

## Disjunction with additives<sup>1</sup>

Anne MUCHA — *University of Edinburgh*

Wataru UEGAKI — *University of Edinburgh*

Mary AMAECHI — *University of Ilorin*

Tim JANTARUNGSEE — *University College London*

**Abstract.** We present compositional semantic analyses of complex disjunction involving an additive particle in Igbo and Thai. In Igbo, complex disjunction is constructed with an additive particle and a possibility modal in the first clause. We analyze this structure as involving conjoined possibilities, along the lines of Zimmermann’s (2000) analysis of disjunction. In Thai, the relevant construction involves a combination of negation and an additive particle which is independently observed in conditionals. We analyze this construction as an indicative conditional with a negated consequent of the form ‘if  $p$ , then not  $q$ ’. We examine predictions of these analyses and discuss their implications, especially on the role of additive particles and modality in the realization of disjunctions cross-linguistically.

**Keywords:** disjunction, modality, additive particles, conditionals, Igbo, Thai.

### 1. Introduction

Coordinating sentential connectives such as English *and*, *or* are canonically analyzed as the truth-functional logical operators  $\wedge$  and  $\vee$ , respectively. However, a straightforward one-to-one mapping between natural language connectives and these logical operators has been challenged from theoretical and cross-linguistic perspectives (Zimmermann, 2000; Zeevat and Jasinskaja, 2007; Bowler, 2014; Murray, 2017). The present paper contributes to this line of research by discussing relevant observations from two unrelated, under-researched languages, namely Igbo (Niger-Congo, Nigeria) and Thai (Kra-Dai, Thailand). These languages have in common that they employ additive particles in constructions that express disjunctive meaning. In Igbo, the standard disjunctive strategy involves an additive element combined with a possibility modal. A first illustration of this structure is provided in example (1), with the modal (*nwèrè íké*) and the additive particle (*mà*) in bold.

- (1) Ó **nwèrè íké** bú-rú nà Paul bù dọkítà **mà** ò bú bú-rú nà John bù dọkítà.  
it MOD( $\diamond$ ) be-rV that Paul be doctor ADD it be be-rV that John be doctor  
“Paul is a doctor or John is a doctor.” **Igbo**

The Thai language likewise makes use of an additive particle to express disjunction, but in a different type of construction. In the example in (2), the additive particle *gôr* combines with negation (*mâi*) to convey disjunctive meaning.

- (2) Paul pen mǒr **mâi gôr** John pen mǒr.  
Paul be doctor NEG ADD John be doctor  
“Paul is a doctor or John is a doctor.” **Thai**

It is well-known that languages make use of different strategies for expressing disjunctive meaning (Haspelmath, 2007; Mauri, 2008). In this paper, we zoom in on this variation and

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demonstrate how two natural languages use additives for this purpose. The strategies observed in Thai and Igbo are interesting in several respects once we elucidate how the disjunctive interpretations arise compositionally, with potential implications for the semantic analysis of additives and disjunction cross-linguistically. The remainder of the paper is structured as follows. In Sect. 2, we provide some relevant cross-linguistic and theoretical background to our study. Sect. 3 presents our findings on disjunction in Igbo, first discussing some relevant data on the interpretation of (1) and similar examples, and then proposing a compositional analysis. In Sect. 4, we discuss disjunction in Thai, again presenting empirical observations as well as a proposal to account for them. Sect. 5 summarizes our findings and provides some conclusions.

## 2. General background

The use of overt modal operators in the encoding of disjunction, as observed in Igbo, has received some attention in the previous semantic literature. For instance, Bowler (2014) reports that in Warlpiri (Pama-Nyungan), disjunction is expressed by means of juxtaposition of possibilities, as illustrated in example (3), where *marda* is an epistemic possibility modal.

- (3) Gloria marda, Cecilia marda yanu tawunu-kurra=ju.  
 Gloria maybe Cecilia maybe go.PST town-ALL=TOP  
 “Gloria or Cecilia went to town.”  
 (lit. “Maybe Gloria, maybe Cecilia went to town.”) Warlpiri (Bowler, 2014: 138)

Warlpiri presents a particularly interesting case with regard to how languages express conjunction and disjunction. According to Bowler (2014), Warlpiri actually has a sentential connective that semantically encodes disjunction, namely *manu*. What Warlpiri lacks, in comparison to an English-like system of connectives, is a conjunctive coordinator. In the absence of a connective encoding ‘and’-like conjunction, the disjunctive *manu* gets strengthened to conjunctive meaning in unembedded contexts. This is illustrated in example (4).

- (4) Ngapa ka wantimi manu warlpa ka wangkami.  
 water AUX fall.NPST manu wind AUX speak.NPST  
 “Rain is falling and wind is blowing.” Warlpiri (Bowler, 2014: 138)

With respect to the composition of disjunctive meaning, Bowler (2014) proposes that *manu* is covertly realized in sentences like (3) as well, and conjoins the possibilities to generate a literal meaning along the lines of  $\diamond P \ \& \ \diamond Q$ .

Natural language data such as (3) would seem to support previous proposals from the theoretical literature on disjunction. In particular, Zimmermann (2000) argues based on free choice phenomena that natural language disjunction should be analyzed as a conjoined list of (epistemic) possibilities (see also Geurts, 2005). In this modal account of disjunction, the English connective *or* is not interpreted as a truth-functional operator, it just presents a list of alternatives. The disjunctive sentence in (5) would have the semantic structure in (6) (where  $\diamond$  is an epistemically interpreted possibility modal). (6) is interpreted as a closed list of epistemic possibilities unless otherwise marked (e.g. by intonation), giving rise to the inference that the alternatives are jointly exhaustive. That is, the hearer infers from (5) that, according to the speaker’s knowledge, one of the alternatives is the true answer to the question under discussion and there is no other true answer. For instance, the exhaustivity inference associated with disjunction entitles the hearer to conclude (7a) from (5). Another restriction is that the disjuncts

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be independent of each other, giving rise to inferences such as (7b) in Zimmermann’s example.

