

Decomposing Necessity — The Hausa exclusive particle *sai* as a window into the building blocks of modal meaning¹

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Abstract. We discuss the modal uses of the Hausa exclusive particle *sai* (\approx only). We argue that the distribution of *sai* in modal environments provides evidence for the following claims on the composition of modal meaning that have been independently made in the literature: i) Future-oriented modality involves a prospective aspect operator that can be realized covertly in some languages (e.g. English, Kratzer 2012b) and overtly in others (e.g. Gitksan, Matthewson 2012, 2013). ii) Necessity interpretations arise from exhaustifying possibilities, i.e. an exhaustivity operator applying to existential modality (e.g. Kaufmann 2012 for the case of imperatives and Leffel 2012 for a relevant analysis of necessity meaning in Masalit). We show that future-oriented necessity in Hausa decomposes into EXH(\diamond (PROSP)), with *sai* contributing exhaustivity.

Keywords: exclusive particles, modality, aspect, conditionals

1. Introduction

The Hausa particle *sai* is argued in the descriptive literature (e.g. Lukas, 1955; Kraft, 1970; Meyers, 1974) to be ambiguous between an exclusive reading (= “only”) (1) and a modal reading (= “must”).²

- (1) *Sai tuwō mātā sukè girkā.*
SAI fufu women 3PL.IPFV.REL cook
“The women are only cooking FUFU.”
- (2) *Sai Audù yà tàfi fuřsùnà.*
SAI Audu 3SG.M.SBJV go prison
“Audu must go to jail.”

In this paper, we argue that (i) *sai* is always exclusive, even in examples like (2), (ii) the so-called *subjunctive* is actually a defective prospective requiring embedding under a (modal) operator (Schuh, 2003; Mucha, 2013), and (iii) when there is no overt modal, there is a covert possibility modal (as can be seen when looking at imperatives, cf. Kaufmann 2012). Putting these pieces together, (2) receives its future oriented modal reading by exhaustifying over future

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²The glosses used are: 1/2/3 = 1st/2nd/3rd person, II = series II pronoun, CIRC.POSS = circumstantial possibility, CN = common noun connective, DEM = demonstrative, EPIS = epistemic, F/M = feminine/masculine, SG/PL = singular/plural, IMP = imperative, IPF or IMPF = imperfective, IND = indicative, INF = infinitive, NEG=negation, PFV = perfective, PN = proper noun connective, POSS = possessive, PROG = progressive, PROSP = prospective, REL = relative, S = singular, SBJV = subjunctive, TRA = transitivizer. High tone vowels remain unmarked, a low tone is marked by an accute accent (à), a falling tone by a circumflex (â). Long vowels are marked (ā). Ungrammatical examples are marked with *, infelicitous ones with #.

possibilities (EXH(\diamond (PROSP))), i.e. (2) intuitively means “the only future possibility is Audu going to jail”.

We first provide a short introduction to the Hausa language and the relevant data concerning *sai* in Section 2, including information on the aspectual system of Hausa, focus and focus-sensitivity, and modality. Section 3 presents our analysis and shows how the different readings can be derived compositionally. Section 4 compares our findings to other cross-linguistic observations on future-oriented modality and discusses the implications. Section 5 discusses whether this proposal can be extended to *sai* in conditionals. Section 6 concludes.

2. Data

Hausa is a West Chadic language of the ‘A’ sub-branch, spoken by about 25 million speakers in Nigeria, Niger, Benin, Sudan, Cameroon, Burkina Faso, and Ghana (Lewis, 2009). Hausa is a tone language with high, low, and falling tones. The canonical word order is SVO. Mucha (2013) shows that Hausa is a tenseless language, encoding aspect rather than tense. Aspect is indicated by a preverbal *pronoun-aspect complex* (‘PAC’), consisting of a weak subject pronoun and an aspect marker (Newman, 2000: 564), e.g. *sun* in (3).

- (3) Q: What happened yesterday?
A: Mātā sun girkà tuwō.
women 3PL.PFV cook fufu
“The women cooked fufu.”

The data presented here were elicited with two speakers between 2012 and 2020, mainly using semantic judgment tasks (Matthewson, 2004). Following this method, speakers are asked to judge whether sentences are felicitous in a given context. We also elicited data with the help of storyboards (Burton and Matthewson 2015). These are pictures that help the viewer to tell a short story designed to contain multiple instances of the construction under consideration. After the story is recorded and transcribed, it is used for subsequent semantic judgment tasks.

2.1. Focus in Hausa

In Hausa, there are two strategies of focus marking: (i) fronting of the focused constituent, and (ii) standard canonical word order (Jaggar, 2001; Hartmann and Zimmermann, 2007: i.a.), see (4)–(5). In the perfective and the imperfective, focus fronting requires a special form of the person-aspect-complex, the so-called *relative* form.

- (4) Q: What did the women cook?
A: Mātā sun girkà **tuwō**.
women 3PL.PFV cook fufu
“The women cooked FUFU.”
- (5) Q: What did the women cook?
A: **Tuwō** mātā sukà girkà.
fufu women 3PL.REL.PFV cook
“The women cooked FUFU.”

The ex-situ focus marking strategy is possible for all TAMs except for the so-called subjunctive (Tuller, 1986: 69), (6)–(7) (see also Jaggar, 2001).

