Future and the composition of modal meaning: the view from Igbo[1]

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Abstract. In many languages, overt 'future markers' play a role in the expression of modal meaning, but their exact semantic contributions vary depending on the particular language and analysis. In some prominent existing accounts, future markers i) contribute prospective time shifting and combine with modal operators or ii) they are part of the functional modal paradigm of a language, on a par with *must*-type necessity modals. The Igbo future marker *ga* presents an interesting variation on ii). On its own, *ga* expresses necessity relative to a stereotypical conversational background (similar to other future modals). Interestingly, however, *ga* also contributes to the composition of other necessity meanings (≈ MUST) as well as circumstantial possibility (≈ ability CAN). We explore this empirical pattern in more detail, sketch an analysis of the relevant modal constructions involving *ga*, and discuss potential theoretical implications from a cross-linguistic perspective.

Keywords: future, modality, ability, Igbo.

1. Introduction

Morphological markers that are used to express predictive future meaning show interesting cross-linguistic variation in their distribution as well as in their specific meaning contributions. Some natural language future markers have been argued to encode purely modal meaning (see e.g. Giannakidou and Mari 2018b on Greek and Italian), while others have been analyzed as prospective aspect operators (Matthewson 2013 on Gitksan) or as encoding a combination of these two meaning components (e.g. Tonhauser 2011 on Paraguayan Guaraní). Depending on their exact semantics, the forms that canonically express futurity in a language play different part in the language's overall modal paradigm. A future marker with purely modal semantics might be used to express modal meanings other than prediction, such as epistemic necessity. Such a future marker can often be argued to be part of the overall modal paradigm of the language (see Enç 1996, among others, on *will* in English). Prospective aspect markers, by contrast, might co-occur with modal expressions and overtly contribute future orientation to the composition of both necessity and possibility meanings. In this paper, we discuss the future marker *ga* in Igbo, which is interesting in that it can be argued to belong to the class of modal future markers, while also contributing to the composition of various modal meanings beyond prediction.

Igbo is a Benue-Congo language spoken in southern Nigeria. There are various geographical dialects, but the standard variety is largely based on the Owerri, Umuahia and Onitsha dialects (Emenanjo, 1978). The data presented in this paper are based on the standard variety. Igbo is a tone language with three level tones: high (á), low (à) and downstep (ꜜá). Vowels are distinguished based on the advanced tongue root (+/−ATR) feature, and vowels in a phonological

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word come from the same ATR set. Verbs often bear inflectional and derivational affixes to express grammatical categories such as TAM and changes in argument structure. Most of the verbal affixes take on the ATR value and tone of the verbal stem (Green and Igwe, 1963; Manfredi, 1991; Emenanjo, 2015). The basic word order in Igbo is SVO and there is no agreement morphology. The exact meaning of the *-rV* (where *V* is a vowel that assimilates in quality and tone to the vowel of the verb stem) suffix that surfaces in some of the data below is debated (Déchaine, 1993; Manfredi, 1997; Uwalaka, 1988; Emenanjo, 2015). With eventive verbs, the temporal interpretation of *-rV* is past, but present with stative verbs. And because the suffix is in complementary distribution with the negative suffix *-ghi*, Déchaine (1993) argues that the *-rV* suffix indicates affirmative polarity; see (1) to (3).[2]

(1) Paul bù-rù òkú!té
Paul carry-rV stone
"Paul carried a stone."

(2) Paul mà-rà ḿ!má
Paul be.beautiful-rV beauty
"Paul is beautiful."

(3) Paul é!bú-ghí òkú!té
Paul carry-NEG stone
"Paul did not carry a stone."

The basic data pattern that we are concerned with in this paper is the following. In Igbo, future meaning, i.e. prediction, is canonically expressed with the pre-verbal morpheme *ga*, as illustrated in (4).

(4) Paul **gà**-èbú òkú!té áhụ̀
Paul GA-carry stone DEF
"Paul will carry the stone."

When *ga* combines with the verbal suffix *ṛịrị*, the sentence obtains a meaning that corresponds to modal necessity (≈ MUST), see (5). Moreover, *ga* combined with the suffix *ni* appears to obtain a possibility reading (≈ CAN), as shown in (6).

(5) Paul **gà**-èbú-**ṛírí** òkú!té áhụ̀
Paul GA-carry-RIRI stone DEF
"Paul must carry the stone."

(6) Paul **gà**-èbú-**ní** òkú!té áhụ̀
Paul GA-carry-NI stone DEF
"Paul can carry the stone."

In the following sections, we take a closer look at the constructions exemplified in (4), (5) and (6), and investigate the empirical behavior and meaning contributions of *ga*, *ṛịrị* and *ni*. We will show that *ga*, *ga ... ṛịrị* and *ga ... ni* display interesting differences not only in modal

[2]Besides *rV*, the following abbreviations are used in our glosses of Igbo sentences: COP = copular, DEF = definite, IMPF = imperfective, INF = infinitive, LOC = locative, NEG = negation, PRED = predicative, PREP = preposition, SFX = suffix, SG = singular.

force/strength, but also in their respective restrictions on modal flavor, and we will propose an account that aims to capture these force-flavor interactions.

Most of the examples presented in this paper make use of contexts adapted from Vander Klok's (2021) revised modal questionnaire for cross-linguistic use. The Igbo sentences and judgments on their felicity stem from the second author's native speaker intuitions. We do not aim at an exhaustive description of the modal system of Igbo in this paper, but instead focus on the constructions in (4)–(6). For the sake of transparency, however, let us mention two additional forms that can be used in Igbo to express necessity and possibility, respectively. As will be discussed in more detail in the next section, strong necessity in all modal flavors is canonically expressed by the construction involving *ga ... ṛịrị* that is illustrated in (5). Weak necessity, by contrast, can be expressed with the dedicated modal *kwesi(ri)*, as illustrated in (7) for the case of deontic weak necessity.

(7) *Context (deontic weak necessity):* In England, it is recommended that face coverings be worn in stores, but it is not a legal requirement. You plan on going shopping, and you think to yourself ...