- (5) Mr. X is in Regent’s Park or Mr. X is in Victoria. (Zimmermann, 2000: 270)
- (6)  $\diamond$  Mr. X is in Regent’s Park &  $\diamond$  Mr. X is in Victoria
- (7) a. Mr. X is not in Hyde Park.  
 b. Regent’s Park is not in Victoria.

Warlpiri is not the only language for which an overtly modal disjunctive strategy along these lines has been observed. Cheyenne (Algonquian) also appears to realize disjunction as a combination of conjunction and modality, as discussed by Murray (2017). The case of Cheyenne is particularly interesting for our purposes since the relevant disjunctive construction involves an additive particle. In (8), the additive *mátò* combines with the conjunctive *naa*, which is the main focus of Murray’s discussion. Moreover, the additive particle forms a sequence with the particle *héva*, which, Murray reports, has modal uses similar to English *maybe*.

- (8) Annie é-ho’soo’e naa máto=héva Shelly é-néméne.  
 Annie 3-dance CONN also=héva Shelly 3-sing  
 “Annie danced or Shelly sang.” Cheyenne (Murray, 2017: 657)

Although Murray (2017) mentions some potential challenges for an analysis of (8) and similar disjunctive constructions in Cheyenne as a conjunction of possibilities, she considers an account along the lines of Zimmermann (2000) to be a promising approach. The Cheyenne construction in (8) is notably similar to the example from Igbo in (1) in that, besides the additive, it only contains one overt modal. A notable difference is that the Cheyenne example in (8) also contains overt conjunction. Against the background of existing analyses of disjunction that involve (covert or overt) conjunctive coordinators, the semantic relation between conjunction and additivity will be crucial for developing appropriate accounts for the disjunctive constructions in Igbo and Thai. This relation has been discussed, for instance, by Zeevat and Jasinskaja (2007), who defend the idea that the meaning of the conjunctive coordinator (*and*) is actually additive. Conversely, Ahn (2015) proposes a conjunctive semantics for additive particles such as English *too* (see Sect. 3 for some discussion). Moreover, existing cross-linguistic and diachronic generalizations can serve to illustrate the proximity. In many languages, the same morphemes can function as conjunctions and as additives, and additive particles are a common diachronic source for conjunctions (Mithun, 1988; König, 1991). The double function of a single particle is illustrated in (9) and (10) by example of Ngamo (Chadic), as discussed by Grubic (2015). Example (9) shows an additive use of the particle *ke(’e)* (glossed by Grubic as ‘also’). As illustrated in (10), however, *ke(’e)* can also be used as a sentence connector, in which case it translates as ‘and’.

- (9) Context: I know that Hawwa built a house, but what about Kule? What did he build?  
**Ke** salko bano.  
 also build.pfv house  
 “He built a house, too.” Ngamo, adapted from Grubic (2015: 204)
- (10) Hawwa kaja mato, Kule **ke** salko bano.  
 Hawwa buy.pfv car Kule also build.pfv house  
 “Hawwa bought a car, and Kule built a house.”

These considerations provide relevant context for understanding complex disjunction in Igbo, to which we turn in the next section.

### 3. Complex disjunction in Igbo

Igbo, a Benue-Congo language spoken predominately in southern Nigeria is a tone language with three tones: high, low and downstep. Verbal morphology is highly productive such as the -rV (V is a copy of the vowel of the preceding syllable of the verb stem) on the verbs in our data examples. The exact semantics of this morpheme is still under debate (Carrel, 1970; Uwalaka, 1988; Déchaine, 1993; Manfredi, 1997). The basic word order is SVO. Igbo has no sentential connector comparable to English *and*, clauses are juxtaposed without an overt connector.<sup>2</sup> We argue that additive particles (including *mà*) serve as sentence connector. The Igbo examples and judgments reported in this paper are based on the third author’s native speaker intuitions.

#### 3.1. Disjunction in Igbo: the basic data

In this subsection we discuss the ingredients of disjunction in Igbo. Igbo does not have a dedicated disjunctive connector. Clausal disjunction in declarative contexts<sup>3</sup> is expressed with the combination of *nwèrè íké* and *mà*, as illustrated in (1) (repeated from above) and (11).

- (1) Ó **nwè-rè íké** bú-rú nà Paul bù dọkítà **mà** ọ bú bú-rú nà John bù dọkítà.  
 it MOD(◇) be-rV that Paul be doctor ADD it be be-rV that John be doctor  
 “Paul is a doctor or John is a doctor.”
- (11) John **nwè-rè íké** bú-rú dọkítà **mà** ọ bú bú-rú ọdé ákwúkwó.  
 John MOD(◇) be-rV doctor ADD it be be-rV writer book  
 “John is a doctor or he is a writer.”

Next, we illustrate the uses of the modal and the additive outside of disjunction contexts. *Nwèrè íké* literally translates as ‘have strength’ and can be described as a variable-flavor possibility modal. Examples (12) and (13) demonstrate deontic and epistemic possibility uses. According to our data, teleological and ability interpretations are available with *nwèrè íké* as well.

- (12) *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 MOD(◇) INF-ride vehicle  
 “Martin may ride the ferris wheel.”

<sup>2</sup>There is the conjunctive *nà*, which is used for coordinating nominals. Note that this is different from the complementizer in (1). See Georgi and Amaechi (2022) for tests confirming that *nà* between two nominals involves coordination.

<sup>3</sup>Interestingly, disjunctive questions involve a slightly different construction. As illustrated in (i), the additive particle *ma* changes to *ka*, and there is no modal in the sentence. (Interrogative marking is realized tonally on the subject pronouns.) We currently have only limited insight into how disjunction works in interrogative environments in Igbo, so we have to set this difference aside for the purposes of this paper.

