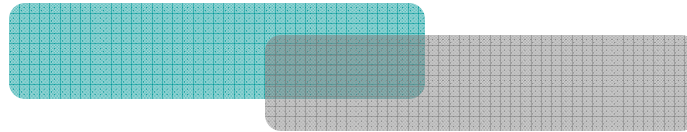# Theories & Technologies
for Human Communication:

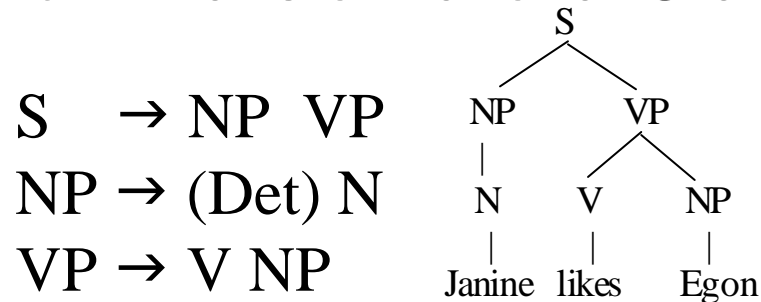# Discourse Analysis, Discourse Structure & Dialogue

Knowledge needed to understand and produce language

- *Phonetics and phonology:* how words are related to sounds that realize them

- *Morphology:* how words are constructed from more basic meaning units

- *Syntax:* how words can be put together to form correct utterances

- *Lexical semantics:* what words mean

- *Compositional semantics*: how word meanings combine to form larger meanings

- *Pragmatics:* how situation affects interpretation of utterance

- *Discourse structure:* how preceding utterances affects processing of next utterance

Grammar Formalisms
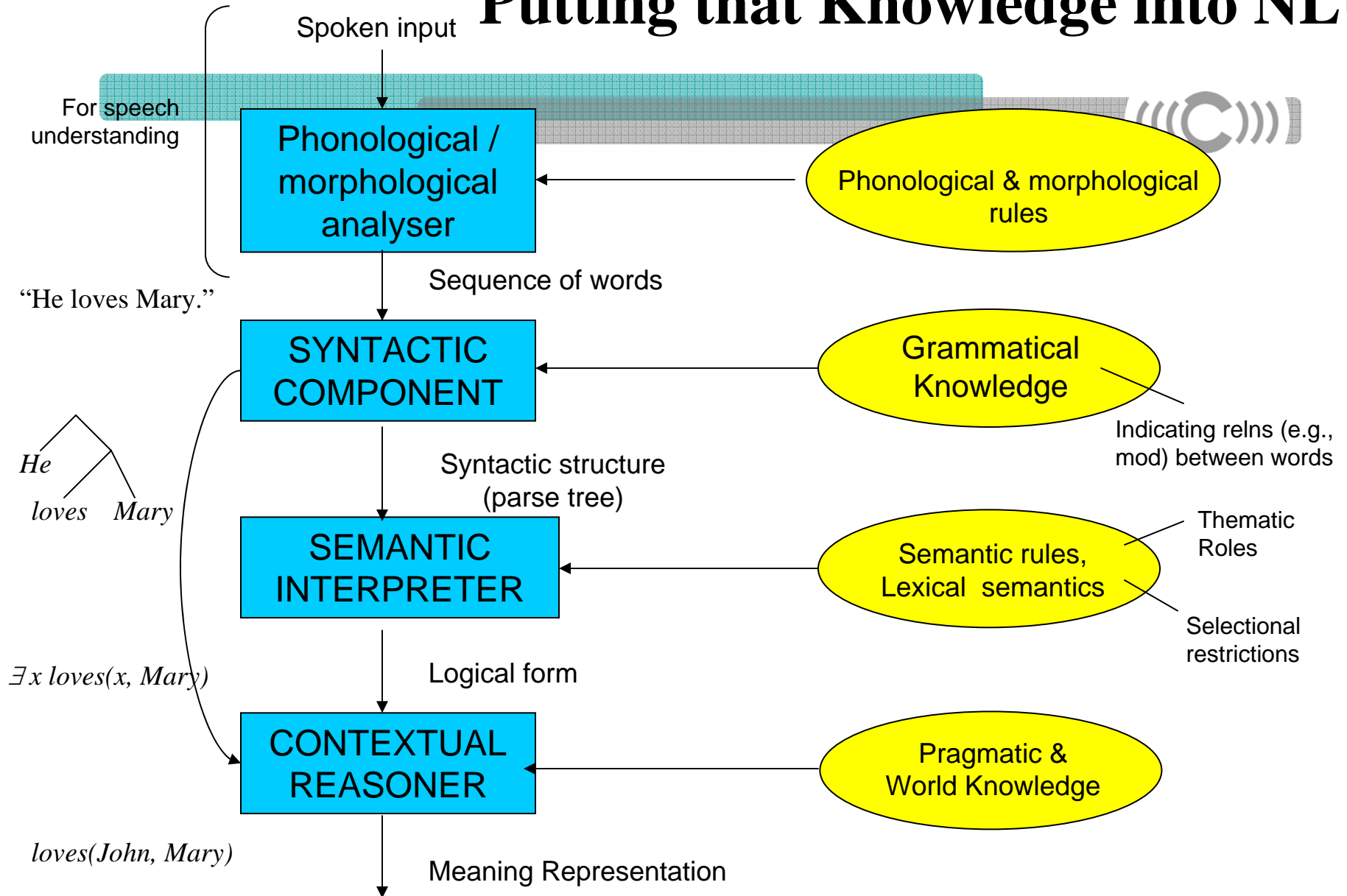
- **Syntax**: Transformational Grammar (Rules, Ops)

