# *Never* in the wrong place,
# an ERP study on the processing of the Italian word *mai*.

Aspects of pragmatic processing, Rovereto, 15 may 2013

# psycholinguistics and ERPs

goals — language-related mechanisms ⟷ cognitive processes

ERPs ⟶ *conflicts*

- morpho-syntactic conflicts

Kaan and Swab (2003)

# the child **throw** the toy

the children **throw** the toy

(LAN) / P600

- conceptual/lexical conflicts

Kutas and Hylliard (1980)

she spread the warm bread with **butter**

she spread the warm bread with **socks**

N400

# psycholinguistics and ERPs

ERPs ⟶ *conflicts and temporal direction*

- linguistic conflicts

Kaan and Swab (2003)

# the child **throw** the toy

the children **throw** the toy

LAN / P600

- non-linguistic (conceptual) conflicts

Kutas and Hylliard (1980)

she spread the warm bread with **butter**

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N400

*backward oriented conflicts*

- unpredictable vs. highly predictable words

Schwanenflugel and LaCount (1988)

He caught a pass and scored another touchdown. There was nothing he enjoyed more than a good game of ... **football / baseball / monopoly**

N400

*forward oriented conflicts*

# Negative Polarity Item (NPI) violations

NPI: *ever*, *any*, *jemals*, *mai*

Saddy et al. (2004)

*a man with a beard was **ever** happy

no man with a beard was **ever** happy

violation of a linguistic rule

P600

N400

**why?**

unexpected word, lexical conflict

task-related effect (conflict monitoring)

semantic/logical violation

last resort, unconvincing

**N400**: (Saddy, Drenhaus and Frisch, 2004; Pablos, Shirley, Erdocia, Laka, Williams and Saddy, 2011)
**N400 + P600** (Drenhaus, Błaszczak and Schütte, 2007; Steinhauer, Drury, Portner, Walenski and Ullman, 2010)

# roadmap of the talk

- NPIs and their semantics:
  *multidimensionality of meaning*

- the case of Italian *mai*:
  questions about its on-line processing

- ERP experiment exploring violations of *mai:*
  implications for cognitive models on NPI processing

# NPIs and their semantics: *multidimensionality of meaning*

NPI licensing: NPIs like negative contexts...

...but also non-negative ones.

neg

a. No man has *ever* set foot on the moon.
b. I doubt that a man has *ever* set foot on the moon.

non-neg

c. If a man has *ever* set foot on the moon, he would be a fan of the Police.
d. Every man who has *ever* set foot on the moon is famous.
e. Before a man had *ever* set foot on the moon,
we thought it was an impossible venture.
f. The moon is the farthest place on which an astronaut has *ever* walked.
g. Have you *ever* set foot on the moon?

what do these contexts have in common?

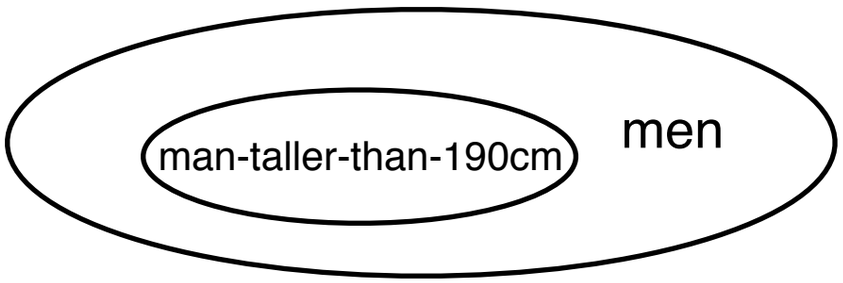
they license entailment from set to proper subsets,
they are *DOWNWARD ENTAILING*
(Ladusaw's generalization)

# NPIs and their semantics: *multidimensionality of meaning*

*DOWNWARD ENTAILING*

No man has *ever* set foot on the moon.
No man taller than 190 cm has *ever* set foot on the moon.

Every man who has *ever* set foot on the moon is famous
Every man taller than 190 cm who has *ever* set foot on the moon is famous




*UPWARD ENTAILING*

A man taller than 190 cm has ~~*ever*~~ set foot on the moon.
A man has ~~*ever*~~ set foot on the moon.

they license entailment from set to proper subsets,
they are *DOWNWARD ENTAILING*
(Ladusaw's generalization)

# NPIs and their semantics: *multidimensionality of meaning*

they license entailment from set to proper subsets,
they are *DOWNWARD ENTAILING*
(Ladusaw's generalization)

linguistic question: why does NPIs behave this way?

accidental property shared by every language in the world
or..

it is the consequence of something deeper

↘ NPIs distribution is determined by their **meaning**
(Kadmon & Landman, 1993; Krifka, 1995; Lahiri, 1998;
Chierchia, 2004, 2006, to appear)

# NPIs and their semantics: *multidimensionality of meaning*

(inspired by Rooth, 1992)

focus sensitive operators: *only, even, contrastive focus* ⟶ activate Domain alternatives

speaker A: did any of your friends vote for Berlusconi?

speaker B: only John and Mary did.

- context provides the Domain: friends = {John, Mary, Anna, Paul}
- *only* activates alternatives
- conventional implicature: they must be entailed by the assertion, otherwise FALSE

J &M & A & P voted for B

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J voted for B | M voted for B | ~~P voted for B~~ | ~~A voted for B~~

# NPIs and their semantics: *multidimensionality of meaning*

(inspired by Chierchia, in press)

*ever* existential quantifier over interval of times

activates domain alternatives

speaker A: have you voted for Berlusconi last elections?

speaker B: a) No I haven't voted for Berlusconi.

b) No I haven't *ever* voted for Berlusconi.

