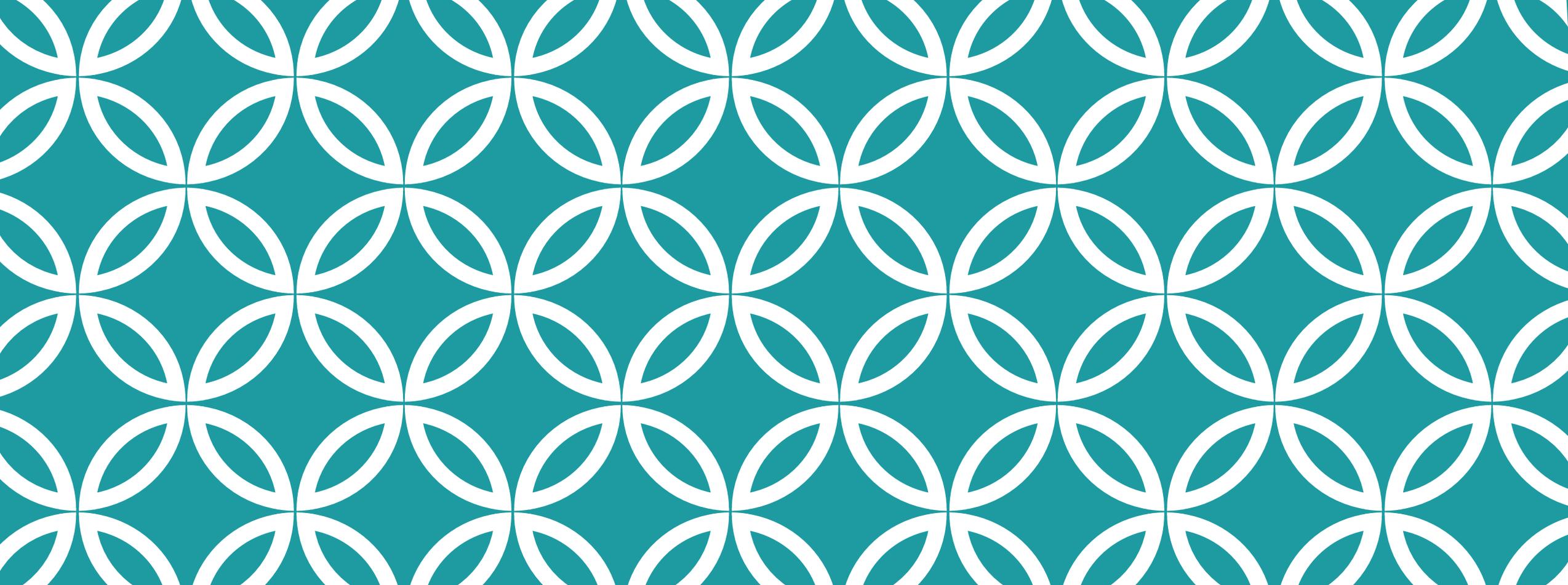


LECTURE 1: ENTAILMENTS

How to spot them and
what to do with them



PREFACE

Course overview

TEXTBOOK

Invitation to Formal Semantics

(formerly known as *Semantics Boot Camp*)

By Elizabeth Coppock and Lucas Champollion

<http://eecoppock.info/semantics-boot-camp.pdf>

COMMENTS WELCOME!

Please email me at eecoppock@gmail.com if you have any feedback on the manuscript:

- typos, errors
- inconsistencies
- confusing bits
- suggestions/ideas

PLAN FOR THIS WEEK (& ASSOCIATED READING)

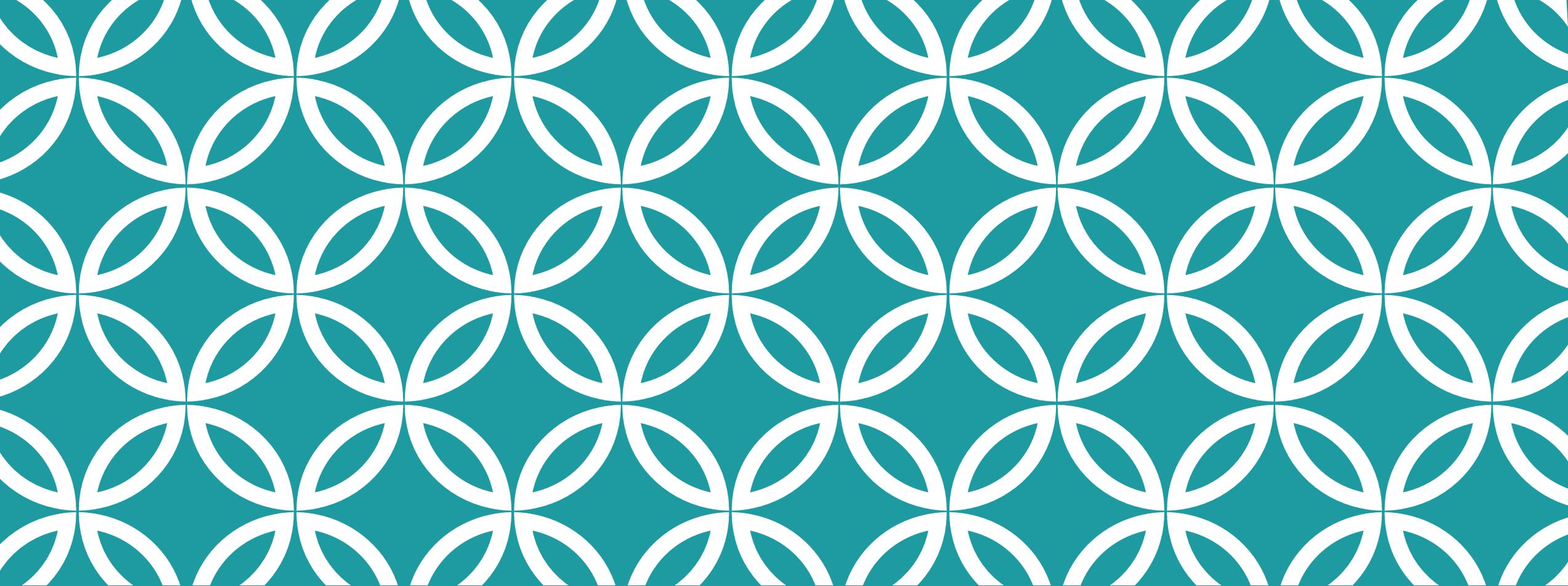
M	Entailment & sets	(chs. 1 & 2)
T	Propositional logic	(ch. 3, 1 st part)
W	Predicate logic	(ch. 3, 2 nd part)
R	Function application	(ch. 4, 5)
F	Quantifiers	(ch. 6)

PLAN FOR NEXT WEEK (& ASSOCIATED READING)

- M Predicate Modification, *the*. (ch. 5)
- T Presupposition (ch. 7)
- W Pronouns and traces (ch. 8)
- R Tense (ch. 12)
- F Intensionality + Indexicality (ch. 13)

OUTLINE FOR TODAY

- I. Semantics vs. pragmatics
- II. Entailment and how to diagnose it
- III. Negative Polarity Item (NPI) licensing



| | **Semantics
& Pragmatics**



SEMANTICS: THE STUDY OF MEANING

What is meaning?



SEMANTICS: THE STUDY OF MEANING

What is meaning?

Can Google understand meaning?

SEMANTICS: THE STUDY OF MEANING

What is meaning?

Can Google understand meaning?

To some extent, but it doesn't understand **implications**.

GOOGLE CORPUS EXAMPLE



HUGH LAURIE

Actor

English, French, German and Spanish

Hugh Laurie is an English actor, comedian, writer, musician and director. He speaks French, German and Spanish. He learned all three at the Dragon School and Eton. He also

would like to be fluent in Italian because he thinks 'it's a beautiful language'.

GOOGLE CORPUS EXAMPLE



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Does Hugh Laurie speak Tagalog?

GOOGLE CORPUS EXAMPLE



HUGH LAURIE

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English, French, German and Spanish

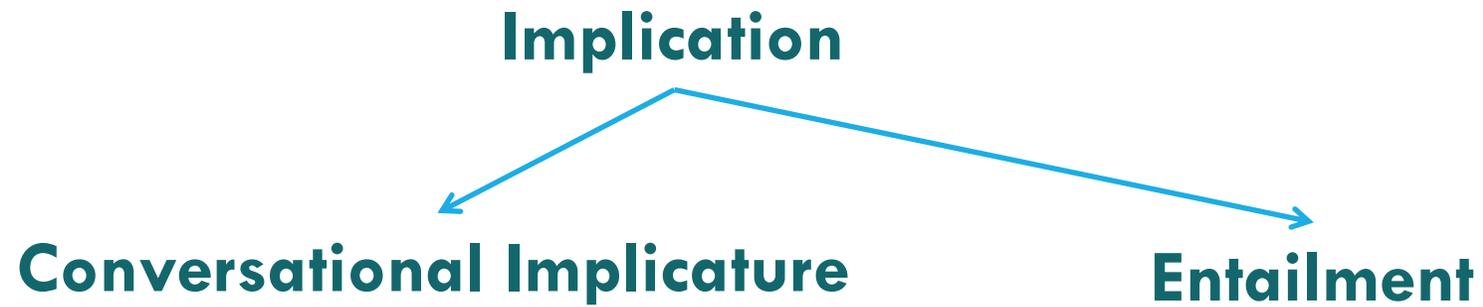
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would like to be fluent in Italian because he thinks 'it's a beautiful language'.

Does Hugh Laurie speak Tagalog?

Does Hugh Laurie speak more than two languages?