Ḿ **kwèsìrì** í-yì íhé kpòchíé íhú ꜜḿ
1SG OUGHT INF-wear thing cover face 1SG
"I ought to wear a face covering."

Another ubiquitous construction in the Igbo modal system involves the expression *nwere ike* (lit. 'have strength'), which can be used to convey possibility meaning in all modal flavors we investigated,[3] including deontic flavor as in (8).

(8) *Context (deontic possibility):* The ferris wheel ride is only for children under 12 years of age. Martin is 10 years of age. It is not obligatory for Martin to go on the ride if he doesn't want to, but ...

Martin **nwèrè íké** í-nyà úgbó
Martin have strength INF-ride vehicle
"Martin may ride the ferris wheel."

The rest of the paper is structured as follows. In Section 2, we investigate in more detail the distribution and interpretation of the constructions shown in (4)–(6). A proposal for an analysis of these data is developed in Section 3. Section 4 provides some discussion of potential theoretical implications of our findings as well as concluding remarks.

2. Data

2.1. The interpretation of sentences with *ga*

To start, let us take a closer look at possible interpretations of sentences with the pre-verbal morpheme *ga*. *Ga* is the canonical future marker in Igbo, see example (4). As stated in the introduction, morphological 'future markers' in some languages semantically encode prospective

[3]Specifically, we have constructed examples showing that *nwere ike* can express epistemic, deontic, teleological and circumstantial possibility.

aspectual meaning. This has been argued explicitly for the morpheme *dim* in the Gitksan language: Matthewson (2013) shows that marking with *dim* is necessary and sufficient for future reference, see (9).

(9) ***(dim)** limx=t James t'aahlakw
*(**FUT**) sing=DM James tomorrow
"James will sing tomorrow." (Gitksan, Matthewson 2013: 357)

What is more, *dim* in Gitksan contributes future orientation (in the sense of Condoravdi 2002) to modal utterances. Therefore, *dim* is obligatory in modal constructions that require future-orientation, as illustrated for the case of circumstantial possibility in (10).

(10) *Context:* We are at a party and people are wanting rides home. I ask you if my friend Sally can ride in your car. The answer is yes, because your car is big enough, it holds five.
ee'e, **da'akxw**-i-t #(dim) makxw-t loo-'y
yes **CIRC.POSS**-TRA-3SG.II #(FUT) catch.a.ride-3SG.II OBL-1SG.II
"Yes, she can come with me." (Gitksan, Matthewson 2013: 371)

Starting from the basic data pattern in (4)–(6), it looks like *ga* in Igbo could be the same kind of 'future marker' as Gitksan *dim*. In other words, it is conceivable that *ga* is a prospective aspect semantically, and that *rịrị* and *ni* denote modal necessity and possibility, respectively. If this were the case, the meaning contribution of *ga* in constructions such as (5) and (6) would be purely temporal, and modal quantification over worlds or situations would come from other operators in the sentence. However, this does not seem to be the right analysis for the case of Igbo. Crucially, and in contrast to Gitksan *dim* according to Matthewson (2013), *ga* does not entail future orientation. This is illustrated in (11) and (12) below. In (11), *ga* combines with a past-shifting aspectual operator encoded by the morpheme *álá*, and the sentence receives a past-oriented epistemic necessity reading.

(11) *Context (epistemic, past-oriented):* Ben goes swimming every day. Ben is not obliged or required to go swimming; it is just a habit of his. It is now time for Ben to be swimming, and when you arrive at his house, he is not there. You conclude:
Ọ́ **gà**-álá ị́-ǃgá ùgbúà
3SG GA-ALA INF-go now
"He must have gone now."

In (12), where *ga* combines with a stative predicate, the resulting interpretation parallels the present-oriented epistemic readings that are also available with the English future modal *will* and other 'future markers' in Indo-European languages.

(12) *Context question (epistemic, present-oriented):* John is not at home, where can he be?
John **gà**-ánọ̀ n'ụ́lọ̀ákwụ́kwọ́
John GA-be PREP.school
"John will be at school."

From data such as (11) and (12), we conclude that *ga* is not a prospective aspect. Moreover, these examples suggest that *ga* itself encodes modal meaning, leading to the observed epistemic interpretations.

Assuming that *ga* itself encodes modality, an obvious question regards its restrictions with respect to modal force and modal flavor. As for modal force, we observe that *ga* is not compatible with possibility readings. This is illustrated in (13) for the case of epistemic possibility.

(13) *Context (epistemic possibility):* The teacher is not consistent. The students never know if he's going to come or not to teach class. Today, it's time to start class and the students are waiting again.

Ọ́ **gà**-àbịá ụ́lọ́ákwụ́kwọ́ táà
3SG GA-come school today
Intended: "He might be coming to school today."

Weak necessity readings as triggered by the context in (14) seem to be available with *ga* (although the dedicated weak necessity modal *kwesi(ri)*, shown in (7), would be more natural in such a context).

(14) *Context (epistemic weak necessity):* When the light is on at John's house, it usually means that he is home. You want to visit John. You walk past John's house and notice that the light is on. You think to yourself:

John **gà**-ánọ̀ n'ụ́lọ̀ ùgbúà
John GA-be.LOC PREP.house now
"John will / should be at home."

Let us now consider modal flavor. As shown in (4), (11) and (12), *ga* can have predictive and epistemic readings. However, *ga* alone is not readily compatible with root (e.g. deontic or teleological) modal flavors. Since intuitions on the flavor restrictions of *ga* are quite subtle, a first comparison with the more complex form *ga ... rịrị* is instructive at this point. Consider the examples below. Both *ga* in (15a) and *ga ... rịrị* in (15b) are felicitous as answers to the simple future question in (15). However, the forms are felicitous in different types of background situations. The background described in (15a) clearly relates to assumptions about normality and stereotypical developments of events. By contrast, the background situation given in (15b) that licenses *ga ... rịrị* can be described as teleological in that it refers to John's goal not to fail his class.

(15) *Context question:* Where will John be tomorrow at noon?

a. *Background situation:* John is a student and tomorrow is a school day, so it's normal for him to be at school (so ...)