# NPIs and their semantics: *multidimensionality of meaning*

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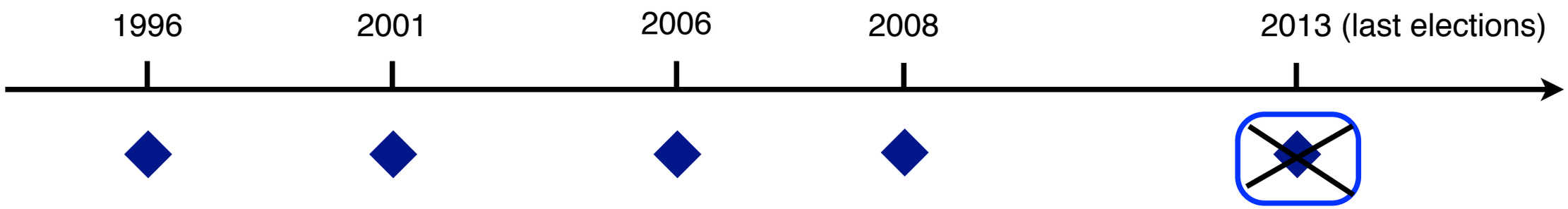

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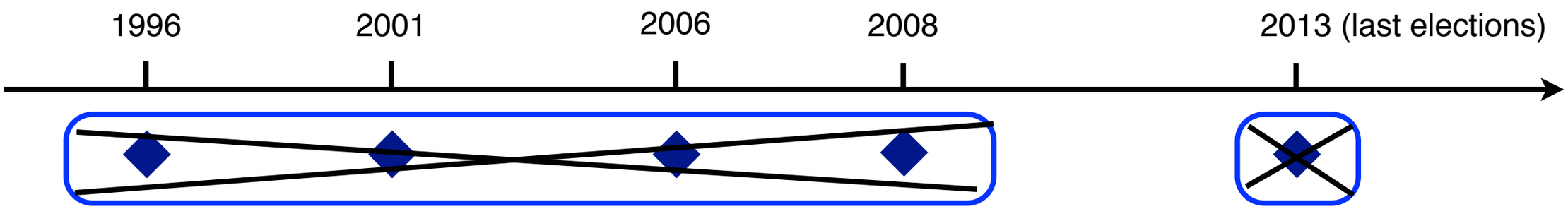


# NPIs and their semantics: *multidimensionality of meaning*

(inspired by Chierchia, in press)

*ever* existential quantifier over interval of times

considers a contrast set (like focus elements)

activates sub-domain alternatives

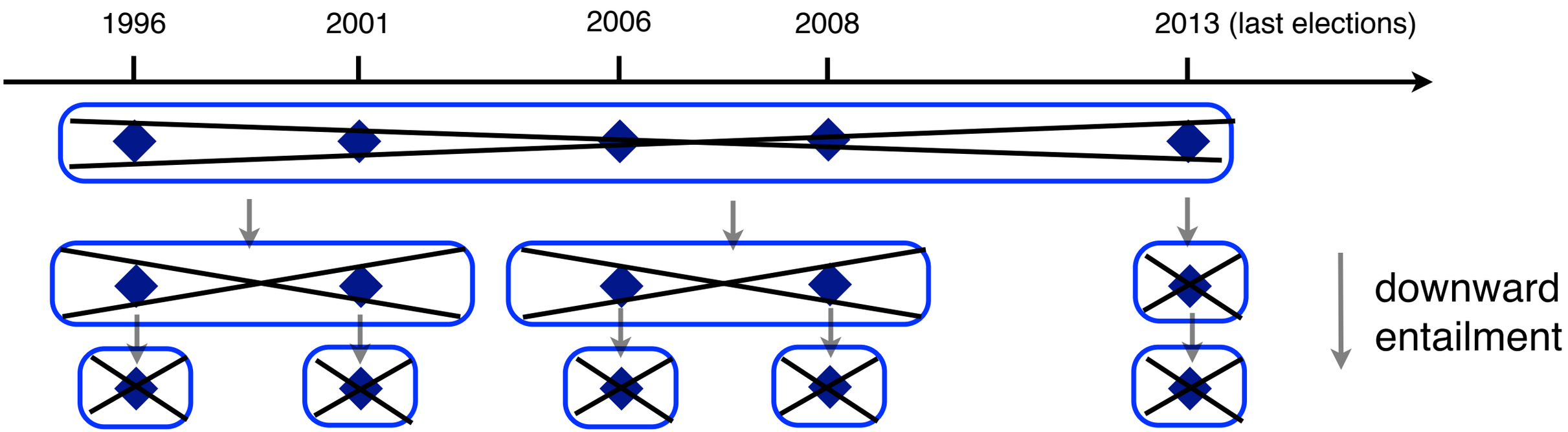
conventional implicature: they must be entailed by the assertion, otherwise FALSE

speaker A: have you voted for Berlusconi last elections?

**OK!**

speaker B: a) No I haven't voted for Berlusconi.

b) No I haven't *ever* voted for Berlusconi.