(i) I hapu-ru fonu gi n’oru ka o bu na i hapu-ru ya n’ime ugbo.  
 you.Q leave-rv phone your PREP-work KA O BU that you.Q leave-rv it PREP-inside vehicle  
 “Did you leave your phone at work or did you leave it on the bus?”

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- (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.

Ó nwèrè íké í-bí’á ùlòák wú’kwò táà.  
 3SG MOD(◇) INF-come school today  
 “He/She might come to school today.”

The second main ingredient of complex disjunction in Igbo is the additive particle *mà* combined with the third person pronoun *ò* and the verb *bù* ( $\approx$  ‘be’). While this combination seems to be conventionalized to some degree in disjunctive constructions, we will propose that *mà* and *ò bù* make distinct semantic contributions to the compositional meaning of disjunctive sentences. In (14), we illustrate the additive use of *mà* outside of disjunction contexts.

- (14) John kpò-rò **mà** Paul.  
 John call-RV ADD Paul  
 “John also called Paul.” / “John called Paul as well.”

Note that both *nwèrè íké* and *mà ò bù* are necessary ingredients of the disjunctive construction. As shown in (15a) and (15b), omitting either component results in ungrammaticality.

- (15) a. \*Ó bú-rú nà Paul bù dọkítà **mà ò bù** (bú-rú nà) John bù dọkítà.  
 It be-RV that Paul be doctor ADD it be be-RV that John be doctor  
 b. \*Ó **nwè-rè íké** bú-rú nà Paul bù dọkítà (bú-rú nà) John bù dọkítà.  
 it MOD(◇) be-RV that Paul be doctor be-RV that John be doctor  
 Intended: “Paul is a doctor or John is a doctor.”

Finally, it is interesting to note that disjunction in Igbo seems to be compatible with both inclusive and exclusive readings. Example (16) illustrates the felicitous use of the disjunctive construction in a context that triggers an exclusive reading. In a context that explicitly favors an inclusive reading, such as (17), the same sentence is equally felicitous.

- (16) *Context (exclusive)*: Your sister asks you what Paul and John do for a living. You know one of them is a doctor but you don’t know which one. You say: ...

Ó **nwè-rè íké** bú-rú nà Paul bù dọkítà **mà** ò bù bú-rú nà John bù dọkítà.  
 it MOD(◇) be-rV that Paul be doctor ADD it be be-rV that John be doctor  
 “Paul is a doctor or John is a doctor.”

- (17) *Context (inclusive)*: Your sister asks you what Paul and John do for a living. You know at least one of them is a doctor. You can’t quite remember though, maybe John is a doctor, maybe Paul is a doctor, maybe both of them are doctors. You say: ...

Ó **nwè-rè íké** bú-rú nà Paul bù dọkítà **mà** ò bù bú-rú nà John bù dọkítà.  
 it MOD(◇) be-rV that Paul be doctor ADD it be be-rV that John be doctor  
 “Paul is a doctor or John is a doctor.”

To summarize the basic data pattern: in Igbo, disjunction is expressed with a possibility modal in the initial disjunct and the combination of an additive particle, a pronoun and a copula introducing the second disjunct. This is the standard strategy of expressing disjunction in declarative clauses in Igbo, and it is compatible with inclusive and exclusive interpretations.

### 3.2. Towards an analysis of complex disjunction in Igbo

To account for the disjunctive interpretations of Igbo sentences such as (1), we will follow previous works such as Bowler (2014) and Murray (2017), who pursue an analysis of similar disjunctive constructions as conjunction of (epistemic) possibilities (in the spirit of Zimmermann, 2000). Similar as in the relevant cases in Warlpiri and Cheyenne, however, the surface realization of disjunction in Igbo does not unequivocally map onto this proposed underlying structure. In the case of Igbo, there are at least two mismatches: firstly (like in Cheyenne), there appears to be only one possibility operator in the sentence, namely *nwèrè íké* in the first clause. Secondly, assuming that *má* is an additive particle, it is not immediately clear how the two clauses are combined, since there is no overt conjunction in the construction (like in Warlpiri). We will discuss both of these issues in turn.

As for the first issue, we submit that the Igbo disjunctive construction underlyingly involves double modalization, i.e. besides *nwèrè íké* in the first clause, an additional possibility operator modalizes the second clause in a sentences like (1). The underlying structure we assume is sketched in (18).

(18) **Underlying structure of (1):** [ [  $\diamond$  doctor(Paul) ] mà [  $\diamond$  doctor(John) ] ]

This assumption is necessary since conceivable alternative analyses with only *nwèrè íké* contributing modal meaning would fail to account for the observed disjunctive interpretations. If we assumed a narrow scope analysis of *nwèrè íké* in which it modalizes only the first clause, the sentence would assert the truth of ‘John is a doctor’, making it incompatible with contexts such as (16) and (17) in which the speaker is uncertain as to whether ‘John is a doctor’ is true. If, on the other hand, *nwèrè íké* took wide scope over both clauses, we would derive truth conditions compatible with an inclusive context such as (17), but would fail to predict an exclusive reading in a context where the speaker knows that only one disjunct is true.

While the assumption of a second possibility modal is necessary to derive truth conditions compatible with disjunctive interpretations, empirical evidence suggests that this additional modal meaning component is actually contributed by ( $\delta$ ) *bù*, i.e. by the verb ‘be’ that occurs with *má* in the disjunctive construction.<sup>4</sup> One observation that supports this conjecture is that *bù* can be replaced by *nwèrè íké*, maintaining a disjunctive interpretation (see (19a)). As (19b) shows, however, it is not felicitous to keep *bù* in the structure and just add the modal. We propose that these observations are in line with the idea that *nwèrè íké* and *bù* make the same meaning contribution in disjunctive constructions (although the structure involving the copula seems to be conventionalized for expressing disjunction).

