The beginning of morpho-syntactic acquisition in infants

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Some of the essential tasks in early acquisition:

• finding word-like units, storing/building a vocabulary

• learning syntactic properties: grammatical categories, agreement, constituents, etc.

How do infants start these tasks?
Prosodic bootstrapping (e.g., Christophe et al., 1997; Christophe, Millotte, Bernal & Lidz, 2008; Morgan, Shi & Allopenna, 1996; Shi, 2005, 2014):

- prosody
- function words/morphemes, e.g., Aux, Det, tense endings, etc.
Classic observation:
children’s early speech production (one-word stage & initial word combinations) lacks functional items

- Functional items are absent in infants’ early knowledge?
Perception Studies
Early bifurcation of function words vs. content words:

- Infants distinguish content words and function words in a language-general fashion,
  - **Newborns** (Shi, Morgan & Werker, *Cognition*, 1999)

Learning and storing specific functors in the native language
Learning and storing specific functors in the native language:

- Recognition & representation of particular forms of function words from 6 months of age; phonetically well specified in representation before age 1
  - Electrophysiological measures: Shafer et al., *JSLHR*, 1998
Infants’ recognition & representation of function words in continuous speech -- English

functors *(the, his, her, their, its)* + content word *(breek, tink)*
nonsense functors *(ke, ris, ler, lier, ots)* + content word *(breek, tink)*
Infants’ recognition & representation of function words in continuous speech -- English

functors *(the, his, her, their, its)* + content word *(breek, tink)*
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**11-month-old infants**

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**13-month-old infants**
Functors & early language acquisition
Functors and early language acquisition:

- **8-11 months:** function words are encoded as independent units; they assist the segmentation of adjacent words (Shi, Cutler et al. JASA 2006; Shi & Lepage, *Dev. Sci.* 2008)

- **8 months:** use functor-like items to parse phrases in line with the head direction of the native language (Gervain, Nespor, Mazuka, Horie & Mehler, *Cog. Psy.*, 2008)

- **11 months:** begin to learn bound functional affixes and morphological paradigms
Functors and early language acquisition:

• 14 months: grouping different determiners as a common class – rudimentary Det category (Shi & Melançon, *Infancy*, 2010)
Functors and early language acquisition:


• 20 months: use Dets to categorize novel nouns to sub-classes (Cyr & Shi, *Child Dev.* 2013)

• 18 months: use function words to recognize verbs (e.g., Cauvet et al., *Lang Learning & Dev.* 2014)
Functors and early language acquisition:

- **17-19 months:** Perceiving non-adjacent grammatical dependencies of functors
e.g.,
  - English: Santelmann & Jusczyk, *Cognition*, 1998:
    
    ... *is walking* ...
    *... can walking ...*
  
  
  French: Van Heugten & Shi, *JASA*, 2010:
    
    *le fipare va* ...
    *les fipares va* ...
Funtors and early language acquisition:

- **24 months**: represent grammatical feature agreement *abstractly* across multiple categories (e.g., Det, N, Pron), Melançon & Shi, BUCLD, 2014

- **24 months**: understand semantic features of determiners & use them to interpret nouns (Correa, Augusto & Ferrari-Neto, BUCLD, 2005; Robertson, Shi & Melançon, *Child Dev.*, 2012), e.g.
  - *le*: singular; *les*: plural
Functors and early language acquisition:

- **Toddlers use functional elements to learn the meaning of verbs** (e.g., Bernal, et al., 2007; Oshima-Takane, et al., 2011)

- **2-year-olds use the Det gender feature during word learning & online processing of nouns.**
  (Johnson, 2005; Melançon & Shi 2011, 2013; Melançon & Shi, in press; Van Heugten & Shi, 2009)
Using function words to learn grammatical categorization & feature agreement
French-learning 14-month-olds’ use of function words to categorize novel words

<table>
<thead>
<tr>
<th>Noun Familiarisation</th>
<th>Verb Familiarisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dets: <em>ton</em> (your), <em>des</em> (some)</td>
<td>Pronouns: <em>il</em> (he), <em>je</em> (I)</td>
</tr>
<tr>
<td>Pseudo Content words: <em>mige, crale</em></td>
<td>Pseudo Content words: <em>mige, crale</em></td>
</tr>
<tr>
<td>Utterances: <em>ton mige, ton crale, des miges, des crales</em></td>
<td>Utterances: <em>il mige, il crale, je mige, je crale</em></td>
</tr>
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**Test Phase**

New determiner: *le* (the)
New pronoun: *tu* (you)

Noun trial: *le mige, le crale*
Verb trial: *tu miges, tu crales*
French-learning 14-month-olds’ use of function words to categorize novel words

*Noun familiarization group*

![Graph showing mean listening time for noun and verb test trial types.](image-url)
French-learning 14-month-olds’ use of function words to categorize novel words

Noun familiarization group

Verb familiarization group

Shi & Melançon, *Infancy*, 2010
## French-learning 20-month-olds’ use Dets to categorize novel nouns to grammatical gender classes