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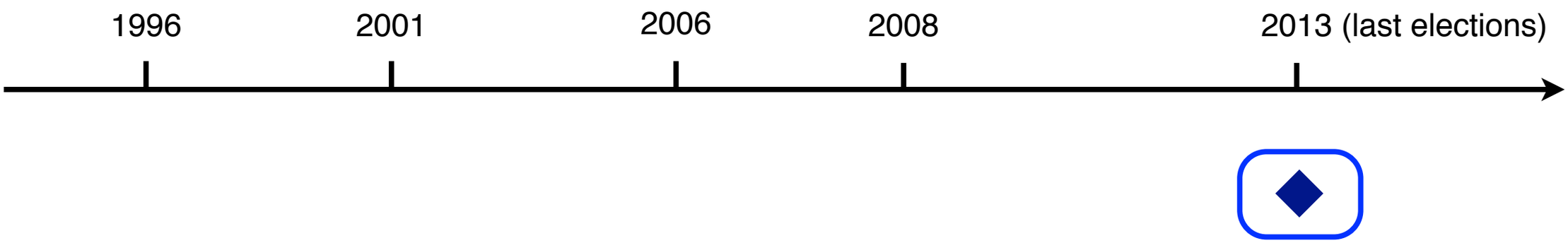

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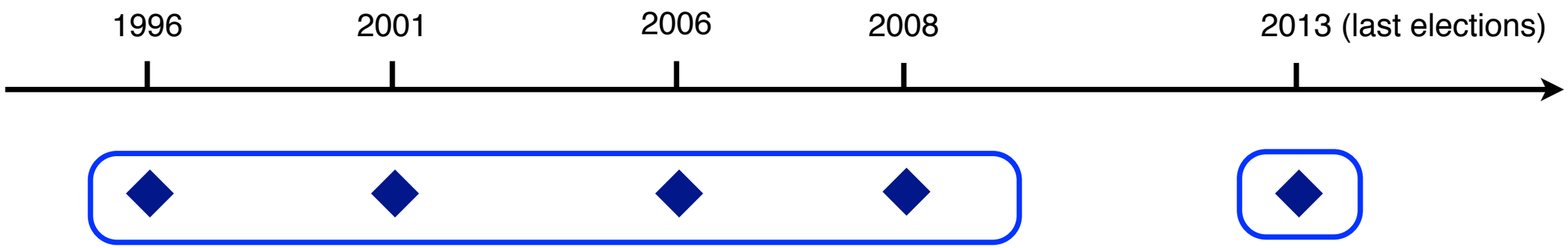

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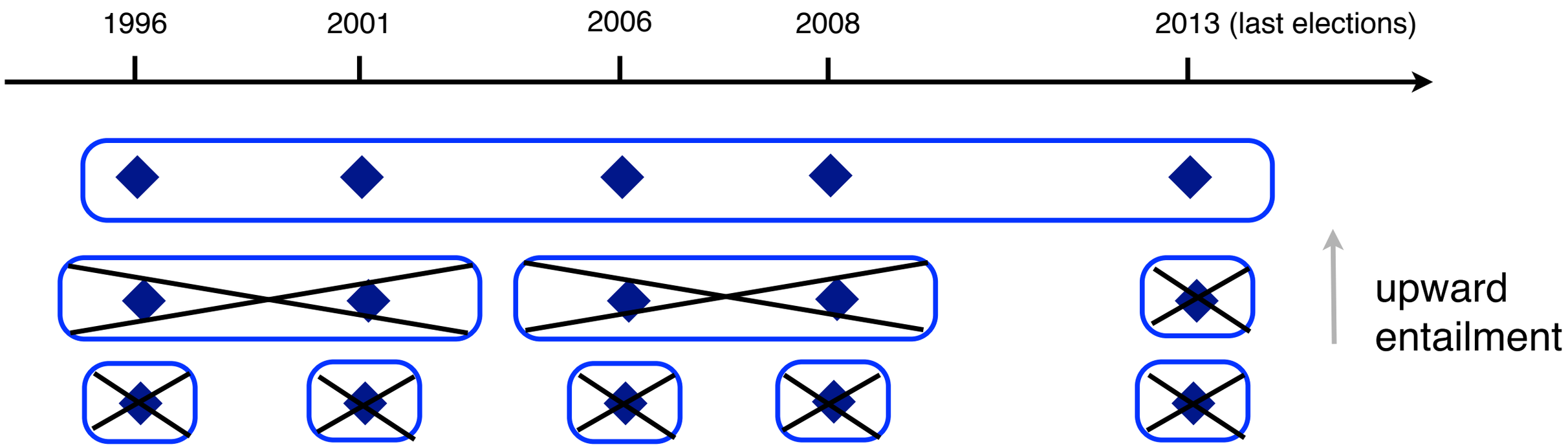