$$S \rightarrow NP \ VP$$
$$NP \rightarrow (Det) \ N$$
$$VP \rightarrow V \ NP$$

```
           S
         /   \
       NP     VP
        |    /  \
        N   V    NP
        |   |    |
     Janine likes Egon
```

- **Semantics**: Predicate Calculus (FOL), Lambda Calculus   (Ops, Models)

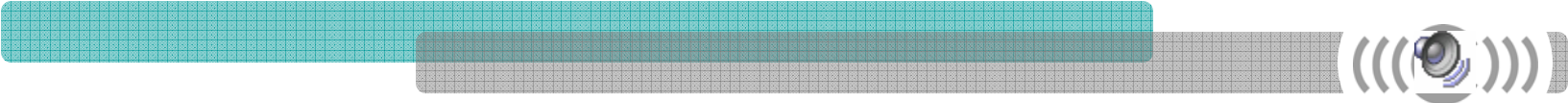$$[[\ \lambda y . \ \lambda x . \ (likes(x, y)) \ ] \ (\mathbf{Egon}) \ ]] \ (\mathbf{Janine})$$

- **Discourse**: DRT
    (Rules, Ops, Models)

x   y
Janine(x)
Egon(y)
likes(x,y)

Putting that Knowledge into NLU

Spoken input

For speech understanding

Phonological / morphological analyser

Phonological & morphological rules

Sequence of words

"He loves Mary."

SYNTACTIC COMPONENT

Grammatical Knowledge

Indicating relns (e.g., mod) between words

He
loves   Mary

Syntactic structure (parse tree)