(19) *Context (abridged):* Doctors as well as people who don’t have much money get discounts on public trains. Your friend asks you why Susie paid so little on her last train ride. You don’t know anything about Susie, but you can think of two possible reasons:

- a. Susie **nwèrè íké** bú-rú dókítà mà ó **nwèrè íké** bú-rú nà ò nwé-ghí  
 Susie MOD( $\diamond$ ) be-RV doctor ADD 3SG MOD( $\diamond$ ) be-RV that 3SG have-NEG  
 é!gó.  
 money

<sup>4</sup>From a broader perspective, the expression of modality with ‘be’ is not a surprise. Similar as in the case of additives and conjunction, the typological literature reports a strong diachronic and cross-linguistic relation between ‘be’ and (epistemic) possibility meaning (Bybee et al., 1994; van der Auwera and Plungian, 1998).

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“Susie is a doctor or she is poor.”

- b. \*Susie **nwèrè íké** bú-rú dọkítà **mà** ó **bù nwèrè íké** bú-rú nà ò  
 Susie MOD(◇) be-RV doctor ADD 3SG be MOD(◇) be-RV that 3SG  
 nwé-ghí é'gó.  
 have-NEG money  
 Intended: “Susie is a doctor or she is poor.”

Moreover, while omitting *má ò bù* from the disjunctive construction results in ungrammaticality (see ex. (15b)), it is grammatical to just leave out *ò bù*, as shown in (20). Crucially, however, the construction then loses its disjunctive interpretation; the meaning of (20) is clearly conjunctive. This shows that (in the absence of an overt modal) having (*ò*) *bù* in the structure is necessary for the construction to be interpreted as disjunction.

- (20) **Ó nwè-rè íké** bú-rú nà Paul bù dọkítà **mà** John bù(-kwà) dọkítà.  
 it MOD(◇) be-RV that Paul be doctor ADD John be-ADD doctor  
 “It might be that Paul is a doctor and John also is a doctor.”  
 NOT: “Paul is a doctor or John is a doctor.”

Let us now turn to the second issue of how the two clauses combine in disjunctive sentences in Igbo. Recall that, based on examples such as (14), we have classified *má* as an additive particle. However, additive particles are usually assumed to denote one-place propositional operators. An example denotation along those lines (adapted from Grubic, 2015) is presented in (21). According to this type of analysis, an additive particle takes a single proposition as its argument, asserts the truth of that proposition, and presupposes a salient antecedent proposition in the contextually relevant alternative set.

- (21)  $[[\text{ADD}]] = \lambda q. \lambda w. q(w)$ , defined iff there is a salient alternative  $p \in \text{ALT}$

Adopting such an analysis for *má* in Igbo would raise the question of how the disjunctive interpretation is compositionally derived, as there is no overt connective in the relevant construction. A possible solution is to posit a covert conjunction in the structure, as Bowler (2014) does for examples like (3) in Warlpiri.

An alternative solution (suggested to us by a reviewer), is to adopt an analysis of the additive particle as a two-place predicate, as proposed by Ahn (2015). In (22), we adapt the lexical entry that Ahn (2015) provides for the English additive particle *too*. In this analysis, the additive takes two propositional arguments, namely (the focus value of) its host proposition and a silent propositional anaphor. It presupposes that the propositional anaphor *q* be a distinct focus alternative of the host proposition *p*, and asserts the conjunction of *q* and *p* (Ahn, 2015: 26). Adopting this idea for Igbo, it would be *mà* itself that conjoins the two clauses in a disjunctive construction, associating with the second clause while the first clause saturates the argument slot for the propositional anaphor. Hence, in this type of analysis, *mà* can be conceived of as a sort of hybrid between additive particle and conjunctive coordinator.

- (22)  $[[\text{ADD}]](q)([[p]]_{\sim C}) = \lambda w: q \in C - \{[[p]]^o\}. q(w) \wedge [[p]]^w$

For the analysis of the disjunctive construction in Igbo, we will adopt this latter solution and propose that the additive *má* indeed has a semantics along the lines of (22), and thus contains a conjunctive meaning component. In what follows, we present some additional empirical motivation for choosing this analytical option.

As reported above, Igbo does not have a disjunctive connector that would correspond to English ‘or’. Likewise, Igbo does not seem to have a genuine connective that conjoins clauses. The most appropriate translations of clausal conjunction involve yet a different additive element, namely the suffix *-kwa*. An example is provided in (23).

(23) *Context:* Susie works as a doctor in a hospital. In her spare time, she gives classes at the local college.

Susie *bù* *dókítà* *ó* *bù-kwà* *ónyéńkúzí*.

Susie be doctor 3sg be-ADD teacher

“Susie is a doctor and she is a teacher.”

Lit: “Susie is a doctor, she is also a teacher.”

However, the literature provides examples in which *má* seems to function as a conjunctive coordinator, such as in (24) from Eme (2005). *Má* and *-kwa* can also occur together in a conjunctive construction, as shown in (25).

(24) a. *Sópùrú mà* *fěé* *Chínékè* *gí* *ńkè* *ómá*.

“Honor and adore your god profoundly.”

b. *Há* *bùrù* *í**bù* *mà* *ńné* *’há* *dì* *gírírí*.

“They are fat but their mother is slim.”

(Eme, 2005: 98)

(25) John *nwè-rè* *ákwúkwo* *mà* *nwé-kwá* *é’gó*.

John have-rV book ADD have-ADD money

“John has a book and also has money.”

The above data suggest that Igbo is a language in which additive particles (including *mà*) also serve as sentence connectors. We take it that a hybrid analysis along the lines of (22) is particularly attractive for particles with this double function. However, our main empirical argument for attributing the conjunctive meaning contribution to *mà* (rather than to a covert connective) is the following: if the disjunctive construction involved covert conjunction (and if *má* denoted a simple one-place additive as in (21)), then we would expect *má* to be optional. More precisely, a covert connective could conjoin the two clauses and, assuming that each clause is modalized, the result would be a conjunction of possibilities. As shown in (26), however, omitting *má* from the disjunctive sentence in (1) results in ungrammaticality.

