The expression of Strong and Weak Necessity in Igbo: A simplified degree-based approach

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SULA-TripleA 2026

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Outline

1. Introduction
2. Igbo Data
3. Analysis
4. Other accounts

How languages encode strong and weak necessity?

Igbo: Strengthen underspecified necessity:

- weak/underspecified *kwesi* and *ga*
- *-ṛịrị* as a strengthener

How languages encode strong and weak necessity?

Igbo: Strengthen underspecified necessity:

- weak/underspecified *kwesi* and *ga*
- *-rịrị* as a strengthener

Igbo is distinct from other attested strategies:

- Weakening strong necessity morphologically:
  - Greek: strong necessity modal *prepi* + counterfactual morphology (von Fintel and Iatridou (2008)).
  - Javanese: strong necessity *kudu* + particle *-ne* (Vander Klok and Hohaus (2020)).
- Lexicalize the contrast (English, Russian)
- No overt marking:
  - Afrikaans *moet* and Samoan *tatau* - strong or weak necessity (Weingartz and Hohaus (2024)).

Weak and Strong necessity in Igbo

Common constructions in Igbo for expressing weak (1-a) and strong (1-b) necessity:

(1) a. Ị **kwèsì**(-rì) í-gā
2SG KWESI(-rV) INF-go
'You should go.'

b. Ị **ga** a ga-**ṛịrị**
2SG GA PTCP go-RIRI
'You must go.'

ga can be stronger than *kwesi*, even without *ṛịrị*:

(2) M **kwesi**-ri ị nọ. N'eziokwu m **ga** nọ (**ṛịrị**).
1SG KWESI-rV INF stay in.fact 1SG GA stay (RIRI)
'I should stay. In fact, I must.'

Outline

- An overview of collected data: What is the distribution of the modal forms *kwesi*, *ga*, and *-ṛiṛi* across modal flavors and strengths?
- Formal analysis: a degree-based account of weak necessity
- Discussion of other accounts (Mucha et al. 2024; Portner and Rubinstein 2014)

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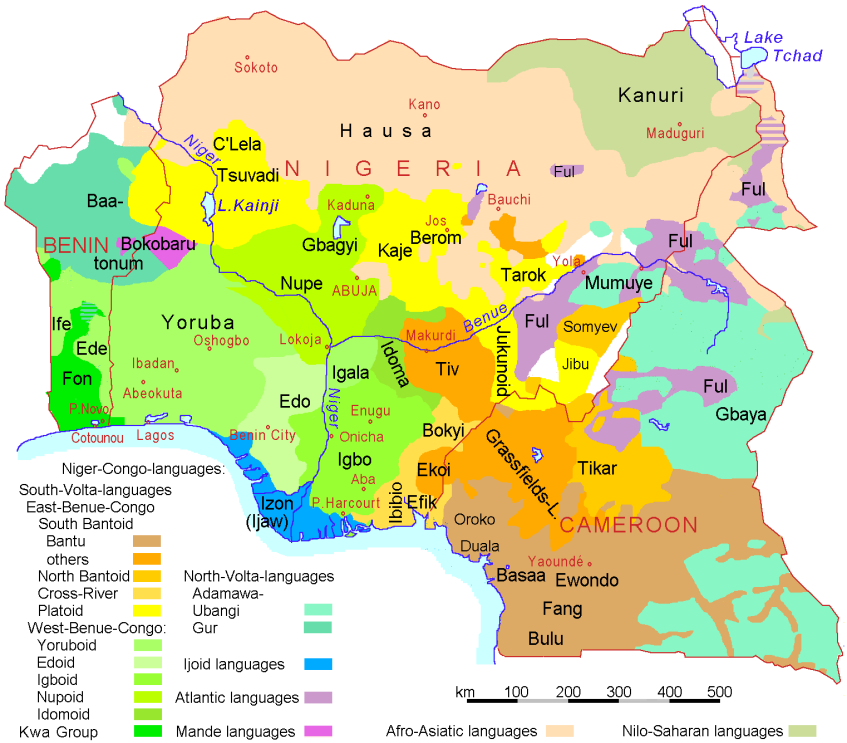
Igbo Language

- Niger-Congo, southeastern Nigeria
- 33 million speakers (Eberhard et al. (2025))
- Around 30 dialects

- SVO word order
- Vowel harmony based on Advanced Tongue Root (ATR)
- 3 levels of tone: high, low, and downstep



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Data collection: Methodology

- Video and in-person elicitation sessions with a native speaker following the methodology of Matthewson (2004)
- Ngwa variety of Igbo
- Tasks: translation from English, production in context, acceptability judgments
- The contexts are based on existing literature on strong and weak necessity (Vander Klok (2014), Portner and Rubinstein (2014)) and supplemented with original ones
- Additional resources of data: results from fieldwork Mucha et al. (2024), Uegaki et al. (2024) and data from grammatical descriptions Emenanjo (2015), Green and Igwe (1963), Uchechukwu (2008)

Strong Epistemic Necessity

(3) You know that John goes to school at 9 a.m. every day. You look at the clock and see that it is 9 a.m., therefore, **John must be at school**

a. John **ga**-a-nọ na ụlọ=akwụkwọ.
John GA-PTCP-stay in school
Consultant comment: 'he will, **but not really future,** just confirmation.'

b. John **ga**-a-nọ-**ṛịrị** na ụlọ=akwụkwọ.
John GA-PTCP-stay-RIRI in school

c. John **kwesi**-ri ị nọ na ụlọ=akwụkwọ.*
John KWESI-rV INF stay in school

d. John **kwesi-ṛịrị** ị-nọ na ụlọ=akwụkwọ.
John KWESI-RIRI INF-stay in school

*Nb. In some other strong epistemic contexts *kwesi* without *-ṛịrị* is out. E.g. Doctor: It must be a headache.

Weak Epistemic Necessity

(4) You know that Ann goes hiking from 7 a.m. until 8 a.m. every day. Most of the time Ann goes to the lake, but sometimes she goes to the mountains. It is now 7.30 a.m. and your friend asks where Ann is. You say to your friend: **Ann should be at the lake right now**.

a. Ann **ga** ị nọ na ọdọ=mmiri ụgbua.
   Ann GA INF be at river now

b. #Ann **ga** ị nọ**-rịrị** na ọdọ=mmiri ụgbu=a.
   Ann GA INF be-RIRI at river now

c. Ann **kwesi**-ri ị nọ na ọdọ=mmiri ụgbua.
   Ann KWESI-rV INF be at river now

d. #Ann **kwesi** ị nọ**-rịrị** na ọdọ=mmiri ụgbua.
   Ann KWESI INF be-RIRI at river now

Strong Teleological Necessity

(5) Your friend is asking how to get to the seaside. There is only one road to go to the seaside. You say: **In order to get there, you must take that road.**

a. Tupu i-ruo ebe ahu, ị **ga** e-so ụzọ a.
before 2SG-reach place DEM 2SG GA PTCP-pass road this

b. Tupu i-ruo ebe ahu, ị **ga** e-so**-rịrị** ụzọ a.*
before 2SG-reach place DEM 2SG GA PTCP-pass-RIRI small road

c. #Tupu i-ruo ebe ahu, ị **kwesi**-ri i-so ụzọ a.*
before 2SG-reach place DEM 2SG KWESI-rV INF-pass road this

d. Tupu i-ruo ebe ahu, ị **kwesi-rịrị** i-so ụzọ a.
before 2SG-reach place DEM 2SG KWESI-RIRI INF-pass road this.

*Nb. In other strong teleological contexts *kwesi* without *-rịrị* is okay, but *ga* without *-rịrị* is not.

Weak Teleological Necessity

(6) There are different ways to get to the shopping center. You can go by foot, by bus, or drive yourself. You are not sure how to go. Your friend advises you to get the bus because it is cheaper. To get to the shopping center, **you should take the bus.**

a. i **ga** ị were ụgbọ=ala ga.
   2SG GA INF take vehicle go

b. #i **ga-rịrị** ị were ụgbọ=ala ga.
   2SG GA-RIRI INF take vehicle go

c. i **kwesi**(-ri) ị were ụgbọ=ala ga.
   2SG KWESI(-rV) INF take vehicle go

d. #i **kwesi-rịrị** ị were ụgbọ=ala ga.
   2SG KWESI-RIRI INF take vehicle go

Data Overview

A. For weak necessity, *-ṛiṛi* constructions are infelicitous:

B. For strong necessity

- *-ṛiṛi* constructions are licensed
- Variation depending on the context for *ga* and *kwesi* without *-ṛiṛi*.
- But *ga* more permissible than *kwesi* for some flavors

C. All structures licensed in bouletic contexts

Strength	**Flavor**	**ga**	**ga-ṛiṛi**	**kwesi**	**kwesi-ṛiṛi**
A. Weak	Deontic	✓	#	✓	#
	Teleological	✓	#	✓	#
	Epistemic	✓	#	✓	#
B. Strong	Deontic	#	✓	#	✓
	Teleological	#/✓	✓	#/✓	✓
	Epistemic	✓	✓	#/✓	✓
	Circumstantial	✓	✓	✓	✓
C.	Bouletic	✓	✓	✓	✓

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Analysis Outline

The technical challenge:

- *ga* p and *kwesi* p can both convey necessity more or less weakly
- But *ga* p can be stronger than *kwesi* p
  - Indicates degrees of weak necessity
- *ga/kwesi -ṛiṛi* p is always (equally) strongly necessary

Analysis Outline

The technical challenge:

- *ga* p and *kwesi* p can both convey necessity more or less weakly
- But *ga* p can be stronger than *kwesi* p
  - Indicates degrees of weak necessity
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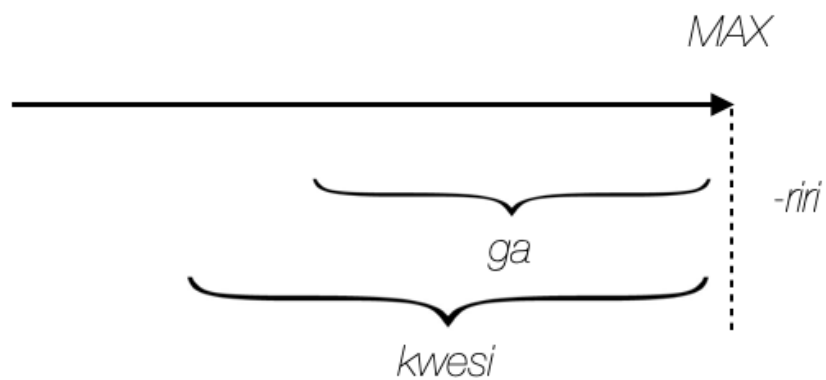
Proposal

