

# Agenda

## Today

- Introduction to the course experiment

## Wednesday

- Methods and measures

## Next Monday

- Fleshing out the (old) course experiment
- **Have read:** Student paper from last semester (S16\_final\_paper.pdf)

## Next Wednesday

- Revising the course experiment
- **Have read:** Demberg & Sayeed (2016)

# INTRODUCTION TO THE COURSE EXPERIMENT

# Follow-up study based on:

## **The Neural Integration of Speaker and Message**

**Jos J. A. Van Berkum<sup>1,2,3</sup>, Danielle van den Brink<sup>3,4</sup>,  
Cathelijne M. J. Y. Tesink<sup>3,4</sup>, Miriam Kos<sup>3</sup>, and Peter Hagoort<sup>1,3,5</sup>**

### **Abstract**

■ When do listeners take into account who the speaker is? We asked people to listen to utterances whose content sometimes did not match inferences based on the identity of the speaker (e.g., “If only I looked like Britney Spears” in a male voice, or “I have a large tattoo on my back” spoken with an upper-class accent). Event-related brain responses revealed that the speaker’s identity is taken into account as early as 200–300 msec after the beginning of a spoken word, and is processed by the same early interpretation mechanism that constructs sentence meaning based on just the words. This finding is difficult to reconcile with standard “Gricean” models of sentence interpretation in which comprehenders initially compute a local, context-independent meaning for the

sentence (“semantics”) before working out what it really means given the wider communicative context and the particular speaker (“pragmatics”). Because the observed brain response hinges on voice-based and usually stereotype-dependent inferences about the speaker, it also shows that listeners rapidly classify speakers on the basis of their voices and bring the associated social stereotypes to bear on what is being said. According to our event-related potential results, language comprehension takes very rapid account of the social context, and the construction of meaning based on language alone cannot be separated from the social aspects of language use. The linguistic brain relates the message to the speaker immediately. ■

### **INTRODUCTION**

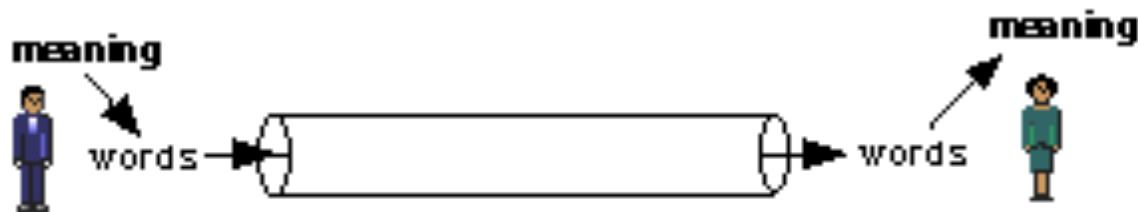
# Van Berkum et al. (2008)

## **The Neural Integration of Speaker and Message**

1. What was the theoretical basis/motivation for the study?
2. What was the specific research question?

# Semantics vs. Pragmatics

## Conduit Metaphor



## Words Don't Mean Things — People Mean Things

→ We almost always mean more than we actually say

*Simon is a very nice man.*

*Nice store you got here. It'd be a shame  
if something happened to it.*

*Is it hot in here?*

# Semantics vs. Pragmatics

## Two Kinds of Meaning

1. Literal or encoded meaning (i.e., message meaning)
2. Speaker meaning (i.e., utterance meaning)

→ The words are just a starting point, a clue to what was really meant

**Semantics:** Rules governing lexical and sentential meaning

**Pragmatics:** Rules governing speaker meaning

# Pragmatics

How does the hearer figure out what the speaker means?

→ “Reading between the lines”

- Much (most?) of communication is via highly-sophisticated inferencing (aka, Gricean reasoning)
  - Rational re-construction of what the speaker likely meant based on set of shared assumptions about how rational speakers behave
  - Implied meanings are a predictable and systematic
- Speaker-specific characteristics (e.g., gender, race) can have a strong effect on language comprehension

# Rubin (1992)

## Participants

- 62 undergrad native speakers of US English

## Procedure

- Listened to a 4-min pre-recorded lecture by a “university instructor” with US accent (Ohio) on introductory topic
  - Half heard a Humanities lecture
  - Half heard a Science lecture
- While listening, participants viewed a photograph meant to represent the speaker
  - Half saw a Caucasian woman
  - The other half saw an Asian woman

## Tasks

- Rated speaker accent, ethnicity, teaching qualifications, etc. (all on 7-point scale)
- Comprehension test