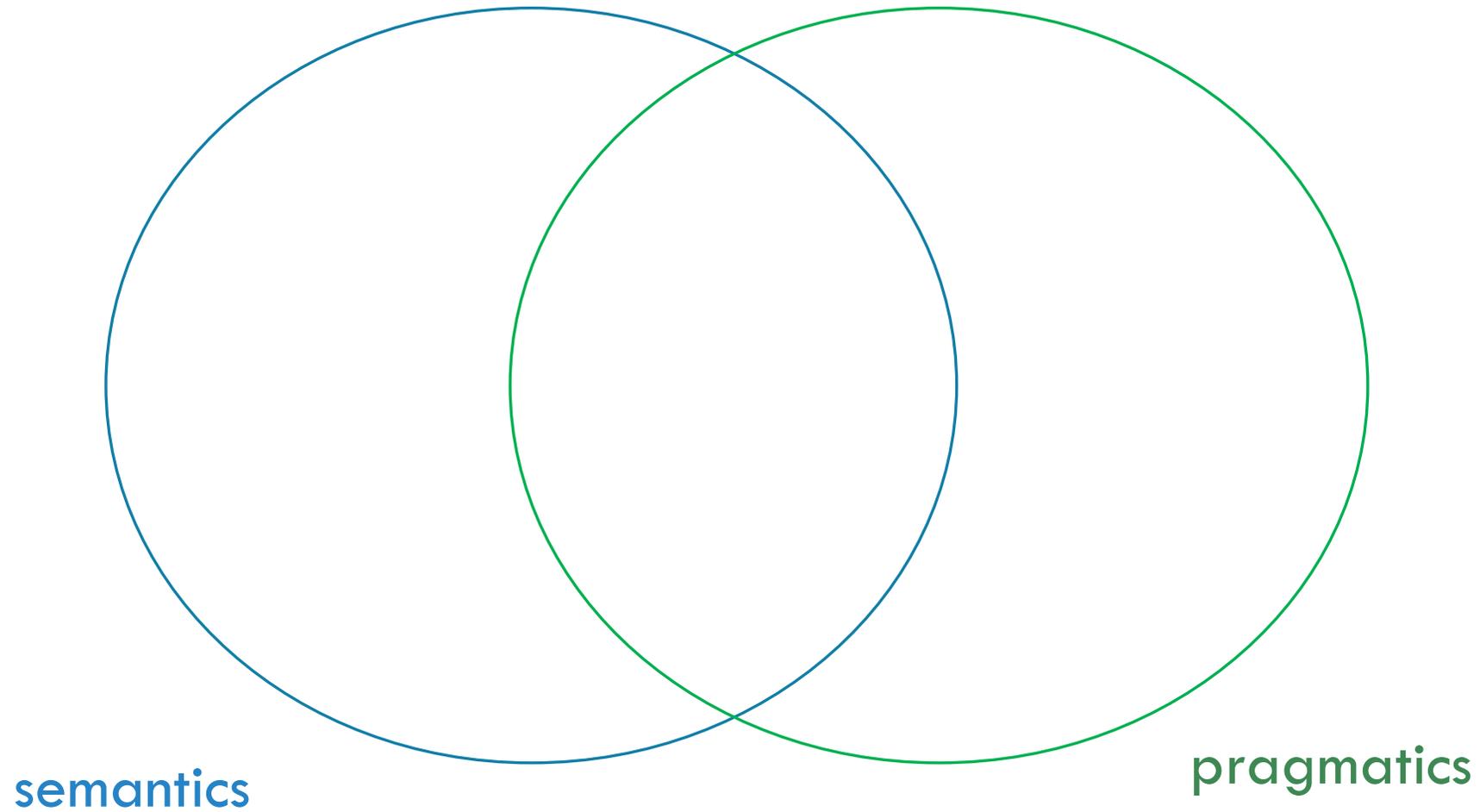
TYPES OF IMPLICATIONS



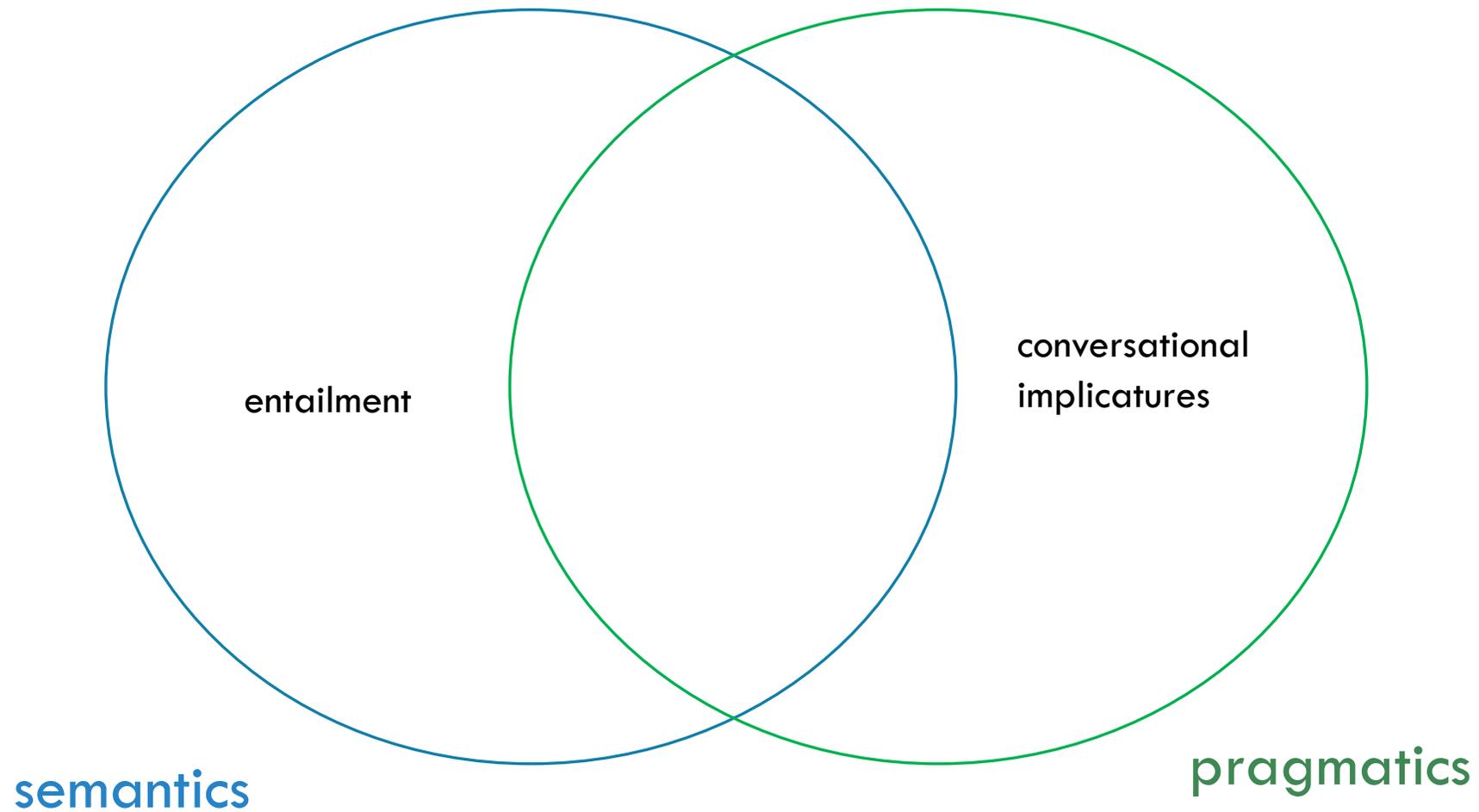


SEMANTICS VS. PRAGMATICS

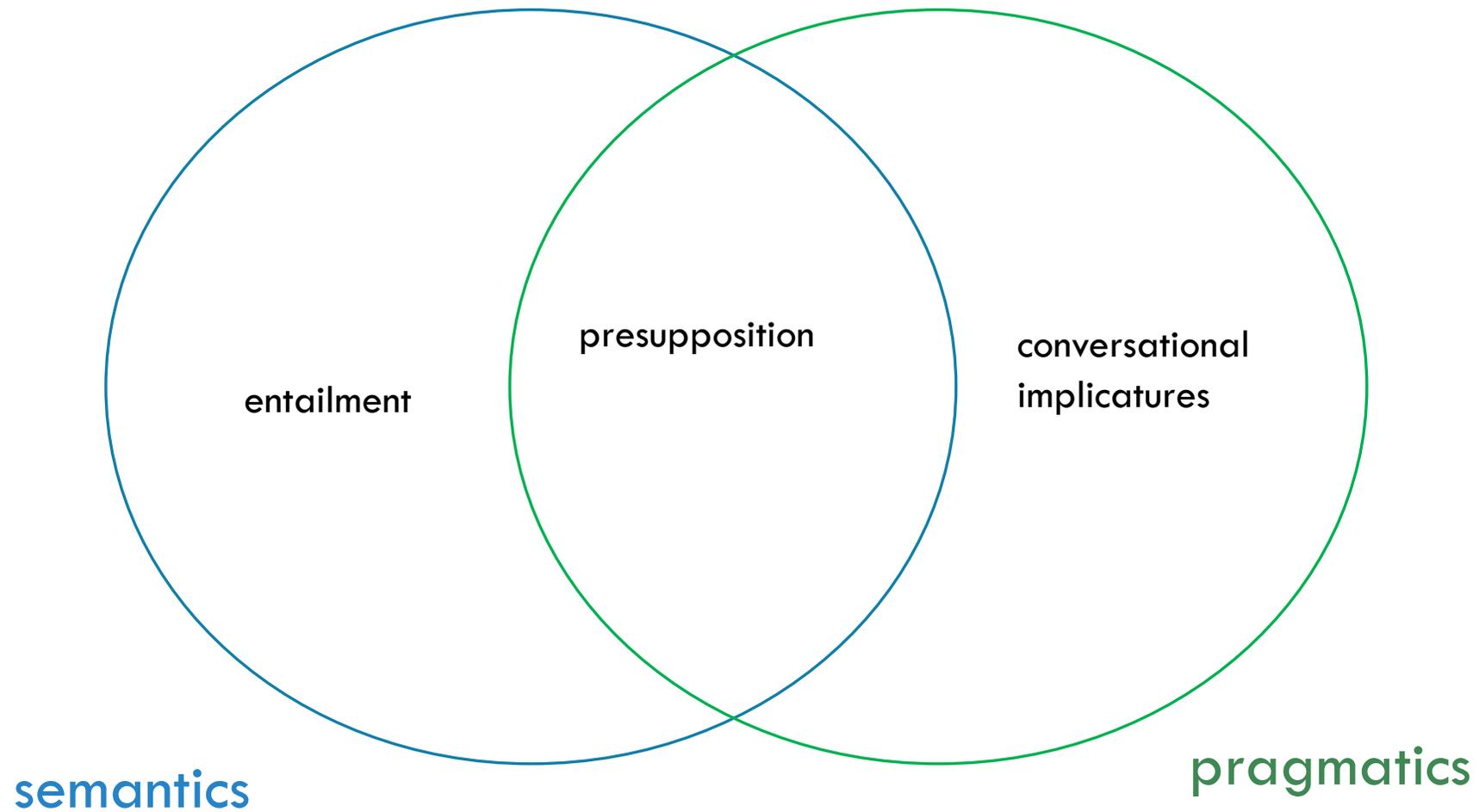
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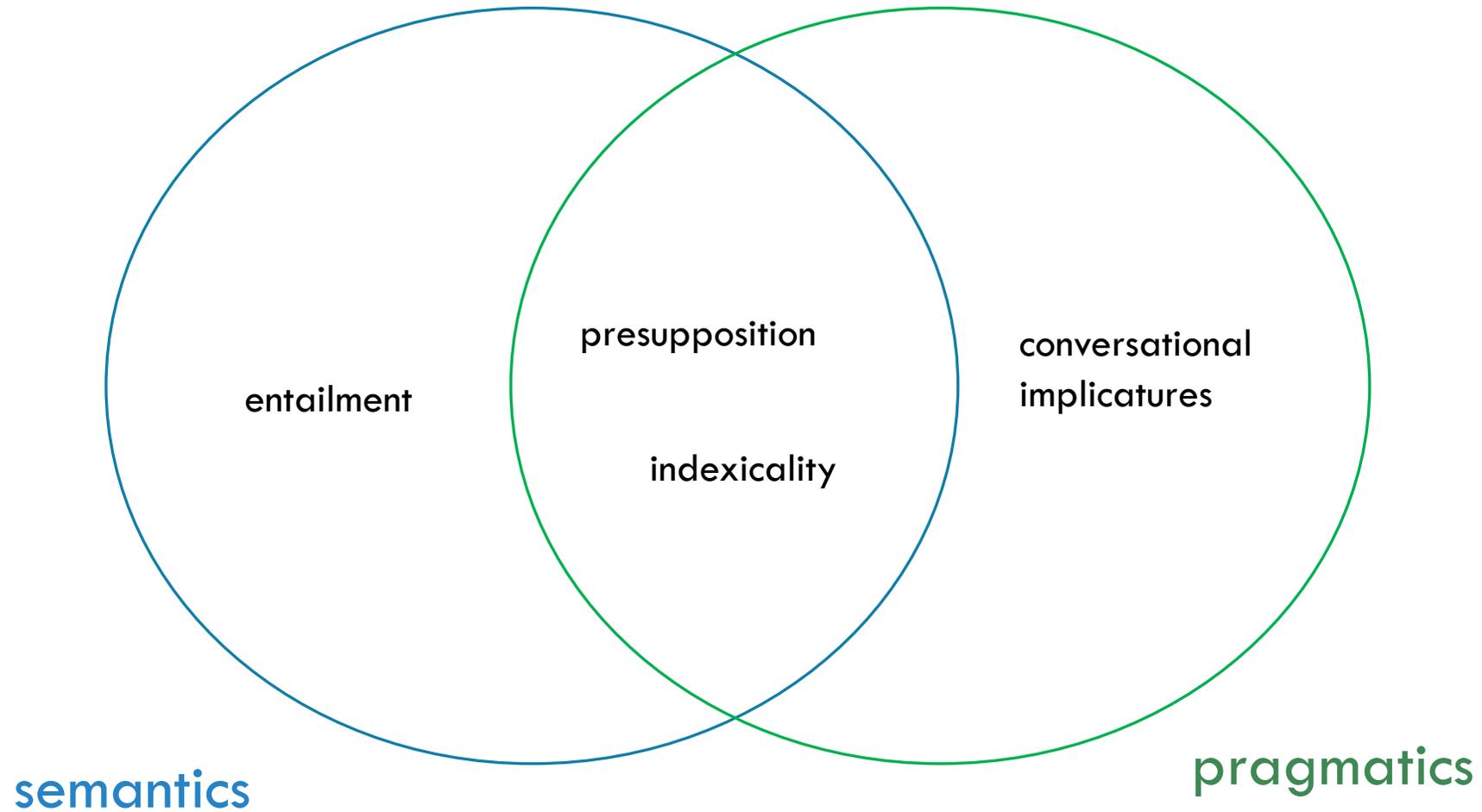
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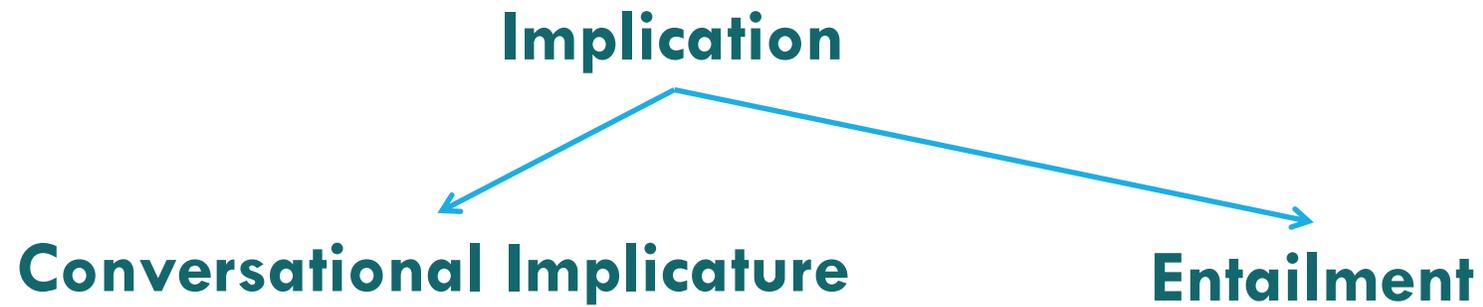
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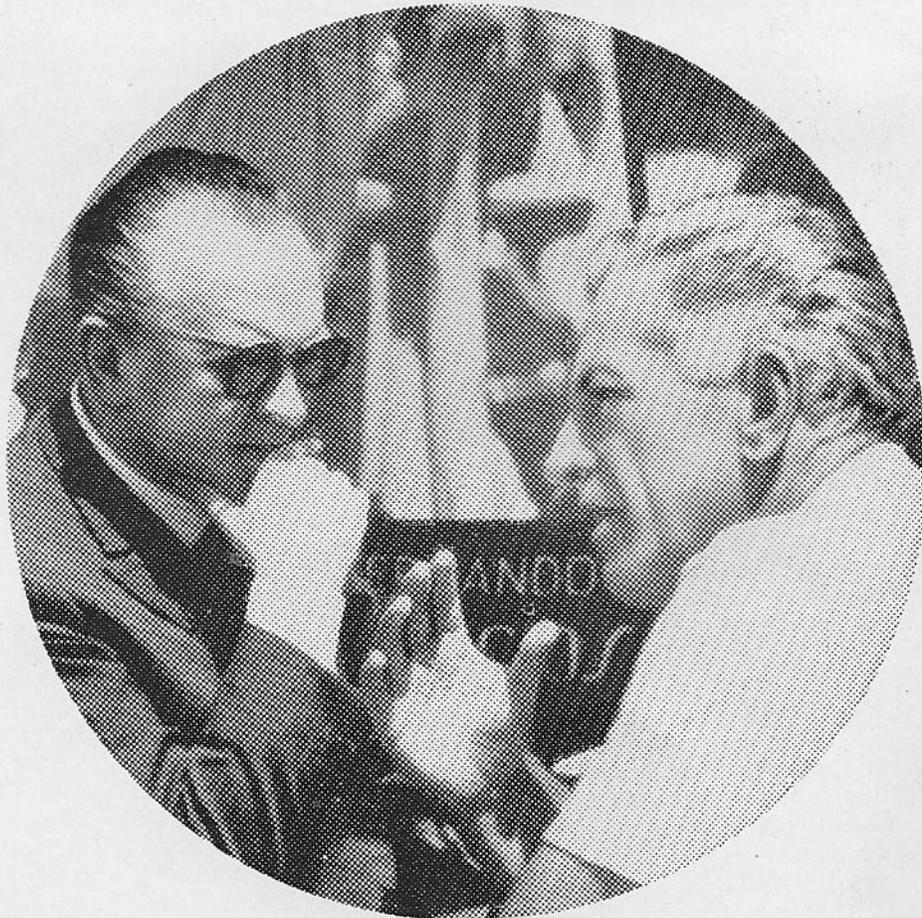
SEMANTICS VS. PRAGMATICS