John **gà**-ánọ̀ n'ụ́lọ̀ákwụ́kwọ́
John GA-be PREP.school
"John will be at school."

b. *Background situation:* There is an exam tomorrow and you know that John wouldn't miss it because then he would fail (so ...)

John **gà**-ánọ̀-**rịrị́** n'ụ́lọ̀ákwụ́kwọ́
John GA-be-RIRI PREP.school
"John will / must be at school."

Additional evidence that the quantificational domain of *ga* relates to assumptions about normal or stereotypical courses of events comes from the observation that *ga* can express 'pseudo-epistemic' meaning (in the sense of Yalcin 2016). A relevant example is given in (16).

(16) *Context (from Yalcin 2016: 231):* Jones is in a crowded office building when a severe earthquake hits. The building topples. By sheer accident, nothing falls upon Jones; the building just happens to crumble in such a way as not to touch the place where he is standing. He emerges from the rubble as the only survivor. Talking to the media, Jones says in wonderment:

Ḿ **gà**-à-rà àbṵ́ ónyé ꜜnwṵ́-ꜜrṵ́ ànwṵ́ ùgbúà
I GA-SFX-rV COP person die-rV dead now
"I should be dead now."

Yalcin (2016) notes that truly epistemic modal expressions (such as English *might* or *probably*) are not felicitous in situations like (16). Note that in this context, the truth of the prejacent (i.e. the speaker being dead) is not compatible with their knowledge in the actual world. Rather, the speaker seems to be making a claim about what their situation would be had it unfolded normally: they would have died like all the other poor people in the office building. Yalcin concludes that English *should* and *ought* under their pseudo-epistemic readings are quantifiers over 'normal' worlds. In Section 3, we will implement a similar idea to account for the behavior of *ga* and its interaction with the suffix *ṛịrị̀*, to which we now turn.

2.2. The interpretation of sentences with *(ga ...) ṛịrị̀*

Let us first look at how the combined form *ga ... ṛịrị̀* differs from *ga* alone in terms of modal flavor. While the predictive and normality-related readings illustrated above are more naturally expressed by *ga* alone, *ga ... ṛịrị̀* is used to convey necessity in all other modal flavors. A teleological use of *ga ... ṛịrị̀* has already been shown in (15b). In (17) we illustrate the deontic use of *ga ... ṛịrị̀*:

(17) *Context (deontic necessity):* In Indonesia, the law states that when you ride a motorbike . . .

Ị́ **gà**-ékpù **ṛị́rị́** helmet
2SG GA-wear RIRI helmet
"You must wear a helmet."

While *ga* alone can be used in some epistemic or pseudo-epistemic contexts as shown in the previous subsection, *ga ... ṛịrị̀* is often preferred for expressing epistemic necessity. What is more, *ṛịrị̀* is obligatory in epistemic necessity contexts with full certainty, i.e when the speaker is entirely sure that the prejacent follows from the facts (for discussion of such cases see e.g. Mihoc et al. 2019).

(18) *Context (epistemic necessity with full certainty):* The teacher says: There are 3 boxes. The ball is in box A or in box B or in box C. It is not in A. It is not in B. So . . .

Ọ́ **gà**-àdị́ ***(ṛị́rị́)** n'ákpàtì C
3SG GA-be.PRED RIRI PREP.box C
"It must be in C."

Crucially, not only *ṛịrị̀* but also *ga* is obligatory in (18). Marking the sentence with *ṛịrị̀* without *ga* is in fact not well-formed, as shown in (19). This observation generalizes to all instances of *ga ... ṛịrị̀*, i.e. *ṛịrị̀* cannot occur on its own.

(19) ?? Ọ́ dị̀-**rị̀rị̀** n'ákpàtì C.
3SG be.PRED-RIRI PREP.box C
Intended: "It must be in C."

However, *rị̀rị̀* can also combine with the weak necessity modal. Interestingly, the resulting meaning is strong necessity in this case, as illustrated in (20).

(20) *Context (teleological necessity):* The best pizza in town is sold at Gino's. You have invited your sister for dinner, and you decide to order pizza. You tell your sister:
Ányị́ **kwèsì-rị̀rị̀** ị́-$^{!}$zú nà ǹké Gino
1PL OUGHT-RIRI INF-buy PREP one.of Gino
"We have to order from Gino's."

More generally, *rị̀rị̀* seems to manipulate modal strength in that it always forces a strong necessity reading.[4] Recall that, while *kwesi(ri)* is the dedicated weak necessity modal in Igbo, *ga* is also somewhat compatible with weak epistemic necessity readings, as illustrated in (14). By contrast, the use of *ga ... rị̀rị̀* is not felicitous in a weak necessity context:

(21) *Context (epistemic weak necessity):* When the light is on at Mary's house, it usually means that she is home. You want to visit Mary. You walk past Mary's house and notice that the light is on. You think to yourself:
Mary **gà**-ánọ̀ **rị́rí** n'úlọ̀ ùgbúà
Mary GA-be.LOC RIRI PREP.house now
Intended: "Mary will / should be at home."

Next, we conclude this data section by considering the properties of *(ga ...) ni*.

2.3. The interpretation of sentences with *(ga ...) ni*

As noted at the beginning of our discussion (see ex. (6)), when *ga* is combined with the post-verbal marker *ni*, this combination results in a possibility meaning. It is important to note, however, that this construction is mainly associated with circumstantial possibility / ability readings. Some representative examples of the use of *ga ... ni* are provided in (22)–(24).

(22) *Context:* Ben was in a motorbike accident and he sprained his ankle. Ben is able to walk now. However, the doctor told Ben that he is not allowed to walk until 5 weeks after the accident.
Ben **gà**-àgá-**ní** íjè ùgbúà
Ben GA-go-NI walk now
"Ben can walk now."

(23) *Context:* The travel vans have a limit of 13 people by law. But the drivers don't care, and stop for more than 13 people. Also, the vans are bigger than you think ...

[4]This observation has been documented before in a small case study on Igbo modality by Zimmermann (2019), which, in accordance with our arguments in this paper, arrives at the conclusion that *ga* is a modal operator rather than a semantic future shifter. Many thanks to Malte Zimmermann for sharing this study with us. The idea that *ga* is a necessity modal that is strengthened by *rị̀rị̀* also seems in line with a brief overview of Igbo modality presented by Emenanjo (2015: ch.18).

