontic scenarios, on the other hand, children and adults did not differ.

Thus we see that children’s syntactic and semantic “errors” (input divergences) mirror diachronic patterns. The kinds of syntactic and semantic changes that take place over time occur naturally in child language. This might serve as evidence that children’s reanalyses are a source of innovations that eventually result in language change (Lightfoot 1979, Clark & Roberts 1993, Roberts & Roussou 2003, Yang 2000, van Gelderen 2004, Kroch 2006, Cournane, *to appear*).

6. Conclusion

We have discussed the learnability challenges associated with acquiring words that can express different modal flavors, such as *must* or *have to*. The main source of difficulty was that these modals interact differently with tense and aspect, based on the flavor they express. Because these flavor-based interactions only applied to grammatical modals, and not to lexical modals that express similar meanings, we have argued that there had to be something principled about the scope/flavor interactions of grammatical modals that would guide the learner to the correct mappings. We proposed that what sets grammatical modals apart from lexical modals, and allows both polysemy and flexible scope is their anaphoricity: the domain of quantification of a grammatical modal is determined anaphorically, via an event variable that needs to be bound locally, making the grammatical modal dependent on its grammatical environment (and thus scope) for full flavor determination. This account predicts that children will exploit anaphoricity when modal learning, and, in particular, that they will pay special attention to the lexical status of a modal: morpho-syntactic cues to the functional nature of a modal word should lead children to expect polysemy and flexible scope. Furthermore, children who postulate modal polysemy should concurrently postulate flexible scope, and we can then expect children to learn the correct scope/flavor mappings.

We then turned to modal change and modal acquisition data, and discussed the flavor-based asymmetries in acquisition and change that are also tied to grammatical modality, namely, the tendency for grammatical modals to evolve from lexical modals, and to start with root rather than epistemic flavors, and the tendency for children to acquire root before epistemic flavors of grammatical modals. We discussed how the anaphoricity proposal might make sense of these trends. First, we argued that the unidirectionality in the modal change patterns could be due to the ease with which a lexical verb with a root meaning

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might be syntactically reanalyzed as a grammatical root modal, by having its event argument be converted in a dependent event variable. The source of confusability between a lexical and a grammatical root could be the relatively close syntactic position of a lexical verb and a grammatical root modal, which scopes right above the VP. This contrasts with the relative lack of confusability between a lexical verb with an epistemic meaning and a grammatical epistemic, which scopes high.

As for modal acquisition, we found that children's apparent reanalyses both in production and comprehension were in line with the modal change patterns, proving initial support for the view that children's innovations might be a source of language change. We further saw preliminary data in support of the acquisition predictions made by the anaphoricity proposal. In particular, we saw that children paid attention to the lexical status of a modal: morpho-syntactic cues to the functional nature of a modal word seem to lead children to postulate polysemy with *want*. Furthermore, with polysemous *must* children seem to pay attention to its interactions with aspectual markers in deciding how to interpret the modal. Though these preliminary results are encouraging, much more remains to be done, to test specifically (i) when and how children postulate modal polysemy; (ii) when and how children understand the interactions of modals with tense and aspect; and (iii) when and how children make use of morphological cues to differentiate lexical from grammatical modality.

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