- Take Kratzer 1981, 1991 as a starting point
- Add gradability via preference orderings over propositions
- Distinguish *ga* p and *kwesi* p in terms of modal degrees.
- *-ṛiṛi* encodes a degree maximalising operation



A teleological case study: Planning a holiday

Destination options:
Italy or Spain or Sweden

Transport options:
plane or train

Goals:
Go somewhere warm
Have a low carbon footprint
Practice Italian

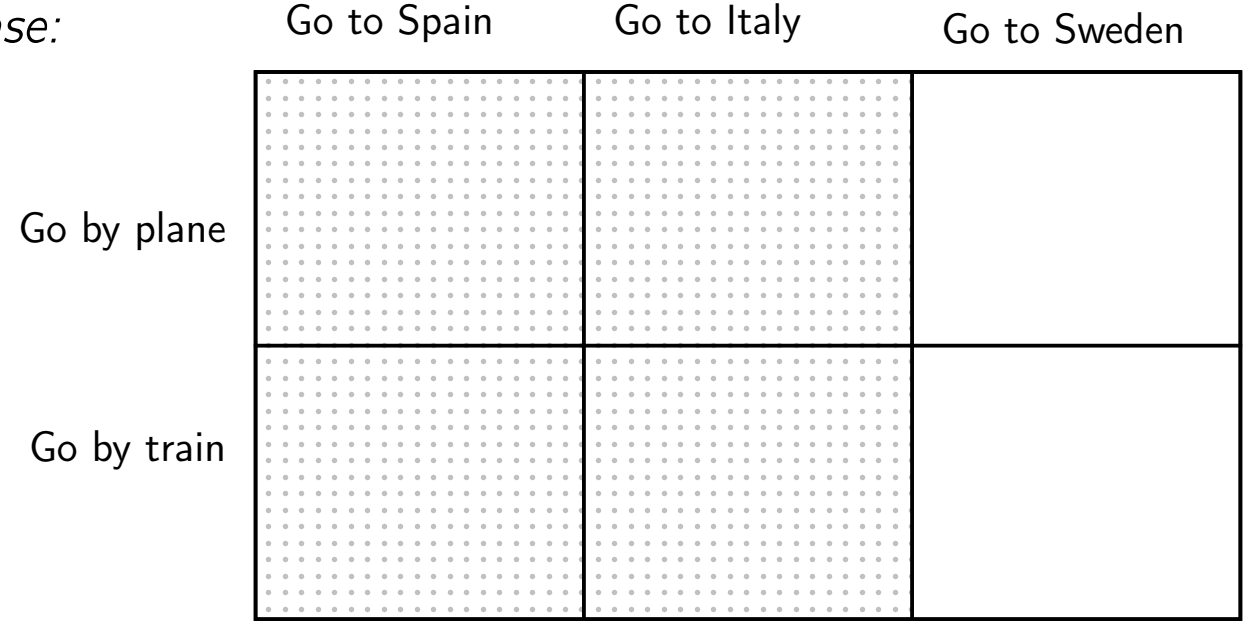
Kratzer's (1981; 1991) Modal Semantics

The Modal Base:

	Go to Spain	Go to Italy	Go to Sweden
Go by plane			
Go by train			

Kratzer's (1981; 1991) Modal Semantics

The Modal Base:



o_1 Go somewhere warm.

Kratzer's (1981; 1991) Modal Semantics

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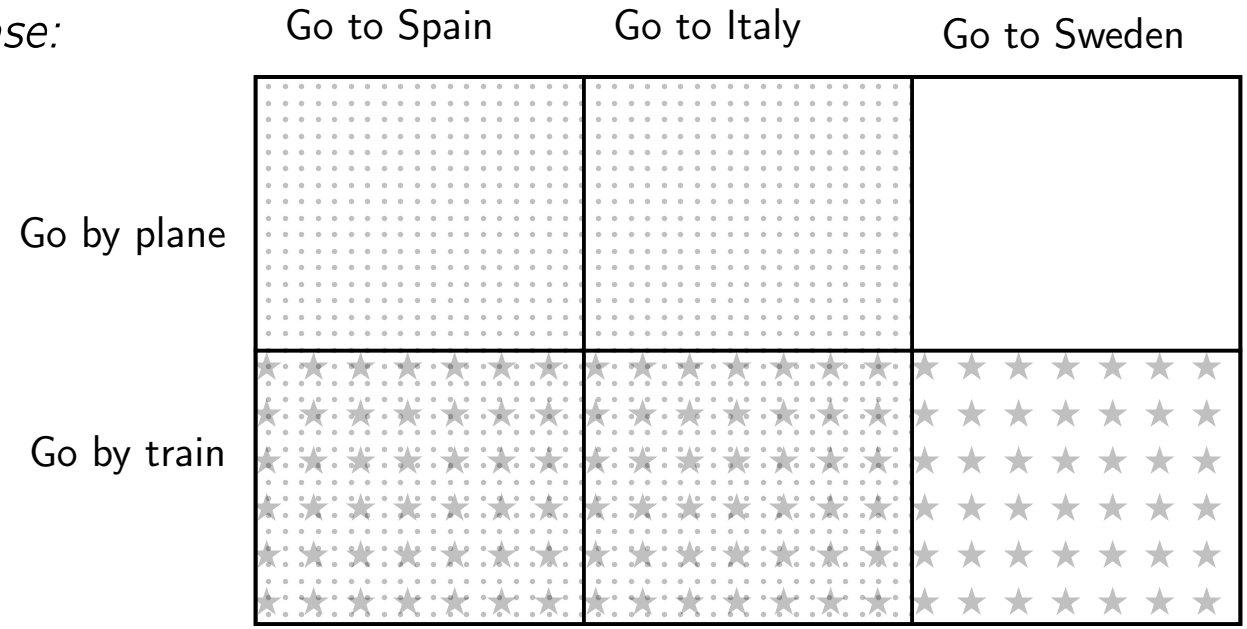

o_1 Go somewhere warm.

o_2 Have a low carbon footprint.

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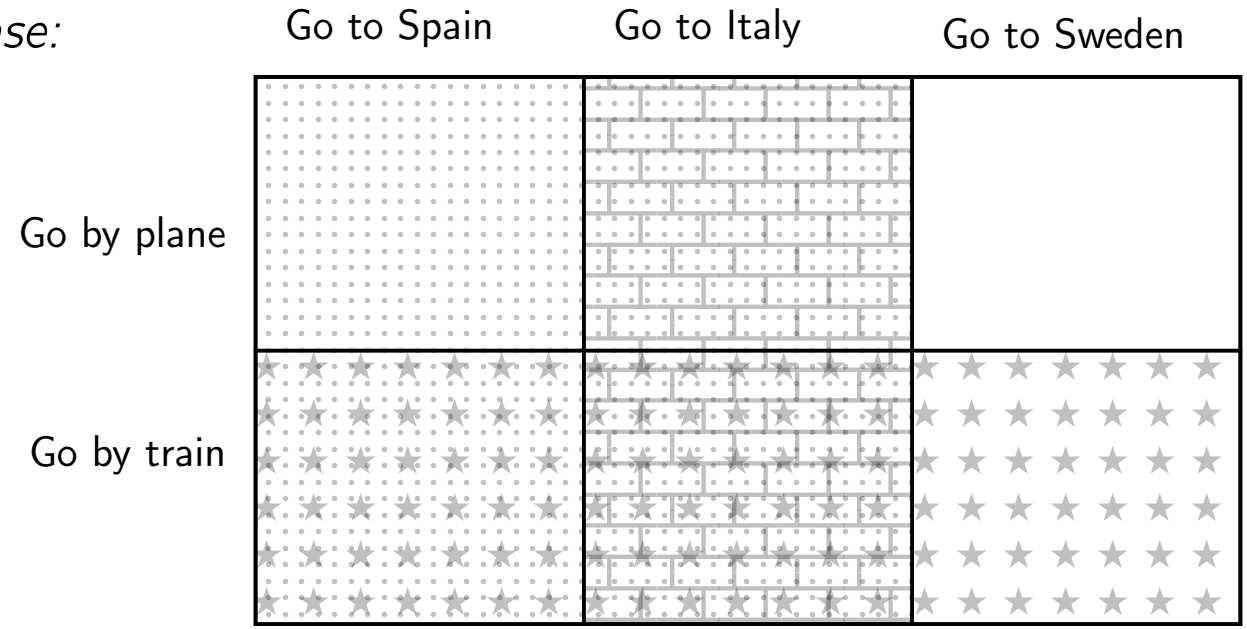

o_1 Go somewhere warm.

o_2 Have a low carbon footprint.

o_3 Practice Italian.

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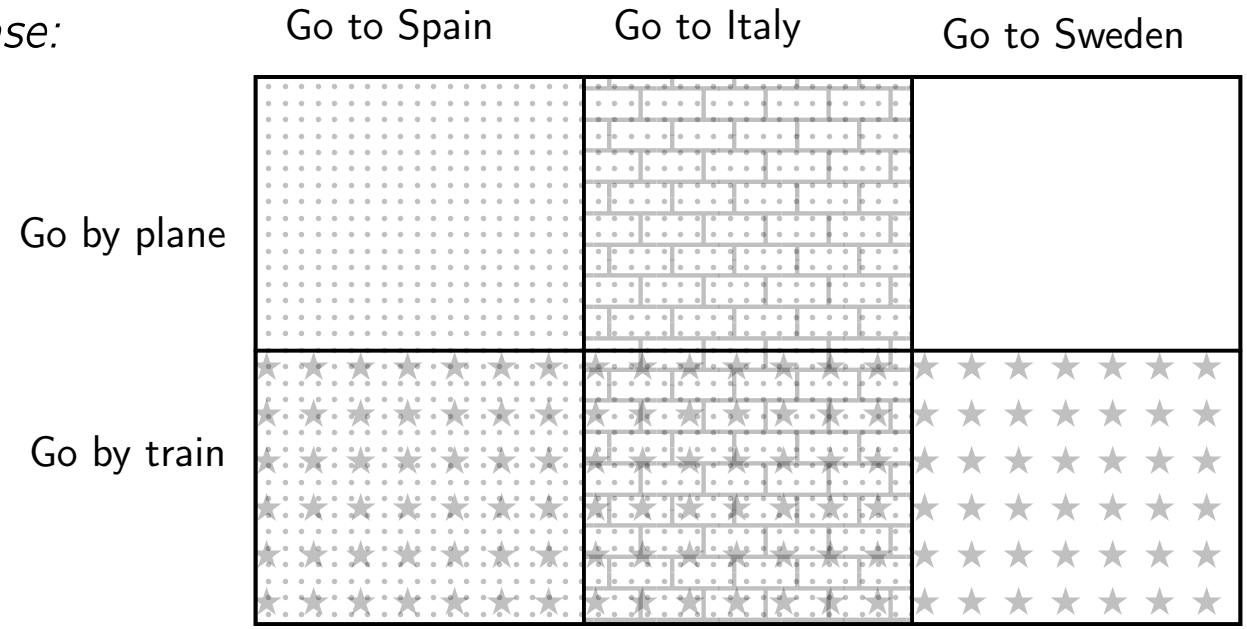

