French root, stem and maybe thematic vowel

L2C2
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Verbal Morphological Structure

- Romance languages = verbal morphological system inherited from Latin
- Stem = form after inflectional suffix stripping
- Theme vowel (Th) = conjugational vowel merged with the root in stem formation (Latin: a/e/i)

### Verbal Morphological Structure Diagram

![Diagram showing the structure of verbs in Romance languages]

### Language Patterns

<table>
<thead>
<tr>
<th>Language</th>
<th>ã</th>
<th>Õ</th>
<th>Ê</th>
<th>Ë</th>
<th>ï</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latin</td>
<td>amãre</td>
<td>prendãere</td>
<td>vidãere</td>
<td>audãere</td>
<td></td>
</tr>
<tr>
<td>Spanish</td>
<td>amar</td>
<td>prender</td>
<td>ver</td>
<td>oír</td>
<td></td>
</tr>
<tr>
<td>Portuguese</td>
<td>amar</td>
<td>prender</td>
<td>ver</td>
<td>ouvir</td>
<td></td>
</tr>
<tr>
<td>Italian</td>
<td>amare</td>
<td>prendere</td>
<td>vedere</td>
<td>udire</td>
<td></td>
</tr>
<tr>
<td>Catalan</td>
<td>amar</td>
<td>prendre</td>
<td>veure</td>
<td>sentir</td>
<td></td>
</tr>
<tr>
<td>French</td>
<td>aimer</td>
<td>prendre</td>
<td>voir</td>
<td>ouïr</td>
<td></td>
</tr>
</tbody>
</table>
• Is there a Th morpheme representation in French?

• Is there a stem (root+Th) representation in French?

• How 1st and 3rd verbal groups stems are represented and processed in French?

• Which are the differences between the subgroups:
  a) -er/eE,
  b) -ir/-ire/-dre/-indre

• How the stress system influence word representation and processing?

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**French Specificities**

**Prosody:**
Iambic system

**Phonology:**
Idiosyncratic relation between grapheme and phoneme
Morphological System

- Word forms can be studied diachronically (parameter settling), but mental representations and processing have to be explained synchronically.

- Morphemes are stored economically and are operated by a computational system.

### Stem Representation Vs No Stem


**Aronoff, 2004 (WFR)**

**Beard, 1995 (LMBM)**

**Embick & Halle, 2005 (DM)**

<table>
<thead>
<tr>
<th>Person</th>
<th>Present</th>
<th>Simple Past</th>
<th>Imperfect</th>
<th>Future</th>
<th>Conditional</th>
<th>Subjunctive</th>
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<tbody>
<tr>
<td>1st sg</td>
<td>parl-e</td>
<td>parl-ai</td>
<td>parl-ai-s</td>
<td>parl-e-r-ai</td>
<td>parl-e-r-ai-s</td>
<td>parl-e</td>
</tr>
<tr>
<td>2nd sg</td>
<td>parl-e-s</td>
<td>parl-as</td>
<td>parl-ai-s</td>
<td>parl-e-r-as</td>
<td>parl-e-r-ai-s</td>
<td>parl-e-s</td>
</tr>
<tr>
<td>3th sg</td>
<td>parl-e</td>
<td>parl-a</td>
<td>parl-ai-t</td>
<td>parl-e-r-a</td>
<td>parl-e-r-ai-t</td>
<td>parl-e</td>
</tr>
<tr>
<td>1st pl</td>
<td>parl-ons</td>
<td>parl-â-mês</td>
<td>parl-i-ons</td>
<td>parl-e-r-ons</td>
<td>parl-e-r-i-ons</td>
<td>parl-i-ons</td>
</tr>
<tr>
<td>2nd pl</td>
<td>parl-ez</td>
<td>parl-â-tes</td>
<td>parl-i-ez</td>
<td>parl-e-r-ez</td>
<td>parl-e-r-i-ez</td>
<td>parl-i-ez</td>
</tr>
<tr>
<td>3th pl</td>
<td>parl-ent</td>
<td>parl-è-r-ent</td>
<td>parl-ai-ent</td>
<td>parl-e-r-ont</td>
<td>parl-e-r-ai-ent</td>
<td>parl-ent</td>
</tr>
</tbody>
</table>
French Stems

**eE**
- jeter
  - jet-
  - jett-

/e/ -> /E/ /_

**IR**
- dormir
  - dorm-
  - dor-

C -> o/\_C

**IRE**
- écrire
  - écri-
  - écriv-

o -> v/\_C

**DRE**
- prendre
  - prend-
  - pren-

C -> o/\_C

**INDRE**
- joindre
  - join-
  - joign-

n -> gn/\_V
Models

- **Obligatory Decomposition:** polymorphemic words are represented in the morphemic and lexical levels (Taft, 1979).

- **Race Model:** activation of the whole-word and morphemes in a parallel dual-route (Baayen, Dijkstra & Schreuder, 1997).