(6) Q: What should the women cook?

A: Mātā sù girkā **tuwō**.
 women 3PL.SBJV cook fufu
 “The women should cook FUFU.”

(7) Q: What should the women cook?

A’: ***Tuwō** mātā sù girkā.
 fufu women 3PL.SBJV cook
 (intended:) “The women should cook FUFU.”
 (Comment: “It should be ‘Tuwō mātā **za** sù girkā’ - it is future tense but it means ‘should’ here.”)

Both authors suggest that the impossibility of ex-situ focus with the subjunctive in examples like (7) is semantic in nature. Tuller (1986: 71–74) proposes that it is a clash between the focus requiring the adjacent person-aspect-complex to be *definite*, because backgrounded material must be “known”, and an inherent *indefiniteness* of the subjunctive, which expresses uncertainty or doubt. Similarly, Jaggar (2001: 504) proposes a clash between the “highly specific” focus and the “non-specific” modal.

2.2. The exclusive particle *sai*

Sai is an exclusive focus-sensitive particle. Consider example (8). Like the corresponding English sentence, it has the meaning components in (a)–(c) (e.g. Beaver and Clark, 2008).

(8) *Sai tuwō* mātā sukà girkā.

SAI fufu women 3PL.PFV.REL cook

“The women only cooked FUFU.”

- | | | |
|----|---|-------------|
| a. | The women cooked nothing else | (exclusive) |
| b. | The women cooked fufu | (prejacent) |
| c. | It is expected or normal to cook more than that | (mirative) |

The *exclusive* meaning component is asserted, whereas the *prejacent* and the *mirative* meaning component behave like presuppositions: for example, while the asserted exclusive meaning component does not project, these meaning components project when the sentence is negated, as in (9). This leads to the inference that the women cooked fufu and other things.

(9) Bā *sai tuwō* mātā sukà girkā ba.

NEG SAI fufu women 3PL.PFV.REL cook NEG

“The women didn’t just cook FUFU.”

- | | | |
|----|---|-------------|
| a. | The women cooked nothing else | (exclusive) |
| b. | The women cooked fufu | (prejacent) |
| c. | It is expected or normal to cook more than that | (mirative) |

Sai can only associate with an ex-situ focused constituent (Zimmermann, 2006). We assume

that the reason is syntactic rather than semantic: *sai* is preferably initial³, but must be adjacent to its associate (similar to focus-sensitive particles in German, cf. Buring and Hartmann 2001).

(10) *DO focus*

- a. (*Sai) *mātā* (*sai) *sunà* *girkà* (*sai) *tuwō*.
 SAI women SAI 3PL.IPFV cook SAI fufu
 (intended:) “The women are only cooking FUFU.”
- b. Sai *tuwō* *mātā* *sukè* *girkà*.
 SAI fufu women 3PL.REL.IPFV cook
 “The women are only cooking FUFU.”

(11) *Subject focus*

- a. *Sai *mātā* *sunà* *girkà* *tuwō*.
 SAI women 3PL.IPFV cook fufu
- b. Sai *mātā* *sukè* *girkà* *tuwō*.
 SAI women 3PL.REL.IPFV cook fufu
 “Only WOMEN are cooking fufu.”

In sentences without an ex-situ focus, *sai* associates with the whole sentence, e.g. (12)–(13).

(12) *Sentence focus: Did something happen?*

- Ā’*à*, *sai* *mātā* *sun* *girkà* *tuwō*.
 no SAI women 3PL.PFV cook fufu
 “No, except that the women cooked fufu.”

(13) *Sentence focus: Is something happening?*

- Ā’*à*, *sai* *mātā* *sunà* *girkà* *tuwō*.
 no SAI women 3PL.IPFV cook fufu
 “No, except that the women are cooking fufu.”

When such sentences (with *sai* and canonical SVO word order) are in the so-called subjunctive, a modal reading occurs. We will argue in the following sections that *sai* is an exclusive focus-sensitive particle in these examples, too, associating with the whole sentence (recall from Section 2.1 that focus fronting is ungrammatical in the subjunctive).

2.3. Modal readings of *sai*

Let us now illustrate the modal uses of *sai* with some examples. A crucial generalization is that all of these modal uses involve future-oriented necessity readings, for instance deontic necessity as in (2) (repeated below) and pure circumstantial necessity as in (14). As illustrated in (15), *sai* is also compatible with weak necessity.

(2) DEONTIC NECESSITY:

- According to the Nigerian law,
 ... *sai* Audù yà *tàfi* fuřsùnà.
 SAI Audu 3SG.M.SBJV go prison
 “Audu must go to jail.”

³According to our data, topicalized constituents can precede *sai*.

- (14) CIRCUMSTANTIAL NECESSITY: The harmattan weather is bothering Binta. It is cold, and sand is coming into her nose and eyes. She cannot help sneezing!

Sai Bintà tà yi atìshāwà.
 SAI Binta 3SG.F.SBJV do sneezing
 “Binta has to sneeze.”

- (15) WEAK (DEONTIC) NECESSITY:

Màsu cin àbinci sai sù wankè hannuwànsù, àmmā dōlè
 people eating food SAI 3PL.SBJV wash hands.3PL.POSS but necessarily
 ma’aikàta sù wankè hannuwànsù.
 workers 3PL.SBJV wash hands.3PL.POSS
 “Customers should wash their hands, but waiters have to wash their hands.”

