

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

Motivation for syllables as
units of representation

Bibliography

10 - Sentence Production Models

Nick Riches

Newcastle University

December 4, 2018

5 min ex.

Mods of sent. prod

1. Message level

- 1a. info at ML
- 1b. ML to FL

2. Functional level

- 2a. Info at FL
- 2b. FL to PosL
- The linking problem
- Errors in children

3. Positional level

- 3a. Info at PosL
- PosL to PhonL

4. Phonetic level

- 4a. Info at PhL
- 4b. PhL to ArtL
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Models of sentence production

1. Message level
2. Functional level
3. Positional level
4. Phonetic level

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5 min ex.

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1. Message level

1a. info at ML

1b. ML to FL

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3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

Motivation for syllables as
units of representation

Bibliography

Look at the following speech errors. What does this say about the integration between (a) planning the structure of the sentence, and (b) inserting words in sentences, and (c) producing phonemes.

1. I'm a weekend for maniacs.

Nick Riches

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

Motivation for syllables as
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A SUBJ + be + NOUN PHRASE + for + NOUN PHRASE

B I am a weekend for maniac + PL



C I am a weekend for maniac-s

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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Models of sentence production

1. Message level

2. Functional level

3. Positional level

4. Phonetic level

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Mods of sent. prod

1. Message level

- 1a. info at ML
- 1b. ML to FL

2. Functional level

- 2a. Info at FL
 - 2b. FL to PosL
- The linking problem
- Errors in children

3. Positional level

- 3a. Info at PosL
- PosL to PhonL

4. Phonetic level

- 4a. Info at PhL
 - 4b. PhL to ArtL
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Bibliography

1. **Message level** - Very abstract representation of what we are going to say
2. **Functional level** - Activations of relevant lemmas. Still no syntactic frame
3. **Positional level** - Syntactic frame chosen, insertion of invariant lexemes/morphemes
4. **Phonetic level** - Insertion of variant lexemes/morphemes and syllabification
5. **Articulatory level** - Speech motor programme assembled.

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

Motivation for syllables as
units of representation

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1. **Conceptual level** (corresponding to Garrett's message level)
2. **Formulation level** (corresponding to Garrett's Function, Positional, and Phonetic levels)
3. **Articulation level** (corresponding to Garrett's Articulatory level)

5 min ex.

Modes of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

Motivation for syllables as
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Five-minute exercise

Models of sentence production

1. Message level

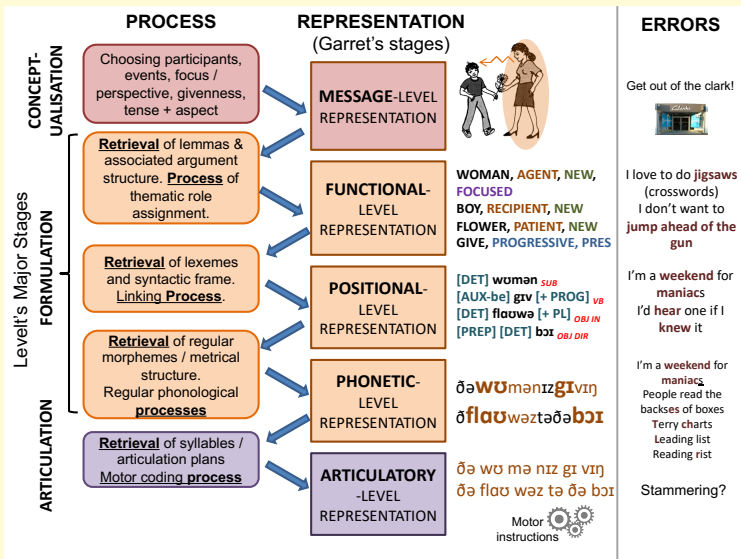
2. Functional level

3. Positional level

4. Phonetic level

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1a. What information is represented at the message level?



5 min ex.

Mods of sent. prod

1. Message level

- 1a. info at ML
- 1b. ML to FL

2. Functional level

- 2a. Info at FL
- 2b. FL to PosL
- The linking problem
- Errors in children

3. Positional level

- 3a. Info at PosL
- PosL to PhonL

4. Phonetic level

- 4a. Info at PhL
- 4b. PhL to ArtL
- Motivation for syllables as units of representation

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1a. What information is represented at the message level?