- **Words and Rules:** regular and irregular words are accessed by the declarative/procedural systems (Pinker & Ullman, 2002).
## Verbal Inflection Warm-up Review

<table>
<thead>
<tr>
<th>Language</th>
<th>Reference</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>Stanners et al., 1979</td>
<td>Regular inflected verbs do not have different representations while irregulars do</td>
</tr>
<tr>
<td></td>
<td>Pinker, &amp; Ullman, 2002</td>
<td>Word &amp; Rules, Pinker, 1999</td>
</tr>
<tr>
<td>German</td>
<td>Clahsen, 1999</td>
<td>Dual-route model</td>
</tr>
<tr>
<td>Spanish</td>
<td>Dominguez et al., 2000</td>
<td>Augmented Addressed Model</td>
</tr>
<tr>
<td>Catalan</td>
<td>Rodriguez-Fornells et al., 2001</td>
<td>Dual-route model</td>
</tr>
<tr>
<td></td>
<td>Oltra-Massuet, 1999</td>
<td>Full-decomposition model, Halle, &amp; Marantz, 2013</td>
</tr>
<tr>
<td>Italian</td>
<td>Orsolini, &amp; Marslen-Wilson, 1997</td>
<td>Dual-route model</td>
</tr>
<tr>
<td></td>
<td>Say, &amp; Clahsen, 2002</td>
<td>Word &amp; Rules, Pinker, 1999</td>
</tr>
<tr>
<td>French</td>
<td>Meunier, &amp; Marlen-Wilson, 2004</td>
<td>Connexionism or dual-route model</td>
</tr>
<tr>
<td></td>
<td>Kilani-Schoch, &amp; Dressler, 2005</td>
<td>Dual-route model</td>
</tr>
<tr>
<td>Portuguese</td>
<td>Verissimo, &amp; Clahsen, 2009</td>
<td>Words &amp; Rules, Pinker, 1999</td>
</tr>
<tr>
<td></td>
<td>Bassani, &amp; Lunguinho, 2011</td>
<td>Full-decomposition model, Halle, &amp; Marantz, 2013</td>
</tr>
</tbody>
</table>
Hypothesis

Full priming = Identical Prime (*parlons - parlons*)
No priming = Control Prime (*fermer - parlons*)
? = Test Prime (*parler – parlons*)

**Hypothesis 1:** full prime in Test Condition means the same lexical representation activated by the priming:
- a) verb completely decomposed  
  (root+(Th)+T+Agr)
- a) Rule-based stem
- b) phonological abstract representation /eE/

**Hypothesis 2:** partial prime in Test Condition means a distinct, but related representation between the priming and the target:
- a) verb partially decomposed  
  (stem+T+Agr)
- a) Stem allomorphs are stored
- b) phonological representation /eE/
**Method**

**Subjects:** 48 subjects, 23 women, right hand, French as L1, mean age 21.8 years

**Experience:** cross-modal priming with lexical decision task: auditory prime (woman voice .wav) and visual target (uppercase)

**Study:** 6 verb types:
1) 1st Group [-er], regulars
2) 1st Group [-er], morphophonological /e/, /ε/
3) 3rd Group [-ir]
4) 3rd Group [-ire]
5) 3rd Group [-dre]
6) 3rd Group [-indre]

**Prime types (conditions):**
- identical inflected (full priming)
- control inflected (no priming)
- test infinitive

**Target:** present tense inflected form 1st plural [-ons]

**Stimuli:**
- 3 lists
- Experimental: 126 pair of verbs (21 per condition)
- Fillers: 294 pairs (84 w-w, 210 w-p (84 phono., 126 unrel.))
Results: error and outliers
Results: error and outliers
Results: error and outliers
Results: RT summary

![Bar chart showing RT summary for different categories and prime types.](chart.png)
Results: RT summary
Results: RT summary

ER Density

IR Density

DRE Density

eE Density

Identity

Control

Test
Results: Mixed Model Analysis

- Cross-modal priming
- 4 categories ([-er], [-ir], [-dre], /eE/)
- 3 conditions (identity, control, test)
- Split-splot design with 3 lists

- Student’s $t$-test
- Multivariate Analysis of Variance (ANOVA)
- Tukey

Mixed Effects
- verbs.lmer1 = lmer(RT ~ Category * PrimeType + (1|Subject), data = verbs8)
- verbs.lmer2 = lmer(RT ~ Category * PrimeType + (1|Target), data = verbs8)
- **verbs.lmer3 = lmer(RT ~ Category * PrimeType + (1|Subject) + (1|Target), data = verbs8)**
- verbs.lmer4 = lmer(RT ~ Category * PrimeType + (1+PrimeType|Subject) + (1|Target), data = verbs8)
- verbs.lmer5 = lmer(RT ~ Category * PrimeType + (1|Subject) + (1|NbLettres), data = verbs8)
- verbs.lmer6 = lmer(RT ~ Category * PrimeType + (1|Subject) + (1|NbSyll), data = verbs8)
- verbs.lmer.sex = lmer(RT ~ Sex * Category * PrimeType + (1|Subject) + (1|Target), data = verbs8)
- verbs.lmer.pre = lmer(RT ~ Prefixe * Category * PrimeType + (1|Subject) + (1|Target), data = verbs8)
Results: Mixed Model Analysis