SEMANTIC INTERPRETER

Semantic rules, Lexical semantics

Thematic Roles

Selectional restrictions

$\exists x\ loves(x, Mary)$

Logical form

CONTEXTUAL REASONER

Pragmatic & World Knowledge

$loves(John, Mary)$

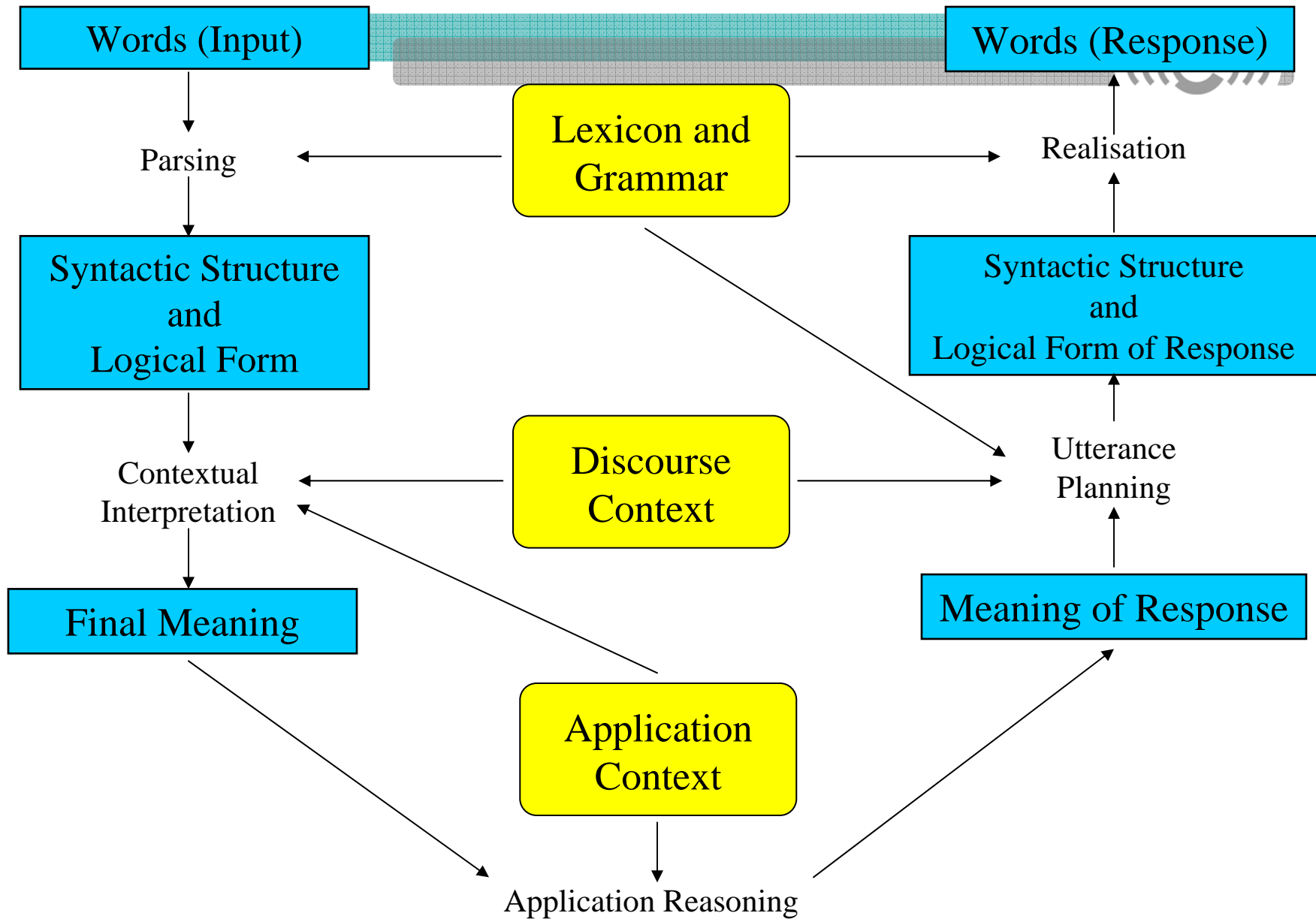Meaning Representation

HAL

What HAL can do

- Recognizes speech and understands language
- Decides how to respond and speaks reply
- Has a personality
- Recognizes the user's goals, adopts them, and helps to achieve them
- Remembers the conversational history
- Customizes interaction to different individuals
- Learns from experience
- Possesses vast knowledge, and is autonomous

It's not that simple

- Syntax affects meaning
  - *(a)   Flying planes is dangerous.*
  - *(b)   Flying planes are dangerous*.
- Meaning and world knowledge affects syntax
  - *(a)   I saw the Grand Canyon flying to LA.*
  - *(b)   I saw a condor flying to LA.*
- Prosody affects meaning
  - John called Bill an Republican and then he insulted him.

A More Realistic Version

Words (Input)		Words (Response)

Parsing

Lexicon and Grammar

Realisation

Syntactic Structure and Logical Form		Syntactic Structure and Logical Form of Response

Contextual Interpretation

Discourse Context

Utterance Planning

Final Meaning		Meaning of Response

Application Context

Application Reasoning

The Role of Context

Context of situation
- Who is speaking to whom, when, where, & for what purpose; the physical setting, the social scene in which the discourse occurs; the roles & status of the participants involved
    - needed for deictics, politeness, cooperation & inference

Context of culture
- the speech community; what is possible for, or normally done by, members of the community; the speech events participated in, the speech acts performed, the topics talked about
    - e.g. insults as a way of establishing group membership.