TYPES OF IMPLICATIONS



SAMUEL BRONSTON



Samuel Bronston (left), producer of "King of Kings," with the film's director, Nicholas Ray. The epic drama, presented by Metro-Goldwyn-Mayer, unfolds a story of the life and times of Christ. It was filmed in 70mm Super Technirama Technicolor, with a cast of thousands.

BRONSTON UNDER OATH AFTER GOING BANKRUPT:

Q. Do you have any bank accounts in Swiss banks, Mr. Bronston?

A. No, sir.

Q. Have you ever?

A. The company had an account there for about six months, in Zürich.

Q. Have you any nominees who have bank accounts in Swiss banks?

A. No, sir.

Q. Have you ever?

A. No, sir.

IN FACT

Bronston personally had had an account with International Credit Bank in Geneva.

He made deposits and drew checks totalling up to \$180,000 during the five years in which the company was active.

He closed it just before the bankruptcy filing.

18 U.S. CODE SECTION 1621 – PERJURY

Whoever...

willfully subscribes as true any material matter
which he does not believe to be true

is guilty of perjury...

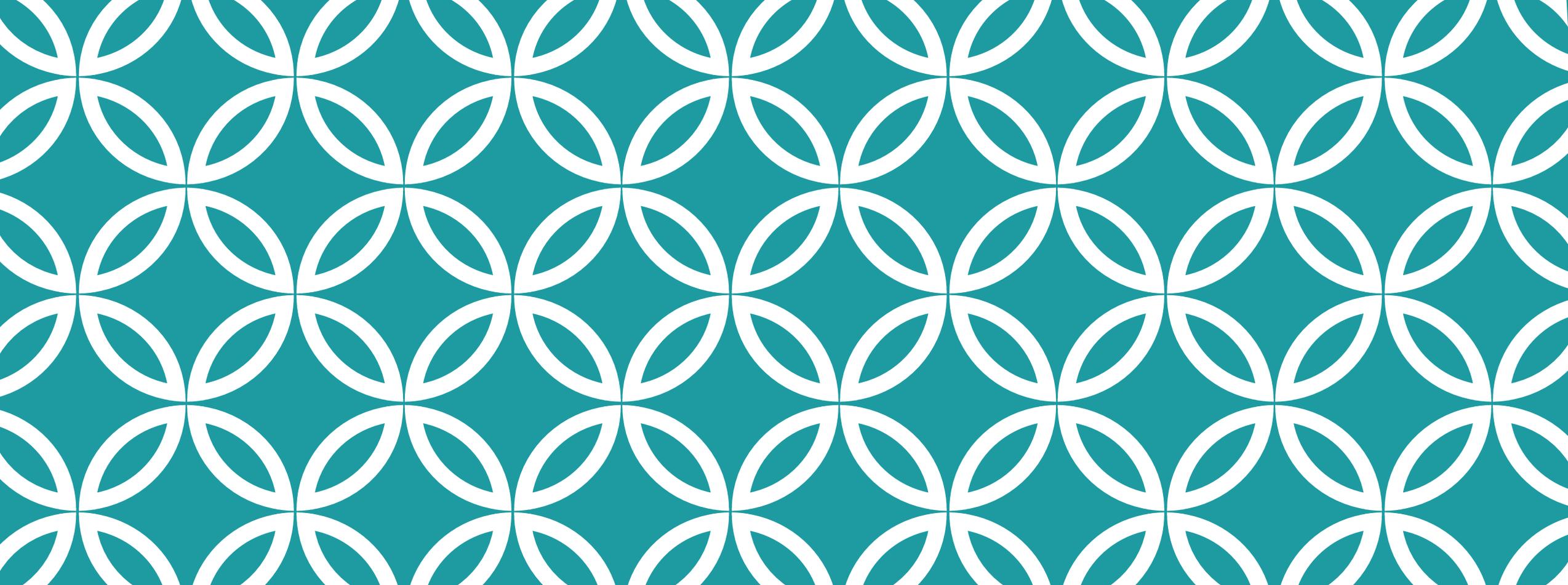
BRONSTON UNDER OATH AFTER GOING BANKRUPT:

Q. Do you have any bank accounts in Swiss banks, Mr. Bronston?

A. No, sir.

Q. Have you ever?

A. The company had an account there for about six months, in Zürich.



II

Entailment

ENTAILMENT

A sentence A **entails** sentence B

if and only if

Whenever A is true, B is true too.

DIAGNOSTICS FOR ENTAILMENT

1. Defeasibility test
(a.k.a. “Cancellability” or “Cancellation” test)
2. Reinforcement test

DEFEASIBILITY TEST: IDEA

If $A \rightarrow B$ is an **entailment**,
then **asserting** A and then asserting **the negation of** B
is **contradictory**.

DEFEASIBILITY TEST: EXAMPLES

- (a) Joan likes some of her presents.
- (b) Joan doesn't like all of her presents.

DEFEASIBILITY TEST: EXAMPLES

- (a) Joan likes some of her presents.
- (b) Joan doesn't like all of her presents.
- (c) Joan likes some of her presents, and in fact she likes all of them.

DEFEASIBILITY TEST: EXAMPLES

- (a) Joan likes some of her presents.
- (b) Joan doesn't like all of her presents.
- (c) Joan likes some of her presents, and in fact she likes all of them. [not contradictory]

DEFEASIBILITY TEST: EXAMPLES

(a) Joan likes some of her presents.

(b) Joan doesn't like all of her presents.

(c) Joan likes some of her presents, and in fact she likes all of them.

= the negation of (b)

NEGATION

A sentence A expresses the **negation** of sentence B

if and only if

it is impossible for A and B to both be true, and it is also impossible for A and B to both be false.

CONSTRUCTING NEGATIONS

Sentence

Matt is tall.

Negation

Matt is not tall.