(26) \**Ó nwè-rè íké* *bù-rú* *nà* Paul *bù* *dókítà* *ò* *bù* *bù-rú* *nà* John *bù* *dókítà*.

it MOD(◇) be-rV that Paul be doctor it be be-rV that John be doctor

Intended: “Paul is a doctor or John is a doctor.”

We take the above observations to suggest that the conjunctive meaning component is indeed contributed by *má*, rather than by a covert conjunction. At the same time, *má* does not seem to be an exact equivalent of a connective like English ‘and’, as it is not normally used to conjoin clauses and also has purely additive uses such as illustrated in example (14). To account for the observed behavior of *má*, we therefore adopt the lexical entry in (22).

In sum, the arguments presented above result in a compositional analysis in which disjunctive meaning in Igbo is derived as conjunction of possibilities. For the modal operators in the construction, we assume a standard possibility meaning in a Kratzerian possible worlds semantics (Kratzer, 1981, 2012; Hacquard, 2011). A lexical entry is provided in (27).

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- (27) For any conversational background  $f$ :  
 $[[\diamond]]^f = \lambda p. \lambda w. \exists w' [w' \in \cap f(w) \wedge p(w') = 1]$

The composition of our example sentence (1) (repeated below) thus proceeds as follows. *Má* takes as its argument a propositional anaphor as well as its host proposition ( $[\diamond \text{ John is a doctor}]$ ), and presupposes that the value of the propositional anaphor is a focus alternative of the denotation of the host proposition. The first clause ( $[\diamond \text{ John is a doctor}]$ ) serves as the antecedent of the additive, and the denotations of the two clauses are conjoined as per the asserted meaning component of *má*. The resulting truth conditions are shown in (28).

- (1) **Ó nwè-rè íké** bú-rụ nà Paul bù dọkítà **mà ọ** bú bú-rụ nà John bù dọkítà.  
 it MOD( $\diamond$ ) be-rV that Paul be doctor ADD  $\diamond$  be-rV that John be doctor  
 “Paul is a doctor or John is a doctor.”

- (28)  $[[ (1) ]]^f \approx \lambda w. \exists w' [w' \in \cap f(w) \wedge \text{Paul is a doctor in } w'] \wedge$   
 $\exists w'' [w'' \in \cap f(w) \wedge \text{John is a doctor in } w'']$   
 (defined iff *Paul might be a doctor* is a focus alternative of *John might be a doctor*)

To conclude this section, let us address some interesting further observations regarding the modal analysis we adopt for complex disjunction in Igbo. The first observation is that formalizing disjunction as conjunction of possibilities does not straightforwardly derive the disjunctive syllogism exemplified in (29).<sup>5</sup>

- (29) a. Paul is a doctor or John is a doctor.  
 b. Paul is not a doctor.  
 c. (Therefore) John is a doctor.

We observe that with complex disjunction in Igbo, the inference pattern in (29) is in fact context-dependent. For instance, an Igbo speaker can felicitously utter (31) as a reaction to hearing (and believing) the disjunctive construction in (1) and the utterance in (30). More precisely, (31) would be felicitous in a situation where the speaker does not know for sure that between John and Paul, one of them is a doctor. If, on the other hand, the speaker knows that one of the disjuncts is true, the continuation in (32) is appropriate.

- (30) Paul á-bụ-<sup>1</sup>ghị dọkítà!  
 Paul A-be-NEG doctor  
 “Paul is not a doctor!”
- (31) John á-bụ-kwá-<sup>1</sup>ghị dọkítà.  
 John A-be-ADD-NEG doctor  
 “Maybe John is not a doctor, either.”  
 (lit. “John is also not a doctor.”)
- (32) Yá bú nà John bù dọkítà.  
 3SG.EMPH COP that John COP doctor

<sup>5</sup>Many thanks to Tomasz Klochowicz for bringing this up. In Zimmermann’s (2000) analysis, this property of disjunction is implemented in a closure operation along the lines of (i) (where  $H_c$  represents the speaker’s background knowledge), which yields the salient exhaustive interpretation of disjunctive sentences by ensuring that a conjunction of possibilities as in (28) is interpreted as a closed list.

(i)  $(\forall q) [q \cap H_c \neq \emptyset \rightarrow [q \cap p_1 \neq \emptyset \vee \dots \vee q \cap p_n \neq \emptyset]]$  (Zimmermann, 2000: 268)

“(Then) John is a doctor.”

Another interesting issue concerns the flavor of the possibility modal *nwèrè íké*. Our proposal, in a nutshell, is that Igbo transparently realizes (a version of) the underlying meaning of disjunction as proposed by Zimmermann (2000), and that *nwèrè íké* contributes the modal meaning component. In Zimmermann’s proposal, the relevant modality has epistemic flavor, relating to the speaker’s background knowledge. As shown in Sect. 3.1, *nwèrè íké* is clearly compatible with epistemic modal flavor, but it can have other interpretations as well (see Murray (2017) for similar remarks on the Cheyenne disjunction in (8)). In light of this, it is interesting to see what happens in the free choice examples that originally motivated Zimmermann’s (2000) analysis. For illustration, the free choice sentence in (33) involves deontic possibility modals and licenses the inference that both eating a cupcake and eating a cookie are permissible options.

(33) Paul can eat a cupcake or he can eat a cookie.

Since *nwèrè íké* is compatible with deontic modal flavor (see ex. (12)), it can occur in free choice disjunction, as illustrated in (34).

(34) *Context:* There are two sweets on the table. A cupcake and a cookie. Paul can choose either one of them but not both. You don’t care which one he chooses.

Paul **nwèrè íké** í-<sup>1</sup>rí cupcake **mà ò bù ò** ríé cookie.

Paul MOD eat cupcake ADD it be he eat cookie

“Paul can eat a cupcake or he can eat a cookie.”

