

# Integration of Word Meaning and World Knowledge in Language Comprehension

Peter Hagoort,<sup>1,2,2\*</sup> Lea Hald,<sup>1</sup> Marcel Bastiaansen,<sup>1</sup>  
Karl Magnus Petersson<sup>1</sup>

Although the sentences that we hear or read have meaning, this does not necessarily mean that they are also true. Relatively little is known about the critical brain structures for, and the relative time course of, establishing the meaning and truth of linguistic expressions. We present electroencephalogram data that show the rapid parallel integration of both semantic and world knowledge during the interpretation of a sentence. Data from functional magnetic resonance imaging revealed that the left inferior prefrontal cortex is involved in the integration of both meaning and world knowledge. Finally, oscillatory brain responses indicate that the brain keeps a record of what makes a sentence hard to interpret.



# Stimuli

**correct:**

**world knowledge violation:**

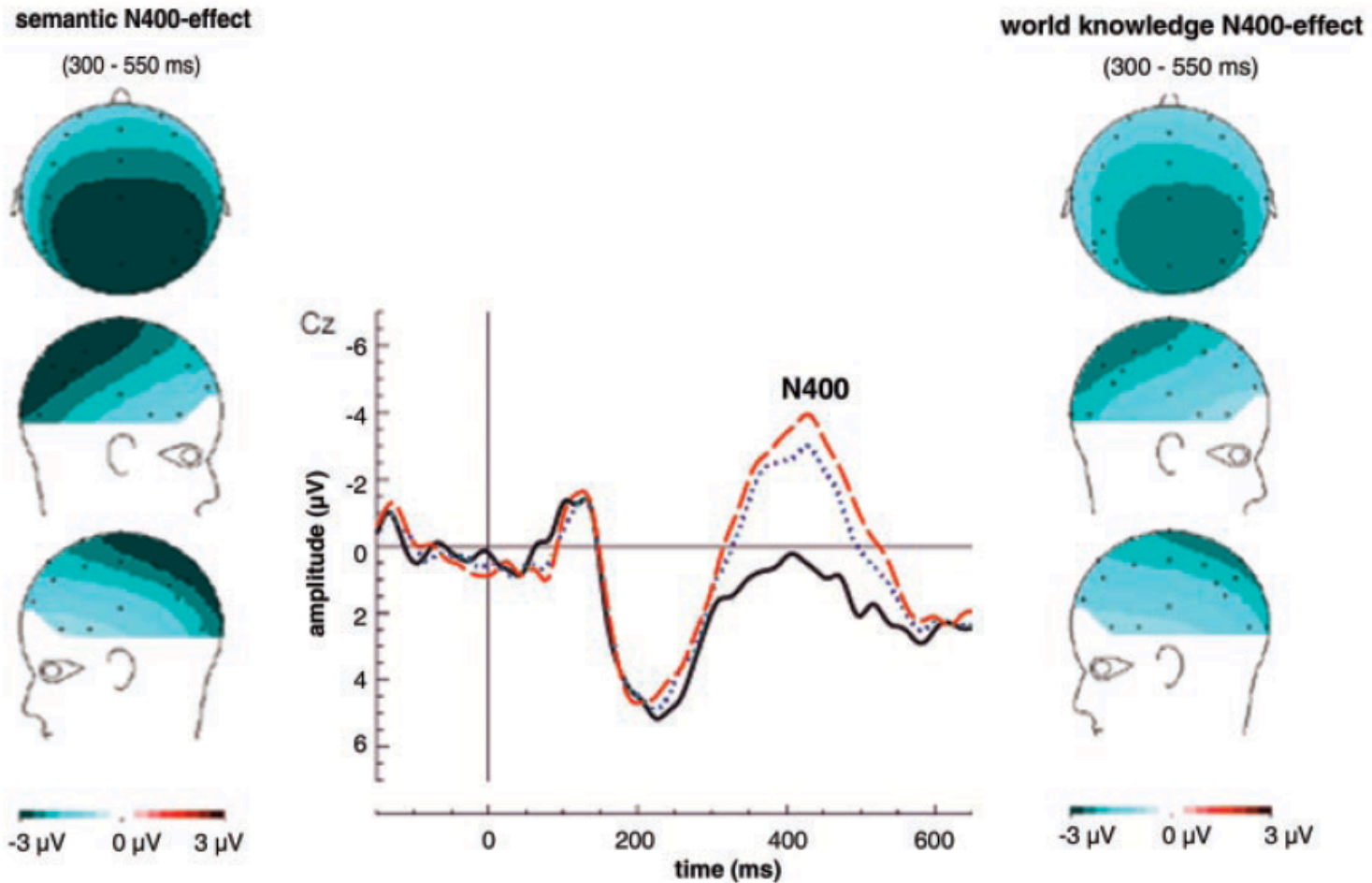
**semantic violation:**

The Dutch trains are yellow and very crowded.

The Dutch trains are white and very crowded.

The Dutch trains are sour and very crowded.

# Main result: identical N400 effects for the two violations



**correct:**

**world knowledge violation:**

**semantic violation:**

The Dutch trains are yellow and very crowded.

The Dutch trains are white and very crowded.

The Dutch trains are sour and very crowded.



## Conclusion

*“While reading a sentence, the brain retrieves and integrates word meanings and world knowledge at the same time ...*

*... it does not take longer to discover that a sentence is untrue than to detect that it is semantically anomalous.”*



## Under the lexical access hypothesis of the N400...

- ... this result is explainable entirely in terms of cloze probability.

correct:

The Dutch trains are yellow and very crowded.

world knowledge violation:

The Dutch trains are white and very crowded.

semantic violation:

The Dutch trains are sour and very crowded.



## What exactly was manipulated?

- According to them:

- **Integration of word meaning.**

- Integration to what? To the syntactic representation that is being built? To some kind of discourse representation? *Dutch trains are sour* is not syntactically or semantically ill-formed -- what it asserts is simply not compatible with the way the world is *in the literal interpretation of the sentence*.

- What would be “semantically ill-formed”?

C.f. *John entered the room happy.* vs.

*??John entered the room intelligent.*

- not a plausibility issue: it is perfectly plausible that there is a time *t* at which John enters the room and at which is is intelligent.



## What exactly was manipulated?

- According to them:
  - **Integration of world knowledge (*Dutch trains are white*).**
    - Sure, but I'd argue that the same holds for *Dutch trains are sour* -- therefore results hardly surprising.