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} *the ordering source*

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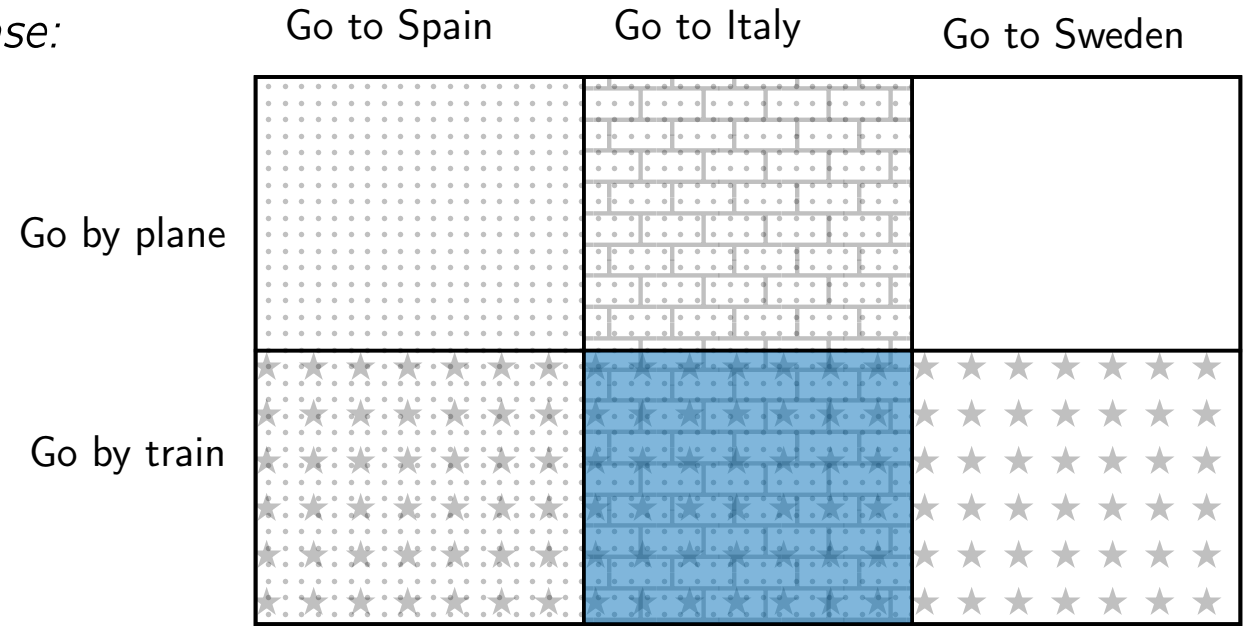


o_1 Go somewhere warm.

o_2 Have a low carbon footprint.

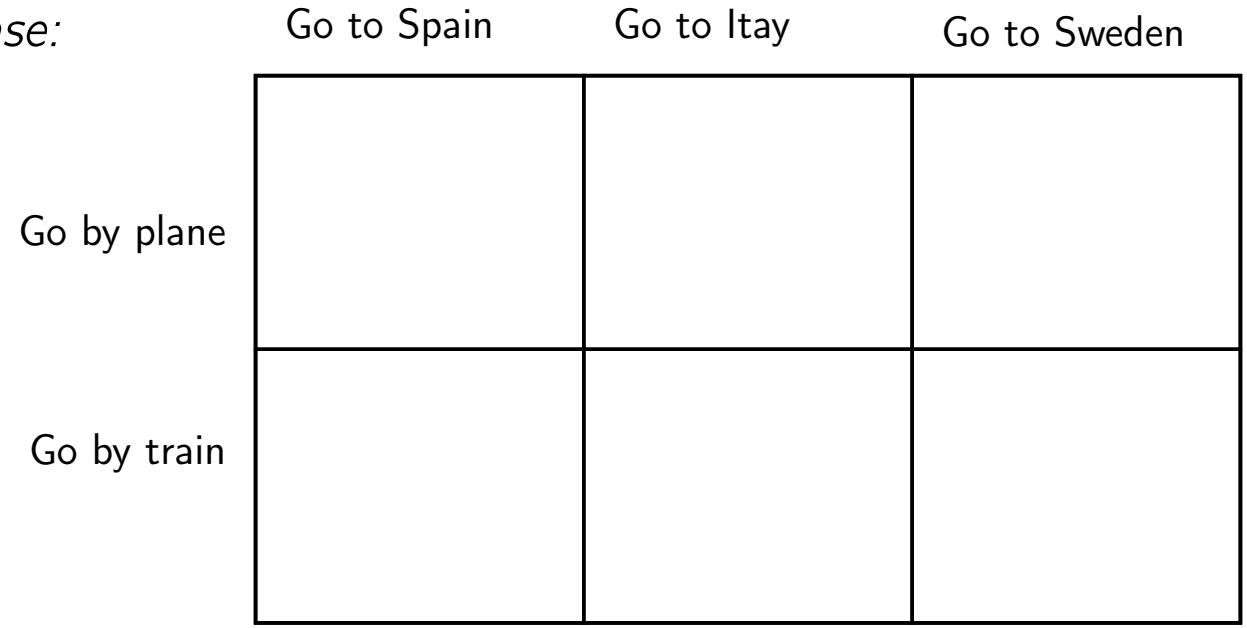
o_3 Practice Italian.

} *the ordering source*

- *Go to Italy by train* is entailed by the most propositions in the ordering source (is true in all o_1, o_2, and o_3 worlds).
- *We have to go Italy by train* is true in this model

Our proposal: degrees of modality from a preference on the ordering source – **strong** (d_3) necessity

The Modal Base:



Go somewhere warm $\gtrsim$ Low carbon footprint $\gtrsim$ Practice Italian

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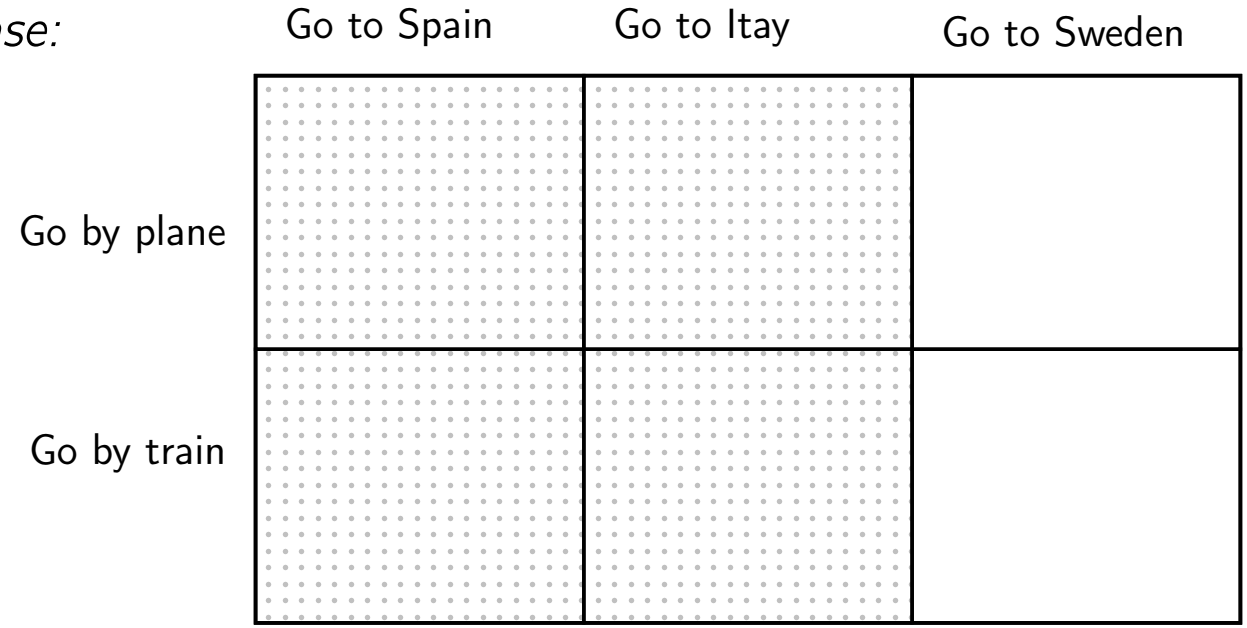

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d_3= Go somewhere warm

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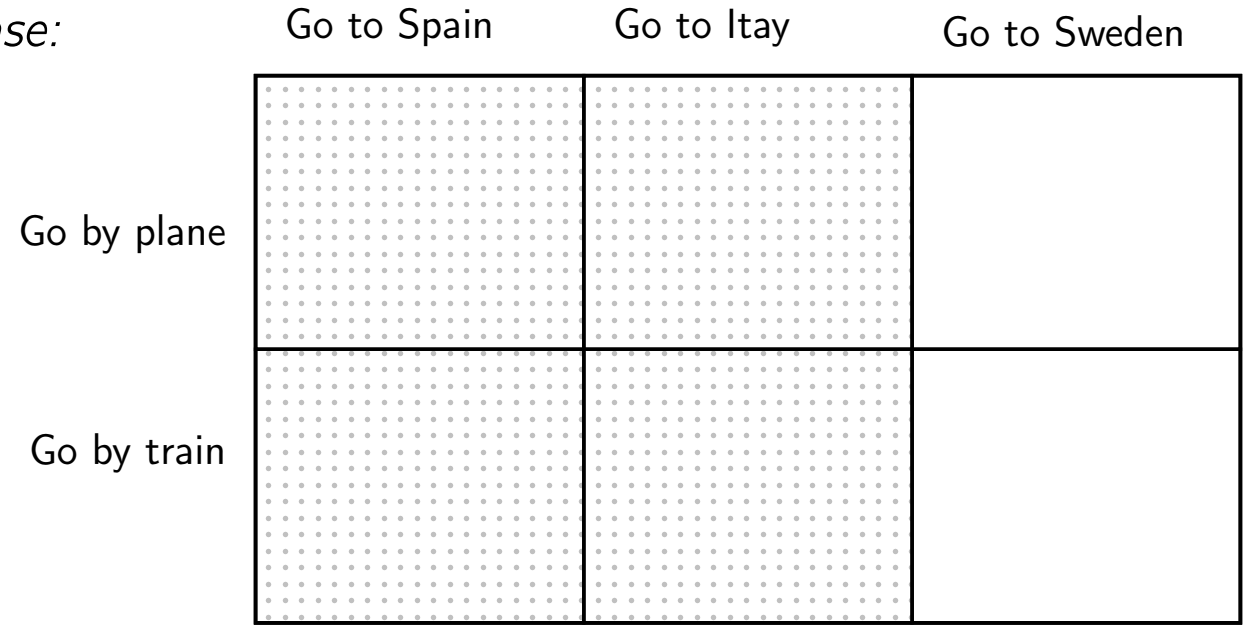