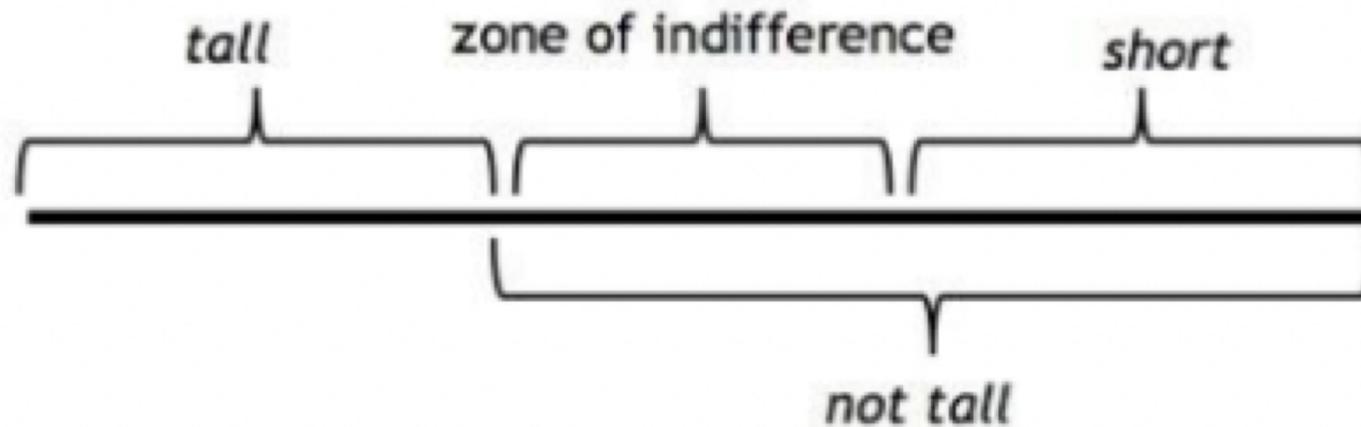
CONSTRUCTING NEGATIONS

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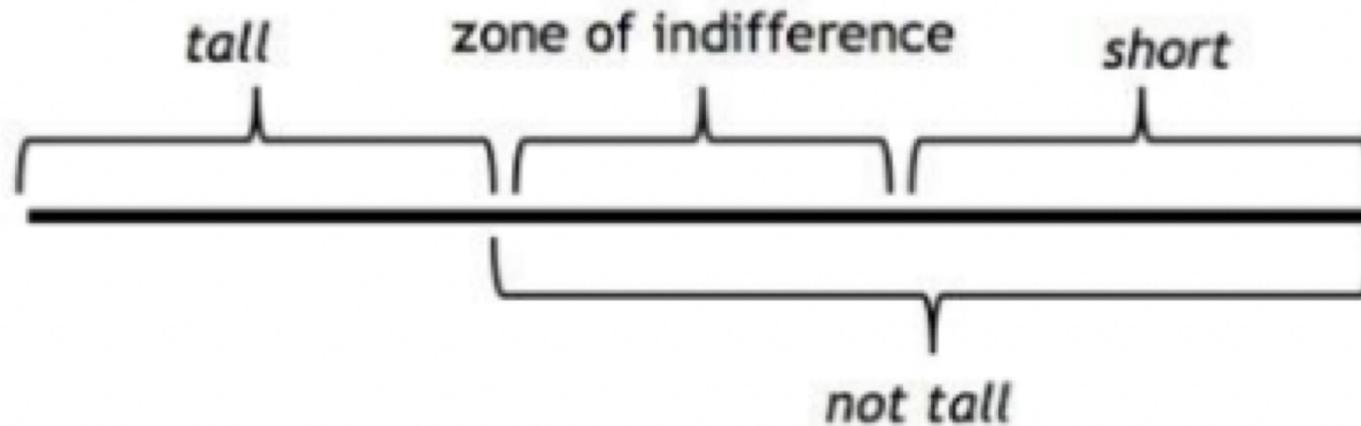
CONTRARY OPPOSITION

Sentence

Matt is tall.

Contrary

Matt is **short**.



CONTRARY OPPOSITION

A sentence A is in **contrary opposition** to sentence B

if and only if

it is impossible for A and B to both be true,
but A and B can both be false at the same time.

CONSTRUCTING NEGATIONS

Sentence

Matt is tall.

Everyone likes pizza.

Negation

Matt is not tall.

CONSTRUCTING NEGATIONS

Sentence

Matt is tall.

Everyone likes pizza.

Negation

Matt is not tall.

Not everyone likes pizza.

CONSTRUCTING NEGATIONS

Sentence

Matt is tall.

Everyone likes pizza.

Sometimes I dance.

Negation

Matt is not tall.

Not everyone likes pizza.

CONSTRUCTING NEGATIONS

Sentence

Matt is tall.

Everyone likes pizza.

Sometimes I dance.

Negation

Matt is not tall.

Not everyone likes pizza.

I never dance.

CONSTRUCTING NEGATIONS

Sentence

Matt is tall.

Everyone likes pizza.

Sometimes I dance.

I always dance.

Negation

Matt is not tall.

Not everyone likes pizza.

I never dance.

CONSTRUCTING NEGATIONS

Sentence

Matt is tall.

Everyone likes pizza.

Sometimes I dance.

I always dance.

Negation

Matt is not tall.

Not everyone likes pizza.

I never dance.

Sometimes I don't dance.

DEFEASIBILITY TEST: EXAMPLES

- (a) Mary used to swim a mile daily.
- (b) Mary no longer swims a mile daily.

DEFEASIBILITY TEST: EXAMPLES

- (a) Mary used to swim a mile daily.
- (b) Mary no longer swims a mile daily.
- (c) Mary used to swim a mile daily, and in fact she still does.

DEFEASIBILITY TEST: EXAMPLES

- (a) Mary used to swim a mile daily.
- (b) Mary no longer swims a mile daily.
- (c) Mary used to swim a mile daily, and in fact she still does. [not contradictory]

DEFEASIBILITY TEST: EXAMPLES

- (a) Mary used to swim a mile daily.
- (b) Mary no longer swims a mile daily.
- (c) Mary used to swim a mile daily, and in fact she still does. [not contradictory]

DEFEASIBILITY TEST: EXAMPLES

- (a) Mary is an Italian physicist.
- (b) Mary is Italian.

DEFEASIBILITY TEST: EXAMPLES

- (a) Mary is an Italian physicist.
- (b) Mary is Italian.
- (c) Mary is an Italian physicist, but she is not Italian.

DEFEASIBILITY TEST: EXAMPLES

- (a) Mary is an Italian physicist.
- (b) Mary is Italian.
- (c) Mary is an Italian physicist, but she is not Italian.
[contradictory]

TO RUN THE DEFEASIBILITY TEST

- 1. Construct** an example of the form
 $A \ \& \ \textit{not-B}$
where $\textit{not-B}$ is the negation of B .

TO RUN THE DEFEASIBILITY TEST

- 1. Construct** an example of the form
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- 2. Ask** a native speaker:
“Does this sound contradictory?”

TO RUN THE DEFEASIBILITY TEST

- 1. Construct** an example of the form
 $A \ \& \ \textit{not-B}$
where $\textit{not-B}$ is the negation of B.
- 2. Ask** a native speaker:
“Does this sound contradictory?”
- 3. Interpret** the result:
If yes, then that indicates $A \rightarrow B$ is an entailment.

YOU TRY IT

- (a) John almost fell over.
- (b) John didn't fall over.

TRY IT AGAIN!

- (a) When I was in the army, I tried LSD.
- (b) I was in the army.

DEFEASIBILITY TEST: SUMMARY

- 1. Construct** an example of the form
 $A \ \& \ \textit{not-B}$
where $\textit{not-B}$ is the denial of B.
- 2. Ask** a native speaker:
“Does this sound contradictory?”
- 3. Interpret** the result:
If yes, then that indicates $A \rightarrow B$ is an entailment.

REINFORCEMENT TEST: IDEA

If $A \rightarrow B$ is an **entailment**,
then **asserting** A and then **asserting** B
is **redundant**.

REINFORCEMENT TEST: EXAMPLES

- (a) Joan likes some of her presents.
- (b) Joan doesn't like all of her presents.

REINFORCEMENT TEST: EXAMPLES

- (a) Joan likes some of her presents.
- (b) Joan doesn't like all of her presents.
- (c) Joan likes some of her presents, but she doesn't like all of them.

REINFORCEMENT TEST: EXAMPLES

- (a) Joan likes some of her presents.
- (b) Joan doesn't like all of her presents.
- (c) Joan likes some of her presents, but she doesn't like all of them. [not redundant]

REINFORCEMENT TEST: EXAMPLES

- (a) Mary is an Italian physicist.
- (b) Mary is Italian.
- (c) Mary is an Italian physicist, but she is Italian.
[redundant]

TO RUN THE REINFORCEMENT TEST

1. **Construct** an example of the form
A & B

TO RUN THE REINFORCEMENT TEST

1. **Construct** an example of the form
A & B
2. **Ask** a native speaker:
“Does this sound **redundant?**”

SUMMARY: TWO DIAGNOSTICS

1. Defeasibility

Is “A & not B” a contradiction? Yes \Rightarrow entailment

2. Reinforcement

Is “A & B” redundant? Yes \Rightarrow entailment.

NOTE ALSO: IMPLICATURES DISAPPEAR UNDER NEGATION

- (a) Joan likes some of her presents.
- (b) Joan doesn't like all of her presents.
- (c) It's not true that Joan likes some of her presents.
=> Joan doesn't like any of them.

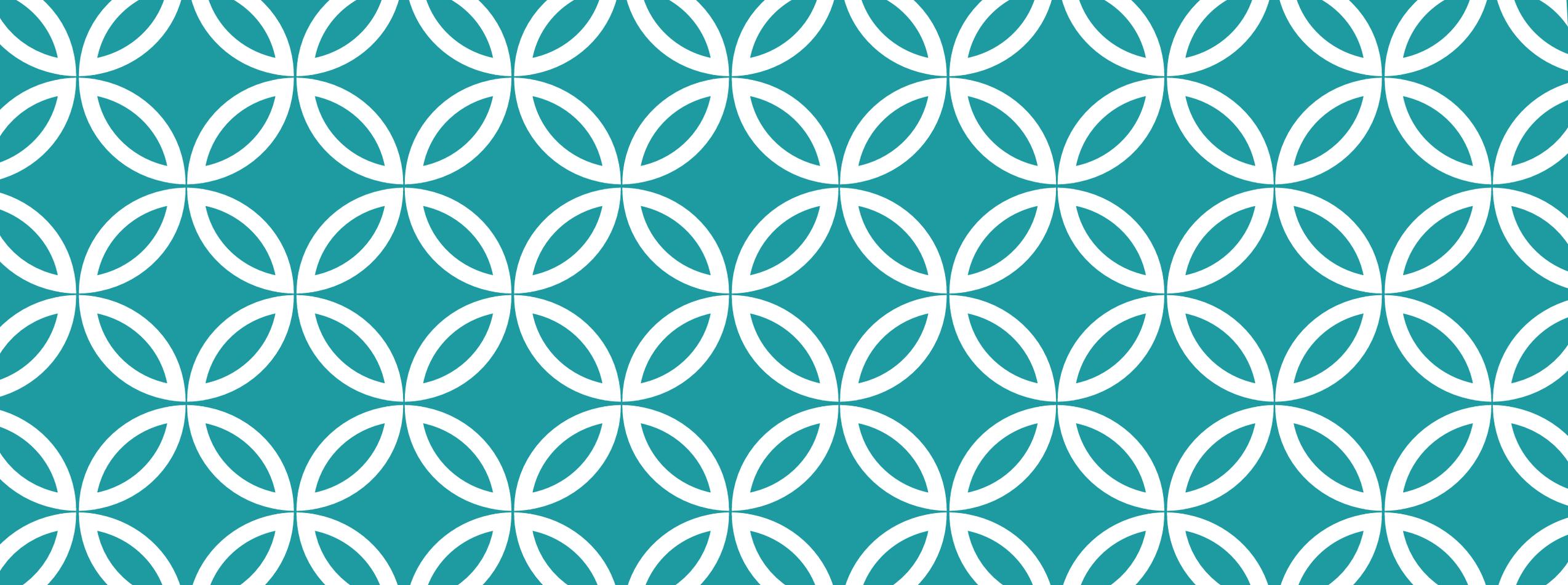
NOTE ALSO: IMPLICATURES DISAPPEAR UNDER NEGATION

(a) Mary is an Italian physicist.

(b) Mary is Italian.

(c) It's not true that Mary is an Italian physicist.

=> Either Mary is not Italian or not a physicist.



Negative Polarity Items
(NPIs)

DISTRIBUTION OF *ANYONE*

X Bob saw **anyone**.

✓ Bob **didn't** see **anyone**.

DISTRIBUTION OF *ANYONE*

X Bob saw *anyone*.

X *Anyone* came.

✓ Bob **didn't** see *anyone*.

✓ **If** *anyone* came, then great.

DISTRIBUTION OF *ANYONE*

X Bob saw **anyone**.

X **Anyone** came.

X Someone who knows **anyone** famous came to the party.

✓ Bob **didn't** see **anyone**.

✓ **If anyone** came, then great.

✓ **Nobody** who knows **anyone** famous came to the party.

DISTRIBUTION OF *ANYONE*

X Bob saw **anyone**.

X **Anyone** came.

X Someone who knows **anyone** famous came to the party.

X John left with **anyone**.

✓ Bob **didn't** see **anyone**.

✓ **If anyone** came, then great.

✓ **Nobody** who knows **anyone** famous came to the party.

✓ John left **without anyone**.

DISTRIBUTION OF *EVER*

X Bob **ever** came.

✓ Bob **didn't** **ever** come.

X Someone who **ever** met Maria Callas came to the party.

✓ **Nobody** who **ever** met Maria Callas came to the party.