# NPIs and their semantics: *multidimensionality of meaning*

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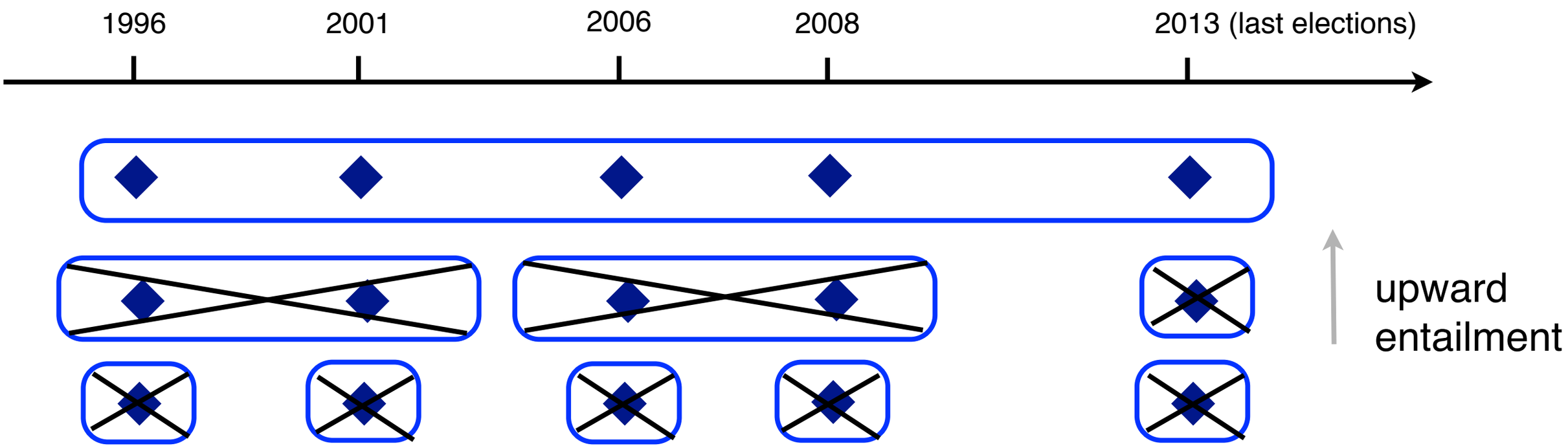
*ever* conventional implicature: they must be entailed by the assertion, otherwise FALSE

there is a *t* in D in which I voted for Berlusconi and for every sub-domain alternative there is not a *t* in which I voted for Berlusconi

⇩

**ANALYTICAL CONTRADICTION**

b) Yes I have *ever* voted for Berlusconi.



# the case of Italian *mai*

- post-verbal position (after the verb or the auxiliary)

*mai* is *ever* = meaning

= distribution

a. Un uomo non ha **mai** camminato sulla Luna.

*A man has not **ever** walked on the Moon*.

b. *Un uomo ha **mai** camminato sulla Luna.

**A man has **ever** walked on the Moon*.

- pre-verbal position (before the verb or the auxiliary)

*mai* means *never* (*ever +* NEG)

c. Un uomo **mai** ha camminato sulla Luna.

*A man has **never** walked on the moon*.

# the case of Italian *mai*

pre-verbal position (before the verb or the auxiliary)

*mai* means *never* (*ever +* NEG)
but only in non-DE contexts!
it means *ever* otherwise.

d. Se io **mai** dovessi andare sulla Luna mi porterei la crema solare.

*If I was **ever** to go on the Moon I would bring the sun protection with me*.

e. Ogni uomo che **mai** sia stato sulla Luna è diventato famoso.

*Every man who has **ever** been on the Moon became famous*.

research question

how does the parser know when *mai* is to be interpreted as *(n)ever*?

on which kind of information does it rely?

when is this info accessed?

# ERP experiment: exploring *mai*

## design

*postverbal*

control

a. Il mister credeva che i ragazzi non avrebbero *mai* giocato sotto la pioggia.
'The coach believed that the boys would not *ever* play under the rain.'

NPI violation

b. *Il mister credeva che i ragazzi avrebbero *mai* giocato sotto la pioggia.
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*preverbal*

preverbal mai

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preverbal violation

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# ERP experiment: exploring *mai*

## design

preverbal mai

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### *perfect system*
### *(predicting monotonicity)*

the parser “knows” whether *mai* is in a DE environment before interpreting it (from semantic or syntactic cues)

performs the right interpretation (negative if not-DE; positive if DE)

### *imperfect system*

the parser does not immediately access the information about the monotonicity of the context

performs the default interpretation of *mai* (NPI) and adds a negation if the interpretation yields an error (non-DE context)

# ERP experiment: exploring *mai*

predictions

*perfect system*
*(predicting monotonicity)*

control - NPI violation

cost of dealing with semantic clash, fixing the structure & meaning

different processes

control - preverbal mai

no clash, no fixing, adding a negation

*imperfect system*
*(repair strategy)*

control - NPI violation

cost of dealing with semantic clash, fixing the structure & meaning

same processes

control - preverbal mai

cost of dealing with semantic clash, adding a negation

# ERP experiment: exploring *mai*

## design

preverbal violation

d. *Il mister credeva che i ragazzi non *mai* avrebbero giocato sotto la pioggia.
'The coach believed that the boys would not *never* play under the rain.'

*fixing negation easily*

the parser fixes the negation, which is indeed present in the sentence, and solves the problem before interpreting *mai*.