Context as co-text
- The prior & upcoming text; what has just been said, what was said earlier , what comes next
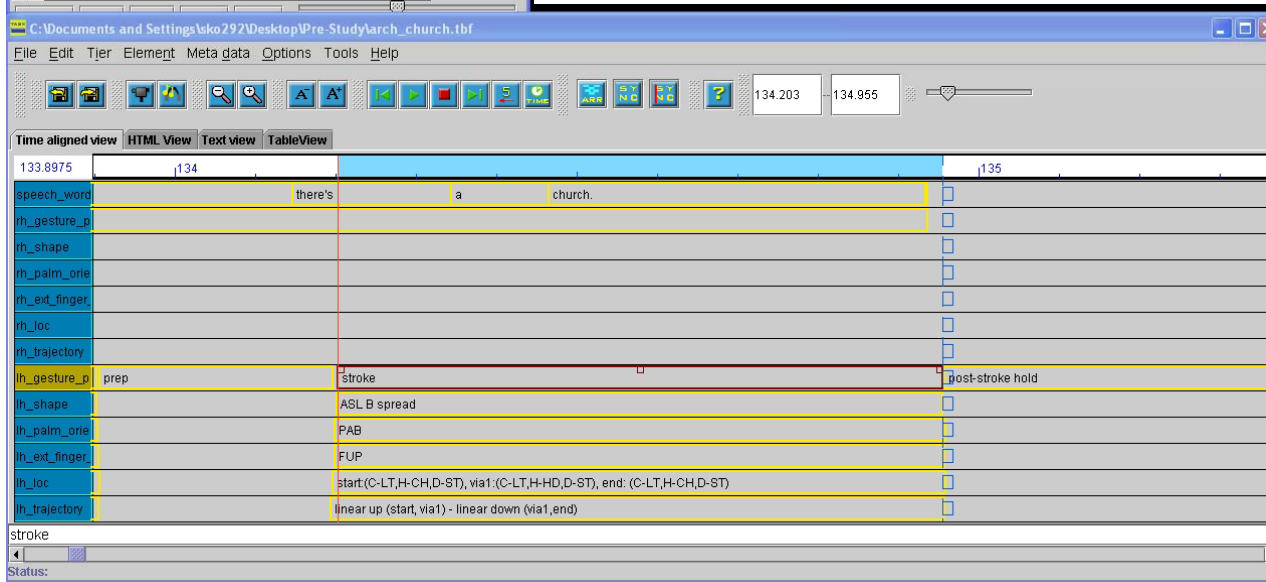   - needed for anaphora, cataphora, given/new, etc.

Cognitive context:
- Knowledge as a set of recognizable conventions, rules, norms & shared assumptions; the process of inferencing tied to current activity & general expectations.
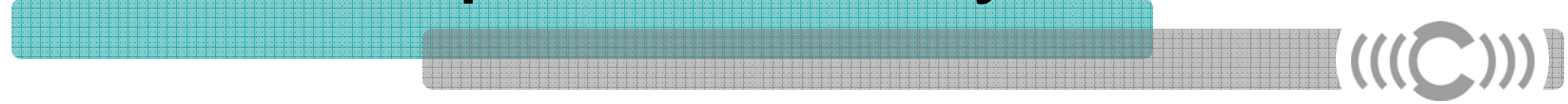   - Needed for reference, conversational implicature, notion of *relevance*

Coding data

- "I find iconic gestures with most introductions and descriptions of landmarks, but there are some that just don't occur there"

Is Transcription Theory-Neutral?

- In various parts of the Brown & Yule (1983) Ch.1 reading, we are reminded that for converting spoken words (as well as written texts) to print, a great deal of interpretation by the analyst or transcriber necessarily occurs (because the process is inherently subjective). Does this introduce interpretation bias/error into all converted texts, even with transcription conventions in place? Is there any way to ensure the original intent of the speaker is accurately represented after conversion to text?