DISTRIBUTION OF *EVER*

✓ No conductor who *ever* met Maria Callas laughed.

DISTRIBUTION OF *EVER*

- ✓ No conductor who *ever* met Maria Callas laughed.
- ✓ Every conductor who *ever* met Maria Callas laughed.

DISTRIBUTION OF *EVER*

- ✓ No conductor who *ever* met Maria Callas laughed.
- ✓ Every conductor who *ever* met Maria Callas laughed.
- ✗ Some conductor who *ever* met Maria Callas laughed.

DISTRIBUTION OF *EVER*

✓ No conductor who met Maria Callas *ever* laughed.

DISTRIBUTION OF *EVER*

- ✓ No conductor who met Maria Callas *ever* laughed.
- ✗ Every conductor who met Maria Callas *ever* laughed.

DISTRIBUTION OF *EVER*

- ✓ No conductor who met Maria Callas *ever* laughed.
- ✗ Every conductor who met Maria Callas *ever* laughed.
- ✗ Some conductor who met Maria Callas *ever* laughed.

SUMMARY

[D NP] VP

- *no*: yes
- *every*: yes
- *some*: no

[D NP] VP

- *no*: yes
- *every*: no
- *some*: no

INTERIM CONCLUSION

Licensing of *ever* is not an all-or-nothing matter;
it depends where you are in the sentence.

LADUSAW'S GENERALIZATION

Negative Polarity Items are licensed only in downward-entailing environments.

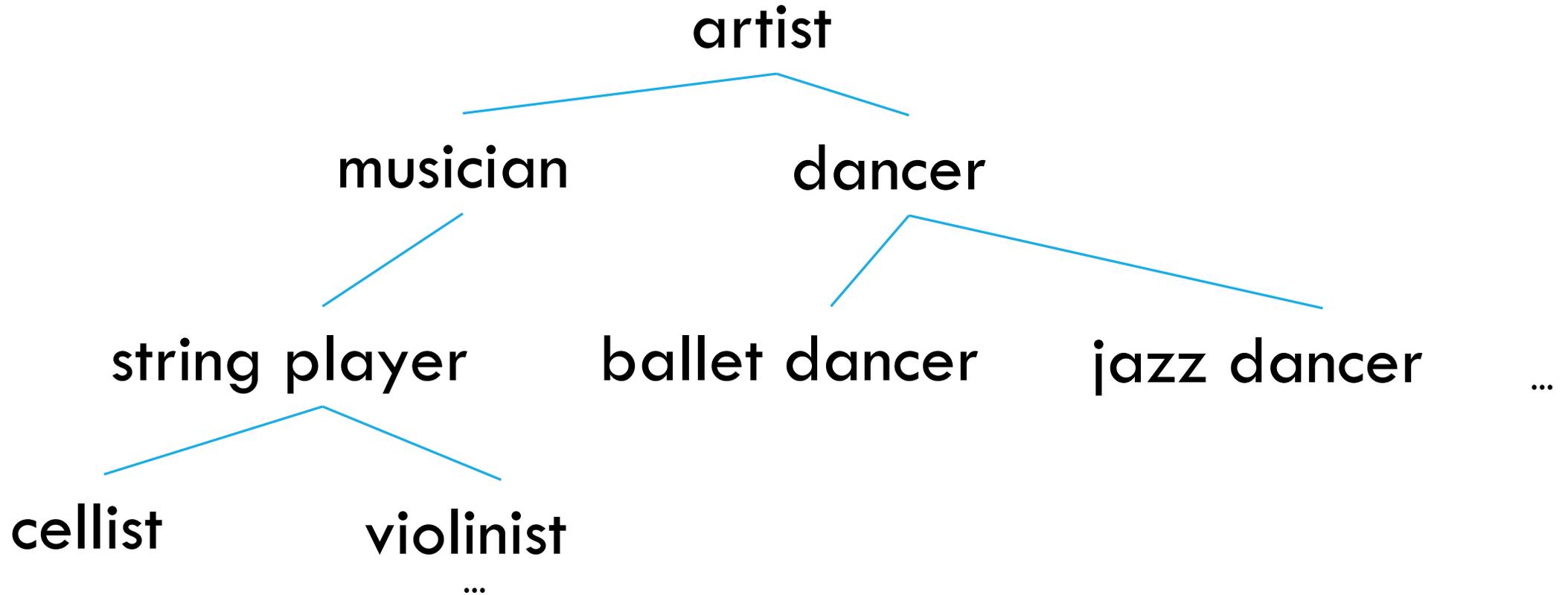
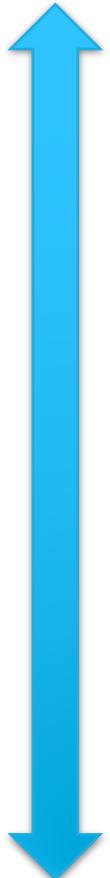
DOWNWARD ENTAILMENT

In any sentence of the form [... X ...]

If replacing X with a more specific phrase yields a sentence that is entailed by the original sentence, then X is in a **downward-entailing environment**.

TAXONOMIC HIERARCHY

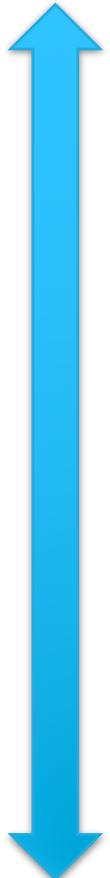
less specific / more general



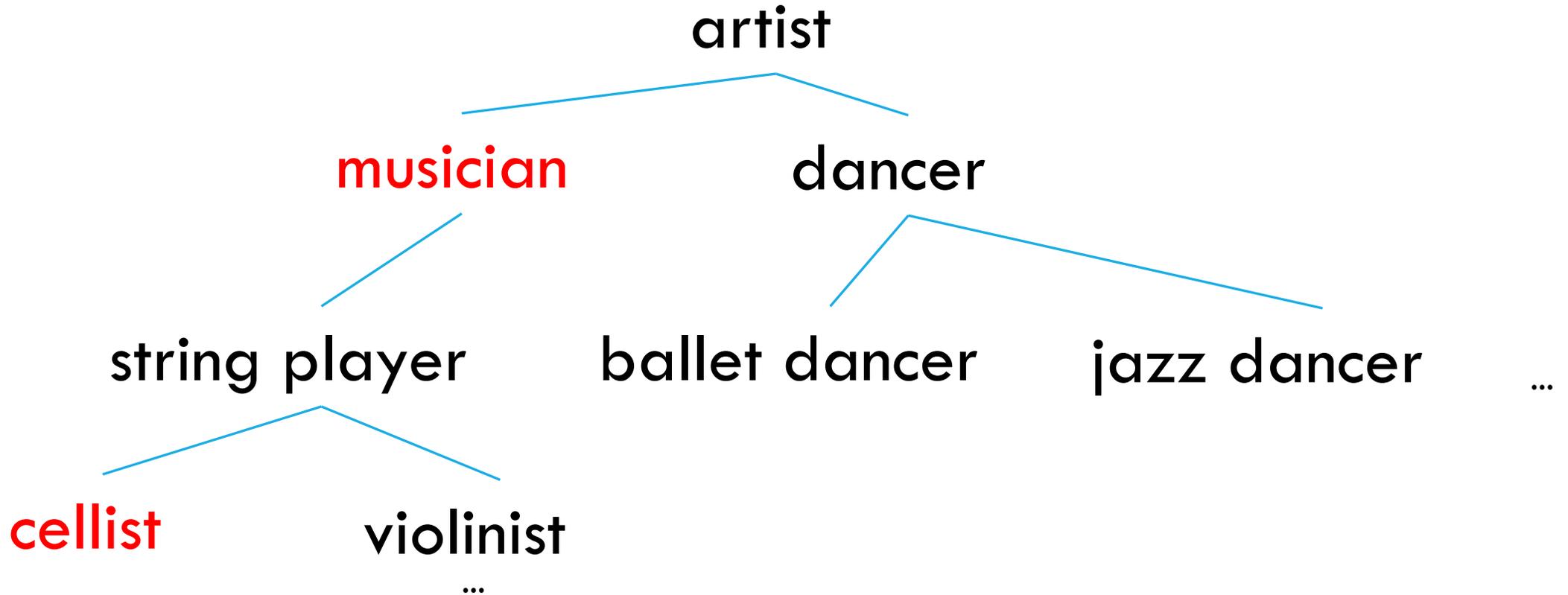
more specific / less general

TAXONOMIC HIERARCHY

less specific / more general



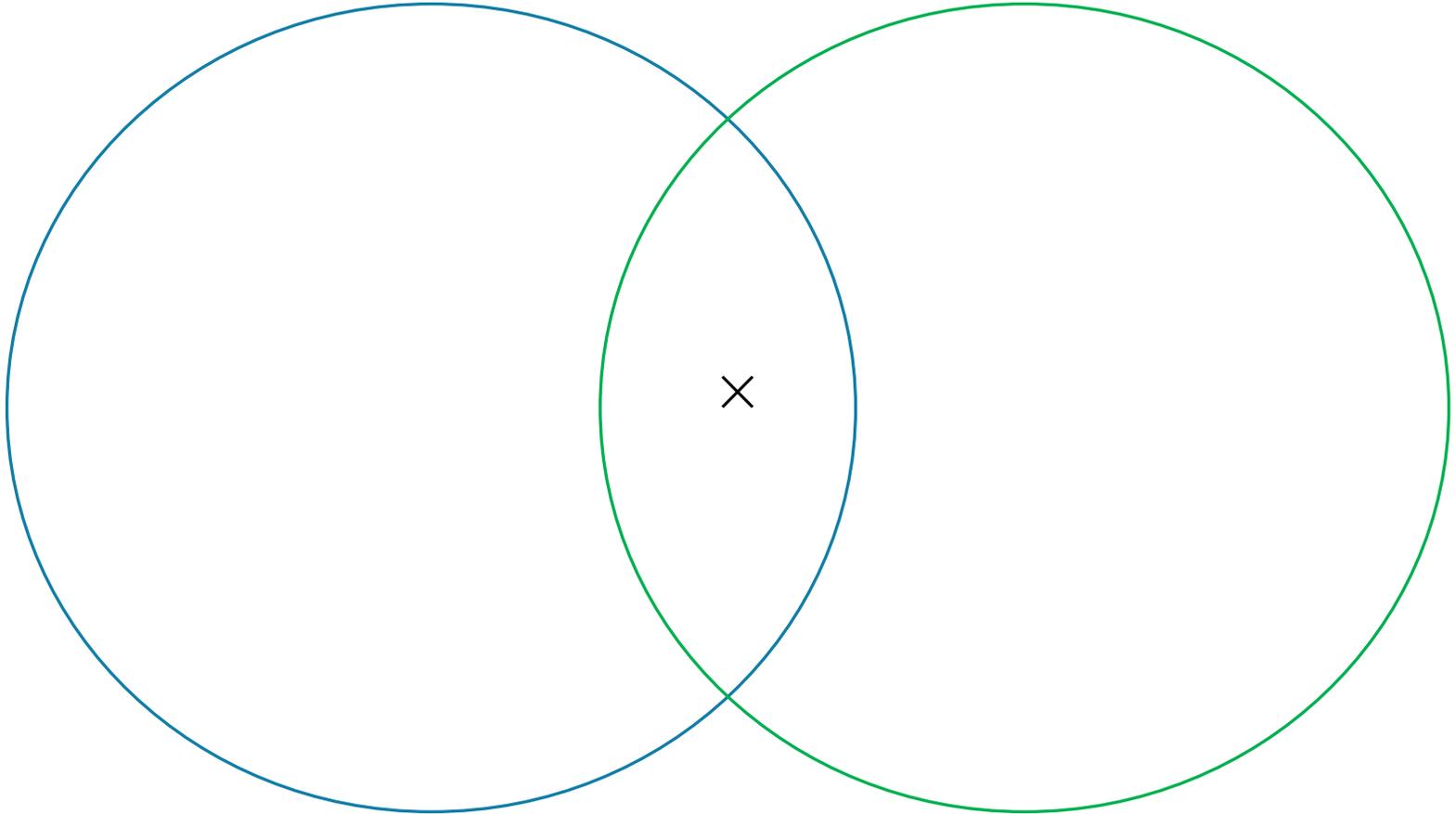
more specific / less general



DOES A ENTAIL B?