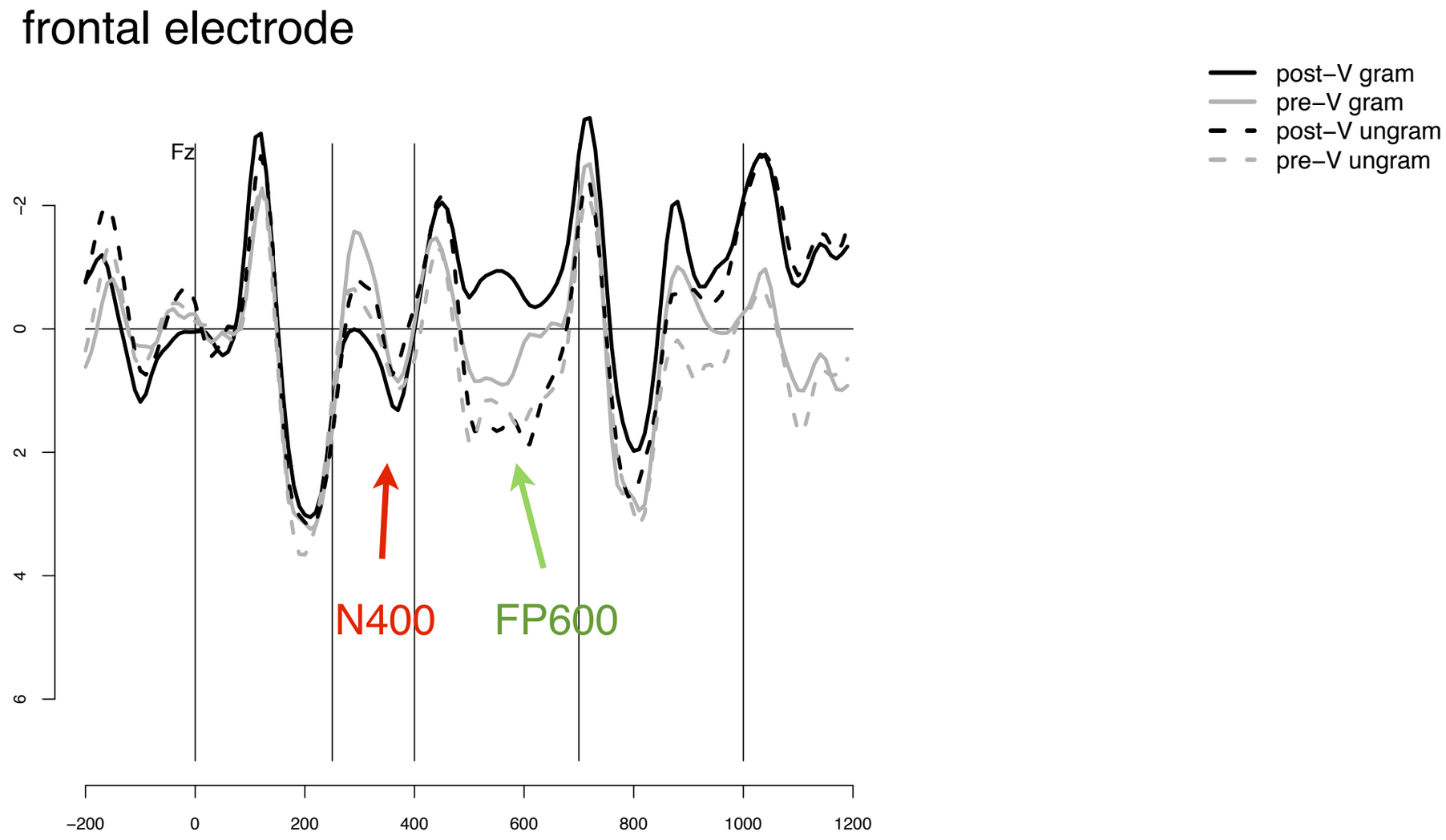
*NPI violation*

the parser interprets *mai* in the wrong context as if it is a NPI violation.

# ERP experiment: exploring *mai*

## results

frontal electrode




control

NPI violation

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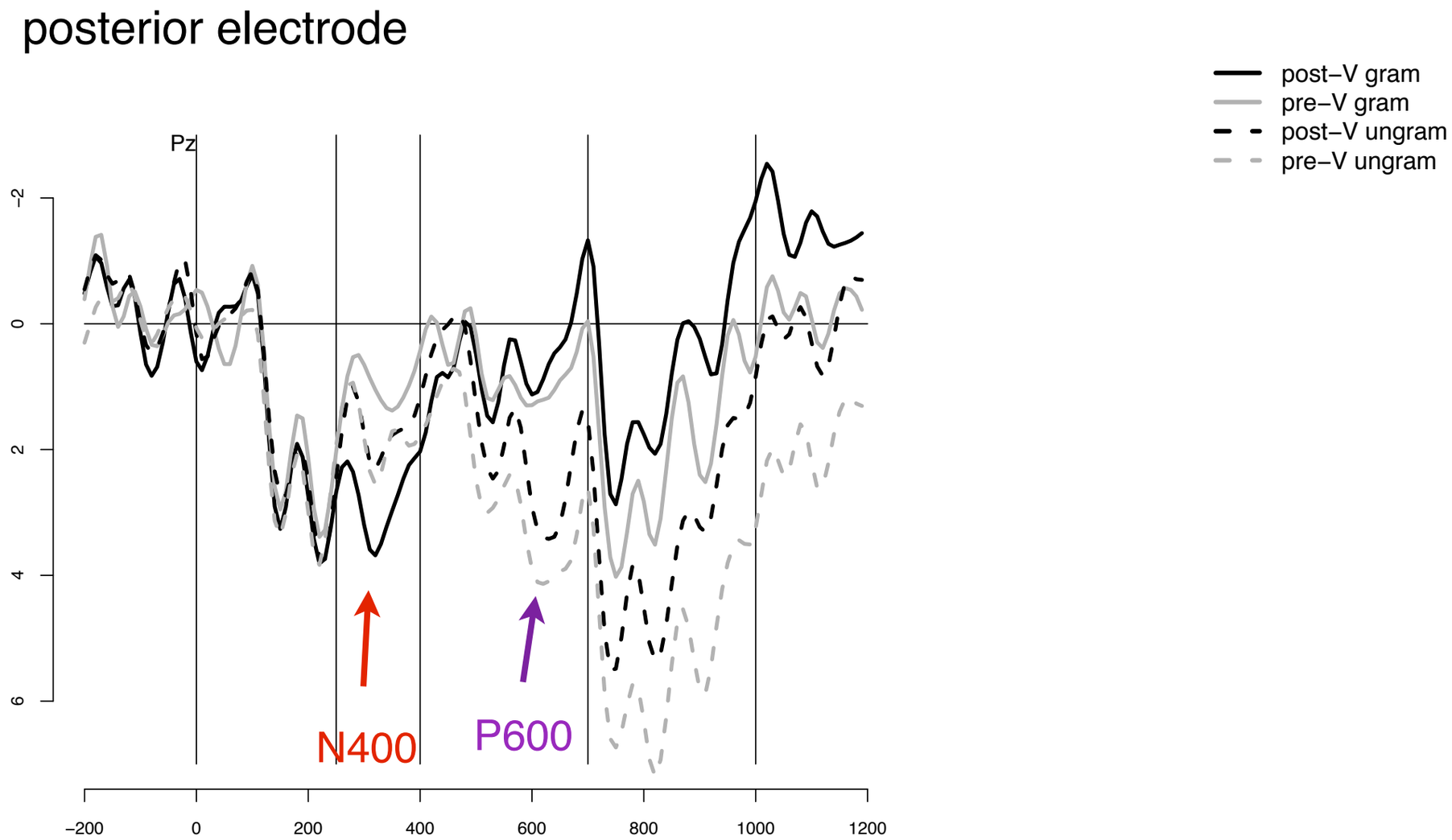