It seems that epistemic readings, by contrast, are not available with *sai*. As will become clearer in the next section, present epistemic necessity as in (16) might be excluded for its temporal orientation. As illustrated in (17), however, future-oriented epistemic readings are not possible, either.

- (16) PRESENT EPISTEMIC NECESSITY: I was told they were sick, why are they at work?

#Sai sù (yi) lāfiyà yāu.
 SAI 3PL.SBJV do health now
 (intended:) “They must be well now.”
 (Comment: “They are not in the office yet, but you think they should come.”)

- (17) FUTURE-ORIENTED EPISTEMIC NECESSITY: Halima knows that Ibrahim and his family planned to travel soon and sees that their bags are packed. She concludes:

#Sai sù tàfi yāu.
 SAI 3PL.SBJV leave today
 “They must be leaving today.”

Crucially, *sai*+subjunctive also does not license possibility readings, as illustrated for deontic possibility in (18) and pure circumstantial possibility in (19). Table 1 below summarizes the relevant empirical generalizations.

- (18) DEONTIC POSSIBILITY: According to Nigerian law,

#Sai mùsùlmī yà aurē mātā huđu.
 SAI muslims 3SG.M.SBJV marry women four
 (intended:) “Muslim men can marry 4 women.”
 (Comment: “With ‘*sai*’, it is mandatory: they have to marry 4 wives!”)

- (19) CIRCUMSTANTIAL POSSIBILITY: Danjuma has a new car and says:

#Sai ìn yi tūkī na mīl 150 à awò dà motāĩ nān.
 SAI 1SG.SBJV do drive of miles 150 per hour with car DEM
 “I can drive 150 miles per hour in this car.”
 (Comment: “With ‘*sai*’ it is like a command, but nobody is commanding me!”)

In the next section, we propose an analysis of the modal uses of *sai* with three main ingredients:
 i) The TAM form that the Hausa reference grammars refer to as ‘subjunctive’ is reanalyzed as a (semantically defective) prospective aspect, following previous work by Schuh (2003) and

	Epistemic	Deontic	Circumstantial	Weak necessity
Necessity	✗	✓	✓	✓
Possibility	✗	✗	✗	n.a.

Table 1: Modal readings of *sai*

Mucha (2013), ii) modality is contributed by a covert possibility operator, and iii) *sai* denotes an exclusive/exhaustive operator (\approx ‘only’), even in its modal uses. The future-oriented necessity readings we observe with *sai* (\approx *must/should* (p)) thus decompose into ONLY(\diamond (PROSP(p))).

3. Analysis

3.1. The ‘subjunctive’ as prospective

As a first step towards analysing the modal readings of *sai*, we adopt the proposal that the low tone marking on the PAC, usually referred to as the ‘subjunctive’ form, encodes prospective aspectual meaning. (Therefore, we refer to it as ‘prosp(ective)’ in what follows.) This is motivated by the observation that with this form, only future-oriented interpretations are available while present- and past-orientated interpretations are excluded. For instance, as shown in Section 2.3, present-oriented epistemic interpretations are impossible with *sai*+prosp. The same is true when the prospective occurs embedded under an epistemic modal, as shown in (20a). For the sentence to obtain a present-oriented epistemic reading, it needs imperfective marking, as in (20b).

(20) PRESENT EPISTEMIC NECESSITY: Two police officers are looking for John and Sue, who are hiding from them in a cabin. One police officer asks: “Where could they be hiding?” The other one answers:⁴

- a. #kīlā sù buye à cikin wancàn àkwàtì.
Possibly 3PL.PROSP hide at in DEM.F box
(intended:) “They could be hiding in that box.”
(Comment: “The sentence is not possible here. It could only be used if they are not in the box, yet, but could possibly get in.”)
- b. kīlā sunà buye à cikin wancàn àkwàtì.
Possibly 3PL.IPFV hide at in DEM.F box
“They could be hiding in that box.”

Moreover, the prospective occurs in the canonical future form in Hausa,⁵ in combination with the future modal *zā*, as illustrated in (21), and generally in future-oriented modal constructions, such as (22).

(21) Hawwa **zā tà** gudu.
Hawwa ZĀ 3SG.F.PROSP run
“Hawwa will run.”

⁴This judgment was elicited by use of the Totem Field Storyboard “On the Lam” (TFS, 2011).

⁵This form is referred to as ‘future tense’ in the reference grammars, but Mucha (2013) argues that it encodes a combination of modal and prospective meaning rather than grammatical tense.

- (22) **Dòlè** mātā sù girkà tuwō.
Necessarily women 3PL.PROSP cook fufu
“The women must cook fufu.”

The analysis of the low tone marking as the realization of a prospective aspect is inspired by observations made in Schuh (2003: 20), who sticks with the label ‘subjunctive’, but describes its function as follows:

“The Subjunctive signals an event which will have its inception subsequent to the moment of speaking and/or to an event in a superordinate clause. The temporal, aspectual, and modal (= TAM) interpretation of the event represented by the Subjunctive is dependent on that of the superordinate clause or operator.”

Mucha (2013) proposes the lexical entry in (23) to formalise this intuition. In this analysis, ‘subsequent inception’ translates into prospective aspectuality, i.e. posteriority of the eventual-ity time relative to the reference time (the relevant part is underlined).