<table>
<thead>
<tr>
<th>Familiarization</th>
<th>( un_{\text{masc}} ) ravole(<em>{\text{masc}}) ( une</em>{\text{fem}} ) cagère(_{\text{fem}})</th>
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<tr>
<th>Test</th>
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<tr>
<th>Trial: (Agreeing)</th>
<th>( le_{\text{masc}} ) ravole(<em>{\text{masc}}) ( la</em>{\text{fem}} ) cagère(_{\text{fem}})</th>
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<tr>
<th>Trial: (Non-agreeing)</th>
<th>( la_{\text{fem}} ) ravole(<em>{\text{masc}}) ( le</em>{\text{masc}} ) cagère(_{\text{fem}})</th>
</tr>
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![Looking times (sec)](chart)

- **Agreeing**
- **Non-Agreeing**

- *n.s*
- *\( p < .05 \)*
24-month-olds represent grammatical gender abstractly across multiple categories (Det, N, Pron)

FAMILIARIZATION GR. 1

| un\(\text{MASC}\) mouveille; le\(\text{MASC}\) mouveille |
| une\(\text{FEM}\) gombale; la\(\text{FEM}\) gombale |

TEST PHASE

| Les gombales, elles\(\text{FEM}\) pèsent les graminées. | Les gombales, ils\(\text{MASC}\) pèsent les graminées. |
| Les mouvilles, ils\(\text{MASC}\) demeurent au fleuve. | Les mouvilles, elles\(\text{FEM}\) demeurent au fleuve. |

Etc.

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<th>Mean listening time (sec)</th>
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- Gender Agreement Correct
- Gender Agreement Violated

Melançon & Shi, BUCLD, 2014
Online gender activation across non-adjacent abstract categories (Det, N)

Familiarisation

*une_{FEM} cagère

*une_{MASC} ravole

Online gender activation across non-adjacent abstract categories (Det, N)

Familiarisation

*une_{FEM} cagère

un_{MASC} ravole

Melançon & Shi, JCL, in press.
Learning bound functional morphemes & morphological alternations
Learning bound functional morphemes
French-learning 11-month-olds

Marquis & Shi, *Cognition*, 2012
Learning bound functional morphemes
French-learning 11-month-olds

• **Familiarization:**
nonsense verbs: [glYt] or [trId]

• **Test:**
  - Sentences containing [glyte]
  - Sentences containing [tride]

/ɛ/: suffix in French (infinitive; past participle)

Vowel allophonic changes:
[Y]-[y]; [I]-[i]
Learning bound functional morphemes
French-learning 11-month-olds

- **Familiarization:**
  nonsense verbs: [glYt] or [trIId]

- **Test:**
  - Sentences containing [glyte]
  - Sentences containing [tride]

/e/: suffix in French (infinitive; past participle)

Vowel allophonic changes:
[Y]-[y]; [I]-[i]

Sig. looking difference
Learning bound functional morphemes 
(Control exp: non-functor) 
French-learning 11-month-olds

- **Familiarization:**
  nonsense verbs: [glyt] or [triD]

- **Test:**
  - Sentences containing [glytu]
  - Sentences containing [triDu]

Marquis & Shi, Cognition, 2012
Determining the mechanism of morphological learning (11-month-olds)

An added pre-training phase: many novel roots sharing an artificial functor /u/:

- **Familiarization:**
  nonsense verbs: [glyt] or [trId]

- **Test:**
  - Sentences containing [glytu]
  - Sentences containing [tridu]

Marquis & Shi, Cognition, 2012
Morphological learning - Conclusions

• 11 months: perceive bound functional morphemes and use them to parse novel word roots

• 11 months: begin to understand morphological relatedness of forms (e.g. /glyt/ -/glyte/) – initial knowledge of morphological paradigms

• Bound functional morphemes are learned from their distributional properties with roots; semantics is not required

• 17 months: form-based representations of freq bound morphemes may guide the learning of word meaning,
  – consistent with Hochmann, Endress & Mehler 2010 (stronger word-obj association with infrequent than frequent words)

Evidence of form-based morphological learning.
Prosody and function words conjointly bootstrap syntactic learning
During the first year of life ...

- **Sensitivity to prosody shortly after birth** (e.g., Christophe, Mehler & Sebastian-Gallés 2001; Mehler, et al, 1988; Nazi, Bertoncini & Mehler 1997)

- **Detecting prosodic cues to boundaries of major syntactic constituents** (e.g., Hirsh-Paseck, et al, 1987; Jusczyk, et al., 1992; Kemler, et al., 1989)

During the first year of life …

• Prosodic cues can affect infants’ learning non-adjacent grammatical dependencies (Laguardia, Santos, Shi & Name, 2015)

• Using combined cues of prosody and function words to segment phrases (Babineau, Shi & Melançon, 2014)

• Using frequent items (functors) & prosody to learn word order (Bernard & Gervain, 2012)
Around 2 years of age ...

- Using prosody to resolve grammatical category ambiguity (de Carvalho, Dautriche, & Christophe, Dev. Sci., in press)

- Using prosody to interpret argument structure (Dautriche, et al., Child. Dev., 2014)
Discussion

How do infants break into language?
Prosodic bootstrapping (e.g., Christophe et al., 1997; Christophe, Millotte, Bernal & Lidz, 2008; Morgan, Shi & Allopenna, 1996; Shi, 2005, 2014):

- prosody
- function words/morphemes
Discussion

Larger theoretical question:

Does early child language contain abstract grammar?
Discussion

Function words/morphemes are present in early representation.

Morpho-syntactic acquisition begins very early, even before infants talk.

The knowledge of functional categories & lexical categories in 1- to-2-year-olds is abstract: Infants show grammatical productivity.
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