Go somewhere warm $\gtrsim$ Low carbon footprint $\gtrsim$ Practice Italian

d_3= Go somewhere warm

- *Go to Italy or Spain by train or plane* is entailed by d_3 (is true in all d_3 worlds)
- *We have to go to Italy or Spain by train or plane* is true in this model

Our proposal: degrees of modality from a preference on the ordering source – **weak** (d_2) necessity

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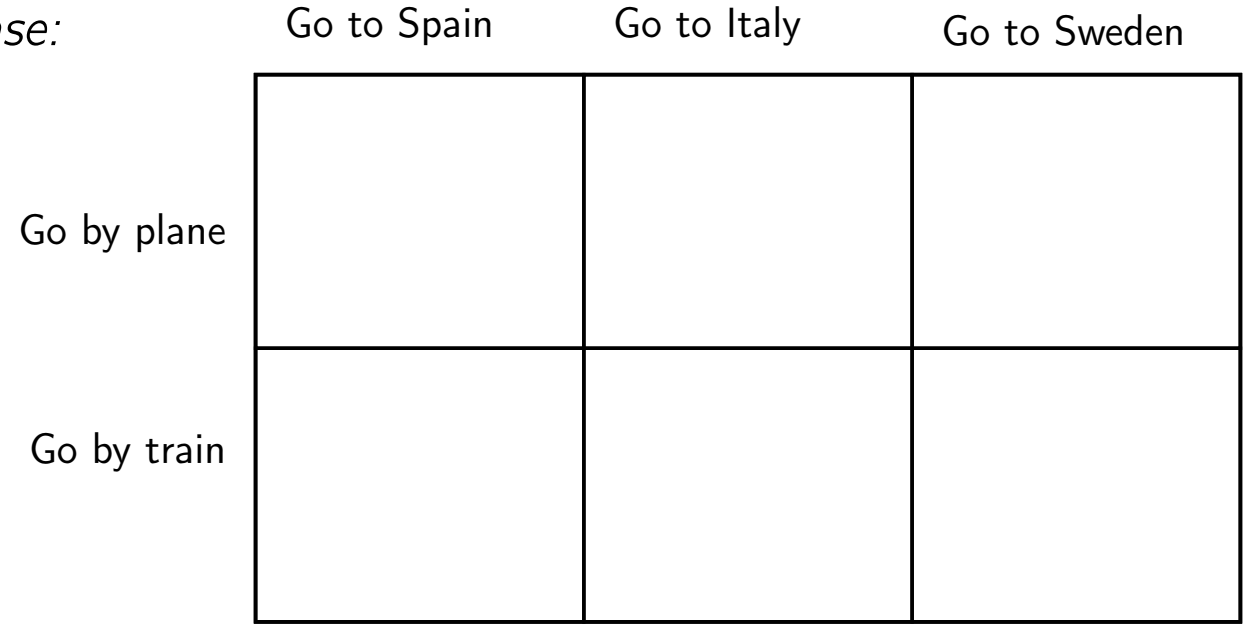

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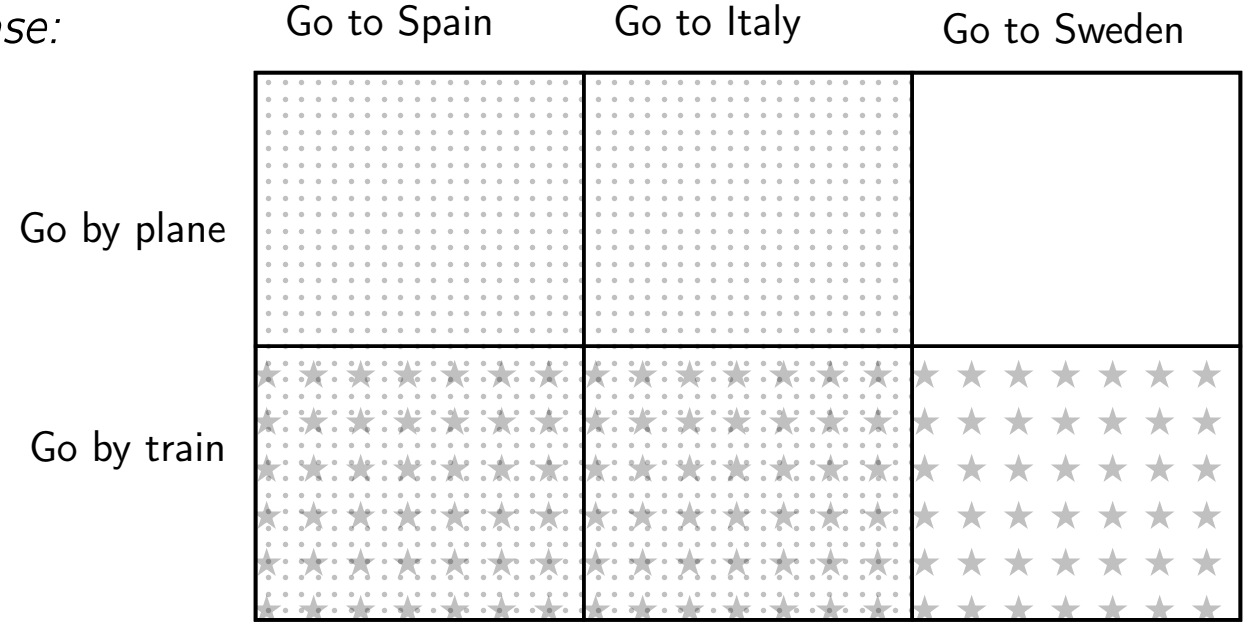

Go somewhere warm $\gtrsim$ Low carbon footprint $\gtrsim$ Practice Italian

d_2= Go somewhere warm & have a low carbon footprint

Our proposal: degrees of modality from a preference on the ordering source – **weak** (d_2) necessity

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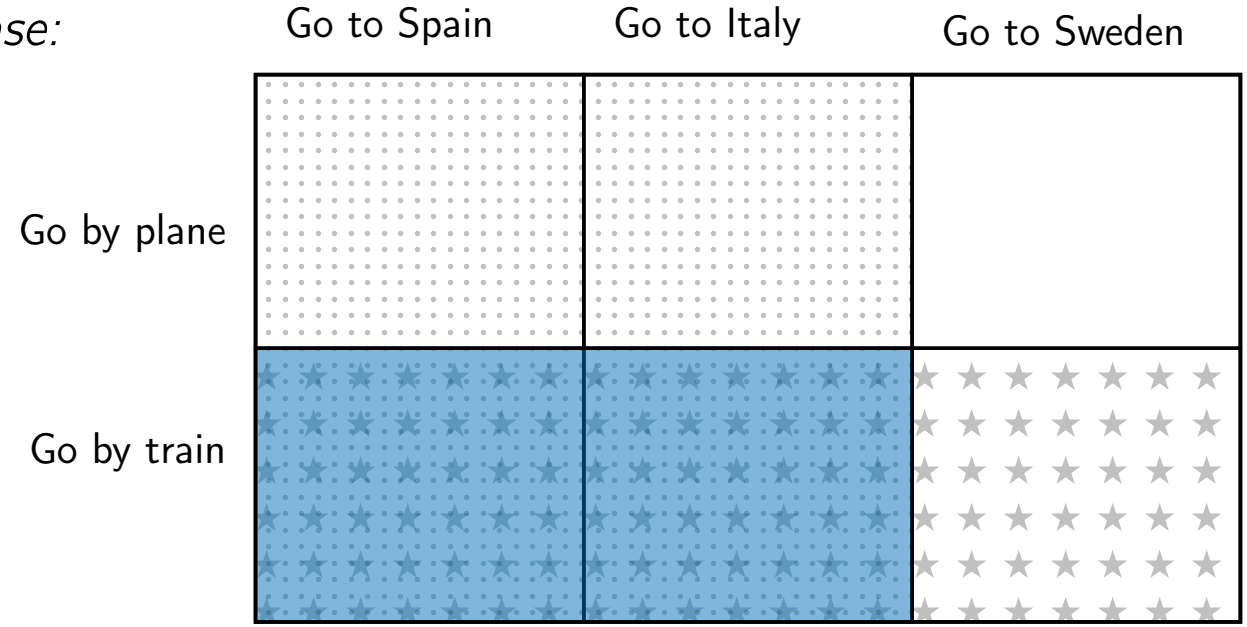

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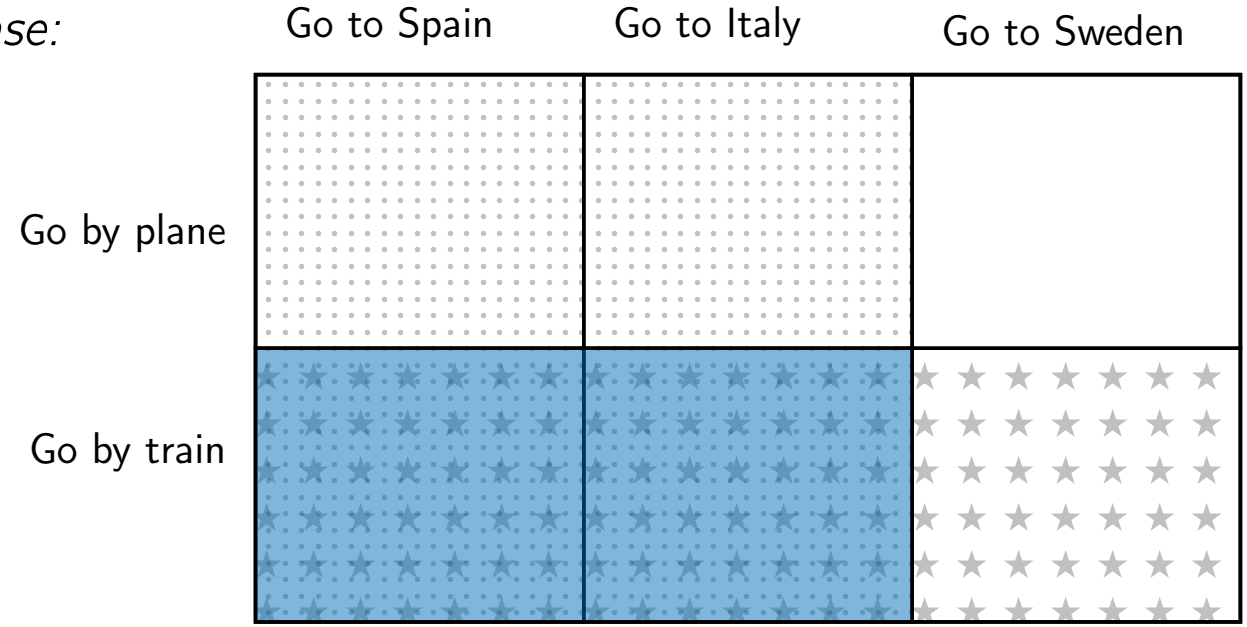