Úgbó **gà**-èbú-**ní** ḿmádù 20
vehicle GA-carry-NI people 20
"Travel vans can fit 20 people."

(24) *Context:* Ani came to visit a small island in the Philippines. She noticed that the climate and many of the plants are similar to some places she visited in Indonesia, where duku trees grow. The temperature is the same, the rainfall is the same, the types of rocks and the soil are the same. But when she looked around, she didn't find any duku trees anywhere. But because the temperature, rainfall, and soil are the same, she thinks that ...

Ósísí duku **gà**-ètó-**ní** ébè à
tree duku GA-grow-NI place this
"Duku trees can grow here."

The use of *ga ... ni* to express other modal flavors is highly restricted. It is particularly interesting to note that *ga ... ni* cannot be used with epistemic flavor, in contrast to *ga* and *ga ... ṛiṛị*. In other words, although *ga* is in principle compatible with epistemic readings (see (11), (12) and (14)), and although adding *ni* seems to weaken the modal force to possibility (see (22)–(24)), the combination of *ga* and *ni* cannot be used to express epistemic possibility, as shown in (25).[5]

(25) *Context (epistemic possibility):* The teacher is not consistent. The students never know if he's going to come or not to teach class. Today, it's time to start class and the students are waiting again.

Ọ́ **gà** bị́á-**ní** ụ́lọ̀ákwụ́kwọ́ táà
3SG GA come-NI school today
Intended: "He might be coming to school today."

Another interesting observation is that *ni*, unlike *ṛiṛị*, can occur without *ga* or another modal operator in the sentence. Moreover, like ability expressions in many other languages (see e.g. Bhatt 2006; Hacquard 2009, among many others) sentences with *ni* give rise to an actuality entailment when the aspectual interpretation of the sentence is perfective, as in (26): the sentence in (26a) (with *ni* but without *ga*) triggers the inference that Paul carried the stone in the actual world, and it is infelicitous to cancel that inference, as shown in (26b).

(26) a. Paul bùrù**-nì** òkú$^{!}$té áhụ̀ ...
Paul carry.RV-NI stone DEF
"Paul was able to carry the stone ..."

b. **# ... mànà ò bú-bè-ghì òkú$^{!}$té áhụ̀**
... but 3SG carry-yet-NEG stone DEF
"... but he never carried the stone."

By contrast, no such actuality inference arises when *ga* combines with *ni*. This is shown for a simple sentence with *ga ... ni* in (27), which receives a non-past interpretation by default. Note, however, that the same *ga ... ni* construction can receive a past interpretation if the context sets a past reference time, as in (28). In this case too, *ga ... ni* does not give rise to an actuality entailment.

[5]In (13), we showed that *ga* alone is likewise incompatible with this same context. To express epistemic possibility, the *nwere ike*-construction, illustrated in (8), is used.

(27) Paul **gà**-èbú-**ní** òkú!té áhụ̀ mànà ò bú-bè-ghì òkú!té áhụ̀
Paul GA-carry-NI stone DEF but 3SG carry-yet-NEG stone DEF
"Paul can carry that stone, but he never carried the stone."

(28) *Context:* Last year, you worked in the field and asked Paul to carry a heavy stone for you. Paul had the ability to do it, but he still declined your request. You tell your friend:
Paul **gà**-èbú-**ní** òkú!té áhụ̀ mànà ọ́ jụ̀-rụ̀ í-!bú !yá
Paul GA-carry-NI stone DEF but 3SG refuse-rV INF-carry it
"Paul was able to carry the stone, but he refused to do it."

3. Towards an analysis

3.1. The semantics of *ga*

Before we move on to proposing an analysis of the future marker *ga*, let us briefly summarize its main empirical properties as laid out in the data section:

(29) Sentences with *ga*
a. are compatible not only with future, but also with past and present temporal orientation;
b. are compatible with (weak and strong) necessity readings, but not with possibility readings;
c. are compatible with predictive (= future), epistemic and pseudo-epistemic readings, but not (or only marginally) with other modal flavors.

From the observation in (29a), we conclude that the semantic contribution of *ga* is not that of a prospective future shifter. The examples we presented as (11) and (12) display a present temporal perspective as well as past and present temporal orientation, respectively. In other words, there is no future shift of the reference time or the event time in these examples. However, the sentences are modalized; they receive an epistemic-like interpretation. It therefore seems reasonable to generalize that the meaning of *ga* is modal, and that the predictive reading of the 'future marker' *ga* is just one specific instance of its modal meaning.[6] From (29b), we derive the assumption that *ga* encodes universal modal force, i.e. it is a marker of modal necessity. Recall from Section 2 that, intuitively, sentences with *ga* are weaker than sentences with *ga ... ṛịrị*. As will become clear in the next subsection, we will analyze this observation as a difference in modal strength, by positing different quantificational domains for *ga* with and without *ṛịrị*. Hence, based on the observations in (29a) and (29b), we propose the basic semantics in (30) for *ga*. According to (30), *ga* takes as its arguments a quantificational domain *D* and a proposition *p*, and asserts that all possible worlds in *D* are worlds in which *p* is true.

[6] This leaves open the question of how exactly the future orientation of (4) and, in fact, any future orientation in modal sentences in Igbo is derived. Although some further investigation of temporal interpretation in Igbo is required, from a cross-linguistic point of view it seems plausible to hypothesize that future orientation is contributed by prospective aspect, which can be covert in some languages. This argument has been made by Kratzer (2012b) for circumstantial modals in English, by Matthewson (2012); Rullmann and Matthewson (2018) for modals cross-linguistically and by Mucha (2015, 2016) for modal future markers. We conjecture that Igbo is one of the languages that encodes prospectivity covertly.