- (23) $[[\text{PROSP}]]^{g,c} = \lambda P_{\langle l, st \rangle} . \lambda e . \lambda t . \lambda w . [\underline{\tau(e)} > t \ \& \ P(e)(w)]$ (Mucha, 2013: 406)

The dependency on a superordinate clause or operator proposed by Schuh (2003) is reflected in the lexical entry in (23) as well: In contrast to other aspectual operators according to standard analyses (see Kratzer 1998; Pancheva and von Stechow 2004, among many others), the Hausa prospective does not introduce existential quantification over events. Building on the analysis of the canonical future form (see (21)) proposed in Mucha (2013), we assume that the prospective is defective in that it requires a superordinate operator to quantify over the event variable introduced by the predicate. Mucha (2013) proposes that the future modal *zā* can serve this function, it selects an argument of type $\langle 1 \langle i \langle s, t \rangle \rangle \rangle$ (i.e. the semantic type of an AspP headed by the prospective) and introduces existential quantification over events in addition to universal quantification over possible worlds. Empirically speaking, however, the prospective can also occur in its bare form. Sentences with the bare prospective usually receive an imperative or exhortative interpretation, as illustrated in (24) and (25).

- (24) **Kà** biyā!
2SG.M.PROSP pay
“(You) pay!”

- (25) **Mù** buya a nan.
1PL.PROSP hide in here
“Let’s hide in here.” (translation based on the TFS “On the Lam”, TFS 2011)

Based on these data, Mucha (2013: 410) conjectures that the bare prospective is licensed by a covert imperative operator (OP_{Imp}) as proposed in Kaufmann (2012). In the next subsections, we elaborate on this idea and show how it helps us derive the modal readings of *sai*+prosp.

3.2. A covert possibility operator

Thus, we start from the idea that examples such as (24) and (25), where no overt operator scopes over the prospective, involve a covert OP_{Imp} . Interestingly, Kaufmann (2012) proposes that OP_{Imp} is a possibility operator, although imperatives usually have a necessity interpretation. Evidence for this proposal comes from examples such as the German (26b), which contains

what Kaufmann dubs an *anti-exhaustifier*, namely *zum Beispiel* (= *for example*). As indicated by the paraphrase in (26c), (26b) can get a possibility interpretation when uttered as a response to the question in (26a).

- (26) a. How could I save money?
 b. Kauf zum Beispiel keine Zigaretten.
 buy.IMP for example no cigarettes
 “For example, don’t buy cigarettes.”
 c. ≈ One of the things you could do is not buy cigarettes. (Kaufmann, 2012: 180/1)

Thus, since imperatives can receive possibility interpretations with anti-exhaustifiers, Kaufmann (2012) proposes that the basic meaning of OP_{Imp} is possibility. In the default case, however, OP_{Imp} combines with a covert exhaustivity operator (EXH), and the combination of OP_{Imp} and EXH gives rise to a necessity interpretation.⁶ Applied to the case of the bare prospective in Hausa, the sentence in (24) would have the underlying structure shown in (27). Its imperative interpretation arises from the combination of an overtly realized prospective aspect (contributing future-orientation), a covert possibility operator OP_{Imp} (contributing modality) and a covert exhaustivity operator EXH (deriving a necessity reading).

- (27) [EXH OP_{Imp} [PROSP [you pay]]]

We propose that in Hausa, *sai* can overtly express EXH in a structure like (27) and that the necessity modal readings we observe with *sai* are exhaustified possibilities akin to what Kaufmann (2012) proposes for analysing imperatives.

An issue that still requires further research concerns potential differences between the covert possibility operator involved in the relevant modal sentences in Hausa and Kaufmann’s OP_{Imp} . In order to derive the default universal force of imperatives, it seems that OP_{Imp} needs to be exhaustified in the absence of an overt anti-exhaustifier. However, preliminary evidence suggests that bare prospective sentences in Hausa might be compatible with possibility interpretations without any overt modification. For illustration consider the example in (28), which we presented to one speaker who accepted it under the intended possibility reading.

- (28) DEONTIC POSSIBILITY (WITH BARE PROSPECTIVE): According to Nigerian law,
 mùsùlmī yà aurē mātā huđu.
 muslims 3SG.M.PROSP marry women four
 “Muslim men can marry 4 women.”

This judgment suggests that the prospective can be licensed by a possibility operator without exhaustification. For the analysis of the Hausa data, we therefore simply assume that a covert possibility operator (\diamond) licenses the prospective in the relevant cases and merely point out the interesting parallels to Kaufmann’s analysis of imperatives. We will come back to this in Section 5, where we discuss the distribution of *sai* in conditionals.

What is crucial for our purposes is that possibility readings such as (28) are excluded with *sai* (see ex. (18) for direct comparison). Thus, we propose that in the relevant modal uses of *sai*, its function is exhaustification of possibilities, as illustrated in (29a), where *sai* scopes over

⁶For reasons of space we omit the details of Kaufmann’s formal analysis. The interested reader is referred to Kaufmann (2012: ch. 5).

the covert possibility operator as well as the prospective to derive the observed future-oriented necessity interpretation. In parallel to the imperative examples, exhaustification can also be covert as in (29b); the corresponding sentence without *sai* (i.e. with a bare prospective) can get the same reading.