Entities we wish to talk about, and what kind of **situation** or **event** they are participating in.

Relational information, e.g. what is the relationship between an entity and an action? Is that entity the **AGENT** of the action, or the **PATIENT** of the action?

5 min ex.

Modes of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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1a. What information is represented at the message level?

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1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

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3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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We take a particular **perspective** on the action.

We decide which entity to **focus** on.

Focused element expressed using full Noun Phrase (not pronoun), and placed sentence finally.

1. I saw a strange man in the street. [He *TOPIC*] was wearing [the weirdest clothes I've ever seen *FOCUS*].

1a. What information is represented at the message level?

Focus on the verb

Tense

Are we inside or outside of the event? (**grammatical aspect**)

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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units of representation

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1a. What information is represented at the message level?

1. John **has chopped** the carrot PERFECTIVE aspect for completed event
2. John **is chopping** the carrot PROGRESSIVE aspect for ongoing event

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

Motivation for syllables as
units of representation

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1b. How do we get from the Message level to the Functional level?

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

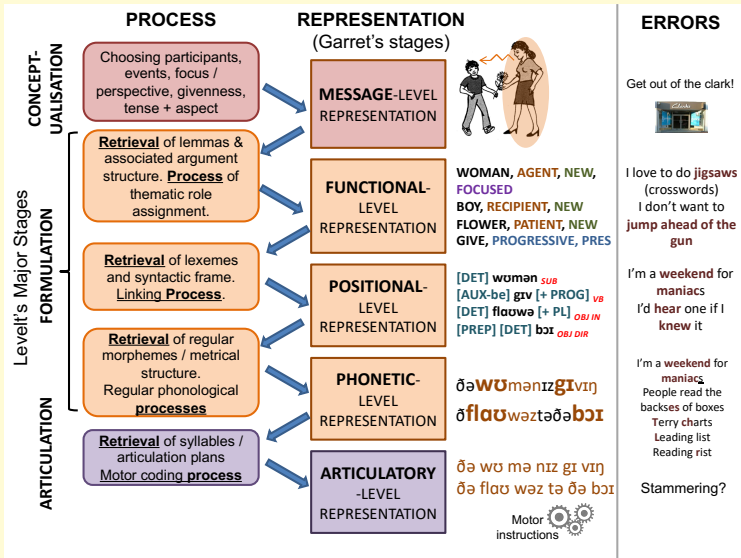
4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

Motivation for syllables as units of representation

Bibliography



1b. How do we get from the Message level to the Functional level?

We **retrieve** (a) the lemmas (b) the argument structure

We assign thematic thematic relations

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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1b. How do we get from the Message level to the Functional level?

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

Motivation for syllables as
units of representation

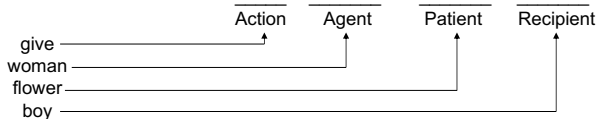
Bibliography

"The woman is giving the flower to the boy"

Message Level Representation

1. Retrieval of Semantic
Representation
(in lemma)

2. Retrieval of Argument
Structure (also in lemma)



3. Process of Thematic Role Assignment

Functional Level Representation

Adapted from Schwartz (1987)

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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Five-minute exercise