(30) $[\![ga]\!]^{w,c} = \lambda D_{\langle s,t\rangle}.\lambda p_{\langle s,t\rangle}.\ \lambda w.\ \forall w'\ [w' \in D(w) \rightarrow p(w') = 1]$

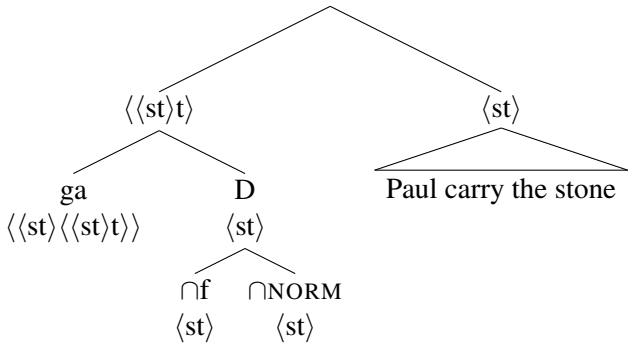
Our observation in (29c) becomes relevant for the definition of *ga*'s quantificational domain. We propose that what unifies the observed modal flavors of *ga* as listed in (29c) is that they are associated with quantification over normal or stereotypical worlds, i.e. possible worlds consistent with how situations normally develop. That normality assumptions play a role in epistemic modality has already been proposed by Kratzer (1981, 2012a), where they function as a stereotypical ordering source restricting an epistemic modal base. The proposal that predictive readings of modal future markers can be analyzed in parallel to their epistemic readings figures prominently in the works of Giannakidou and Mari (2018b, 2023) on Greek and Italian. Finally, as already noted in Section 2, Yalcin (2016) analyzes pseudo-epistemic *should* and *ought* in English as quantifiers over 'normal' worlds.[7] Since all and only these flavors seems to be readily available for sentences with *ga* alone, we propose that its quantificational domain is constructed from the following two components. The first, which we call ∩NORM, is the set of worlds consistent with the normality assumptions in the actual world, see (31). The second component is a generalized modal base as shown in (32), i.e. the set of worlds accessible from the actual world in the context of utterance. This ∩f should be thought of as the intersection of the propositions that make up an under-specified conversational background.

(31) $[\![\cap\text{NORM}]\!]^{w,c} = \lambda u_s.$ u is compatible with the normality assumptions in w

(32) $[\![\cap f]\!]^{w,c} = \lambda v_s.$ v is contextually accessible from w in c

The quantificational domain of *ga*, we propose, is the intersection of these two sets of possible worlds, both represented (covertly) in the syntax.[8] In (33), we sketch the LF structure of our original future sentence in (4) (*Paul* ***gà****-èbú òkú*^{l}*té áhù*), and in (34) we make explicit the denotation of the quantificational domain *D*. The truth conditions of (4) are provided in (35).

(33) LF structure of (4):



(34) $[\![D]\!]^{w,c} = [\![\cap f]\!]^{w,c} \cap [\![\cap\text{NORM}]\!]^{w,c}$
$= \lambda z_s.$ z is accessible from w in c & z is compatible with normality assumptions in w
shorthand: $\lambda z_s.\ z \in \text{ACC}_c(w, z)\ \&\ z \in \cap\text{NORM}$

[7] We should note that Yalcin (2016) proposes a clear distinction between epistemic and pseudo-epistemic modality, and assumes that only the latter is sensitive to stereotypicality.

[8] This aspect of our proposal is similar to the analysis of epistemic modality and future marking proposed by Giannakidou and Mari (2018a, 2023), where a modal base is narrowed down by a set of worlds that is ideal with respect to stereotypicality assumptions (rather than restricted *and* ordered by a stereotypical conservational background as in Kratzer (1981, 2012a)'s original framework). We thank Alda Mari for drawing our attention to the similarities between their observations on Italian and ours on Igbo.

(35) $[\![(4)]\!]^{w,c} = [\![ga]\!]^{w,c}([\![D]\!]^{w,c})(\lambda w.\exists e$ [Paul carry the stone (e,w)])
= $\forall w'$ [w' $\in$ ACC$_c$(w,w') & w' $\in \cap$NORM $\rightarrow \exists e$ [Paul carry the stone (e,w')]]

In effect, *ga* quantifies over only those worlds that are compatible with normality assumption in the actual world. The subtle differences between the modal flavors listed in (29c) depend on the contextual information represented in $\cap$f, and temporal orientation depends on the aspectual properties of the embedded proposition (see also footnote 6).

3.2. The semantics of *(ga) ... ṛịrị*

Again, we first summarize the main empirical properties of the morpheme *ṛịrị* and its interpretation in combination with *ga*, before we extend our account to sentences like (5) (repeated below).

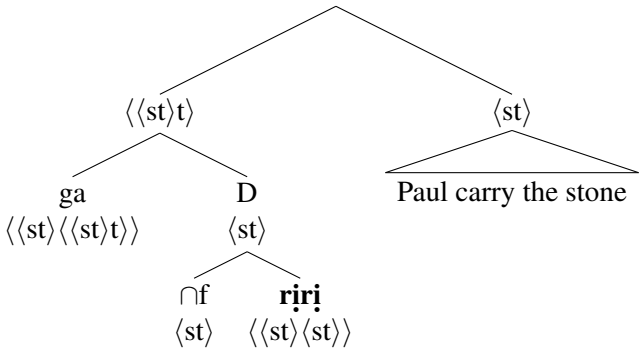
(36) a. Sentences with *ga ... ṛịrị* are compatible with a variety of modal flavors, including epistemic, deontic, teleological and pure circumstantial flavor;
b. Sentences with *ga ... ṛịrị* are intuitively stronger than sentences with *ga* alone. *Ga ... ṛịrị* always expresses strong necessity;
c. It seems that *ṛịrị* always occurs in combination with a modal operator. When *ṛịrị* combines with a weak necessity modal, the resulting interpretation is strong necessity.

(5) Paul **gà**-èbú-**ṛ́ịrí́** òkú!té áhụ̀
Paul GA-carry-RIRI stone DEF
"Paul must carry the stone."

We propose to account for these observations by analyzing *ṛịrị* as a domain widener for (necessity) modals. More specifically, we take *ṛịrị* to denote an identity function over sets of possible worlds, as shown in (37). In the composition of modal sentences with *ga*, *ṛịrị* 'replaces' the normality set $\cap$NORM, and takes the modal base $\cap$f as its argument, as shown in (38). The resulting truth conditions in (39) are identical to the truth conditions of the future sentence without *ṛịrị*, except that *ga* quantifies over the entire modal base.