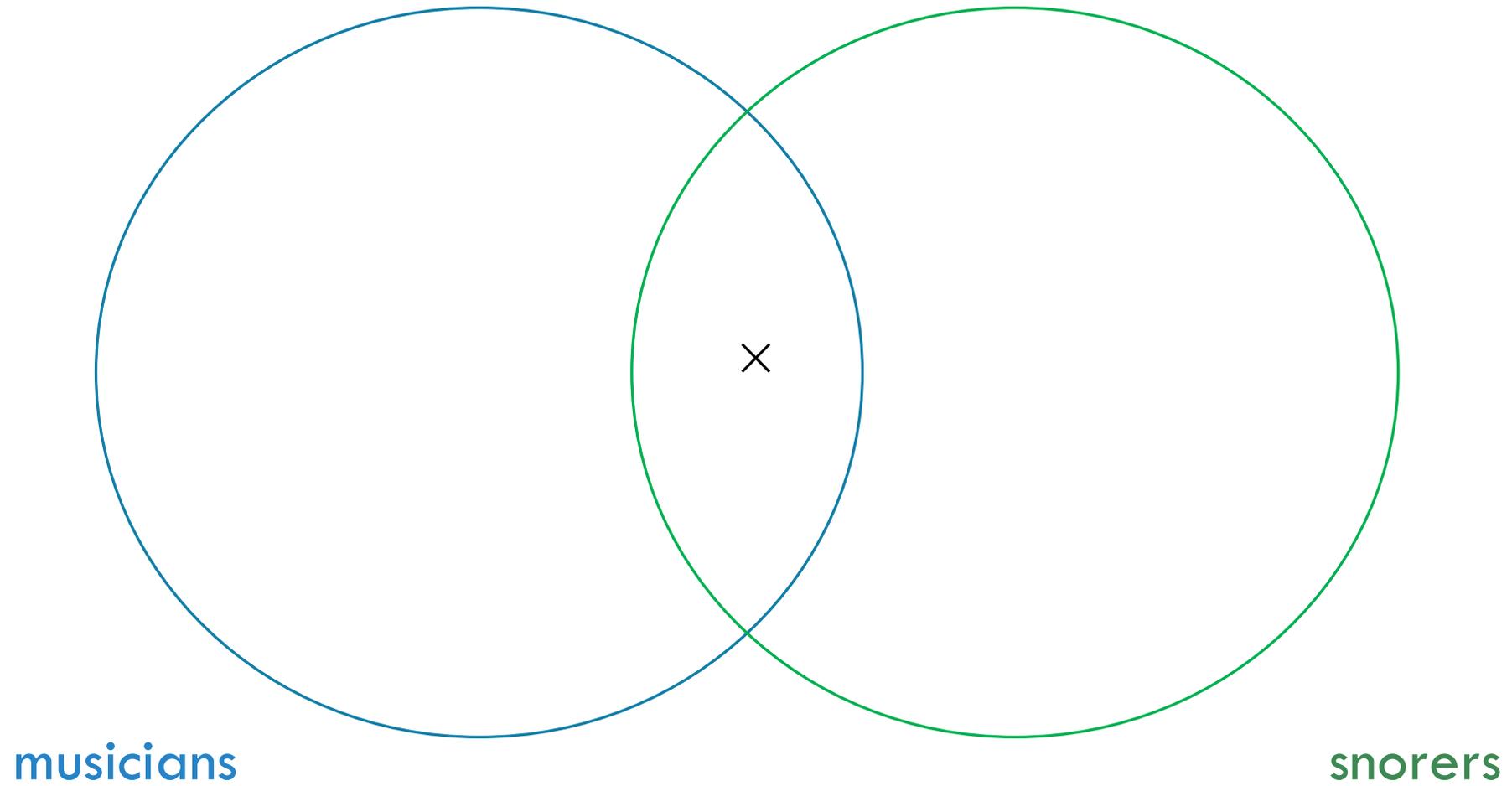
A: Some musicians snore.

B: Some cellists snore.

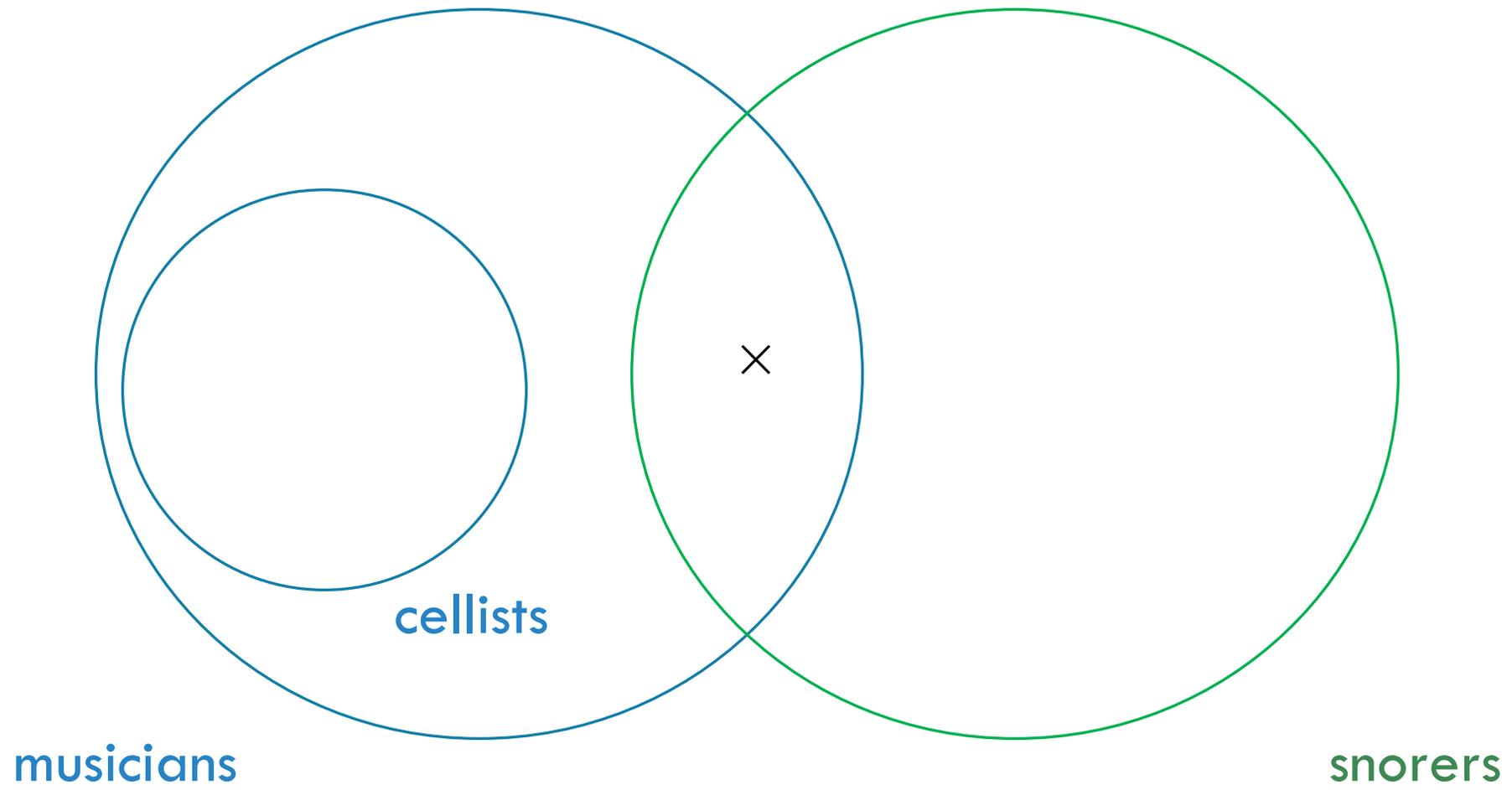


musicians

snorers



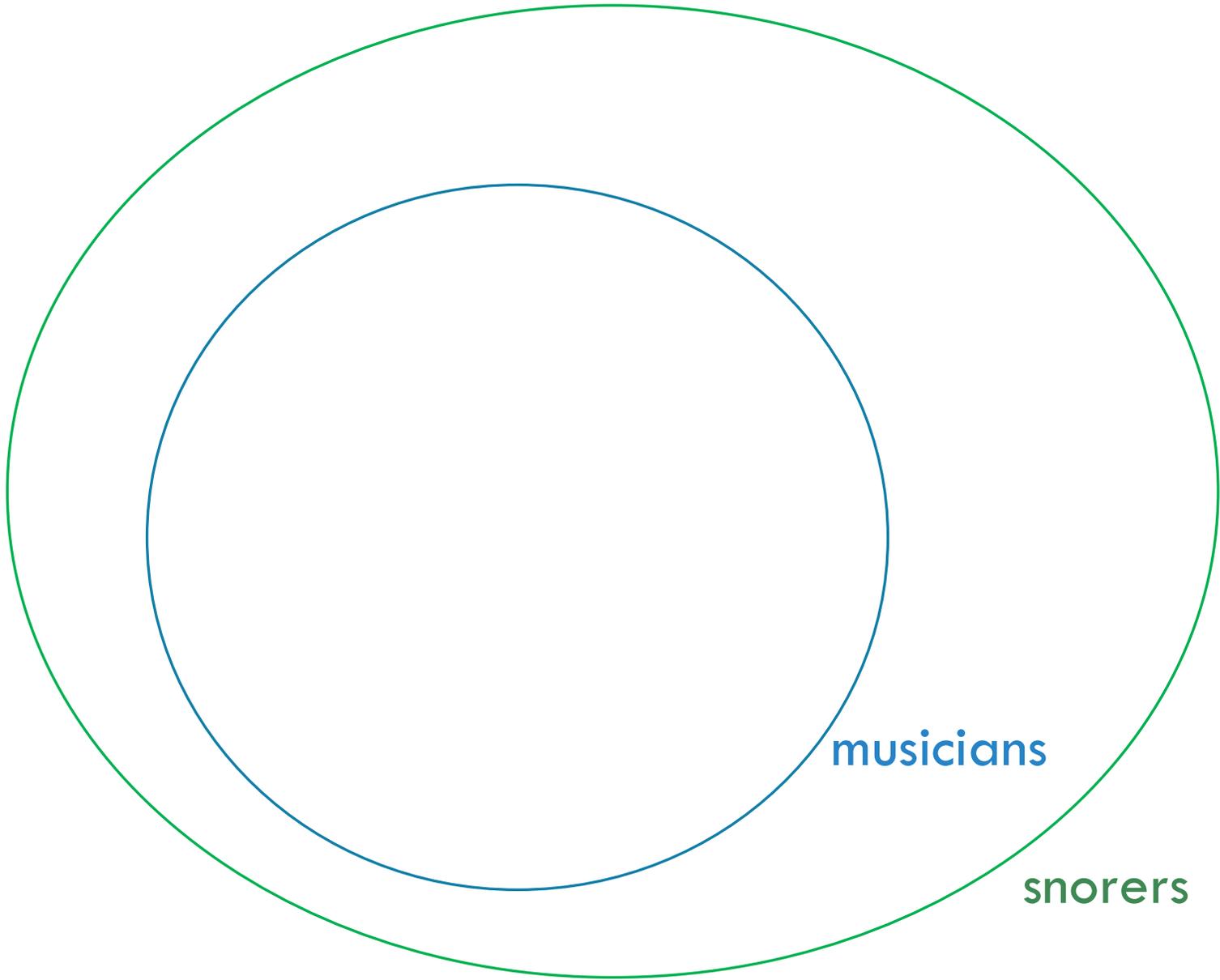
Some Xs are Ys: The intersection of Xs and Ys is non-empty



DOES A ENTAIL B?