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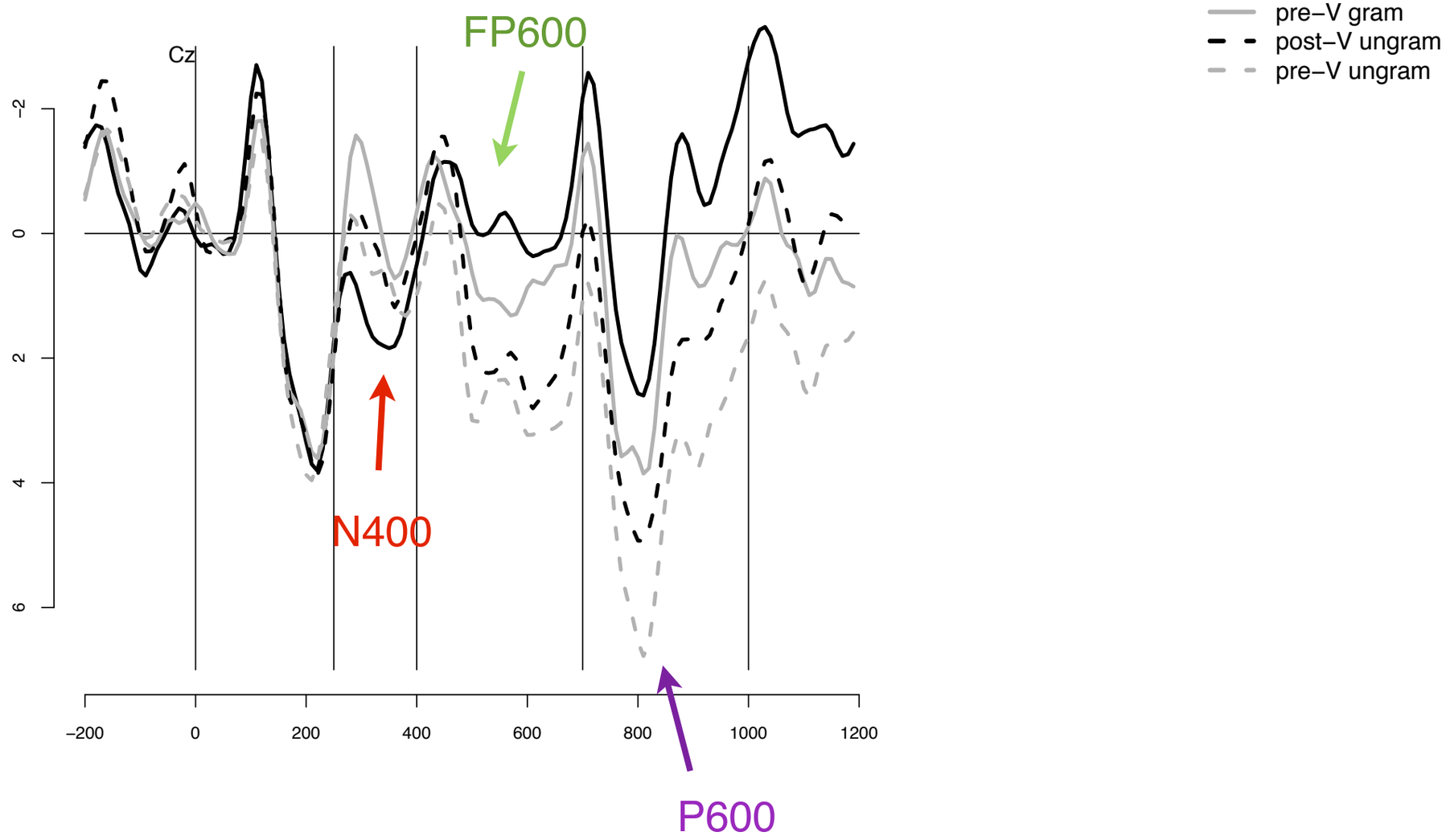
# ERP experiment: exploring *mai*