Go somewhere warm $\gtrsim$ Low carbon footprint $\gtrsim$ Practice Italian

d_2= Go somewhere warm & have a low carbon footprint

- *Go to Italy or Spain by train* is entailed by d_2 (is true in all d_2 worlds)
- *We should go to Italy or Spain by train* is true in this model

Our proposal: degrees of modality from a preference on the ordering source – **weak** (d_2) necessity

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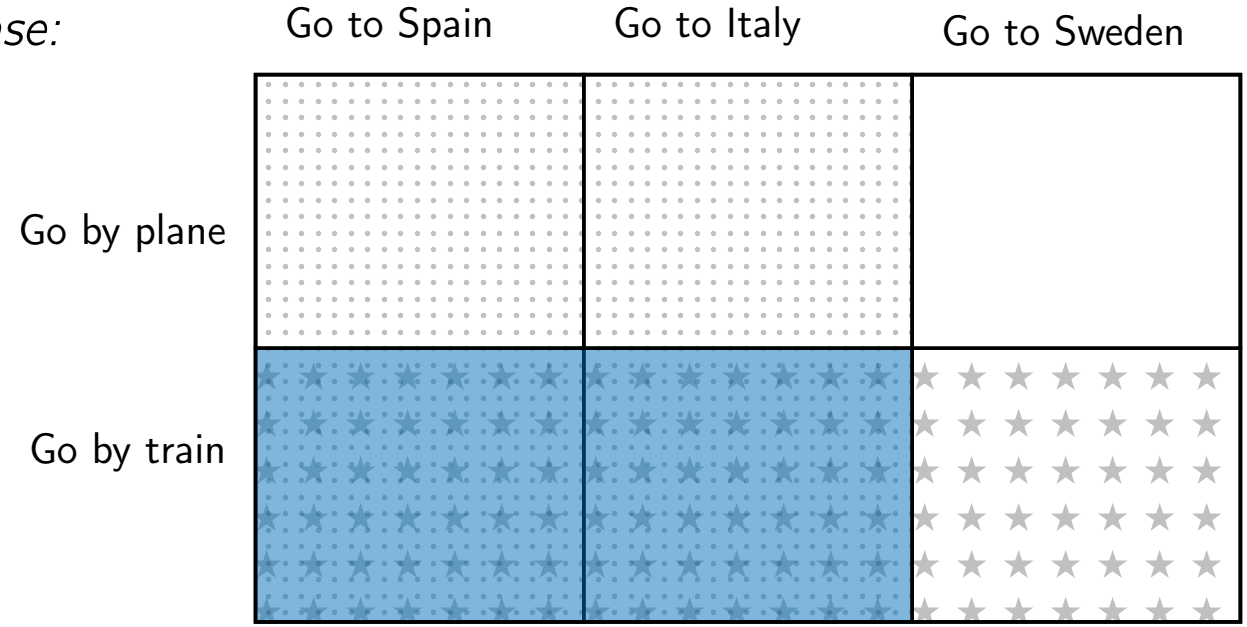

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d_2= Go somewhere warm & have a low carbon footprint

- *Go to Italy or Spain by train* is entailed by d_2 (is true in all d_2 worlds)
- *We should go to Italy or Spain by train* is true in this model

We should go to Italy or Spain by train or plane is also true in this model.

(Monotonicity)

Our proposal: degrees of modality from a preference on the ordering source – **weaker** (d_1) necessity

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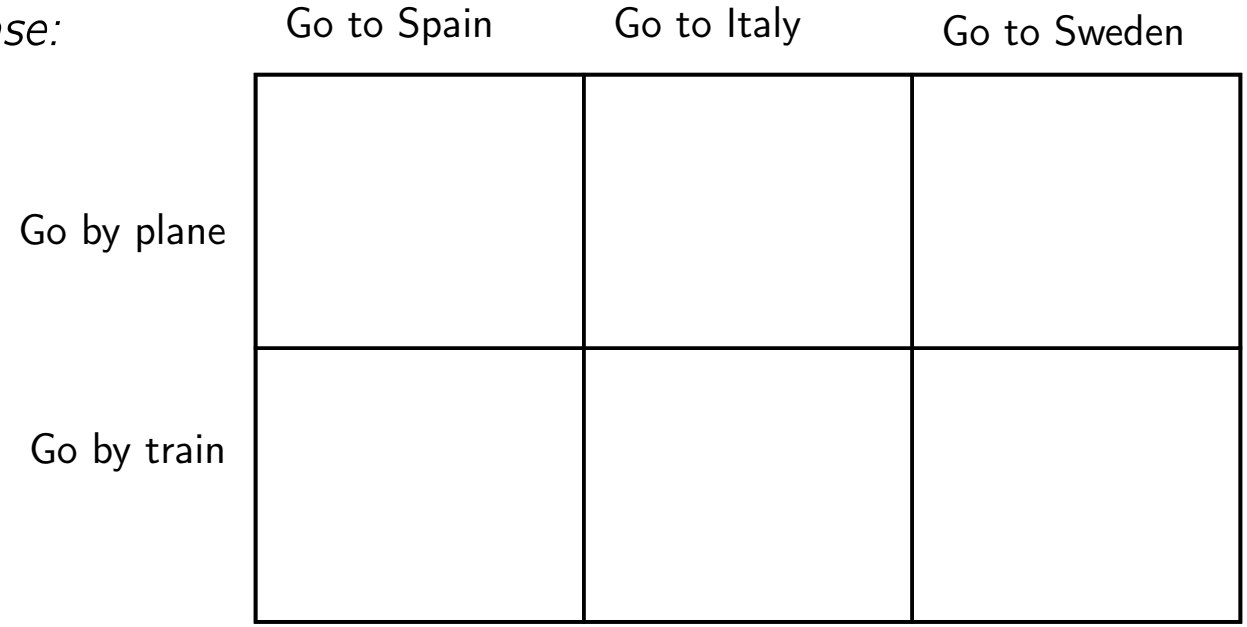

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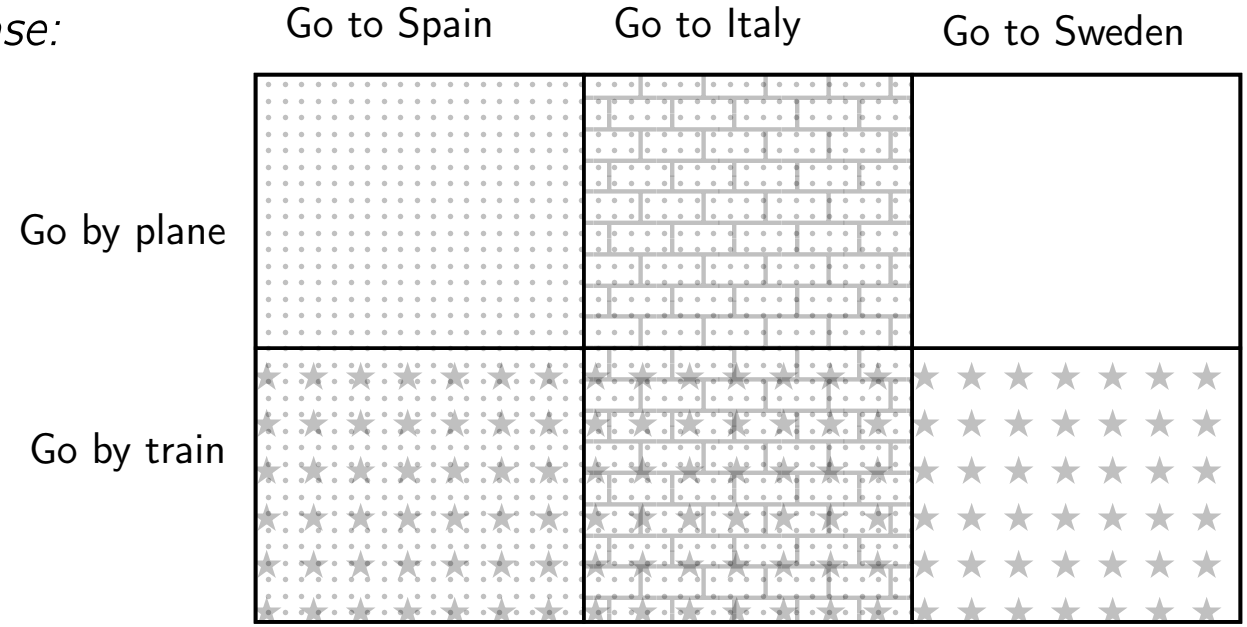

Go somewhere warm $\gtrsim$ Low carbon footprint $\gtrsim$ Practice Italian

d_1= somewhere warm & low carbon footprint & practice Italian

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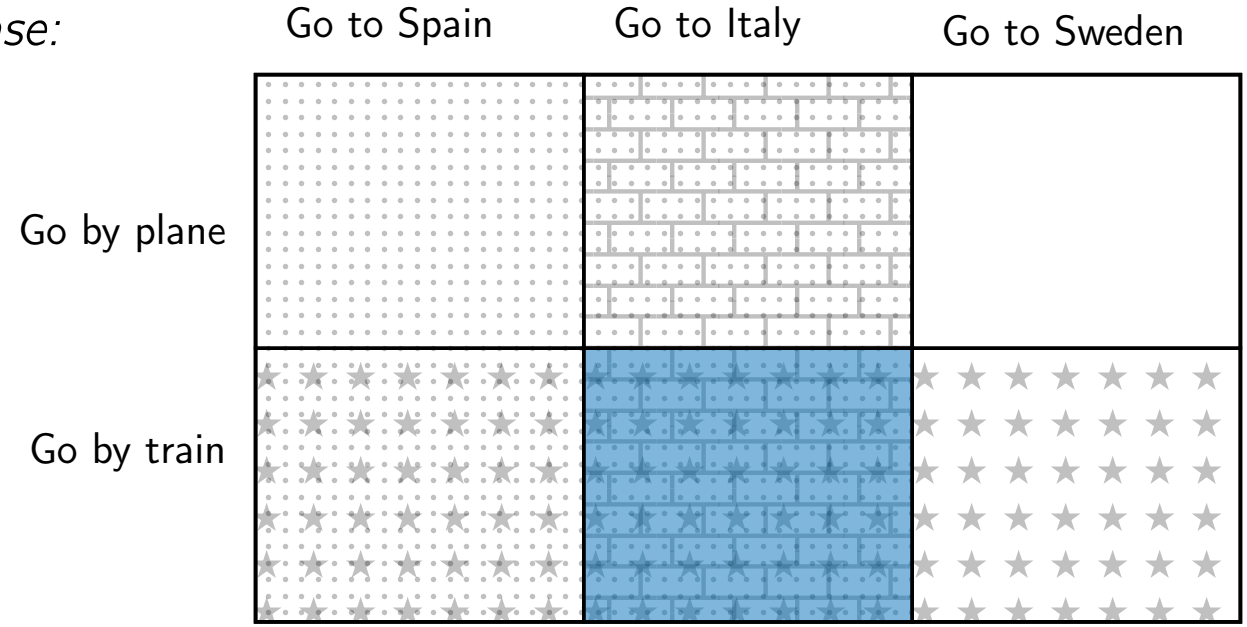