Models of sentence production

1. Message level

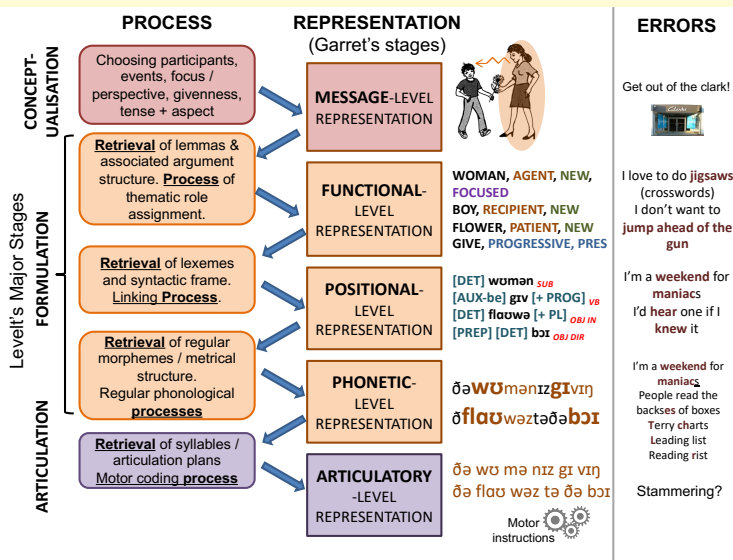
2. Functional level

3. Positional level

4. Phonetic level

Bibliography

2a. What information is represented at the functional level?



5 min ex.

Mods of sent. prod

1. Message level

- 1a. info at ML
- 1b. ML to FL

2. Functional level

- 2a. Info at FL
- 2b. FL to PosL
- The linking problem
- Errors in children

3. Positional level

- 3a. Info at PosL
- PosL to PhonL

4. Phonetic level

- 4a. Info at PhL
- 4b. PhL to ArtL
- Motivation for syllables as units of representation

Bibliography

2a. What information is represented at the functional level?

Semantic information: arguments with correct roles

Focusing information

No syntactic information

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

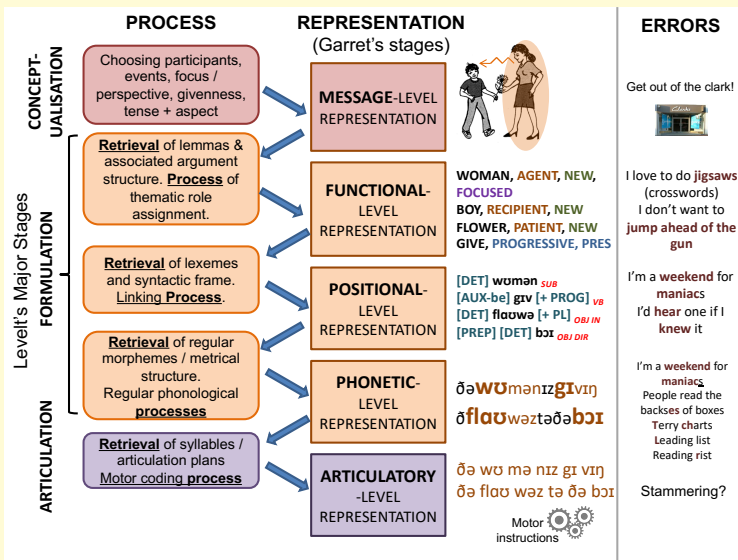
4a. Info at PhL

4b. PhL to ArtL

Motivation for syllables as
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2b. How do we get from the Functional level to the Positional level?



5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

Motivation for syllables as units of representation

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2b. How do we get from the Functional level to the Positional level?

We **retrieve** (a) the lexemes (b) the syntactic frame

We **link** or **map** the arguments to their correct position in the frame.

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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2b. How do we get from the Functional level to the Positional level?

5 min ex.

Mods of sent. prod

1. Message level

- 1a. info at ML
- 1b. ML to FL

2. Functional level

- 2a. Info at FL
- 2b. FL to PosL
The linking problem
Errors in children

3. Positional level

- 3a. Info at PosL
- PosL to PhonL

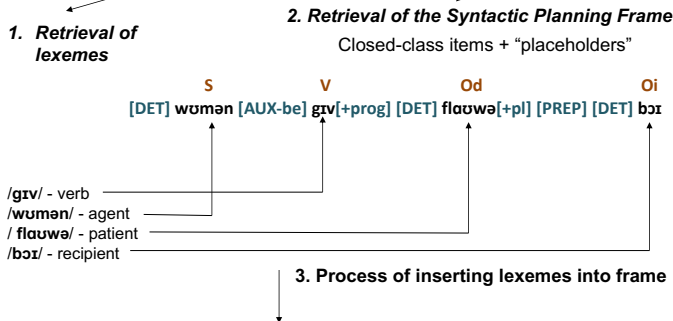
4. Phonetic level

- 4a. Info at PhL
- 4b. PhL to ArtL
Motivation for syllables as
units of representation

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"The woman is giving the flower to the boy"

Functional Level Representation



Positional Level Representation

Adapted from Schwartz (1987)

2b. How do we get from the Functional level to the Positional level?