- (29) a. Sai sù tunà sañai.
 SAI 3PL.PROSP remember well
 [SAI \diamond [PROSP [they remember]]]
 b. Sù tunà sañai.
 3PL.PROSP remember well
 [EXH \diamond [PROSP [they remember]]]
 “They must/should remember.”

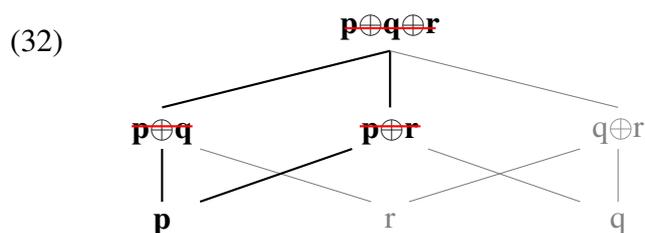
3.3. Deriving the modal readings

Let us now proceed to show how the future-oriented necessity readings with *sai* are derived. As for the semantics of *sai*, we adapt Coppock and Beaver (2014)’s analysis of *only*. As shown in the lexical entry in (30), under this analysis *sai* denotes a propositional operator that is sensitive to alternatives. It applies to a proposition *p*, it presupposes that the set of relevant alternatives ALT contains a true proposition that is at least as strong as *p*, and asserts that all true propositions in ALT are at most as strong as *p*.

- (30) $[[sai]] = \lambda p. \lambda w. \exists p' \in ALT [p'(w) \wedge p' \geq p]. \forall p' \in ALT [p'(w) \rightarrow p \geq p']$

The exclusion of alternatives with *sai/only* is illustrated in (32), by example of the alternative set in (31). Due to the presupposition of *sai*, only those propositions are considered that entail the prejacent *p* and all relevant propositions that are stronger than *p* are asserted to be false. In effect, *sai/only* excludes all propositions in the alternative set except for *p*.

- (31) ALT = e.g. $\{p, q, r, p \oplus q, p \oplus r, q \oplus r, p \oplus q \oplus r\}$



In our proposal, *sai* retains the same function in its modal uses. We illustrate the derivation by reference to example (2), repeated below.

- (2) According to the Nigerian law,
 ... *sai* Audù yà tafi fuřsùnà.
 SAI Audu 3SG.M.PROSP go prison
 “Audu must go to jail.”

Recall from Section 2 (ex. (6) and (7)) that with the prospective ex-situ focus is impossible. Therefore, in the relevant cases of *sai*+prosp, *sai* always associates with the whole sentence. Furthermore, in our analysis the prejacent contains a covert possibility operator. We will work

with the simplified lexical entry in (33) (where MB stands for modal base). Note that, in line with the idea that the prospective must be licensed by a superordinate operator to close off the event variable, our version of the \diamond operator in (33) encodes existential quantification over events in addition to existential quantification over possible worlds.

$$(33) \quad \llbracket \diamond \rrbracket = \lambda P. \lambda w. \exists w' \in MB(w) [\exists e [P(e)(w')]]$$

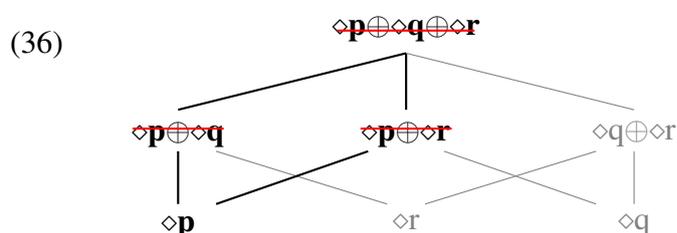
The LF structure of the sentence in (2) is sketched in (34). In (35), the meaning of the prejacent is derived by applying the possibility operator to the denotation of the AspP headed by the prospective.⁷

$$(34) \quad [\text{sai } [\diamond [\text{PROSP Audu goes to prison }]]]$$

(35) The meaning of the prejacent

- a. $\llbracket [\text{PROSP Audu goes to prison}]^t \rrbracket$
 $= \lambda e. \lambda w. \text{Audu-goes-to-prison}(e)(w) \wedge \tau(e) \succ t$
- b. $\llbracket [\diamond \text{PROSP Audu goes to prison}]^t \rrbracket$
 $= \lambda w. \exists w' \in MB(w) [\exists e [\text{Audu-goes-to-prison}(e)(w') \wedge \tau(e) \succ t]]$

Hence, in (2) *sai* associates with the proposition that *it is possible that there is a future event of Audu going to prison*, (35b). The alternatives in ALT are other future possibilities (e.g. $\exists w' \in MB(w) [\exists e [\text{Audu-pays-a-fine}(e)(w') \wedge \tau(e) \succ t]]$). Any such possibility not entailed by the prejacent is excluded, as illustrated in (36). Hence in (2), *sai* has the effect of excluding all future possibilities except Audu going to prison. The denotation of the sentence, derived by applying the meaning of *sai* to (35b), is given in (37).