# Rubin (1992)

## Results

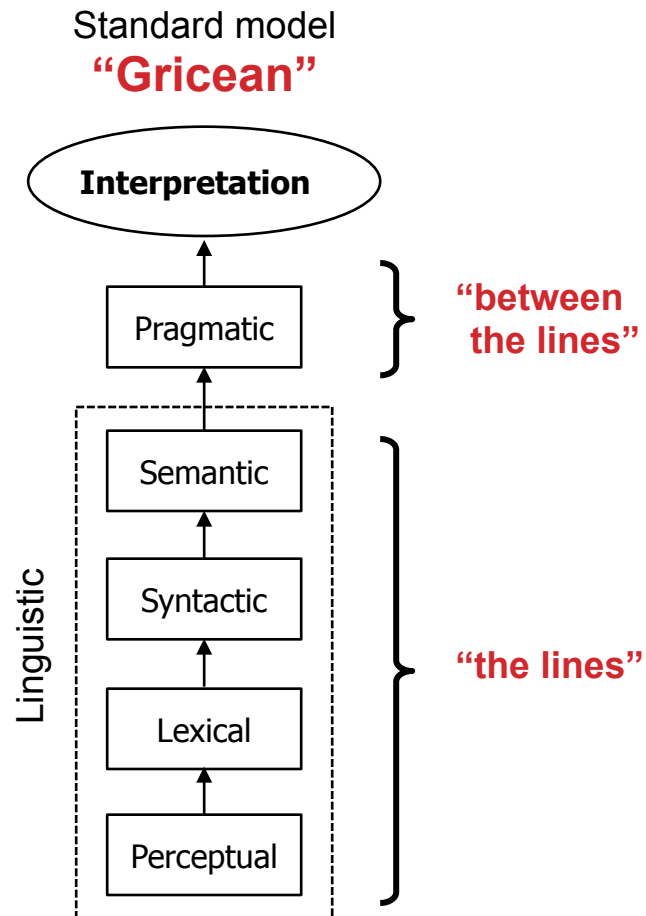
**TABLE 1. Cell Means and Standard Deviations for 8 Dependent Variables (Study I)**

Lecture Topic: Instructor Ethnicity:	Humanities				Science			
	Caucasian		Asian		Caucasian		Asian	
<i>N</i> =	16		17		16		13	
Perceived accent	3.44	(2.56)	4.94	(1.98)	2.75	(2.44)	3.77	(1.88)
Perceived ethnicity	2.75	(1.98)	5.53	(1.97)	2.06	(1.39)	6.23	(0.93)
Comprehension	11.94	(4.34)	9.93	(5.70)	12.5	(5.9)	7.31	(4.70)
Teaching qualifications	8.69	(3.61)	8.18	(1.81)	7.25	(2.46)	9.15	(2.73)
Attitude homophily	5.56	(5.51)	6.00	(4.95)	2.38	(4.24)	3.38	(4.37)
Background homophily	12.75	(4.12)	12.18	(4.03)	13.25	(4.48)	10.31	(3.54)
Values homophily	15.88	(4.53)	14.94	(2.88)	14.81	(3.21)	14.46	(3.86)
Appearance homophily	11.13	(5.04)	10.71	(5.77)	10.13	(4.77)	7.69	(3.22)