(37) $[\![ṛịrị]\!] = \lambda W_{\langle s,t\rangle}.\ W$

(38) LF structure of (5):



(39) $[\![(5)]\!]^{w,c} = [\![ga]\!]^{w,c}([\![D]\!]^{w,c})(\lambda w.\exists e$ [Paul carry the stone (e,w)])
= $\forall w'$ [w' $\in$ ACC$_c$(w,w') $\rightarrow \exists e$ [Paul carry the stone (e,w')]]

Thus, *ṛiṛị* removes the restriction to 'normal' worlds in the quantificational domain of *ga*. In contrast to sentences with *ga* alone, the modal flavor of sentences with *ga ... ṛiṛị* is provided only by the modal base (∩f). Given the underspecified definition of ∩f, the flavor of *ga ... ṛiṛị* thus solely depends on the context of utterance, which accounts for our observation in (36a). By removing the inbuilt normality restriction of *ga*,[9] *ṛiṛị* also has the effect of widening the domain of the universal quantifier. This, we propose, accounts for the intuition that sentences with *ga ... ṛiṛị* are intuitively stronger than sentences with *ga* alone, see (36b). Finally, the assumption that *ṛiṛị* is a modifier of modal bases helps us make sense of the observation that it seems to need a modal 'host', such as *ga* or the weak necessity modal *kwesi(ri)*. In the analysis sketched here, *ṛiṛị* does not itself encode modality, but merely manipulates a modal's domain of quantification.

3.3. The semantics of *(ga) ... ni*

Finally, in (40) we summarize some relevant properties of sentences with *(ga) ... ni*.

(40) a. In contrast to *ga* alone and *ga ... ṛiṛị*, sentences with *ga ... ni* express possibility;
b. Sentences with *ga ... ni* always come with non-epistemic flavor. Specifically, *ga ... ni* expresses circumstantial possibility / ability meaning;
c. In contrast to *ṛiṛị*, *ni* can occur on its own, and in this case also expresses circumstantial possibility / ability.
d. Actuality entailments arise with *ni* alone, but not with *ga ... ni*.

We propose that, taken together, the observations in (40a)–(40c) point to the conclusion that *ni* comes with its own modal meaning. More specifically, we adopt a version of Hacquard's (2009) lexical entry for circumstantial possibility to model the meaning of *ni*, which is event-relative and assumes that the modal attaches low in the LF structure, taking the vP as its argument:

(41) $[\![ni]\!]^{w,c} = \lambda P_{\langle s,\varepsilon t\rangle}.\lambda e_{\varepsilon}.\ \exists w'$ [w' is compatible with circumstances in w so that P(w',e)]

Adopting this event-relative modal meaning for *ni* potentially allows us to capture all of the observations listed in (40). Most straightforwardly, assuming that *ni* itself is a modal marker accounts for its independent status in contrast to *ṛiṛị*, as stated in (40c). Moreover, Hacquard's analysis of modals in French explicitly aims to explain the distribution of actuality entailments with modal sentences. As a reminder, we repeat our example (26a) of an actuality entailment arising with *ni*:

(26a) Paul bùrù**-nì** òkú$^{!}$té áhù̩ ...
Paul carry.RV-NI stone DEF
"Paul was able to carry the stone ..."
(...**# mànà ò bú-bè-ghì òkú$^{!}$té áhù̩**)
but 3SG carry-yet-NEG stone DEF
"but he never carried the stone."

[9]This inbuilt restriction is essentially a stipulation. However, following Kratzer (2012a), we hypothesize that it might have some conceptual grounding in that stereotypical ordering has a privileged role in the domain of modal flavors, as briefly discussed in Section 4.

According to Hacquard (2009), actuality entailments arise only with root modals (including circumstantial modals) when they co-occur with perfective aspect, due to their specific compositional interaction. Root modals occupy a lower syntactic position than aspect at LF, and perfective aspect anchors the modalized event to the actual world. In the lexical entry for perfective in (42) (adapted from Hacquard 2009: 295), this world anchoring is represented in the underlined meaning component.

(42) $[\![\text{PERFECTIVE}]\!]^{w,c} = \lambda P_{\langle \varepsilon t \rangle}.\lambda t_i.\ \exists e\ [\underline{e \text{ in } w} \ \&\ \tau(e) \subseteq t \ \&\ P(e)]$

By contrast, with imperfective aspect or an epistemically interpreted modal, no actuality entailment arises. Epistemic modals, unlike root modals, are assumed to occupy a higher syntactic position than aspect. In this configuration, even if an epistemic modal co-occurs with perfective aspect, the perfective anchors the event to the possible worlds introduced by the modal, not to the actual world. Actuality entailments are also suspended with imperfective aspect, which is assumed to come with its own modal meaning component, and therefore does not anchor the event to the actual world. An example of the relevant aspectual contrast in French is reproduced in (43): (43a) shows a circumstantial possibility sentence with perfective aspect, and gives rise to an actuality entailment. In the imperfective circumstantial possibility sentence in (43b), no actuality entailment arises.

(43) a. Jane a pu soulever cette table, # mais elle ne l'a pas soulevée.
Jane can-past-pfv lift this table, # but she didn't lift it

b. Jane pouvait soulever cette table, mais elle ne l'a pas soulevée.
Jane can-past-impf lift this table, but she didn't lift it
"Jane was able to lift this table, but she didn't do it." (Hacquard, 2009: 288)

Returning to Igbo, a crucial step towards modeling the semantics of sentences with *ni* such as (26a) therefore consists in identifying their aspectual properties. This is by no means an easy task, and a detailed analysis of aspect semantics in Igbo is well outside the scope of this paper. However, preliminary evidence suggests that sentences that give rise to actuality entailments with *ni* are in fact semantically perfective. In (45)–(47), we examine possible aspectual interpretations of the sentence in (26a) without *ni*, i.e., its unmodalized version shown in (44). (We consider versions of the sentence with definite or indefinite object NPs, since definiteness is well-known to influence aspectual interpretation in some languages.)