$$(37) \quad \llbracket [\text{sai } \diamond \text{PROSP Audu goes to prison}]^t \rrbracket$$

$$= \lambda w. \forall p' \in ALT [p'(w) \rightarrow [\lambda w. \exists w' \in MB(w) [\exists e [\text{Audu-goes-to-prison}(e)(w') \wedge \tau(e) \succ t]] \geq p']], \text{ defined iff } \exists p' \in ALT [p'(w) \wedge p' \geq \lambda w. \exists w' \in MB(w) [\exists e [\text{Audu-goes-to-prison}(e)(w') \wedge \tau(e) \succ t]]]$$

4. Crosslinguistic comparison and implications

In this section, we address the cross-linguistic implications of our proposal and put our observations on Hausa in the context of related analyses of modal expressions. In particular, we have argued that modal uses of *sai* are restricted to future-oriented necessity, where future-orientation is contributed by a prospective aspect operator and the necessity interpretation arises from exhaustification of possibilities. Both of these ideas have been put forward independently in the literature on modality, and we discuss them in turn in the following subsections.

⁷In the derivation, we simplify the temporal interpretation by representing the reference time as a contextual parameter. For a more refined analysis see Mucha (2013).

4.1. Future-oriented modality involves a prospective aspect

Throughout the previous sections, we have referred to the temporal interpretation of the modal *sai*-construction as future-oriented. The terminology is based on Condoravdi (2002)'s seminal work on the temporal properties of modals, where she introduces a distinction between the *temporal perspective* of modals on the one hand, and their *temporal orientation* on the other. The temporal perspective, roughly, refers to the time at which the evidence for the use of the modal is evaluated. The temporal orientation of a modal, which is most relevant for us here, is the time at which the modalized eventuality is temporally located. Thus, our example sentence in (2) is future-oriented in the sense that the event of Audu going to prison is temporally located after the evaluation time (which is the utterance time under the most salient reading).

- (2) According to the Nigerian law,
 ... *sai* Audù yà tàfi fuřsùnà.
 SAI Audu 3SG.M.PROSP go prison
 "Audu must go to jail."

In English (and many other languages) the problem then arises that modals like *must* are not always interpreted with future-orientation. Epistemic uses in particular (e.g. in "Audu must be sick") are commonly associated with a present temporal orientation. Condoravdi (2002) rejects previous accounts which analyse English modals such as *must* as ambiguous (i.e. as encoding a temporal shift in their future-oriented but not in their present-oriented use, see e.g. Enç 1996) and provides a unified account capturing the observation that present-orientation notably occurs with stative predicates. However, in Condoravdi's analysis as well, modals directly contribute their temporal orientation, albeit in a way that varies with the lexical aspect of the embedded predicate.

Kratzer (2012b) explores an alternative approach, proposing that future-orientation with modals in English comes from a covert prospective aspect operator in the scope of the modal auxiliary, as illustrated in the (simplified) structure of the sentence "Mary can climb Everest" given in (38). Under such an account, the modal auxiliary itself can be stripped of any temporal meaning, since its temporal orientation is contributed by aspect.

- (38) [Present [Mary can [Prosp [climb Everest]]]]

Independent evidence for this idea was provided in Matthewson (2012, 2013)'s work on Gitksan (Tsimshianic). This language, like Hausa and unlike English, has overt prospective aspect marking. Crucially, the prospective morpheme *dim* shows up in future-oriented modal environments in Gitksan, as illustrated in the circumstantial possibility sentence in (39).

- (39) da'akhlxw-i-s Henry **dim** jam-t
 CIRC.POSS-TRA-PN Henry PROSP cook-3SG.II
 "Henry is able to cook." / "Henry was able to cook." (Matthewson, 2012: 436)

In the case of present- or past-orientation, e.g. in the epistemic possibility sentence in (40), no *dim* occurs. Adding the prospective aspect marker as in (41), however, yields a future-oriented epistemic interpretation.

- (40) yugw=ima'=hl wis
 IMPF=EPIS=CN rain

“It might have rained.” / “It might be raining.” /
 ≠ “It might rain (in the future).” (Matthewson, 2012: 435)

✓ Context: You see the flowers looking fresh and damp and puddles. ✓ PAST TO
 ✓ Context: You hear pattering on the roof. ✓ PRES TO
 # Context: You hear thunder, so you think it might rain soon. # FUT TO

- (41) yugw=ima’=hl dim wis
 IMPF=EPIS=CN PROSP rain
 ≠ “It might have rained.” / ≠ “It might be raining.” /
 “It might rain (in the future).” (Matthewson, 2012: 435/6)
- # Context: You see the flowers looking fresh and damp and puddles. # PAST TO
 # Context: You hear pattering on the roof. # PRES TO
 ✓ Context: You hear thunder, so you think it might rain soon. ✓ FUT TO

Building on observations of this kind, more recent works such as Chen et al. (2017) and Rullmann and Matthewson (2018) further explore the idea that across languages, aspect provides the temporal orientation of modals (while tense provides their temporal perspective). The Hausa data we have discussed in this paper provide additional evidence for this idea, since temporal orientation of modals in Hausa seems to work very much like what Matthewson (2012, 2013) reports for Gitksan. Future-oriented circumstantial modals occur with the prospective aspect (see ex. (22)) and epistemic modals get a future-oriented interpretation (only) with the prospective (see ex. (20)).

A particularity of the construction that we focus on in this paper is that the modal reading of *sai* in Hausa only arises in combination with the prospective in the first place. In light of the idea that temporal orientation is always provided by aspect, it is thus expected that the modal *sai*-construction is restricted to future-oriented interpretations.