The syntactic planning frame consists of (a) closed class morphemes, and (b) slots/placeholders for open class morphemes, e.g.

1. [DET] ___ [AUX-be] ___ [+prog][DET] ___ [PREP][DET] ___
(**dative**, e.g. *the woman is giving the flowers to the boy*)
2. [DET] ___ [AUX-be] ___ [+perf][PREP][DET] ___
(**passive**, e.g. *the cat was chased by the dog*)
3. [DET] ___[+past][DET]____. [PREP][DET]____.
(**locative**, e.g. *the dog chased the cat up the tree*)

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

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3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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The linking problem

Jackendoff, 1990

5 min ex.

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- 1a. info at ML
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2. Functional level

- 2a. Info at FL
- 2b. FL to PosL

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3. Positional level

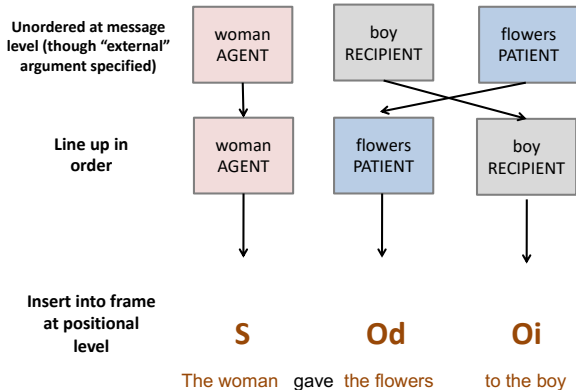
- 3a. Info at PosL
- PosL to PhonL

4. Phonetic level

- 4a. Info at PhL
- 4b. PhL to ArtL

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3a. Info at PosL

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4a. Info at PhL

4b. PhL to ArtL

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But note this won't always give the right results, e.g.

1. The man_{AG}. **gave** the woman_{REC}. the present_{PAT}.

5 min ex.

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1. Message level

- 1a. info at ML
- 1b. ML to FL

2. Functional level

- 2a. Info at FL
 - 2b. FL to PosL
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- 3a. Info at PosL
- PosL to PhonL

4. Phonetic level

- 4a. Info at PhL
- 4b. PhL to ArtL

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Have a look at these errors in children. How have they arisen?

1. Can I fill some salt into the bear?
2. I'm going to cover a screen over me. (Bowerman, 1982)
3. The lady is filling the sweets into the jar.
4. The lady is covering the scarf on her head. (Ebbels, 2007)

5 min ex.

Mods of sent. prod

1. Message level

- 1a. info at ML
- 1b. ML to FL

2. Functional level

- 2a. Info at FL
 - 2b. FL to PosL
- The linking problem

Errors in children

3. Positional level

- 3a. Info at PosL
- PosL to PhonL

4. Phonetic level

- 4a. Info at PhL
- 4b. PhL to ArtL

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Why are these errors happening?

Fill + Salt FILLER + *jar* THING BEING FILLED



Verb + NP + with + NP

Verb + NP + into + NP

salt

jar

Mis-selection of frame at positional level, but correct
linking of arguments **for that frame**

5 min ex.

Modes of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

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3. Positional level

3a. Info at PosL

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4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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Five-minute exercise