results

central electrode




NPI violation = preverbal violation = N400 + FP600 + P600

preverbal *mai* = larger N400 + FP600

# ERP experiment: exploring *mai*

## discussion

### grammatical control

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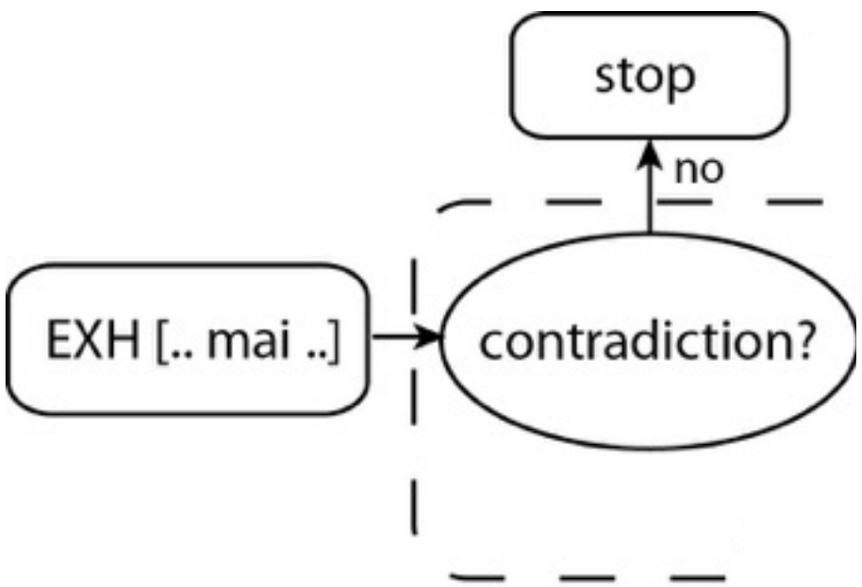

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discussion

preverbal *mai* = bigger N400 + FP600

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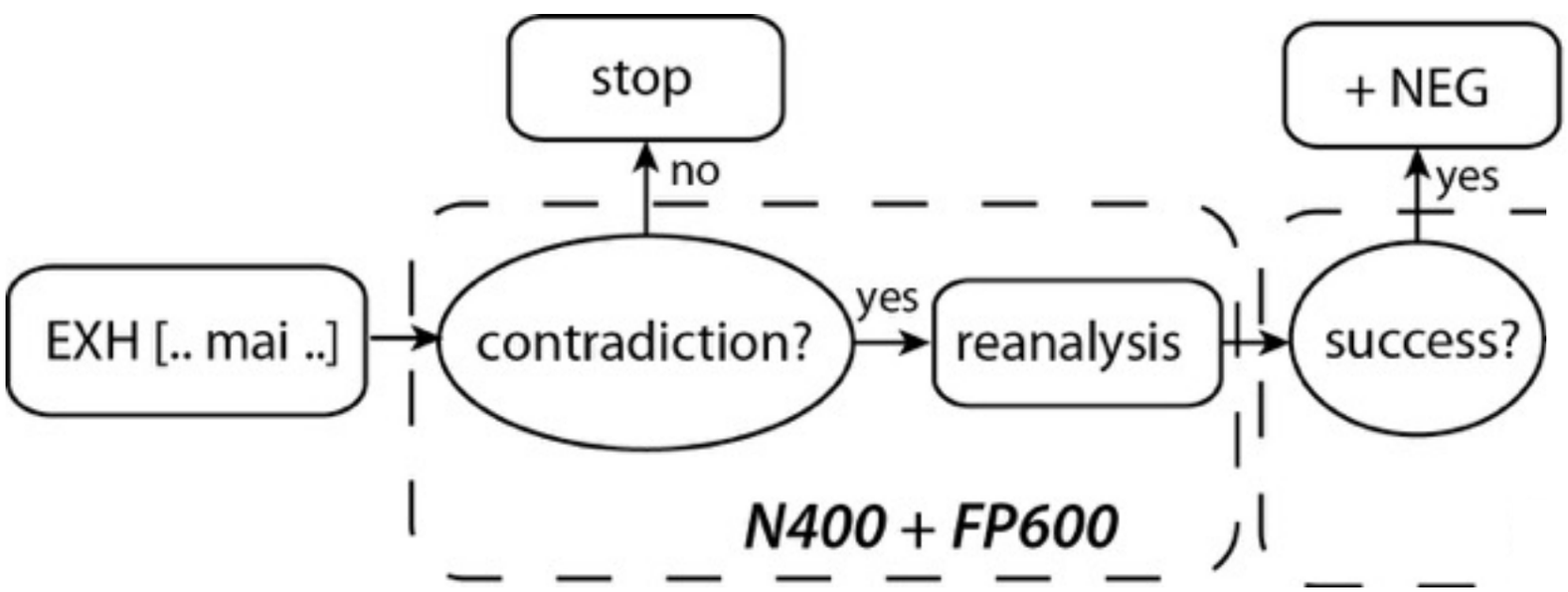