According to Zimmermann (2000), free choice disjunction underlyingly involves additional epistemic possibility operators, i.e. (33) is construed as the list of deontic possibilities that are compatible with the speaker’s knowledge. If the speaker can be assumed to have exhaustive knowledge of what is and isn’t allowed,<sup>6</sup> this reduces to a list of deontic possibilities. Geurts (2005), while endorsing a modal analysis of disjunction, contests the proposal that the relevant modality is always epistemic. In Geurts’s account, the logical form of an overtly modalized disjunction such as (33) does not contain additional covert modals, only the overtly realized deontic possibility. While we do not currently have data from Igbo that would refute either analysis, the observation that Igbo uses the same variable-flavor possibility modal in free choice disjunction and in the “standard” complex disjunctive construction seems well in line with Geurts’s (2005) idea that modal disjunction involves some flavor-variability. In future research, it would be interesting to investigate how free choice is expressed in languages that encode disjunction as conjunction of variable-flavor modality (e.g. Igbo) as compared to languages that conjoin clearly epistemic modals (which seems to be the case in Warlpiri, for instance).

#### 4. Complex disjunction in Thai

Thai, a Kra-Dai language spoken as the national language of Thailand, has a SVO basic word order and analytic morphology. This study focuses on the Central Thai variety spoken in and around Bangkok, which comprises five tones: mid, low, falling, high and rising. Thai has a rich inventory of functional words, many of which have received little attention in the formal semantics literature. Using examples and judgments based on the native intuitions of the fourth author and three additional speakers, we argue that the complex disjunction formed with an

<sup>6</sup>This is captured in the *Authority Principle*, see Zimmermann (2000: 286).

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additive and negation particle in Thai has the underlying structure of an indicative conditional.

### 4.1. Disjunction in Thai: the basic data

This subsection presents some basic data on disjunction in Thai. The construction that we are mainly interested in was first presented in example (2) and is repeated below.

- (2) Paul pen mǎr **mâi gôr** John pen mǎr.  
Paul be doctor NEG ADD John be doctor  
“Paul is a doctor or John is a doctor.”

In this construction, the two disjuncts are connected by a combination of the negation marker *mâi* and the additive particle *gôr*. In (35) and (36), we illustrate the use of these particles outside of disjunction contexts.

- (35) Susie pen mǎr dae kaǎ **mâi** mi ngoen.  
Susie COP doctor but 3SG NEG have money  
“Susie is a doctor but she doesn’t have money.”

- (36) John **gôr** too hǎa Paul.  
John ADD phone find Paul  
“John also called Paul.”

Interestingly, the complex disjunction in Thai differs from the Igbo disjunctive construction in that it is only compatible with exclusive interpretations. Inclusive readings are not available for disjunction with *mâi gôr*. The examples in (37) and (38) illustrate the contrast.

- (37) *Context (exclusive)*: Your sister asks you what Paul and John do for a living. You know one of them is a doctor but you don’t know which one. You say: ...  
Paul pen mǎr **mâi gôr** John pen mǎr.  
Paul be doctor NEG ADD John be doctor  
“Paul is a doctor or John is a doctor.”
- (38) *Context (inclusive)*: Your sister asks you what Paul and John do for a living. You know at least one of them is a doctor. You can’t quite remember though, maybe John is a doctor, maybe Paul is a doctor, maybe both of them are doctors. You say: ...  
#Paul pen mǎr **mâi gôr** John pen mǎr.  
Paul be doctor NEG ADD John be doctor  
“Paul is a doctor or John is a doctor.”

Moreover, Thai differs from Igbo in that it has a morphologically simple disjunctive connective in its grammar, namely *rǎe*. In contrast to the complex construction, disjunction with *rǎe* seems to be compatible with both exclusive and inclusive interpretations. For instance, the sentence in (39) is felicitous in both context presented in (37) and (38).

- (39) Paul pen mǎr **rǎe** John pen mǎr.  
Paul be doctor or John be doctor  
“Paul is a doctor or John is a doctor.” ✓ exclusive, ✓ inclusive

In summary, disjunction in Thai can be expressed with an additive particle (*gôr*) preceded by negation. The resulting construction is compatible with exclusive, but not with inclusive

disjunctive meaning. In contrast to Igbo, complex disjunction in Thai co-exists with monomorphemic disjunction, expressed by the connective *rǐe*, which can have exclusive as well as inclusive interpretations.

#### 4.2. Towards an analysis of complex disjunction in Thai

Similarly as for Igbo, we submit a compositional analysis of complex disjunction in Thai, which however cannot be read off directly from the surface structure of disjunctive sentences. Taking the surface structure at face value, we would predict for the sentence in (2) (repeated below), that the first disjunct ('Paul is a doctor') is asserted and the second ('John is a doctor') negated, rather than a disjunctive meaning that leaves open which proposition is true.

- (2) Paul pen mǒr **mâi gôr** John pen mǒr.  
 Paul be doctor NEG ADD John be doctor  
 "Paul is a doctor or John is a doctor."

To explain how the combination of negation and the additive results in a disjunctive interpretation, we propose that sentences like (2) have an underlying structure akin to indicative conditionals, as sketched in (40). According to (40), the first disjunct in (2) restricts a covert (epistemic) necessity modal, as would an antecedent proposition in a modal analysis of conditionals (Kratzer, 1991, 2012). The resulting interpretation can be paraphrased as '*If Paul is a doctor, it is not the case that also John is a doctor*'. Crucially, this semantically excludes situations in which both Paul and John are doctors, thus making the sentence incompatible with an inclusive context such as (38).

- (40) **Underlying structure of (2):** [ □ [ Paul is a doctor ] NOT ADD John is a doctor ]

Suggestive empirical evidence for this idea comes from the observation that *gôr* can serve as a 'conditional linker' in overt conditionals, in which case it is most accurately translated as 'then'. The example in (41) shows an overt indicative conditional with *gôr*.