Models of sentence production

1. Message level

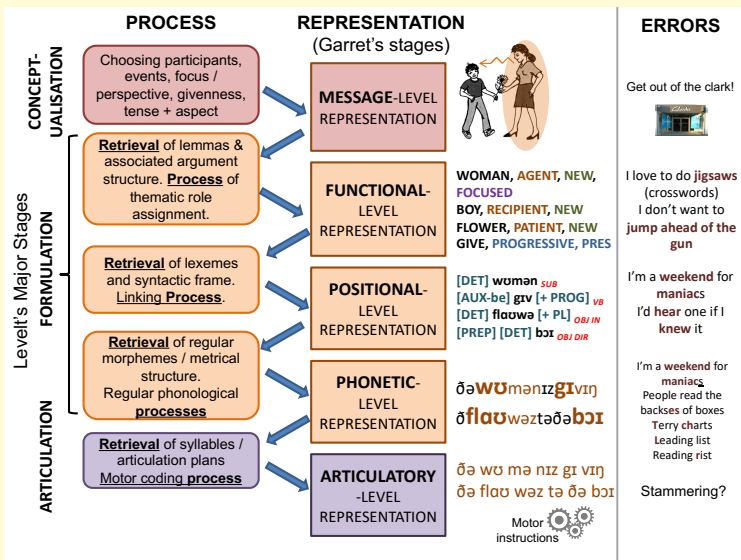
2. Functional level

3. Positional level

4. Phonetic level

Bibliography

3a. What information is represented at the Positional level?



5 min ex.

Mods of sent. prod

1. Message level

- 1a. info at ML
- 1b. ML to FL

2. Functional level

- 2a. Info at FL
- 2b. FL to PosL
- The linking problem
- Errors in children

3. Positional level

- 3a. Info at PosL
- PosL to PhonL

4. Phonetic level

- 4a. Info at PhL
- 4b. PhL to ArtL
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3a. What information is represented at the Positional level?

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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Now we have syntactic information!

We represent the **sentence frame**, and **lexemes which are phonetically invariant** (i.e. their pronunciation is similar whatever context they occur in)

3b. How do we get from the Positional level to the Phonetic level?

We **retrieve** (a) segments, and (b) metrical structure

We assemble a phonological sequence (consisting of segments, combined with metrical structure).

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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3b. How do we get from the Positional level to the Phonetic level?

5 min ex.

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1. Message level

- 1a. info at ML
- 1b. ML to FL

2. Functional level

- 2a. Info at FL
 - 2b. FL to PosL
- The linking problem
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3. Positional level

- 3a. Info at PosL
- PosL to PhonL

4. Phonetic level

- 4a. Info at PhL
 - 4b. PhL to ArtL
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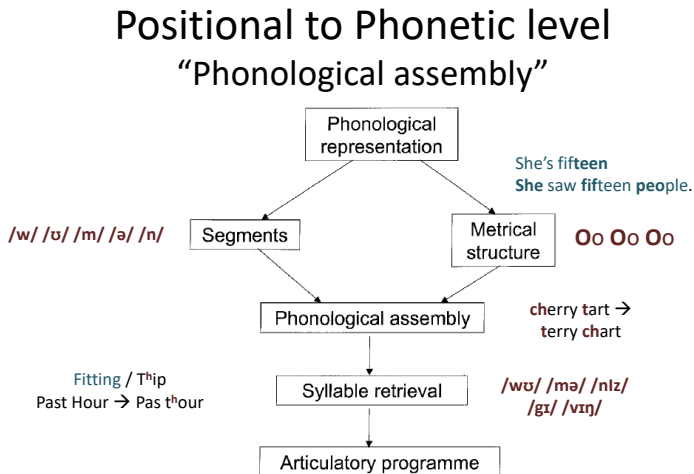


Figure 3. Levelt et al.'s (1999) model of speech production.

3b. How do we get from the Positional level to the Phonetic level?

Evidence that segments and metrical structure are stored separately:

1. Stress shift

1.1 She's **fif-teen** / I saw **fif-teen men**.

1.2 Five o'**clock** in the after-**noon** / We had **after-noon tea**.

1.3 It was ca-ta-**stroph**-ic / It was a **ca**-ta-strophic **fail**ure

2. Evidence from aphasia (Nickels & Howard, 1999)

2.1 Aphasic individuals often produce phonemes in correct order, but not correct stress pattern

2.2 Are much better at naming items with more frequent stress patterns

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

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3a. Info at PosL

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4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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Five-minute exercise