Linear mixed model fit by REML ['lmerMod']
Formula: RT ~ Category * PrimeType + (1 | Subject) + (1 | Target)
    Data: verbs8

REML criterion at convergence: 43347.67

Random effects:
Groups     Name   Variance  Std.Dev.
Target     (Intercept)  3518     59.31
Subject    (Intercept) 12095    109.98
Residual                       26122   161.62
Number of obs: 3316, groups: Target, 84; Subject, 44

Fixed effects:

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std. Error</th>
<th>t value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>670.394</td>
<td>23.027</td>
<td>29.113</td>
</tr>
<tr>
<td>CategoryDRE</td>
<td>28.564</td>
<td>22.738</td>
<td>1.256</td>
</tr>
<tr>
<td>CategoryeE</td>
<td>75.375</td>
<td>22.656</td>
<td>3.327</td>
</tr>
<tr>
<td>CategoryIR</td>
<td>27.952</td>
<td>22.793</td>
<td>1.226</td>
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<tr>
<td>PrimeTypeCONTROL</td>
<td>72.141</td>
<td>13.450</td>
<td>5.364</td>
</tr>
<tr>
<td>PrimeTypeIDENTITY</td>
<td>-25.614</td>
<td>13.290</td>
<td>-1.927</td>
</tr>
<tr>
<td>CategoryDRE:PrimeTypeCONTROL</td>
<td>17.016</td>
<td>19.527</td>
<td>0.871</td>
</tr>
<tr>
<td>CategoryeE:PrimeTypeCONTROL</td>
<td>-32.983</td>
<td>19.322</td>
<td>-1.707</td>
</tr>
<tr>
<td>CategoryIR:PrimeTypeCONTROL</td>
<td>7.371</td>
<td>19.666</td>
<td>0.375</td>
</tr>
<tr>
<td>CategoryDRE:PrimeTypeIDENTITY</td>
<td>-3.748</td>
<td>19.081</td>
<td>-0.196</td>
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<tr>
<td>CategoryeE:PrimeTypeIDENTITY</td>
<td>2.043</td>
<td>18.969</td>
<td>0.108</td>
</tr>
<tr>
<td>CategoryIR:PrimeTypeIDENTITY</td>
<td>11.493</td>
<td>19.134</td>
<td>0.601</td>
</tr>
</tbody>
</table>
Discussion

• The results suggest that [-er], [-ir], [-dre] verbs are decomposed in the visual recognition by a similar process.

• Roots are stored as single lexical items and Stems are computed when merged with the possible thematic vowel.

• Thematic vowel
  ❖ The morphemes [e], [es] are the singular subjunctive morphemes for all classes
  ❖ Past simple and subjunctive imperfect have a clear Th
  ❖ It is most “economic” to process a Th than deal with root allomorphs and whole-word storage

• Morphophonological can be further analysed and described by metrical phonology and irregulars by lexeme-based theories or distributed morphology

• Masked priming
  ▫ Semantic control
  ▫ Orthographic control
Thank you!
Bibliography


Root, Stem and Thematic Vowel Representation

<table>
<thead>
<tr>
<th>1st Group (reg.)</th>
<th>3th Group</th>
<th>1st Group (morph.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[amar] word inf</td>
<td>[abr] word inf</td>
<td>[afogar] word inf</td>
</tr>
<tr>
<td>[ama] stem</td>
<td>[abr] stem</td>
<td>[afoga] stem</td>
</tr>
<tr>
<td>[am] root</td>
<td>[abr] root</td>
<td>[afog] root1</td>
</tr>
<tr>
<td>[amo] word 1s pre</td>
<td>[abro] word 1s pre</td>
<td>[afogo] word 1s pre</td>
</tr>
<tr>
<td>[a] inf</td>
<td>[abr] tns</td>
<td>[afog] copu1</td>
</tr>
<tr>
<td>[amo] word 1s pre</td>
<td>[abro] word 1s pre</td>
<td>[afogo] word 1s pre</td>
</tr>
</tbody>
</table>

- French
  - Target: [aim] root, [e] inf
  - Prime: [aim] root, [ons] agr
- Portuguese
  - Target: [ama] stem, [r] tns
  - Prime: [ama] stem, [r] tns

- Full priming
- Partial priming
Morphological decomposition

REGULARS

AIM

AIMONS

IRREGULARS

VOIS

VERRA
Morphological decomposition

MORPHO. [e], [ε]

achète
achetons

achEt-
achêt-e
achet-ons
[ε] [ε]

MORPHO. [o], [□]

bloquais
bloque

bloqu-ent
bloqu-ais
[□] [o]
Morphological operation

OPERATION

portons
portera

portera
porter-a

port-ons
port-en-a