→ Non-linguistic information can have strong effect on comprehension

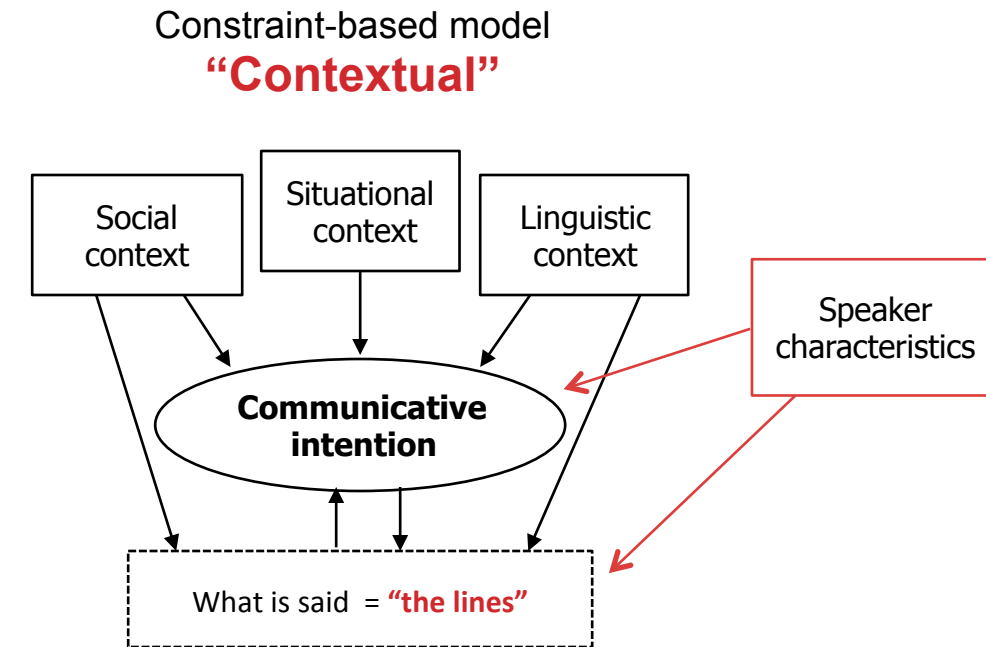
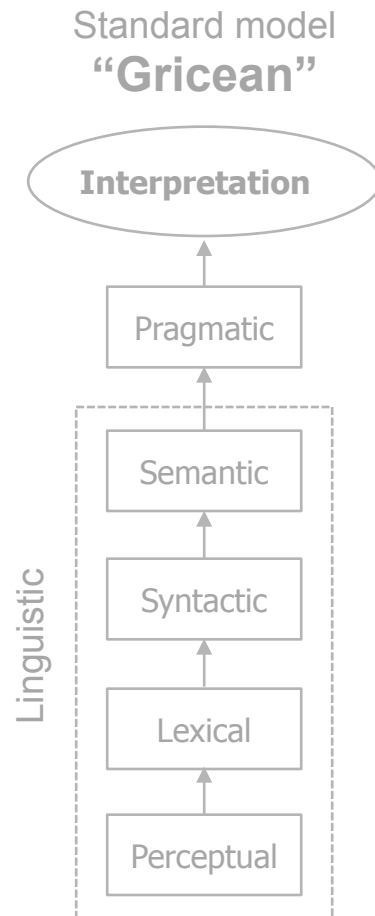
# Semantics vs. Pragmatics

## Language processing architecture



# Semantics vs. Pragmatics

## Language processing architecture



→ Contextual information constrains our expectations and inferences

# Van Berkum et al. (2008)

## The Neural Integration of Speaker and Message

1. What was the theoretical basis/motivation for the study?
  - Debate between Gricean vs. contextual models
2. What was the specific research question?
  - Which of the above models is correct?
  - Can the construction of meaning based on language alone be separated from social aspects of language use?
  - Do listeners model the speaker to help determine what is being said?
  - Are voice-dependent inferences about who is speaking brought to bear on comprehension?
  - Goal is to investigate:
    1. When during auditory language processing is speaker identity as conveyed by voice taken into account, and
    2. Whether it is processed by the same brain system that combines the meanings of individual words into a larger whole

# Van Berkum et al. (2008)

## The Neural Integration of Speaker and Message

1. What was the theoretical basis/motivation for the study?
2. What was the specific research question?
3. What was the Independent Variable(s) and levels?
4. What was the Dependent Variable(s)?

# Van Berkum et al. (2008)

## Independent Variable

“control” condition

- Speaker consistency (consistent, inconsistent) “Experimental” or “critical” contrast
- Semantic anomaly (correct, anomaly) Secondary comparison

Fillers (not manipulated):

- World-dependent anomaly
- True and coherent

## Dependent Variable

- ERP measures (polarity, scalp distribution, latency)
  - N400 effect

# Van Berkum et al. (2008)

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4. What was the Dependent Variable(s) and task?
5. What was the task (what did the participant have to do)?
6. Was it a within-subjects or between-subjects design?

# Van Berkum et al. (2008)

## The Neural Integration of Speaker and Message

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6. Was it a within-subjects or between-subjects design?
7. What steps were taken to eliminate potential confounds and order effects?
8. What potential confounds were not controlled for?

# Van Berkum et al. (2008)

## Steps to control for potential confounds

- Used 3 speaker dimensions to create consistency manipulation
- Used 21 different speakers to avoid idiosyncratic effects of voice
- Matched sound files on prosodic contour, frequency of critical word, duration of critical word, duration of preceding sentence fragment, time from critical word onset to sentence end
- Pseudorandomized Latin Square
  - No participant heard the same sentence in more than one condition, each condition was heard by an equal number of participants
  - To avoid order effects (no more than 2 of same condition in a row)
  - Each speaker produced equal number of consistent vs inconsistent
- Norming test to validate materials
  - Rate on 5-point scale “How normal is it to have speaker say this” (1 = completely normal, 5 = very strange)
- Breaks: 5 blocks of 10 min each to avoid fatigue effects
- Anything that they may have missed?