Models of sentence production

1. Message level

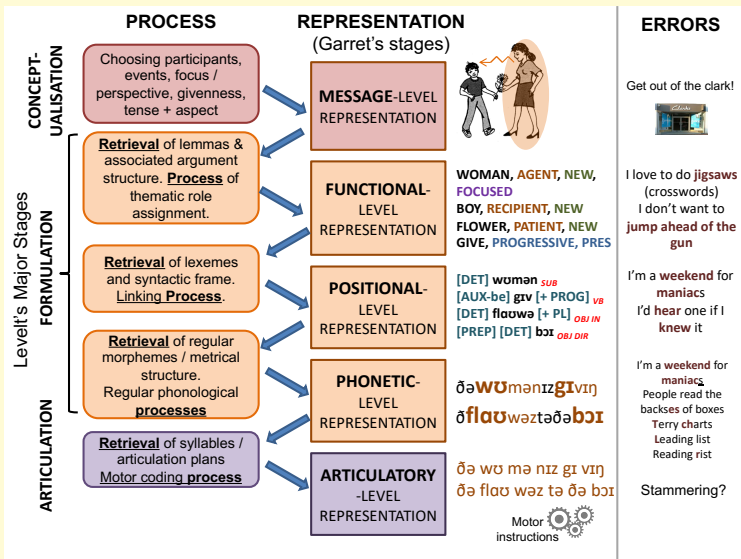
2. Functional level

3. Positional level

4. Phonetic level

Bibliography

4a. What information is represented at the phonetic level?



5 min ex.

Mods of sent. prod

1. Message level

- 1a. info at ML
- 1b. ML to FL

2. Functional level

- 2a. Info at FL
- 2b. FL to PosL
- The linking problem
- Errors in children

3. Positional level

- 3a. Info at PosL
- PosL to PhonL

4. Phonetic level

- 4a. Info at PhL
- 4b. PhL to ArtL
- Motivation for syllables as units of representation

Bibliography

4a. What information is represented at the phonetic level?

A phonological sequence consisting of segments, and information related to metrical structure (e.g. word stress).

Phonetically-variant lexemes/phonemes are realised at this level, e.g.

1. DETERMINER: A book / **An** elephant
2. DETERMINER: The (**ð**ɪ) man / The (**ð**i:) essay
(tongue is retracted for second)
3. PARTICLE: I want **to** (**t**u:) eat / I want **to** (**t**ə) drink
(second is longer and involves more lip rounding)

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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4a. What information is represented at the phonetic level?

A number of errors may occur at this level including

1. Swapping errors, e.g. cherry tart \Rightarrow terry chart
2. Anticipation errors, e.g. cherry tart \Rightarrow terry tart
3. Perseveration errors, e.g. cherry tart \Rightarrow cherry chart

NB these errors respect syllabic position, so perhaps they occur later at the syllable retrieval stage?

5 min ex.

Mods of sent. prod

1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

Motivation for syllables as
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4b. How do we get from the Phonetic level to the Articulatory level?

5 min ex.

Mods of sent. prod

1. Message level

- 1a. info at ML
- 1b. ML to FL

2. Functional level

- 2a. Info at FL
- 2b. FL to PosL
- The linking problem
- Errors in children

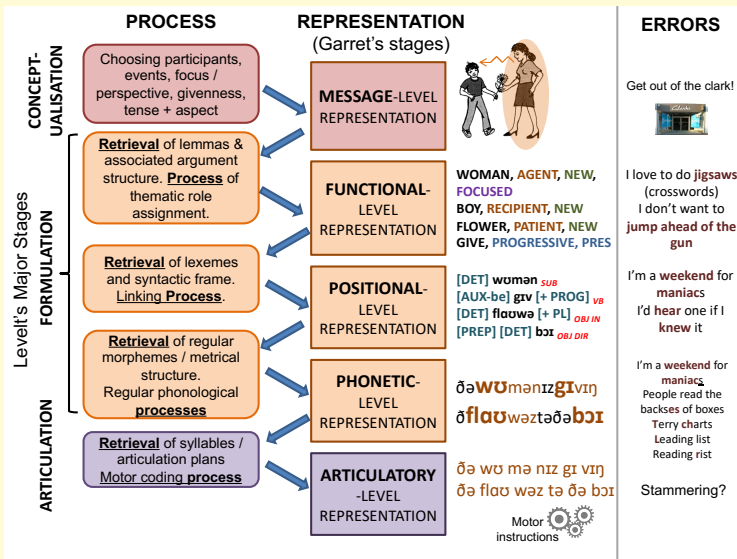
3. Positional level

- 3a. Info at PosL
- PosL to PhonL

4. Phonetic level

- 4a. Info at PhL
- 4b. PhL to ArtL
- Motivation for syllables as units of representation

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4b. How do we get from the Phonetic level to the Articulatory level?