- (41) tâa kun mâi rîp kun gôr mâi tan.  
 if 2SG NEG hurry 2SG GOR NEG on.time.  
 "If you don't hurry, then you won't be on time."

Note that this analytical approach does not require conjunction in the structure of sentences like (2), whether realized covertly or as a meaning component of the additive. In fact, it seems plausible to assign a different meaning to *gôr* than we assumed for the Igbo additive particle *má* in Sect. 3. In contrast to Igbo, Thai has designated conjunctive coordinators, such as *lé* shown in (42). Crucially, in examples such as (43), where *lé* and *gôr* occur together, it is *lé* that contributes the conjunctive meaning.

- (42) *Context:* Susie works as a doctor in a hospital. In her spare time, she gives classes at the local college.  
 Susie pen mǒr **lé** (pen) ajarn.  
 Susie COP doctor and COP teacher  
 "Susie is a doctor and she is a teacher."

- (43) kaǒ pûut paa-sǎa angrît **lé gôr** paa-sǎa tai dâai.  
 3SG speak language England and ADD language Thai able.to

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“S/he is able to speak English and also Thai.”

For the sake of concreteness, we adopt the semantics in (21) (repeated below) for *gôr* and thus treat it as a one-place additive operator.

(21)  $[[\text{ADD}]] = \lambda q. \lambda w. q(w)$ , defined iff there is a salient alternative  $p \in \text{ALT}$

Besides the additive semantics for *gôr*, the composition of complex disjunction in Thai involves the negation marker *mâi*, for which we provide a lexical entry in (44), and the covert epistemic necessity operator defined in (45) (again following Kratzer, 1981, 2012; Hacquard, 2011).

(44)  $[[\text{mâi}]] = \lambda p. \lambda w. \neg p(w)$

(45) For any epistemic conversational background  $f_{\text{epis}}$  :  
 $[[\square]]^{f_{\text{epis}}} = \lambda p. \lambda w. \forall w' [w' \in \cap f_{\text{epis}}(w) \rightarrow p(w')]$

The composition of the sentence in (2) is sketched in (46). The covert modal operator takes as its propositional argument the result of applying the additive operator ( $[[\text{gôr}]]$ ) and the negation operator ( $[[\text{mâi}]]$ ) to the denotation of the second clause ( $[[\text{John pen mor}]]$ ). The modal’s conversational background is updated with the denotation of the first clause ( $[[\text{Paul pen mor}]]$ ). Thus, the modal base is restricted to worlds in which Paul is a doctor. The resulting truth conditions state that in all worlds in the updated modal base (i.e. in which Paul is a doctor), John is not a doctor. The additive contributes the presupposition that  $[[\text{John pen mor}]]$  has a salient alternative in the context. We hold that this presupposition is locally satisfied by the first “disjunct”.

(46)  $[[\text{(2)}]]^{f^*} = [[\square]]^{f^*} ([[ \text{mai} ]] ([[ \text{gôr} ]] ([[ \text{John pen mor} ]])))$ ,  
 where  $f^*(w) = f_{\text{epis}}(w) \cup \{ [[\text{Paul pen mor}]] \}$   
 $\approx \lambda w. \forall w' [w' \in \cap f^*(w) \rightarrow \text{it's not the case that John is a doctor in } w']$   
 (defined if there is a salient alternative to *John is a doctor*)

To the best of our knowledge, this strategy of expressing disjunction has not received much attention in cross-linguistic semantic research. However, similar strategies have been discussed in the typological literature. For instance, Mauri (2008: 44) generalizes that “The combination of a negation and a conditional construction seems to be a common source for the grammaticalization of a disjunctive connective [...]”. Mauri provides an example from the Kwa language Nàńáfŵê, reproduced in (47).

(47) Nàńáfŵê (Mauri, 2008: 44)  
 cén wjélé **sé nán** ánwán jé ó tíké ó fùndréti jé jín ón  
 day some if NEG door that it open.PRF FOC window that.it slam.PRF FOC  
 “Sometimes a door opened or a window slammed.”  
 (lit. “Sometimes, if it wasn’t a door that opened, it was a window that slammed.”)

As indicated by the syntax of the sentence and its literal translation, the example from Nàńáfŵê differs from the structure we propose for Thai in that it is the conditional antecedent, rather than the consequent, that is negated. Indeed, all cross-linguistic examples that we are aware of where disjunction is expressed in a conditional structure involve negation of the antecedent.<sup>7</sup> Thus,

<sup>7</sup>Special thanks to Deniz Özyıldız, Yağmur Sağ and Ciyang Qing for sharing data and observations from Turkish and Mandarin.

complex disjunction in Thai appears to reveal a cross-linguistically rare strategy of expressing disjunctive meaning. Note also that only if the consequent, rather than the antecedent, is negated do we obtain a straightforward explanation for the observed restriction to exclusive disjunctive readings in Thai (see examples (37) and (38)). The meaning that we derive for the relevant construction explicitly states that, according to the speaker’s epistemic state, one disjunct must be false if the other is true.

This brings us to a potential worry raised by our treatment of complex disjunction in Thai. While the conditional analysis correctly rules out inclusive readings, the truth conditions in (46) are in principle compatible with a situation in which both coordinates are known to be false. However, complex disjunction in Thai, like simple disjunction in English, is infelicitous in such a scenario, as illustrated in (48).

- (48) *Context:* Paul and John are brothers, and their parents always wished that they would become doctors. Now Paul is a writer and John is a linguist. Their mother says, with disappointment:

#Paul pen mǒr **mâi gôr** John pen mǒr.  
 Paul be doctor NEG ADD John be doctor  
 # “Paul is a doctor or John is a doctor.”

We submit that this observation can be accounted for in terms of general appropriateness conditions for conditionals. The following quote from Stalnaker (1976: 146) sums up the relevant restriction with respect to indicative conditionals: “It is appropriate to make an indicative conditional statement or supposition only in a context which is compatible with the antecedent.”