4.2. Necessity interpretations arise from exhaustifying possibilities

As shown in the previous sections, the second restriction on the modal *sai*+prosp construction is that it always gives rise to necessity interpretations. In our analysis, this follows from the assumption that *sai*, denoting an exclusive operator akin to *only* in English, excludes alternatives to the possibility expressed by its prejacent. Similar observations have been made in the cross-linguistic literature before. Consider, for instance, the examples from Masalit (Maban) in (42), taken from Leffel (2012). In (42a), epistemic possibility is expressed by the morpheme *tì*. As shown in (42b), adding the exclusive particle *dè* results in the corresponding necessity interpretation. The analysis that Leffel (2012) provides is very similar to ours in spirit, with *dè* excluding other possibilities in a Roothian alternative set.

- (42) a. tí màsàrá tú-tì
 3SG Masalit 3SG-TI
 “He might be Masalit.”
- b. tí màsàrá **dè** tú-tì
 3SG Masalit only 3SG-TI
 “He must be Masalit.” (lit. “He could only be Masalit.”) (Leffel, 2012: 225)

As indicated by the literal translation in (42b) and explicitly discussed by Leffel (2012), the

combination of epistemic possibility and exclusive/exhaustive particles can give rise to epistemic necessity interpretations in English and other languages as well. Interesting evidence that exhaustification of possibilities also plays a role in the derivation of non-epistemic necessity, as we propose for Hausa, comes from recent work by Jeretič and Case (2020) and Jeretič (ta). They discuss the morpheme *ba'iji* in Ecuadorian Siona (Tucanoan), which is used to express deontic or circumstantial necessity:

- (43) Sai-ye **ba-i-ji**.
 go-INF be-IPF-3S
 “We must go.” (Ecuadorian Siona, Jeretič and Case 2020)

Based on its behaviour in embedded contexts, Jeretič and Case (2020) argue that *ba'iji* is actually a possibility modal, and they derive the observed necessity interpretation in unembedded contexts by applying a covert EXH operator to utterances with *ba'iji*. Although the details of the derivation slightly differ from our proposal, the analysis proposed by Jeretič and Case (2020) is strikingly similar to what we have argued for Hausa in that non-epistemic necessity is derived from applying an *only*/EXH-type operator to a modalized sentence with existential modal force. In sentences like (43) in Ecuadorian Siona, possibility is overtly expressed by the morpheme *ba'iji* while exhaustification is covert. Hausa presents the opposite case in which exhaustification is overtly realized with *sai* and existential modality is contributed by a covert possibility operator.

Arguments for deriving non-epistemic necessity interpretations by exhaustification of possibilities have also been made with regard to modal expressions in more familiar languages. In the previous sections, we have already referred to the relevance of Kaufmann (2012)’s analysis of imperatives. Another example, which we only mention here as a pointer, is recent work presented by Ramchand (2018). In a nutshell, Ramchand proposes that circumstantial *must* in English does not encode universal quantification over possible worlds but exclusive CHOICE over “linguistically constructed live alternatives” (see Ramchand (2018: ch.5) for details). Thus, similar to our proposal, in Ramchand’s analysis necessity is associated with the exclusion of alternatives. Whether or not this is the right analysis for modals in English, converging evidence suggests that exhaustification of possibilities is a prolific strategy for deriving necessity interpretations in natural language.

5. A possible extension: *sai* in conditionals

The combination of *sai* and the prospective aspect is also found in the consequent of conditionals, e.g. (44).

- (44) Andreas asks Danjuma if he can drive him to the mountain. Danjuma does not know whether there is a road leading to the mountain, but he has a car and is willing to drive. Danjuma says:
 Ìdan àkwai hanyà, **sai** ìn tūkà ka.
 If.IND exist road SAI 1SG.M.PROSP drive you
 “If there is a road, I will drive you.”

In the descriptive literature, this is sometimes assumed to be another, independent, reading corresponding to *then*, e.g. Kraft (1970):

(45) If there is a road, **then** I will drive you

However, this use of *sai* is only found with the prospective, it is incompatible with other aspects. This is demonstrated in (46) with imperfective aspect.

(46) Peter wanted to drive to Kano. Audu asks Asabe whether Peter has already arrived in Kano. Asabe doesn't know, and tells him to call Ibrahim in order to find out. She says:
 *Ìdan Peter yā ìsa Kanò, **sai yanà** zaunà (à) gidā-n Ìbrāhīm.
 If.IND Peter 3SG.M.PFV reach Kano SAI 3SG.M.IPFV stay (at) house-of Ibrahim
 (intended:) "If Peter arrived in Kano, he is staying at Ibrahim's house."

In this section, we would like to tentatively explore an alternative account, namely that this is another instance of the modal reading discussed in this paper. We adopt a standard account of conditionals under which the *if*-clause restricts a (possibly covert) subsequent modal by changing the modal base *f* (Kratzer, 1981, 2012a) (47). The modal base *f* is a function from worlds to a set of propositions. In conditionals, the set of propositions $f^*(w)$ relevant for the interpretation of the consequent β is the set of propositions $f(w)$ plus the proposition expressed by the antecedent α :

(47) *Conditional modality* Kratzer (2012a)
 For any conversational backgrounds *f* and *g*:
 $[[\text{if } \alpha \beta]]^{f,g} = [[\beta]]^{f^*,g}$,
 where for all $w \in W$, $f^*(w) = f(w) \cup \{[[\alpha]]^{f,g}\}$.