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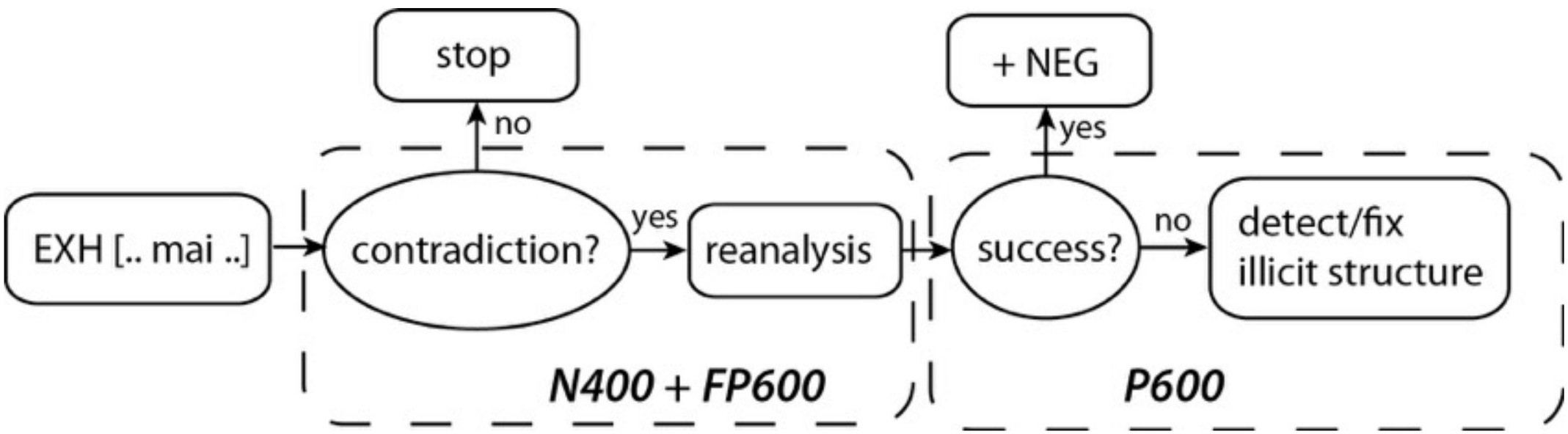

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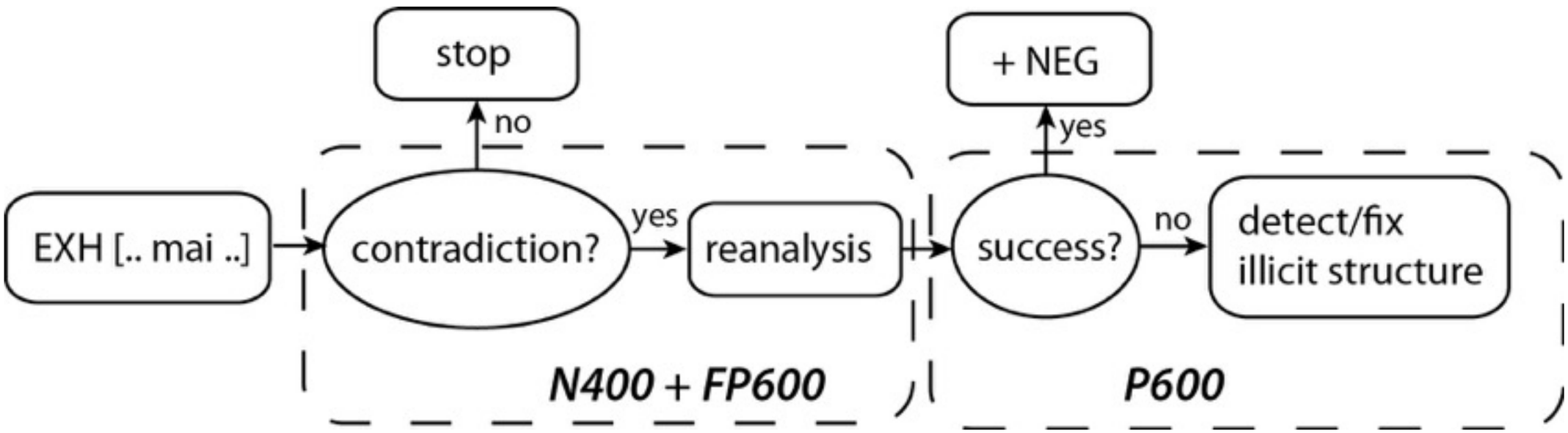

# Negative Polarity Item (NPI) violations

preverbal *mai* = bigger N400 + FP600

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∧

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'The coach believed that the boys would *ever* play under the rain.'

**why?**

- unexpected word, lexical conflict
- task-related effect (conflict monitoring)

wrong predictions!

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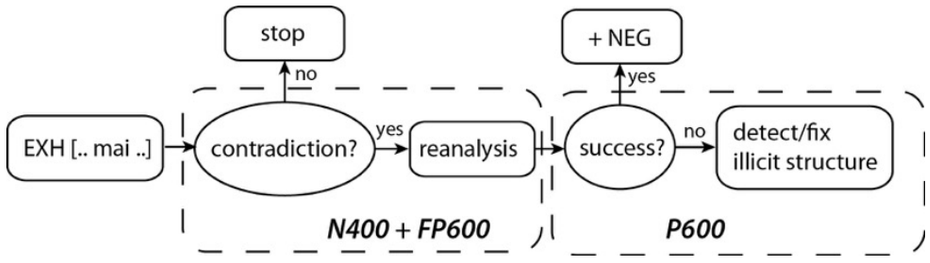


provides a good account

# conclusion

preverbal *mai* = bigger N400 + FP600

c. Il mister credeva che i ragazzi *mai* avrebbero giocato sotto la pioggia.

'The coach believed that the boys would *never* play under the rain.'

adding the negation = repair strategy due to imperfection of the system

cf. Reinhart, 2006

broader implications

- morpho-syntactic conflicts (LAN) / P600
- semantic/logical conflicts N400 / (FP600)
- conceptual/lexical conflicts N400

THANKS FOR THE ATTENTION!