Another interesting issue is how the relevant construction in Thai behaves in “Hurford disjunction” contexts (Hurford, 1974), i.e. in cases where one disjunct entails the other.<sup>8</sup> The English example in (49a) illustrates that Hurford disjunctions are generally infelicitous. As shown in (49b), however, the corresponding conditional with negation in the consequent is fine (Mandelkern and Romoli, 2018).

- (49) a. #Jane is in France or she is in Paris.  
 b. If Jane is in France, she is not in Paris.

If the truth conditions of complex disjunction in Thai equate to those of an indicative conditional, as we propose here, we might expect corresponding examples to be felicitous. Again, however, complex disjunction in Thai patterns with the English disjunction in (49a) in that it is unacceptable if one proposition entails the other.

- (50) #Jane yuu tîi fàràngsèet mâi gôr Jane yuu tîi bpaarîis.  
 Jane be LOC France NEG ADD Jane be LOC Paris  
 # “Jane is in France or she is in Paris.”

We propose that, under a compositional analysis of the complex disjunction, this restriction can be attributed to a distinctness requirement imposed by the additive (Kripke, 2009). This requirement excludes cases like (51), where the prejacent of the additive *too* entails the antecedent proposition. As illustrated in (52), *gôr* in non-disjunctive contexts behaves like *too* in this respect.

<sup>8</sup>We thank Amir Anvari for pointing out the relevance of Hurford disjunctions to our analysis.

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- (51) Sam is happy. # [Sam and Jane]<sub>F</sub> are happy too. (Beaver and Clark, 2009: 73)
- (52) Jane yuu tîi fàràngsèet, # gôr (Jane) yuu tîi bpaarîis.  
 Jane be LOC France ADD Jane be LOC Paris  
 “Jane is in France, # Jane is also in Paris.”

Accordingly, an explicit conditional along the lines of (49b) is acceptable, see (53a), but *gôr* cannot be added in the scope of the negation particle (53b).

- (53) a. tâa Jane yuu tîi fàràngsèet, kao mâi yuu bpaarîis.  
 If Jane be LOC France 3.SG NEG be Paris  
 “If Jane is in France, she is not in Paris.”
- b. #tâa Jane yuu tîi fàràngsèet, kao mâi gôr yuu bpaarîis.  
 If Jane be LOC France 3.SG NEG ADD be Paris  
 Intended: “If Jane is in France, she is not (also) in Paris.”

Based on the proposal that logical independence of the two propositions in the complex disjunction construction is contributed by the additive, we add this restriction to the presupposition of *gôr* and provide a revised lexical entry in (54).

- (54) **Semantics of the additive in Thai (revised):**  
 $[[GÔR]] = \lambda q. \lambda w. q(w)$ , defined iff there is a salient alternative  $p \in ALT$  &  $p$  is logically independent of  $q$

## 5. Summary and conclusion

In this paper, we provided compositional analyses for two instances of complex disjunction with additive particles. In the Igbo language, complex disjunction involves an additive particle as well as a possibility modal in the first clause. We proposed that this presents an overt realization of the meaning that Zimmermann (2000) and Geurts (2005) propose for disjunctive meaning more generally, as conjunction of possibilities. According to these works, connectives like English ‘or’ do not encode logical disjunction; their role is to present possible alternatives. In the constructions we discussed here, this contribution is made by *alternative-sensitive* particles (cf. Hartmann and Zimmermann, 2008), namely additives. In Igbo, we argued, the additive also conjoins the alternatives, and possibility meaning is contributed by an overt possibility modal in the first clause and a copula in the second. Igbo thus provides additional cross-linguistic support for a modal analysis of disjunction, in line with previous works on conjunction and disjunction in understudied languages, such as Bowler (2014) and Murray (2017).

Complex disjunction in Thai also involves an additive particle, but no overt modality. In Thai, the additive combines with negation to express exclusive disjunctive meaning. We proposed that this construction is interpreted as an indicative conditional ( $\approx$  *If p, not also q*), adopting an account in which the antecedent of a conditional restricts a covert epistemic necessity operator. Thus, if our approaches to complex disjunction in Thai and Igbo are on the right track, the two constructions share in common not only that they involve additive particles, but also that they are best analyzed as modalized propositions. While it is not surprising that natural language would make use of conditional structures to express disjunctive meaning, the particular strategy we proposed for Thai is striking from a cross-linguistic perspective, since it contains negation of the consequent and thereby semantically restricts the construction to exclusive readings. An

interesting question for future research concerns the impact of this construction on possible interpretations of simple disjunction. As shown in the previous section, complex disjunction in Thai co-exists with a disjunctive connector *rǔe* (see ex. (39)), which we assume to be a close equivalent of English *or*. Thai also has conjunctive connectives (see e.g. (42) and (43)). Still, disjunction with *rǔe* is readily compatible with inclusive interpretations. This suggests that exclusivity implicatures may be blocked, or at least weakened, in the presence of an additional competing construction that semantically encodes exclusive disjunction.

Finally, while we started out from the observation that both Igbo and Thai employ additive particles in complex disjunction, we arrived at different analyses of the additive particles *mà* and *gôr*. Additives are commonly analyzed as one-place propositional operators that assert the truth of their propositional argument and presuppose an antecedent proposition with certain properties. In Sect. 4, we adopted a version of this account for the Thai additive particle *gôr*. Ahn (2015) proposes an alternative analysis under which the truth conditions of the English additive *too* assert conjunction of the antecedent and the host proposition. We concluded that this type of account best captures the distribution of the additive *mà* and its semantic contribution to complex disjunction in Igbo. As a conjecture for future cross-linguistic research, we submit that a hybrid analysis of additives along the lines of Ahn (2015) might be particularly useful for particles that serve double duty as additives and conjunctives.

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