# Van Berkum et al. (2008)

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8. What potential confounds were not controlled for?
9. What did they find?
10. What did they conclude based on these findings?

# Van Berkum et al. (2008)

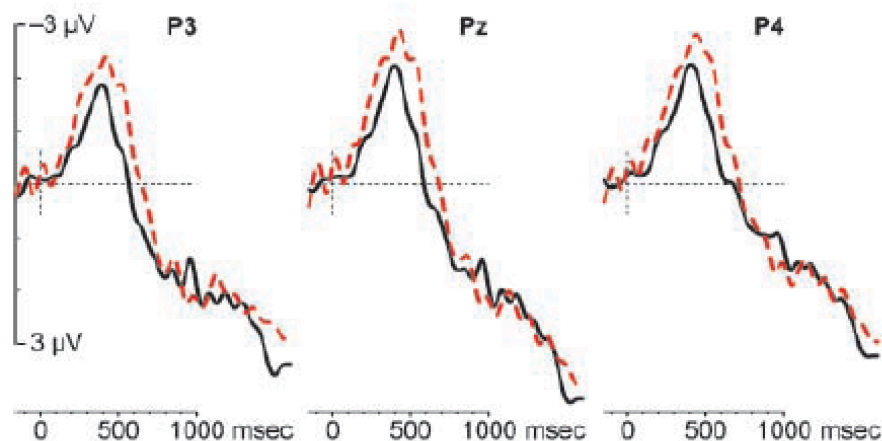
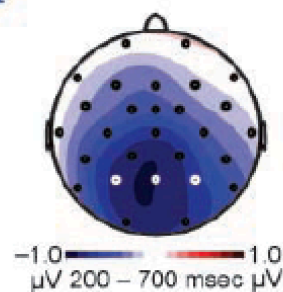
## Results

### A Speaker inconsistency effect

*male/female* : "If only I looked like **Britney** Spears in her latest video"

*upper-/lower-class* : "I have a large **tattoo** on my back"

*young child/adult* : "Every evening I drink some **wine** before I go to sleep"



### B Semantic anomaly effect

"Dutch trains are **sour** and blue"

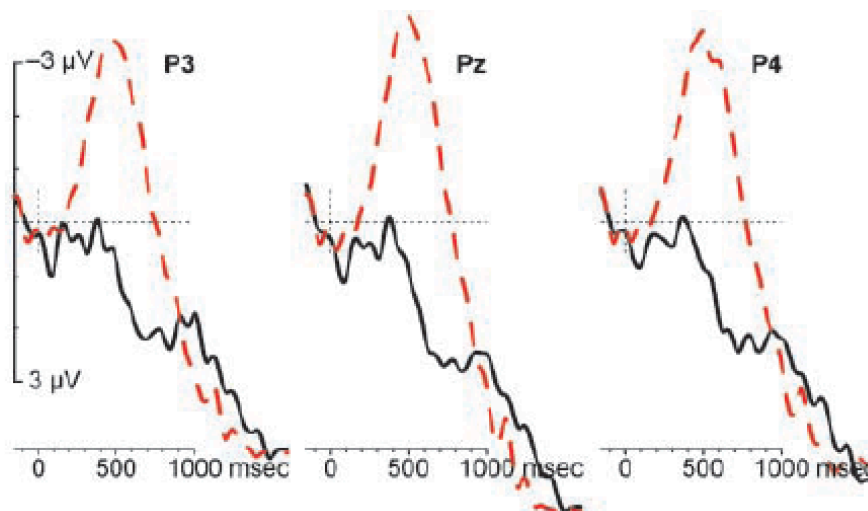
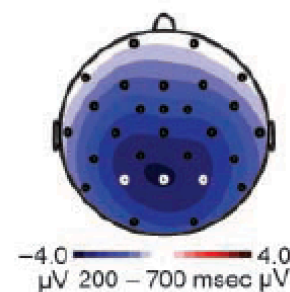
"Dutch trains are **yellow** and blue"

"You wash your hands with **horse** and water"

"You wash your hands with **soap** and water"

"The earth revolves around the **trouble** in a year"

"The earth revolves around the **sun** in a year"



# Van Berkum et al. (2008)

## Conclusions

- Evidence supports the constraint-based (one-step) account of language comprehension
  - Construction of meaning based on linguistic information cannot be separated from social aspects of language use
- The linguistic brain relates the message to the speaker immediately

# Create Groups of 2

**Ideally each group would have a native-German speaker and a programmer**

- Experiment Builder
- Running participants

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