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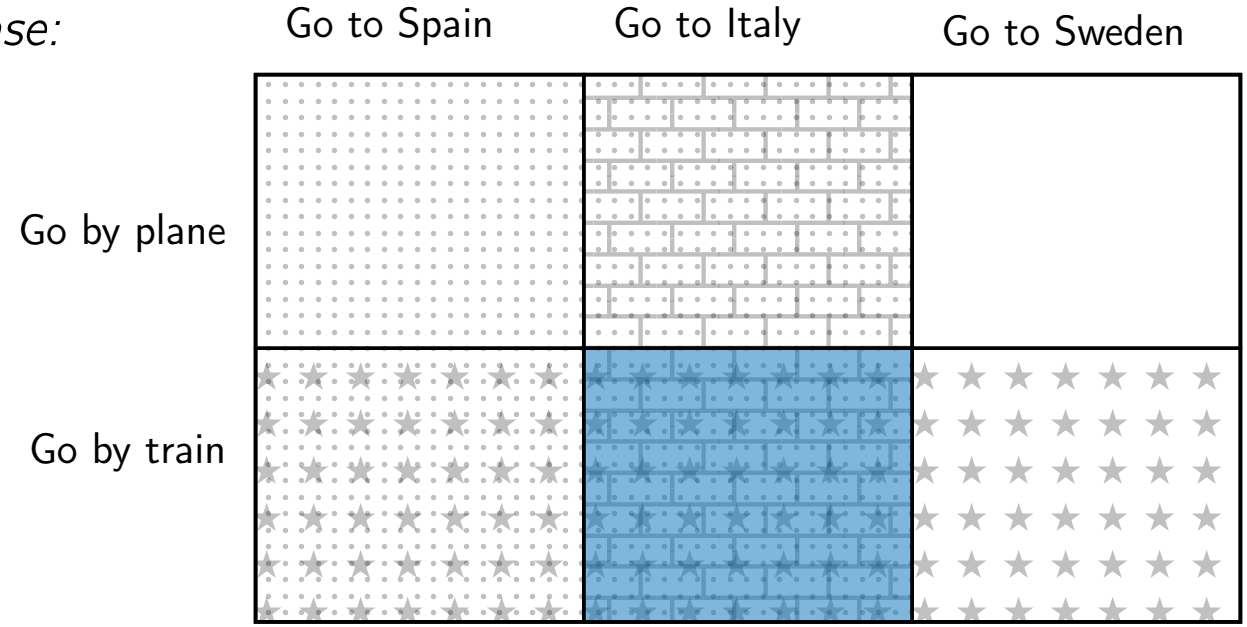

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- *Go to Italy (by train)* is entailed by d_1 (is true in all d_1 worlds)
- *We should probably go to Italy (by train)* is true in this model

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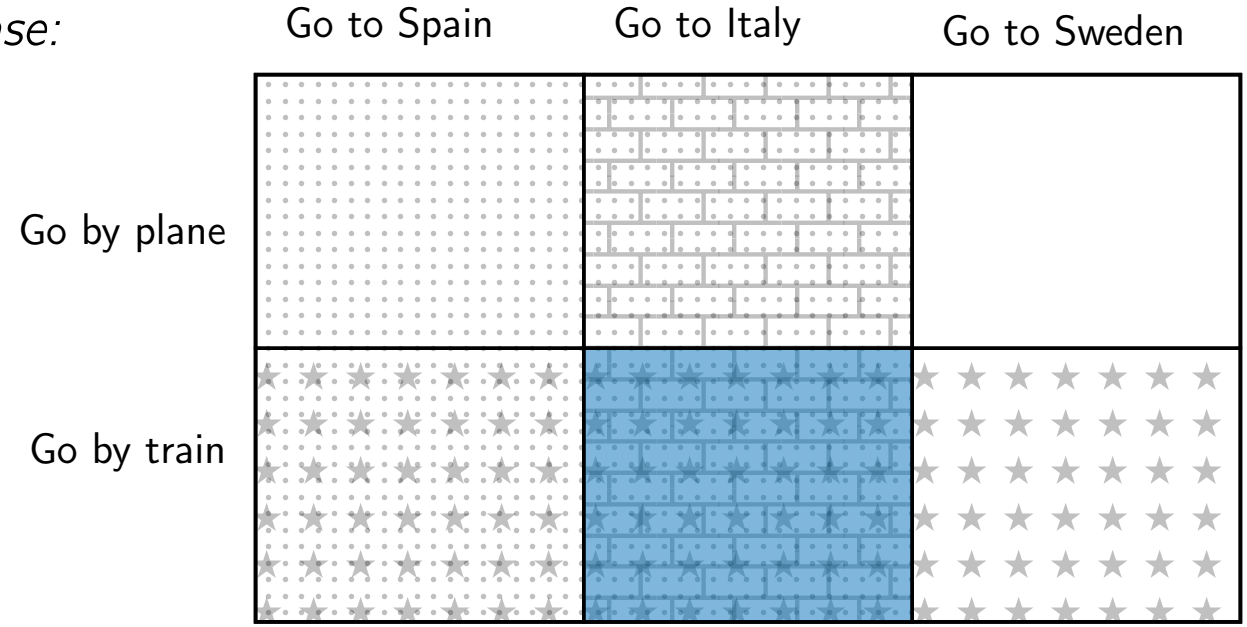

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- *Go to Italy (by train)* is entailed by d_1 (is true in all d_1 worlds)
- *We should probably go to Italy (by train)* is true in this model

Nb: *We should probably go to Italy or Spain by train or plane* and *We should probably go to Italy or Spain by train* is also true in this model. (Monotonicity)

Degree-based necessity and $\Box$

Modal degrees are sets of worlds. E.g.:

- d_3: worlds in the modal base in which we go somewhere warm

A proposition is necessary relative to a degree, given a modal base and an ordering source iff:

- The proposition is true in all of the worlds in that degree
- $\Box_{d_n}\, p \leftrightarrow \forall w \in d_n . p(w)$

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- $\Box_{d_n}\, p \leftrightarrow \forall w \in d_n . p(w)$

Comparison with Kratzer

Kratzer:	Necessity relativised to worlds which are best
Us:	Necessity relativised to worlds which are best to some degree

Application to Igbo

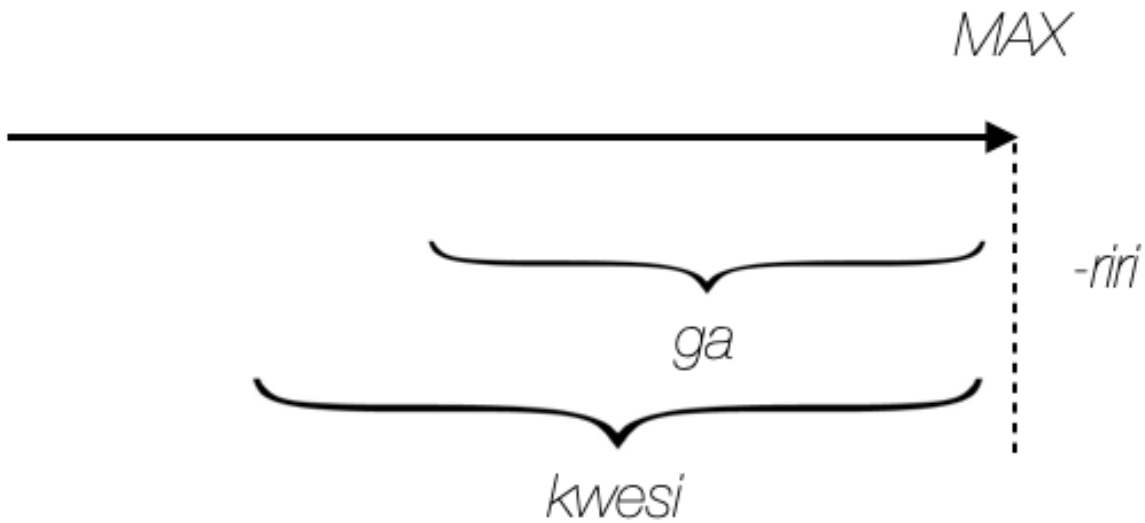

Figure: Modal strength in Igbo

The difference between *kwesi* and *ga*

- *kwesi* p: p is necessary to some degree
- *ga* p: p is necessary to a degree above a contextually specified threshold $\Delta_{O,c}$
  - strategy adopted from degree-based analyses of gradable adjectives
- d argument can be existentially closed (akin to POS in Kennedy 1997 for adjectives)

(7) a. $[\![\text{kwesi}]\!]^{c,O} = \lambda d.\lambda p.\, \Box_d(p) \wedge d \in \Delta_{O,c}$

b. $[\![\text{ga}]\!]^{c,O} = \lambda d.\lambda p.\, \Box_d(p) \wedge d \in \Delta_{O,c} \wedge d \gtrsim \Theta_c(\Delta_{O,c})$

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Result: In some contexts *ga* can get a stronger weak necessity interpretation than *kwesi*:

(2) M **kwesi**-ri ị nọ. N'eziokwu m **ga** nọ (**rịrị**).
1SG KWESI-rV INF stay in.fact 1SG GA stay (RIRI)
'I should stay. In fact, I must.'