(44) Paul bù-rù òkú!té (áhụ̀)
Paul carry-rV stone (DEF)
"Paul carried the / a stone."

Like (26a), the sentence receives a past interpretation by default. As illustrated in (45), (44) is felicitous as an answer to a question that triggers a perfective interpretation. It cannot be used, however, to answer questions triggering an imperfective interpretation. We tested this for two common interpretations of imperfective sentences: an ongoing event interpretation, see (46), and habitual interpretation, (47). While these meanings are expressed by distinct progressive and habitual markers in some languages, both are associated with imperfective aspect meaning, and compatible with imperfective markers in languages that encode a binary perfective / imperfective aspectual distinction. Crucially, both of these interpretations seem to be incompatible with the verb form that triggers an actuality entailment with *ni*.

(45) *Context question (past perfective):* Paul's back is sore. What did he do yesterday?

Paul bù-rù òkú!té (áhụ̀)
Paul carry-rV stone (DEF)
"Paul carried the / a stone."

(46) *Context question (past imperfective / ongoing):* What was Paul doing this morning when you saw him here in the field?

Paul bù-rù òkú!té (áhụ̀)
Paul carry-rV stone (DEF)
Intended: "Paul was carrying the / a stone."

(47) *Context question (past imperfective / habitual):* What did Paul usually do when we used to work in the field?

Paul bù-rù òkú!té (áhụ̀)
Paul lift-rV stone (DEF)
Intended: "Paul used to carry the / a stone."

From these data, we tentatively conclude that sentences such as (45)–(47), as well as (26a), indeed involve perfective aspectual semantics (possibly encoded by the *-rV* morpheme, but see our remarks on this in Section 1). If this assumption is correct, and if *ni* is accurately analyzed as a circumstantial possibility modal as we propose above, Igbo presents yet another example of a language where the compositional interaction of perfective aspect and circumstantial modality results in actuality entailments despite modal meaning being encoded in the sentence. Among a range of available analyses of this and related phenomena (see Hacquard 2020 for an overview and Nadathur 2023 for recent discussion), we adopt Hacquard's (2009) analysis for the sake of concreteness. With *ni* scoping between the vP and a perfective aspect operator as sketched in (48), and the reference time provided by contextual variable assignment (by assumption),[10] the truth conditions come out as in (49).

(48) Structure of (26a): [λw [$_{TP}$ t_1 [$_{AspP}$ PFV [$_{ModP}$ ni [$_{vP}$ Paul carry the stone]]]]]

(49) $[\![(26a)]\!]^{g,c}$ = $[\![\text{PERFECTIVE}]\!]^{g,c}([\![\text{NI}]\!]^{g,c}([\lambda w.\lambda e.\text{Paul carry the stone (e,w)}]))([\![t_1]\!]^{g,c})$
= λw. $\exists$e [e in w & τ(e) $\subseteq$ g(1) & $\exists$w' [w' is compatible with circumstances in w so that e is an event of Paul carrying the stone in w']]

If we adopt from Hacquard (2009) the assumption of "Preservation of Event Description Across Worlds" (PED), i.e., in a nutshell, assuming that the event *e* in (49) can be taken to be same event in the actual world *w* and in the worlds quantified over by *ni*, (49) asserts that Paul carried the stone in the actual world. Hence, negating the existence of such an event is infelicitous, as in (26a). Furthermore, the circumstances in the actual world include Paul's abilities and dispositions, leading to the salient ability interpretation.

[10]We do not currently have sufficient insight into the temporal system of Igbo to decide whether or not the past temporal interpretation of (26a) is semantically encoded. The analysis proposed here assumes that it is not, in which case the past interpretation might be a pragmatic default arising from perfective semantics of the sentence (detailed discussion of how such defaults arise is provided in Smith et al. 2007; Mucha 2015, among others). This is a simplification. Moreover, we diverge from Hacquard's analysis in representing the evaluation world as a bound pronoun in the object language, in order to derive a suitable argument for the modal operator *ga*. In matrix clauses, the evaluation world is identified with the actual world.

Finally, let us spell out the semantics of sentences with *ga* and *ni*, by example of (6), which again we repeat here for convenience.

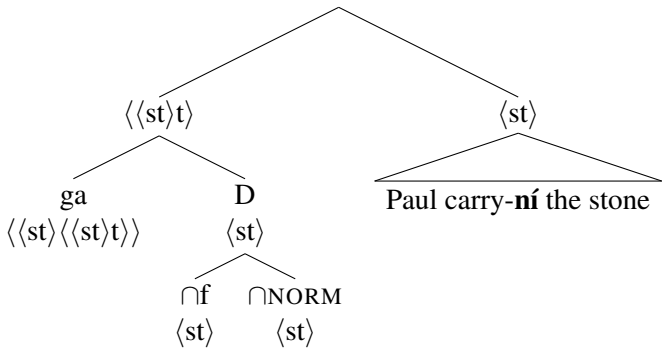
(6) Paul **gà**-èbú-**ní** òkú!té áhụ̀
Paul GA-carry-NI stone DEF
"Paul can carry the stone."

Firstly, recall that this sentence does not give rise to an actuality entailment, irrespective of whether it is interpreted with present or past reference, as shown in examples (27) and (28). Our hypothesis is that *ga* plays a similar role in suspending actuality entailments as imperfective aspect does in languages like French.[11] In existing accounts along the lines of Hacquard (2009) and Bhatt (2006), it is the modal meaning component, broadly in terms of normality, inertia or genericity, that turns the assertion of an actual event into an assertion about a hypothetical ability to realize an event, without any requirement of actual instantiation. We adopt from these works the assumption that the additional layer of modality contributed by *ga* can explain the contrast in actuality entailments between *ga ... ni* and *ni* alone. However, the overall picture is more intricate. It is interesting to note that *ga* cannot occur with the verb form that, by our hypothesis, is associated with perfective aspect. In other words, simply adding *ga* to the sentence in (26a) results in ungrammaticality:

(50) *Paul **gà**-bù-rù-**nì** òkú!té áhụ̀
Paul GA-carry-rV-NI stone DEF
Intended: "Paul was / is able to carry the stone."