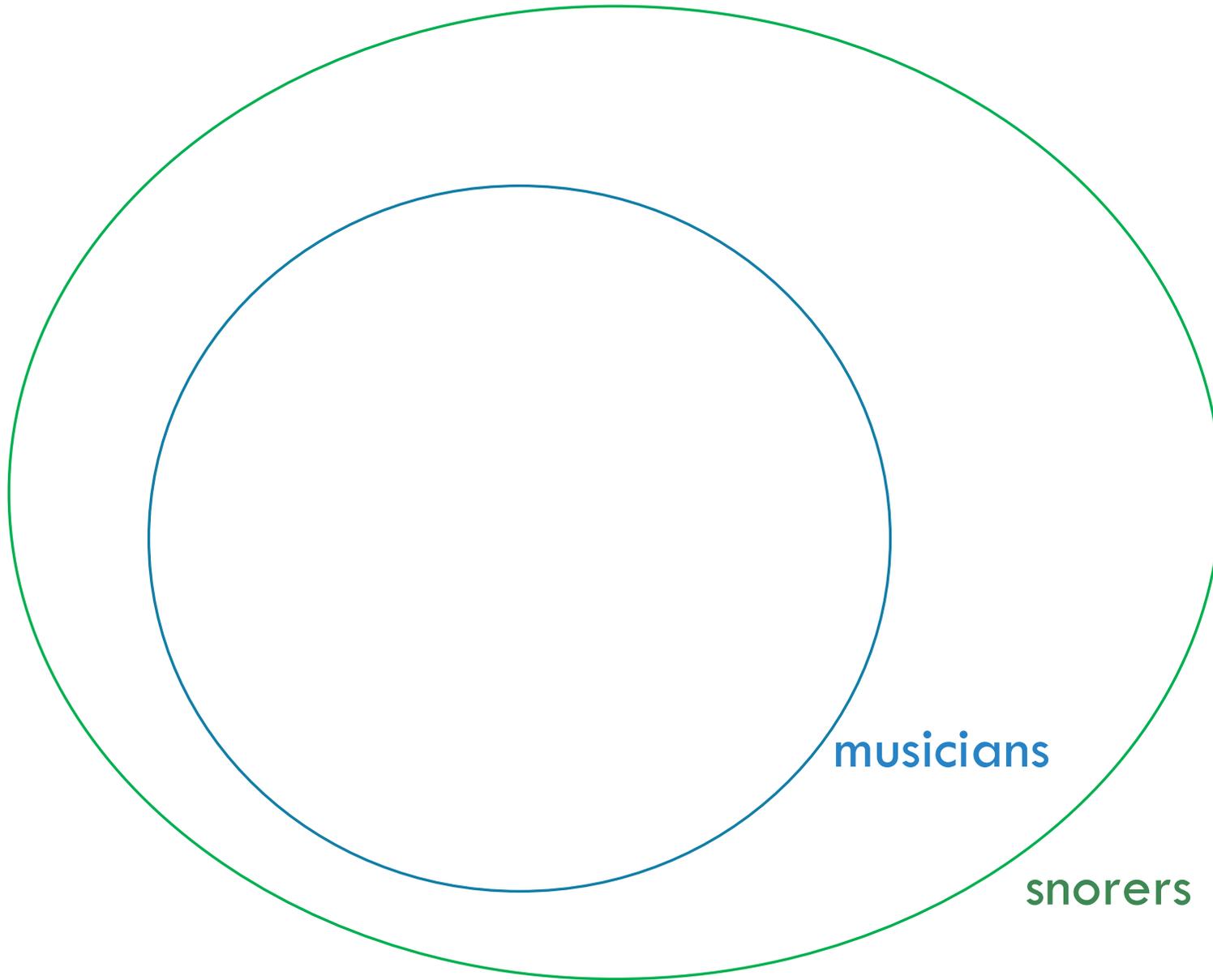
A: Every musician snores.

B: Every cellist snores.

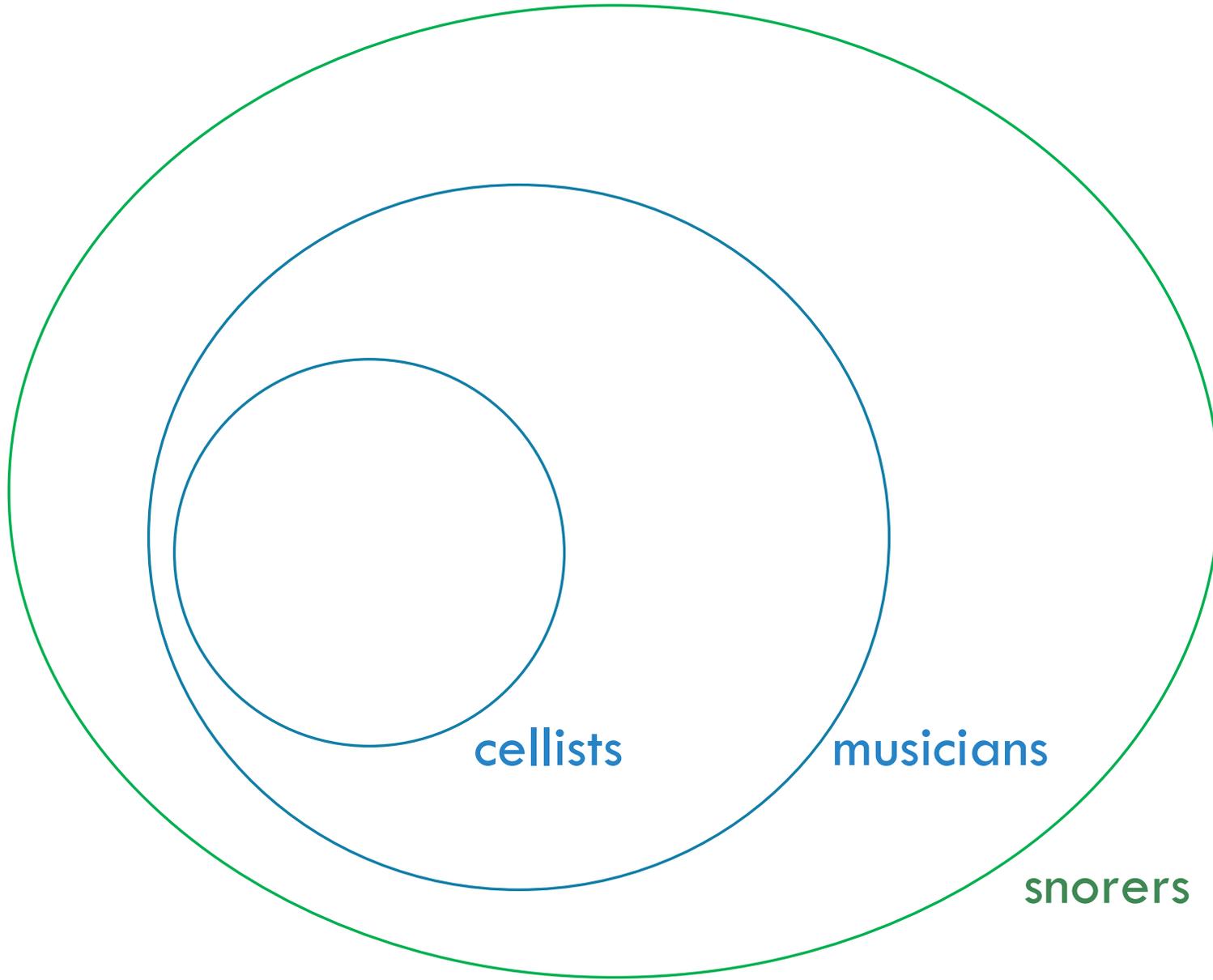


musicians

snorers



Every X is a Y: The Xs form a subset of the Ys.



cellists

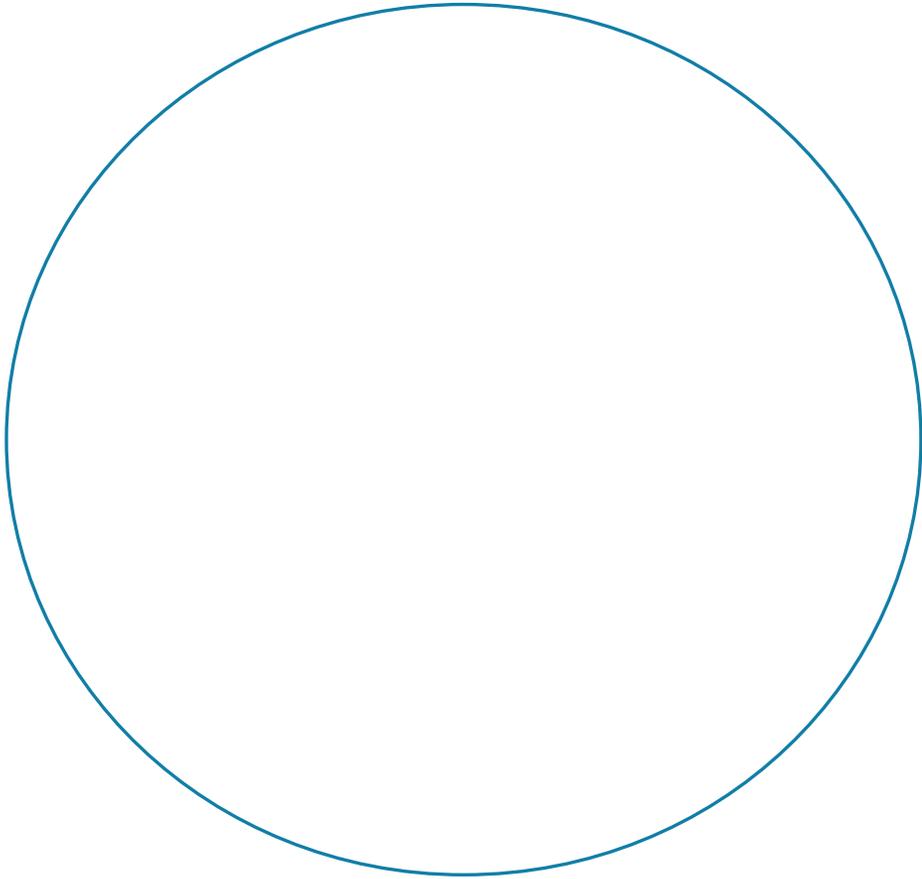
musicians

snorers

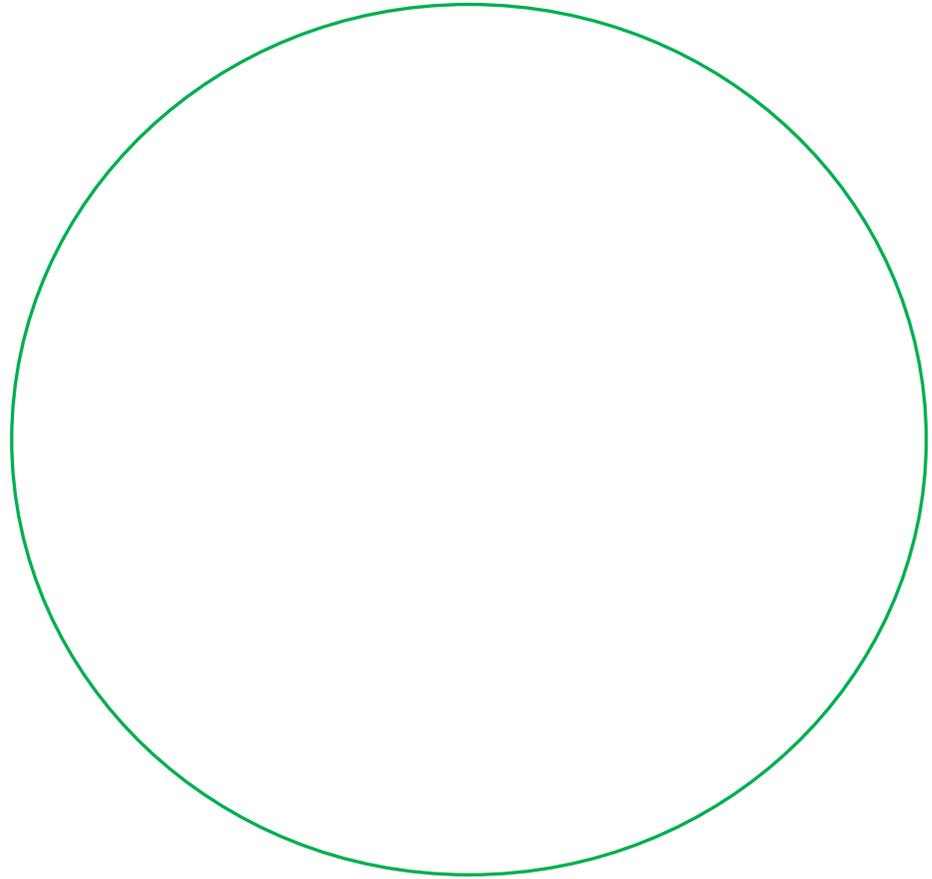
DOES A ENTAIL B?