-*ṛiṛi* as a degree maximaliser

ṛiṛi fills the d argument with the maximal degree of necessity

(8) a. MAX on a set of degrees: $MAX(\Delta_{O,c}) = \iota d'.\forall d \in \Delta_{O,c}..d' \gtrsim d$

b. $[\![\text{-ṛiṛi}]\!]^{c,O} = \lambda\mathcal{P}_{<d,<st,t>>}.\lambda p.\mathcal{P}(MAX(\Delta_{O,c}))(p)$

c. $[\![\text{ga -ṛiṛi}]\!]^{c,O} = \lambda p.\Box_{MAX(\Delta_{O,c})}(p)$

(Trivially satisfied conjuncts suppressed)

-ṛiṛi as a degree maximaliser

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c. $[\![\text{ga -ṛiṛi}]\!]^{c,O} = \lambda p.\Box_{MAX(\Delta_{O,c})}(p)$

(Trivially satisfied conjuncts suppressed)

Result and predictions:

- *ga/kwesi* -ṛiṛi: only has a strong necessity reading
- Since *ga/kwesi* -ṛiṛi is interpreted as the maximum point on the degree scale, we predict no modification akin to *downright/absolutely must* in English

Weak vs. Strong Teleological necessity in Igbo

Based on our previous example for teleological necessity, assuming that context distinguishes *ga* as stronger than *kwesi*:

(9) a. $[\![\text{ga -ṛịrị}]\!]^{c,O}(\textit{Go\_South}) = [\![\text{kwesi -ṛịrị}]\!]^{c,O}(\textit{Go\_South}) = 1$

b. $[\![\exists\text{-CL}]\!]([[ga]]^{c,O})(\textit{Go\_South\_By\_Train}) = 1$

c. $[\![\exists\text{-CL}]\!]([[kwesi]]^{c,O})(\textit{Go\_Italy\_By\_Train}) = 1$

Outline

1. Introduction
2. Igbo Data
3. Analysis
4. Other accounts

Other Accounts: Mucha et al. (2024)

Claims:

- Without *-ṛiṛi*, *ga* is restricted to epistemic weak necessity
  - *ga* p is true iff p is true in all epistemically accessible worlds that are normal/stereotypical

- *-ṛiṛi* replaces $\bigcap NORM$ with the identity function
  ga -ṛiṛi gives rise to a strong necessity reading
  - *ga -ṛiṛi* p is true iff p is true in all epistemically accessible worlds (whether or not they are normal/stereotypical)

Predictions and Problems

ga (without *-ṛiṛị*) unavailable or marked in non-epistemic flavours (e.g., bouletic) – Not borne out

(10) Bouletic necessity: Your friend Musa does not like parties, and usually does not host one for his birthday. But this year Musa suddenly changed his mind. He said to you: **'This year, I have to make a big party'**

a. Na afor a, m **ga** e-me unukwu mmemme.
in year this 1SG GA PTCP-do big celebration

ga-ṛiṛị p should be false if p is false in any accessible, non-normal worlds. – Not borne out

(3) You know that John goes to school at 9 a.m. every day and that it is now 9 a.m., therefore, **John must be at school**

b. John **ga**-a-nọ**-ṛiṛị** na ụlọ=akwụkwọ.
John GA-PTCP-stay-RIRI in school

Other accounts: Portner and Rubinstein (2014)

A degree-based Kratzerian modal semantics for English based on the following data:

(11) a. Susan positively/flat-out/downright must / *should call her mother.
b. Susan very much *must / should call her mother.
c. Susan ?must/should call her mother more than she ?must/should call her father.

Problems

- x Unlike in English, Igbo data do not compel us to treat strong necessity with *-ṛịrị* as extreme in the adjectival sense, i.e. extending a scale.
- x We found no Igbo constructions with *-ṛịrị* that are parallel to English *positively/flat-out/downright must*
- x The proposal does not link to the traditional box/diamond (universal vs. existential) semantics.

Summary

Empirical generalizations

- *kwesi* and *ga* can express weak necessity of all flavors
- *-ṛiṛi* strengthens both to an equal extent
- *ga* is often stronger than *kwesi*.

A novel degree-based analysis

- *ga* and *kwesi* interpreted in terms of modal degrees.
- both *ga* and *kwesi* are derived from single ordering source.
- *ga* requires a higher threshold, predicting its stronger behavior.
- *-ṛiṛi* encodes the maximum degree on the scale
  - *ga*/*kwesi* *-ṛiṛi* constructions express (equally) strong necessity

Future Work

Uses of *-ṛiṛị* with other verbs:

(12) a. A chọ-**ṛiṛị** m ị-ga ebe a.
1SG want-RIRI 1SG INF-go place this
'I really want to go there.'

b. A chọ-**ṛiṛị** m ị-ṅụ ice cream.
1SG want-RIRI 1SG INF-eat ice cream
'I really want to eat ice cream.'

(13) A ma-**ṛiṛị** m.
1SG know-RIRI 1SG
'I really know.'

(14) Ha na-e we-**ṛiṛị** ya.
they PROG-v take-RIRI it
'They are (definitely) taking it.'

Our generalised degree-based account can be plausibly extended to these constructions

Imeela!

Many thanks to Dr. Nkechi Ukaegbu for her invaluable assistance with the Igbo data.

Natalia and Nkechi, Berlin 2025

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Outline

5 Appendix

More Data

More Data: Strong Epistemic Necessity

#kwesi

(15) You have a headache that won't go away, so you go to the doctor. All the tests show negative. So, **it must just be stress**.

a. ọ **ga** bu mgbakasị ahụ
   3SG GA be fatigue that

b. ọ **ga** bu-**rịrị** mgbakasị ahụ
   3SG GA be-RIRI fatigue that

c. #ọ **kwesi**-ri bu mgbakasị ahụ
   3SG KWESI-rV be fatigue that

More Data: Strong Teleological Necessity

#ga, ✓kwesi

(16) Strong teleological necessity: Team A are playing in a tournament. In order to advance **Team A has to beat Team B.**

a. #Ndị otu A **ga**-e-meri ndị otu B
   PL group A GA-V-defeat PL group B

b. Ndị otu A **ga-rịrị** i meri ndị otu B
   PL group A GA-RIRI INF defeat PL group B

c. Ndị otu A **kwesi** i meri ndị otu B
   PL group A KWESI INF defeat PL group B

d. Ndị otu A **kwesi-rịrị** i meri ndị otu B
   PL group A KWESI-RIRI INF defeat PL group B

More Data: Strong Deontic Necessity

(17) In Indonesia, the law states that when you ride a motor bike, **you must wear a helmet.**

a. #ị **ga** e-yị ihe n'isi.
   2SG GA PTCP-wear thing on.head

b. ị **ga** e-yị**-rịrị** ihe n'isi.
   2SG GA PTCP-wear-RIRI thing on.head

c. #ị **kwesi**-ri ị-yị ihe n'isi.
   2SG KWESI-rV INF-wear thing on.head

d. ị **kwesi-rịrị** ị-yị ihe n'isi.
   2SG KWESI-RIRI INF-wear thing on.head

More Data: Weak Deontic Necessity

ex. In England, it is recommended that face coverings be worn in stores, but it is not a legal requirement. You plan on going shopping, and you think to yourself: **I ought to wear a face covering.**

a. E **ga** e-yi ihe mkpuchi ihu.
   1SG GA PTCP-wear thing covering face

b. #E **ga** e-yi**-ṛịrị** ihe mkpuchi ihu.
   1SG GA PTCP-wear-RIRI thing covering face

c. E **kwesi**(-ri) m i-yi ihe mkpuchi ihu.
   1SG KWESI(-rV) 1SG INF-wear thing covering face

d. #E **kwesi-ṛịrị** m i-yi ihe mkpuchi ihu.
   1SG KWESI-RIRI 1SG INF-wear thing covering face
   Consultant's comment: it's compulsory

More Data: Strong Circumstantial Necessity

(18) Water is entering a pipe, which has two outputs: the left output and the right output. You block the left output so that **the water must come out from the right output.**

a. mmiri **ga**-e-si na aka nrị we pụta.
water GA-PTCP-follow in hand right then come.out
Consultant's comment: not strong enough, but fits.

b. mmiri **ga**-e-si-**rịrị** na aka nrị we pụta.
water GA-PTCP-follow in hand right then come.out

c. mmiri **kwesi-rịrị** ị-si na aka nrị we pụta.
water KWESI-RIRI INF-follow in hand right then come.out
Consultant's comment: not strong enough, but fits.

d. mmiri **kwesi**-ri ị-si na aka nrị we pụta.
water KWESI-rV INF-follow in hand right then come.out

More Data: Bouletic Necessity

(19) Your friend Musa does not like parties, and usually does not host one for his birthday. But this year Musa suddenly changed his mind. He said to you: **'This year, I have to make a big party'**

a. Na afor a, m **ga** e-me unukwu mmemme.
in year this 1SG GA PTCP-do big celebration

b. Na afor a, m **ga** e-me**-ṛiṛị** unukwu mmemme.
in year this 1SG GA PTCP-do-RIRI big celebration

c. Na afor a, e **kwesi**-ri m i-me unukwu mmemme.
in year this 1SG KWESI-rV 1SG INF-do big celebration

d. Na afor a, e **kwesi**-ri m i-me-**ṛiṛị** unukwu mmemme
in year this 1SG KWESI-rV 1SG INF-do-RIRI big celebration
Consultant's comment: with certainty

More Data: Probabilistic context

(20) Suppose an urn has 100 marbles, 95 white and 5 black. One marble is drawn at random and the speaker doesn't yet know what colour was drawn. **'It must be white.'**

a. O **ga** a bu nke ọcha.
   3SG GA PTCP be thing white

b. #O **ga** a bu-**rịrị** nke ọcha.
   3SG GA PTCP be-RIRI thing white
   Consultant's comment: no, it must be 100 %

c. O **kwesi**-ri ị bu nke ọcha.
   3SG KWESI-rV INF be thing white

d. #/?O **kwesi** ị bụ-**rịrị** nke ọcha
   3SG KWESI INF be-RIRI thing white

Yalcin (2016) uses the context as (20) to show that the English weak necessity modals should and ought are dispreferred in probabilistic contexts, and argues that they function more as normality modals than as epistemic ones.

Data Overview

- *kwesi* is the default weak necessity modal for all flavors.
- Strong necessity across flavors is typically expressed by the auxiliary *ga* + suffix *-ṛiṛi* attached to the following verb (infinitive or participle).
- *ga* without *-ṛiṛi* also conveys weak necessity, but is stronger than *kwesi*.
- Bare *ga* is not compatible with strong deontic contexts, but fits weak necessity contexts of all flavors.
- *kwesi* + *-ṛiṛi* is acceptable in all strong necessity contexts, although this combination is primarily colloquial.
- *-ṛiṛi* can modify verbs other than modals.

Formal Analysis – Details

Preferences in the ordering source as a pre-order

For propositions in the ordering source, we assume a degree-based measure function. E.g., for teleological strength, for an agent (or group of agents), A:

(21) a. $\lambda p.\lambda w.\mu_{\mathfrak{T},A,w}(p) : \langle st, \langle s, d\rangle\rangle$
b. $\mu_{\mathfrak{T},A,w}(p) = d$ iff p is important to A's plan to degree d in w

This induces a pre-order on propositions, $\succsim_{\mathfrak{T}}$ such that:

(22) a. Reflexivity. $\forall p.p \succsim_{\mathfrak{T}} p$
b. Transitivity. $\forall p, q, r.[(p \succsim_{\mathfrak{T}} q \wedge q \succsim_{\mathfrak{T}} r) \rightarrow p \succsim_{\mathfrak{T}} r]$

But $\succsim_{\mathfrak{T}}$ is not anti-symmetric:

(23) $\exists p, q\,[p \succsim_{\mathfrak{T}} q \wedge q \succsim_{\mathfrak{T}} p \wedge p \neq q]$

I.e. One can place importance on different propositions to the same degree.