We **retrieve** syllables, along with their articulation plans.

We **assemble** motor instructions.

5 min ex.

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1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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10 - Sentence
Production Models

Nick Riches

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1. Message level

1a. info at ML

1b. ML to FL

2. Functional level

2a. Info at FL

2b. FL to PosL

The linking problem

Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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Bibliography

(a) Liaison (epenthesis)

Beer and chips → bɪə ɾən tʃɪp s...

CVV CVC CVC C...

Why are you sad? → wɑɪ jɑ: ju: sæd

CVV CV CVV CVC

Motivation for syllables as units of representation

10 - Sentence
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1b. ML to FL

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2a. Info at FL

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Errors in children

3. Positional level

3a. Info at PosL

PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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(b) Resyllabification

A book → ...ə buk
...V CVC

An elephant → ...ə ne lə fənt
...V CV CV CVCC

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5 min ex.

Mods of sent. prod

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2. Functional level

- 2a. Info at FL
 - 2b. FL to PosL
- The linking problem
Errors in children

3. Positional level

- 3a. Info at PosL
- PosL to PhonL

4. Phonetic level

- 4a. Info at PhL
- 4b. PhL to ArtL

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(b) Resyllabification

- | | | | | |
|------------------------|---|------------------------------------|--------------------------|-------------------------------|
| 1. Foot t ball | → | fʊ t | bɒl | (syllable final) |
| 2. t ipping | → | t ^h _I | pɪŋ | (syllable initial) |
| 3. Glass t ower | → | glɑ:s | t ^h əʊ | wə (syllable initial) |
| 4. Last t hour | → | lɑ:s | t ^h əʊ | wə (syllable initial) |

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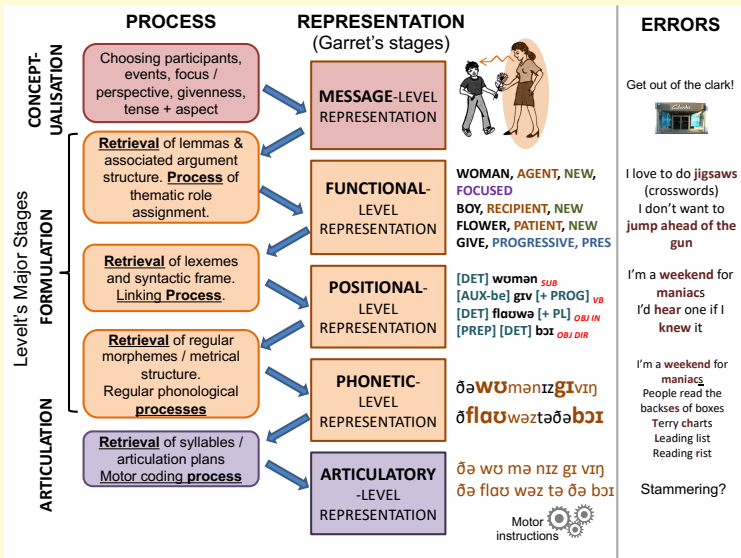
- 4a. Info at PhL
- 4b. PhL to ArtL

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ワ wa	ラ ra	ヤ ya	マ ma	ハ ha	ナ na	タ ta	サ sa	カ ka	ア a
	リ ri		ミ mi	ヒ hi	ニ ni	チ chi	シ shi	キ ki	イ i
	ル ru	ユ yu	ム mu	フ fu	ヌ nu	ツ tsu	ス su	ク ku	ウ u
	レ re		メ me	ヘ he	ネ ne	テ te	セ se	ケ ke	エ e
ヲ wo	ロ ro	ヨ yo	モ mo	ホ ho	ノ no	ト to	ソ so	コ ko	オ o

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PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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Five-minute exercise

Models of sentence production

1. Message level

2. Functional level

3. Positional level

4. Phonetic level

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5 min ex.

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PosL to PhonL

4. Phonetic level

4a. Info at PhL

4b. PhL to ArtL

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