Since examples with *sai* and the prospective are assumed to contain the covert possibility operator in (33), as argued above, this possibility operator may be the operator that is restricted in examples like (44).⁸

(33) $[[\diamond]] = \lambda P. \lambda w. \exists w' \in MB(w) [\exists e [P(e)(w')]]$

However, this combination of *sai* and the prospective aspect is not available in so-called "biscuit-conditionals". These are conditionals in which the truth of the consequent does not depend on that of the antecedent (see e.g. Rawlins, 2020).

(48) A young man seems to be looking for Husaini or Hasan, but they are out for lunch. Their uncle says:
 #Ìdan kanà nēma-n Hùsainì kō Hasàn ne, **sai** sù dāwō nān bà
 if 2SG.IPFV search-of Hussain or Hasan PRT SAI 3PL.PROSP return here NEG
 dà jimàwā ba.
 with spending.time NEG
 (intended:) "If you are looking for Husaini or Hasan, they will be back soon."
 (Comment: "means 'then they should come back soon [...] so that their friend can see them' ")

⁸See also Kaufmann (2012)'s discussion of whether a covert OP_{Imp} is restricted by the *if*-clause in conditional imperatives (Schwager, 2006). Kaufmann ultimately argues against such an account (see also Schwager 2006; Kaufmann and Schwager 2009), proposing instead that such constructions involve two modals (Frank, 1997).

(i) If you are at the intersection, turn right!

One possible explanation lies in the nature of the covert possibility modal. If it corresponds to the operator OP_{Imp} proposed in Kaufmann’s work, then it might share this operator’s *Epistemic Uncertainty Constraint* (Kaufmann, 2012: 157): Kaufmann notes that $OP_{Imp}(p)$ is only felicitous if the speaker believes both p and $\neg p$ to be possible.

- (49) #Ich weiß dass du das auf jeden Fall tun wirst, also tu’s auch!
 I know that you that in any case do will so do.IMP.SG-it too
 “I know that you’re going to do this no matter what, so do it!”

In biscuit conditionals of the kind shown above, there is no epistemic uncertainty on the side of the speaker: the consequent is known to be true in w_0 .

This constraint may also be responsible for the inability of *sai*+prosp to occur with a future-oriented epistemic necessity reading in modal statements⁹ — see (17), repeated below —, since the speaker expresses epistemic certainty.¹⁰

- (17) FUTURE-ORIENTED EPISTEMIC NECESSITY: Halima knows that Ibrahim and his family planned to travel soon and sees that their bags are packed. She concludes:
 #**Sai** sù tàfi yâu.
 SAI 3PL.PROSP leave today
 “They must be leaving today.”

One potential problem with this is that the Epistemic Uncertainty Constraint would predict *sai* to be disallowed in counterfactuals where the consequent is known to be false. However, this isn’t the case, cf (50).

- (50) Andreas asks Danjuma if he can drive him to the mountain. Danjuma knows that there is no road, and no other possibility to get to the mountain apart from walking. Danjuma says:
 Dà dà hanyà, **sai** ìn tūkà ka.
 If.CF exist road SAI 1SG.M.PROSP drive you
 “If there were a road, I would drive you.”

While it is well-known that counterfactual conditionals don’t necessarily have to entail that the counterfactual is false (see e.g. the famous example from Anderson (1951: 37) in (51)), example (50) clearly involves no epistemic uncertainty on the part of the speaker.

- (51) If Jones had taken arsenic, he would have shown just exactly those symptoms which he does in fact show.

Thus, while co-occurrence of *sai* with the prospective in these kinds of examples strongly suggests that this is a further instance of the modal use, further research is needed to see whether this proposal is tenable.

⁹A potential alternative explanation (in the spirit of Hacquard (2006, 2009) and related work) is that the possibility operator sits too low in the structure to receive an epistemic reading. We must leave this for future research, however.

¹⁰See von Fintel and Gillies (2010, 2021) for a relevant discussion.

6. Summary

We discussed the observation that the Hausa exclusive particle *sai* receives a modal reading when combined with the prospective aspect. We proposed that *sai* is an exclusive operator in this modal reading, too: it excludes future possibilities, thus giving rise to future-oriented necessity interpretations. In our analysis, we assumed (following Mucha 2013) that the prospective aspect that *sai* obligatorily co-occurs with in these readings is defective: it requires a higher modal. This modal is assumed to be a covert possibility modal, possibly corresponding to Kaufmann's (2012) imperative operator OP_{Imp} .

We noted that our findings are compatible with observations from English (Kratzer, 2012b) and Gitksan (Matthewson, 2012, 2013) suggesting that future-oriented modality involves a prospective aspect, and with other similar accounts of necessity as EXH/*only* + possibility in Leffel (2012), Kaufmann (2012) and Jeretič and Case (2020); Jeretič (ta).

We also briefly looked at occurrences of *sai* and the prospective aspect in the consequent of conditionals, and tentatively suggested that apart from covert generic/epistemic necessity modals, the covert possibility modal may be a further covert modal found in 'bare' conditionals.

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