A pre-order on O induces a set of degrees

- A degree is a set of worlds (a proposition)

(24) The set of initial degree points, $\mathcal{P}$ based on O and $\gtrsim_{\mathfrak{T}}$:
$\{p : \exists q \in O.p = \bigwedge\{r : r \gtrsim_{\mathfrak{T}} q\}\}$
I.e. initial degree points are conjunctions of propositions in O that are ordered by $\gtrsim_{\mathfrak{T}}$ with no interveners.

(25) A partial-order on initial degree points: $p \geqslant_{\mathcal{P}} q$ iff $q \subseteq p$

(26) An equivalence relation between initial degree points based on $\geqslant_{\mathcal{P}}$
$p \sim_{\mathcal{P}} q$ iff $|\{r : p >_{\mathcal{P}} r\}| = |\{r : q >_{\mathcal{P}} r\}|$
Initial degree points are equivalent wrt the degree scale iff they are strictly higher on the scale to the same extent.

(27) The set of degrees, D, based on $\sim_{\mathcal{P}}$:
$\{p : p = \bigwedge\{q : p \sim_{\mathcal{P}} q\}$
Degrees are conjunctions propositions that are equivalent under $\sim_{\mathcal{P}}$.
D forms a total order, $\geqslant_D$ such that: $d \geqslant_D d'$ iff $d' \subseteq d$

Examples

No order: p, q, r

- p, q and r each correspond to initial degree points — from (24)
- $\geqslant_{\mathcal{P}}$ does not hold between any initial degree point — from (25)
- $p \sim_{\mathcal{P}} q \sim_{\mathcal{P}} r$ — from (26)
- $D = \{p \wedge q \wedge r\}$ (only 1 degree) — from (27)

Ordering between all propositions: $p \gtrsim_{\mathfrak{T}} q \gtrsim_{\mathfrak{T}} r$

- p, $p \wedge q$ and $p \wedge q \wedge r$ each correspond to initial degree points — from (24)
- $p \geqslant_{\mathcal{P}} p \wedge q \geqslant_{\mathcal{P}} p \wedge q \wedge r$ — from (25)
- $\sim_{\mathcal{P}}$ does not hold between any initial degree points — from (26)
- $D = \{p, p \wedge q, p \wedge q \wedge r\}$
  Three degrees s.t.: $p \geqslant_D p \wedge q \geqslant_D p \wedge q \wedge r$ — from (27)

Examples cont.

Ordering between some propositions: $p \gtrsim_{\mathfrak{T}} r$, and $q \gtrsim_{\mathfrak{T}} r$

- p, q, $p \wedge r$ and $q \wedge r$ each correspond to initial degree points — from (24)
- $p \geqslant_{\mathcal{P}} p \wedge q$ and $q \geqslant_{\mathcal{P}} q \wedge r$ — from (25)
- $p \sim_{\mathcal{P}} q$ and $p \wedge r \sim_{\mathcal{P}} q \wedge r$ — from (26)
- $D = \{p, q, p \wedge r, q \wedge r\}$
  Two degrees s.t. $p \wedge q \geqslant_D p \wedge q \wedge r$ — from (27)

Necessity based upon D for O

(28) Necessity based upon D for O:
$\forall d \in D.\forall p.\Box_d\, p \leftrightarrow \forall w \in d.p(w)$
p is d-necessary iff p is true in all q worlds, for some proposition in d.

Fact. If $\Box_d\, p$ and $d \geqslant_D d'$, then $\Box_{d'}\, p$ for all p, d, d'.

Proof. From (27), $d \gtrsim_D d'$ iff $d' \subseteq d$. From (28), $\forall w \in d.p(w)$. Since $\forall$ is monotonic, $\forall d, d'.(d' \subseteq d \wedge \forall w \in d.p(w)) \rightarrow \forall w \in d'.p(w)$. Hence $\Box_{d'}\, p$ for all p, d, d'.

Consistency of $\succsim_{\mathfrak{T}}$ for O

$\succsim_{\mathfrak{T}}$ is consistent for O iff $d_{max} \neq \varnothing$

Your priorities are consistent iff they do not result in necessitating you do inconsistent things.

'Positive' uses of *ga* vs. *kwesi*

In the absence of *-ṛiṛi*, the open degree argument is existentially closed, resembling the working of POS with vague adjectives in their positive form.

(29) a. $[\![\exists\text{-CL}]\!]([[kwesi]]^{c,O}) = \lambda p.\exists d.\, \Box_d(p) \wedge d \in \Delta_{O,c}$

b. $[\![\exists\text{-CL}]\!]([[ga]]^{c,O}) = \lambda p.\exists d.\, \Box_d(p) \wedge d \in \Delta_{O,c} \wedge d \gtrsim \Theta_c(\Delta_{O,c})$

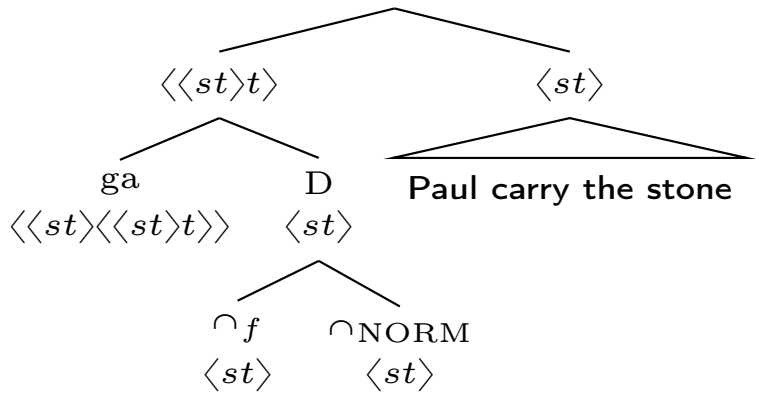
kwesi $p \approx p$ is necessary to some degree
ga $p \approx p$ is necessary to some degree above the contextual threshold

Other Accounts (More Details)

Other Accounts: Mucha et al. (2024)

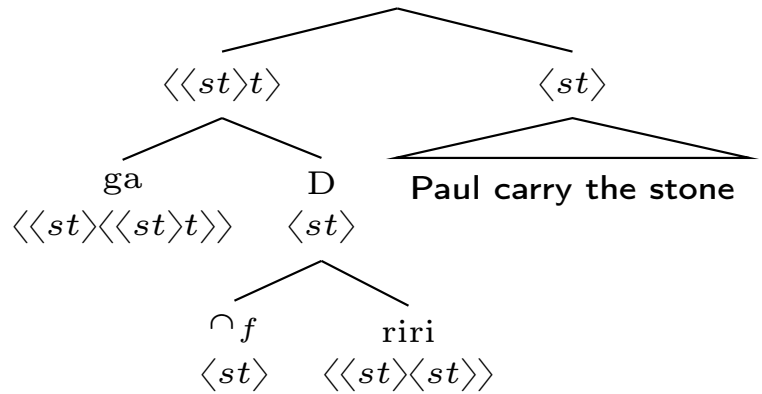
(30) a. Paul gà-èbú òkú!té áhù
Paul GA-carry stone DEF
'Paul will carry the stone.'

b. LF structure of (a):



(31) a. Paul gà-èbú-rịrị òkú!té áhù
Paul GA-carry-RIRI stone DEF
'Paul must carry the stone.'

b. LF structure of (a):



(Mucha et al., 2024, 648, 656-657), their (4), (35), (5), (39), respectively.

30-a is true iff Paul carries the stone in all accessible worlds that are **compatible with normality assumption** in the actual world.

31-a is true iff Paul carries the stone in all accessible worlds.

Bouletic Necessity

(32) Bouletic necessity: Your friend Musa does not like parties, and usually does not host one for his birthday. But this year Musa suddenly changed his mind. He said to you: **'This year, I have to make a big party'**

a. Na afor a, m **ga** e-me unukwu mmemme.
in year this 1SG GA PTCP-do big celebration

b. Na afor a, m **ga** e-me**-ṛiṛị** unukwu mmemme.
in year this 1SG GA PTCP-do-RIRI big celebration

c. Na afor a, e **kwesi**-ri m i-me unukwu mmemme.
in year this 1SG KWESI-rV 1SG INF-do big celebration

d. Na afor a, e **kwesi**-ri m i-me-**ṛiṛị** unukwu mmemme
in year this 1SG KWESI-rV 1SG INF-do-RIRI big celebration
Comment: with certainty

Other accounts: Portner and Rubinstein (2014)

- Analogy to extreme vs. non-extreme adjectives (Morzycki (2012)):
- weak modals (should) $\approx$ non-extreme adjectives (*big*)
- strong modals (must) $\approx$ extreme adjectives (*gigantic*)

(11) a. Susan positively/flat-out/downright must / *should call her mother.
b. Susan very much *must / should call her mother.
c. Susan ?must/should call her mother more than she ?must/should call her father.

Portner and Rubinstein (2014)

- Strong necessity modals depend only on the primary ordering source, while weak necessity modals involve a secondary ordering source that further restricts the set of relevant worlds (following von Fintel and Iatridou (2008))
- The primary source encodes non-negotiable requirements, while the secondary source reflects negotiable ones (following Rubinstein (2012))
- The extreme part of the scale is determined solely by primary priorities; the non-extreme part reflects both primary and secondary priorities.

(33) a. Weak necessity: $[\![N]\!]^c = [\lambda p\, \lambda d\, \lambda w\ .\ d \in D_w \wedge d = \mu_\Sigma(p, w)]$

b. Strong necessity:
$[\![N^+]\!]^c = [\lambda p\, \lambda d\, \lambda w\ .\ d \in (D_w^+ - D_w) \wedge d = \mu_\Sigma(p, w)]$

Problems

- x Unlike in English, Igbo data do not compel us to treat strong necessity with *-ṛiṛi* as extreme in the adjectival sense, i.e. extending a scale.
- x There are not constructions parallel to English *positively/flat-out/downright must* found: **once *-ṛiṛi* is present, no further intensifier is possible**.
- x The proposal does not link to the traditional box–diamond (universal vs. existential) semantics.
- x It cannot derive the scalar structure from a single ordering source, which is crucial for Igbo data, where *ga* and *ga-riri* have the same strong reading in some contexts.