A: No musician snores.

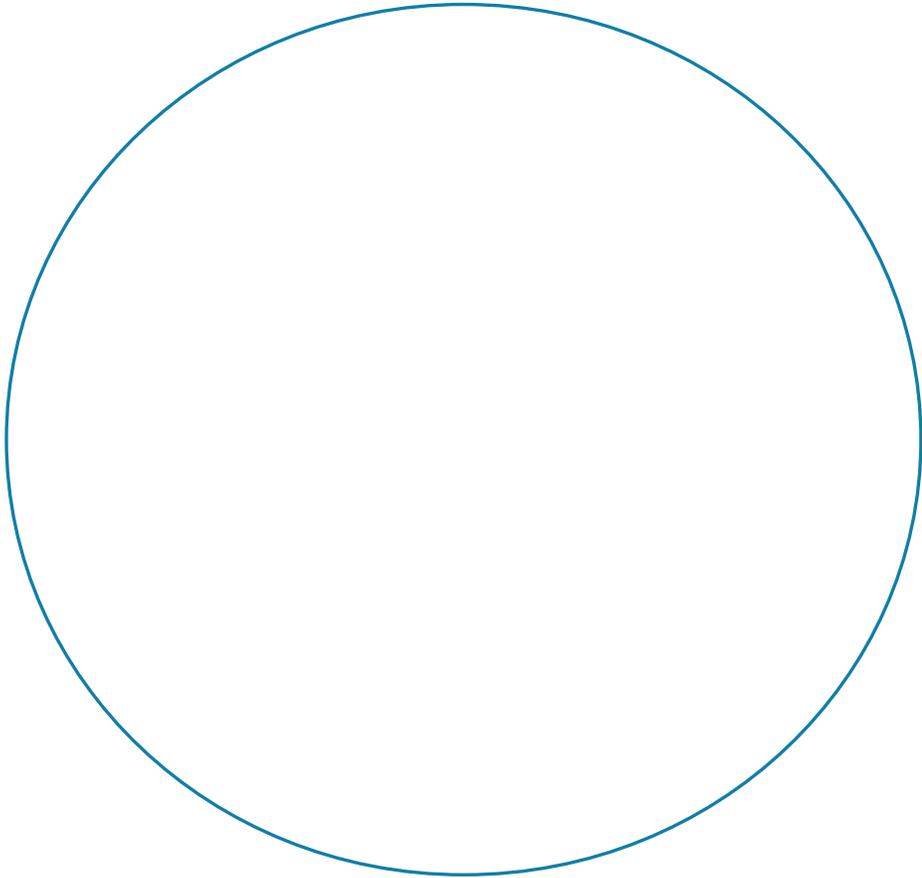
B: No cellist snores.



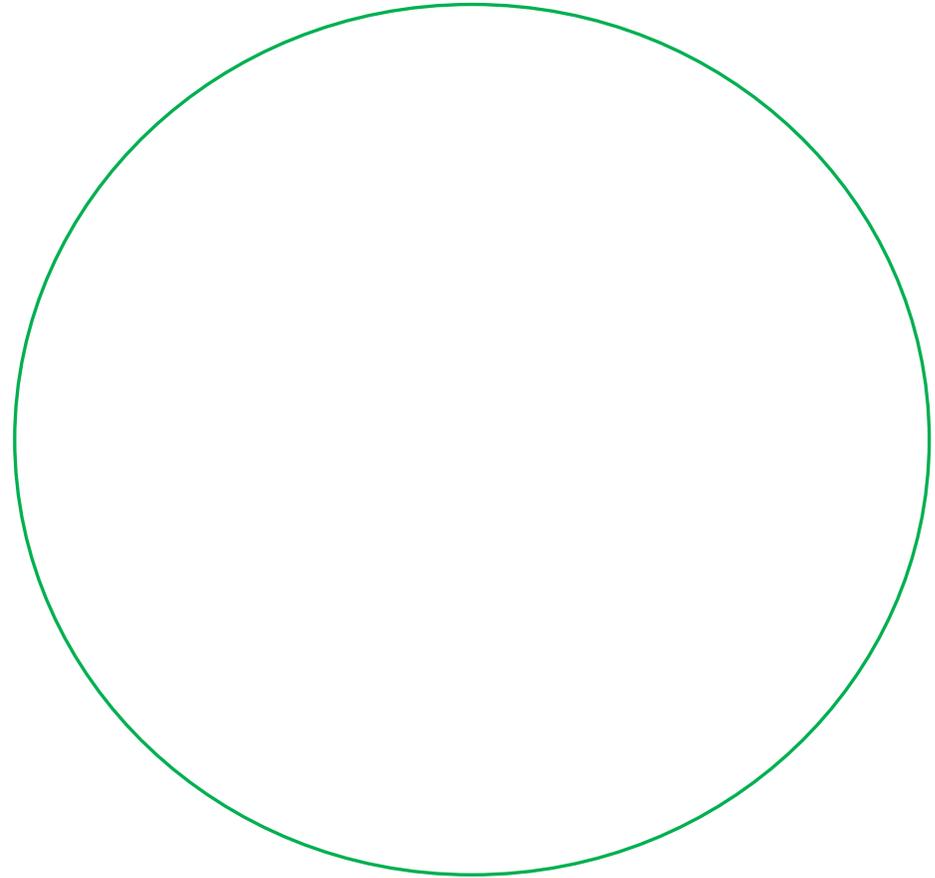
musicians



snorers

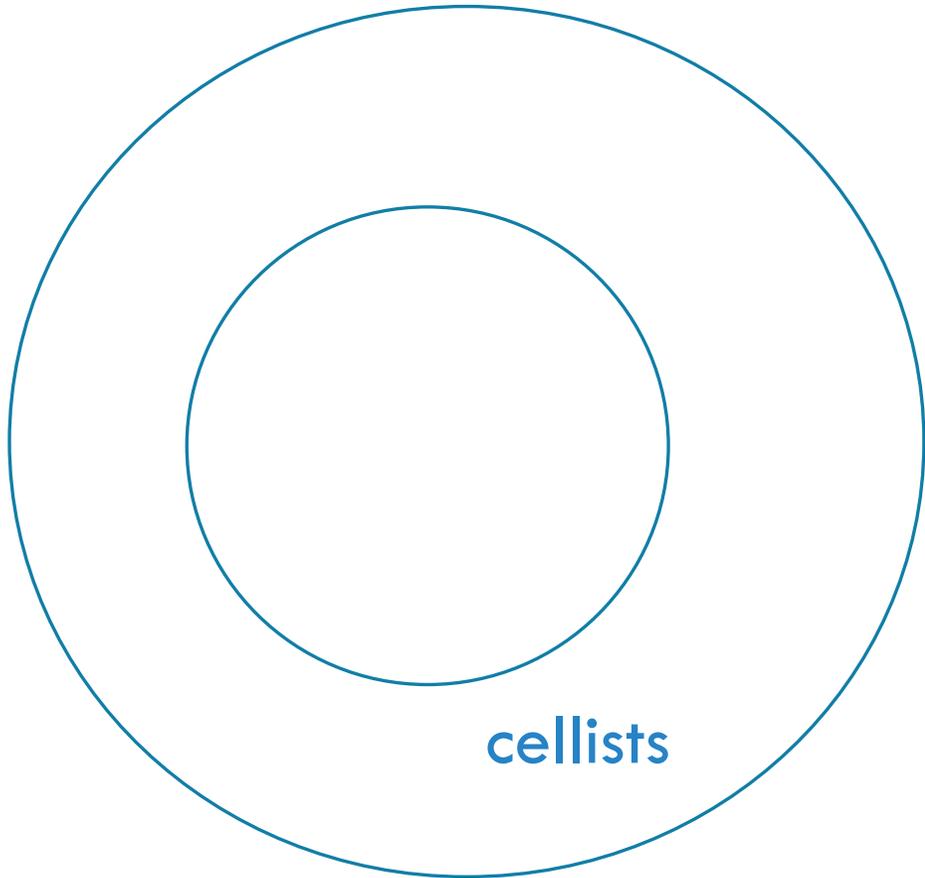


musicians



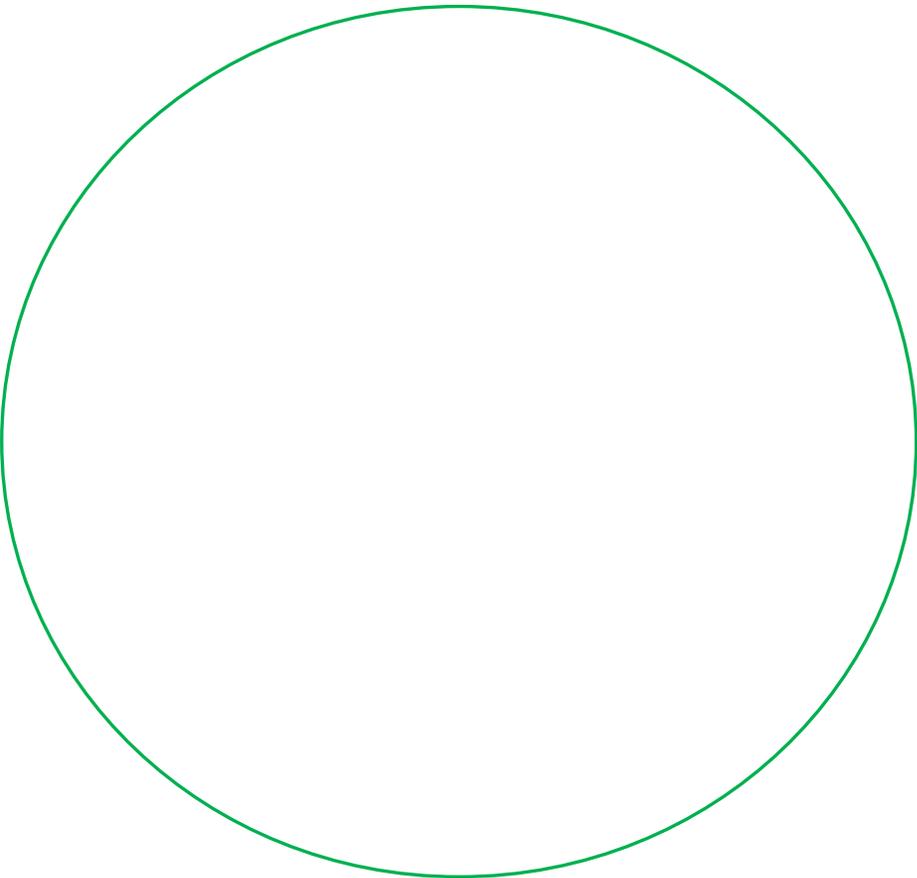
snorers

No X is a Y: The intersection of the Xs and the Ys is empty.



cellists

musicians



snorers

SUMMARY

In a sentence of the form [D NP] VP

If you replace NP with a more specific term (going *down* the taxonomic hierarchy), is the result entailed by the original sentence?

It depends on what the D is.

SUMMARY

[D NP] VP

- *some*: no
- *every*: yes
- *no*: yes

DOES A ENTAIL B?

A: Some musicians snore.

B: Some musicians snore loudly.

DOES A ENTAIL B?

A: Every musician snores.

B: Every musician snores loudly.

DOES A ENTAIL B?

A: No musician snores.

B: No musician snores loudly.

SUMMARY

[D NP] VP

- *no*: *yes*
- *every*: *yes*
- *some*: *no*

[D NP] VP

- *no*: *yes*
- *every*: *no*
- *some*: *no*

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Negative Polarity Items are licensed only in downward-entailing environments.