While we have to leave a comprehensive analysis of actuality entailments in Igbo for future research, we are now in a position to propose an analysis of sentences with *ga ... ni*. In the LF structure sketched in (51), *ga* composes first with its quantificational domain in the same way as shown in Section 3.1, and then with a proposition modalized by *ni*, which, we assume, involves an aspectually neutral base form of the verb (as we also did in the derivations in Sections 3.1 and 3.2).[12] Simplifying over tense information, we derive the truth conditions in (52).

(51) LF structure of (6):



[11] Although our own data and analysis do not really reflect this, examples cited in Emenanjo (2015: 420/1) suggest that *ga* actually has imperfective uses for some speakers (or at least did so in the past).

[12] This assumption is partly motivated by the fact that Igbo has a dedicated imperfective marker which also combines with this basic verb form, as shown in (i).

(i) Paul **nà**-èbú òkú!té áhụ̀
Paul IMPF-carry stone DEF
"Paul is carrying / carries the stone."

(52) $[\![(6)]\!]^{w,c} = [\![ga]\!]^{w,c}([\![D]\!]^{w,c})([\lambda$w.$\exists$e $\exists$w' [w' is compatible with circumstances in w so that e is an event of Paul carrying the stone in w']])
= $\forall$w' [w' $\in$ ACC$_c$(w,w') & w' $\in \cap$NORM $\rightarrow$ $\exists$e $\exists$w" [w" is compatible with circumstances in w' so that e is an event of Paul carrying the stone in w"]]

The truth conditions in (52) state that for all the 'normal' worlds in the relevant context, an event of Paul carrying the stone is possible given the circumstances (including Paul's abilities) in that world. *Ni* itself contributes existential modal force and the circumstantial flavor, and *ga* adds an extra layer of modality relativizing the circumstantial background to a set of worlds that conform to what is normally the case in the actual world. This implementation is very similar to Hacquard's (2009) analysis of imperfective-marked circumstantial possibility. The idea that a modal operator quantifying over normal worlds is involved in the composition of ability attributions is based on ideas presented by Bhatt (1999, 2006). This operator (a GENericity operator in Bhatt's account), is realized as imperfective aspect in many languages, and covert in others such as English. According to Bhatt, it is this modal operator that distinguishes (modal) ability attributions from a basic implicative meaning of *able*. The data from Igbo that we have presented here support this idea in as much as *ga*, which we propose to analyze as a 'normality' modal, systematically occurs in sentences that express ability (and circumstantial possibility more generally). The ability construction that gives rise to an actuality inference, by contrast, does not involve *ga*. One way of phrasing our analysis is that Igbo conventionalizes the implicative meaning of *able* ($\approx$ 'manage') as the combination of *ni* and perfective aspect, and hypothetical ability attribution ($\approx$ 'have the ability') as the combination of *ni* and *ga*. To illustrate this more clearly, we repeat in (53) a condensed version of examples (26) and (28) for comparison.

(53) a. Paul bùrù-**nì** òkú!té áhụ̀ **#** mànà ò bú-bè-ghì òkú!té áhụ̀
Paul carry.RV-NI stone DEF # but 3SG carry-yet-NEG stone DEF
Intended: "Paul was able to carry the stone but he never carried the stone."

b. Paul **gà**-èbú-**ní** òkú!té áhụ̀ mànà ọ́ jụ̀-rụ̀ í-!bú !yá
Paul GA-carry-NI stone DEF but 3SG refuse-rV INF-carry it
"Paul was able to carry the stone, but he refused to do it."

In the final section, we provide some overall conclusions and possible implications of our findings.

4. Conclusions

In this paper, we discussed the interpretation of the Igbo future marker *ga* as well as the compound forms *ga ... ṛịrị* and *ga ... ni*, which express necessity and possibility meanings, respectively. We argued that *ga* denotes a necessity modal whose quantificational domain is inherently restricted by assumptions about normality. Necessity interpretations in a more general sense, including deontic, teleological and epistemic (strong) necessity are conveyed when *ga* is combined with the morpheme *ṛịrị*. Indeed, the combination of *ga* and *ṛịrị* is the canonical form in the functional modal paradigm of Igbo to express strong necessity, i.e. Igbo does not have a dedicated necessity modal akin to 'must' in English. In Igbo, the modality conveyed by English 'must' is compositionally derived from future modality, which we model as universal

quantification over normal worlds. This architecture of modal necessity in Igbo has potential implications for modal semantics more generally. As reflected (more or less explicitly) in works like Yalcin (2010); Kratzer (2012a) and Giannakidou and Mari (2018a), assumptions about normality and stereotypicality might have a privileged role among conversational backgrounds that restrict modal quantification. If so, this special status of stereotypicality is reflected in the way necessity meaning is construed in Igbo (whether or not our particular implementation is the best way to model this). Besides widening the range of possible modal flavors, adding *rịrị* also has the effect of strengthening the force of *ga*, leading to strength differences that are somewhat comparable to the case of epistemic 'will' and 'must' in English (see e.g. Mihoc et al. 2019, Giannakidou and Mari 2023). What is more, *rịrị* has a similar strengthening effect on the weak necessity modal, changing its interpretation to strong necessity. This observation seems to align with recent research suggesting that, at least in some languages, strong necessity meaning is derived from weak necessity. Weingartz and Hohaus (to appear) develop such a proposal to account for the weak and strong necessity readings of individual modals with variable strength in Afrikaans and Samoan. In Igbo, interestingly, strong necessity is explicitly marked with the morpheme *rịrị*, while weaker necessity expressions are morphologically simpler.

Finally, when the 'future marker' *ga* combines with the morpheme *ni*, which we analyzed as a low-scoping modal operator encoding circumstantial possibility, *ga* seems to contribute the normality-related meaning component associated with ability attributions in some analyses (e.g. Bhatt 2006). Recent accounts of circumstantial possibility / ability modals and their actuality entailments (e.g. Louie 2015; Nadathur 2023) are of considerable complexity, involving several layers of modal quantification. Although we could only provide a rough sketch of an analysis of *ga ... ni* in this paper, the fact that ability meaning is encoded in this compositional modal form in Igbo may reflect the semantic complexity of this particular modal meaning.

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