Overview of Talk

- Research goals
- Background
  - The bilingual mental lexicon
  - Masked priming
- The current study
  - Methodology
  - Behavioural results
  - ERP results (preliminary)
- General conclusions
Research Goals
Research Goals

- To determine lexical organization for bilinguals and L2 learners
  - And whether and how this differs from monolinguals

- To determine whether there is a sensitive period in L2 lexical acquisition/organization

- To investigate these questions using both behavioural and ERP data
Research Questions

- Are the mental representations organized together in an integrated neural system?
  - Or are they each organized in separate, language specific, lexicons?

- Is bilingual lexical organization affected by factors such as AoA and proficiency?
Background
Bilingual Lexicons

- **Integrated Lexicons:**
  - Both languages are activated during bilingual language processing (e.g., Costa, 2005; Dijkstra, Timmermans, & Schriefers, 2000; Finkbeiner, Forster, Nicol, & Nakamura, 2004; de Groot, Delmaar, & Lupker, 2000)

- **Separate Lexicons:**
  - The activation of one language does not entail the activation of the other (e.g., Gerard & Scarborough, 1989; Ibrahim, 2009; Li, Mo, Wang, Luo, & Chen, 2009; Soares & Grosjean, 1984)
For early balanced bilinguals, it is generally assumed that the two lexicons are integrated (Costa, 2005; Fabbro, 2001; Kroll & Stewart, 1994; Paradis, 2001).

However, the precise roles of different factors that affect processing of each of a bilingual’s languages remain largely unexplored:

- AoA
- Proficiency
- Language Dominance
- ...
Silverberg & Samuel’s (2004) interactive model

In order to explain the large amount of mixed data when highly proficient bilinguals are tested, Silverberg & Samuel investigated the role of AoA.

They found evidence that a shared semantic level is only present for early bilinguals and not late bilinguals (when proficiency has been controlled for).
Cross-linguistic Priming

- Disagreement as to whether the evidence supports separate or integrated bilingual mental lexicons (Gollan et al., 1997; Finkbeiner et al., 2004)
  - Priming across languages is only possible with more controlled processes [Grainger & Beauvillain, 1988]
  - In some studies priming effects are only found when the prime is in the L1 and the target is in the L2 [Larsen, Fritsch & Grava, 1994; Williams, 1994; Jiang & Forster, 2001; Dimitropoulou et al., 2011]
  - Automatic priming occurs in both directions (L1 to L2 and L2 to L1) [Altarriba, 1992; Tzelgov & Eben-Ezra, 1992; Basnight-Brown & Altarriba 2007; Duñabeitia et al., 2010]
Holcomb & Grainger (2009): repetition priming effects were found but no semantic priming effects were found.
Grossi (2006): found association priming effect in terms of a reduced N400 to associated targets.
Masked Priming: ERP Data


L1 – L1

L2 – L2

L1 – L2
Masked Priming: ERP Data

The Current Study
Research Questions: Revisited

- Are the mental representations organized together in an integrated neural system?
  - Or are they each organized in separate, language specific, lexicons?

- Is bilingual lexical organization affected by factors such as AoA and proficiency?
Participant Information

- English-French Bilinguals
  - Simultaneous bilinguals (AoA = birth)
  - L1 English – Early French (AoA < 7)
  - L1 English – Late French (AoA ≥ 7)
  - Functional English monolinguals (never immersed)
Methods: Conditions & Stimuli

- High frequency items

<table>
<thead>
<tr>
<th>Repetition (REP)</th>
<th>Semantic (SEM)</th>
<th>Translation (TRA)</th>
<th>Unrelated (UNR)</th>
<th>TARGET</th>
</tr>
</thead>
<tbody>
<tr>
<td>meal</td>
<td>eat</td>
<td>repas</td>
<td>tape</td>
<td>MEAL</td>
</tr>
<tr>
<td>snow</td>
<td>cold</td>
<td>neige</td>
<td>door</td>
<td>SNOW</td>
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<td>apple</td>
<td>pie</td>
<td>pomme</td>
<td>web</td>
<td>APPLE</td>
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</table>
Methods: Procedure

Mask  500ms  #######

Prime  52ms  neige

Target  500ms  SNOW
Methods: Procedure

Mask 500ms #######

Prime 52ms neige

Target 500ms TAVE
## Hypotheses

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Results: Behavioural Data
105 participants from the Ottawa region

- The Monolinguals have lowest proficiency (all $p$’s < .001)
- The Simultaneous Bilinguals have highest proficiency (all $p$’s < .001)
- No significant difference between the Early and Late Bilinguals ($p$=.379)
## Conclusions

The masked priming paradigm works!
- Repetition and Semantic priming is found for all groups

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- The Monolinguals and L1 English Late French groups do not show translation priming effects.
## Conclusions

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- The *Simultaneous Bilinguals* and *L1 English Early French* groups DO show translation priming effects.
## Conclusions

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- The Bilinguals show equal priming for the Semantic and Translation conditions
  - Possibly suggesting that translations are treated in the same manner as semantically associated words
Preliminary Results: ERP Data
31 participants from the Ottawa region

- Monolinguals have lowest self-rated proficiency \( (\text{all } p\text{'s } < .07) \)
- Simultaneous Bilinguals have highest self-rated proficiency \( (\text{all } p\text{'s } < .09) \)
- No significant difference between the Early and Late Bilinguals in self-rated proficiency \( (p = 1.0) \) nor in French cloze test scores \( (p = 1.0) \)

<table>
<thead>
<tr>
<th>Participants</th>
<th>N</th>
<th>AoA (St. Dev)</th>
<th>Fr. Prof. (St. Dev.)</th>
<th>Fr. Cloze Score (St. Dev)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sim. Bilinguals</td>
<td>3</td>
<td>0 (0.0)</td>
<td>9.3 (0.6)</td>
<td>36.0 (2.0)</td>
</tr>
<tr>
<td>L1E-Early L2F</td>
<td>11</td>
<td>4.7 (1.0)</td>
<td>6.4 (1.5)</td>
<td>25.3 (10.4)</td>
</tr>
<tr>
<td>L1E-Late L2F</td>
<td>6</td>
<td>9.8 (1.2)</td>
<td>6.2 (1.2)</td>
<td>20.2 (12.8)</td>
</tr>
<tr>
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<td>11</td>
<td>-</td>
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Preliminary ERP Data
ERP Data: Monolinguals

Repetition
Association
Translation
Unrelated
ERP Data: Late Bilinguals

Repetition
Association
Translation
Unrelated

F3

400ms

Fz

400ms
ERP Data: Simultaneous & Early Bilinguals

Repetition
Association
Translation
Unrelated

400ms
We do not find a reduced N400 effect

- Methodological issues
  - No backward mask as in previous ERP masked priming studies
  - Participants in earlier studies may have had time to more fully process the prime

- Topographical differences
  - Our N400 is frontal
Our interpretation

- Early access to repetition target
- Simultaneous and early bilinguals access the translation and association targets with the same timing
- Even the (functional) monolinguals seem to access the translation targets
General Conclusions
AoA is an important factor in the organization of the Bilingual Mental Lexicon
- These data suggest that the lexicons of both languages are shared in simultaneous and early bilinguals
- For sequential bilinguals, AoA seems to be more important than L2 proficiency
General Conclusions

- The behavioural data suggests:
  - A separated semantic representation Late Bilinguals
  - A shared semantic representation for Simultaneous and Early Bilinguals

- However: The ERP data suggests
  - That even our (functional) monolinguals may be quickly processing the translation primes
  - *note: this does not necessarily mean that the translation prime facilitates the target
Future Directions

- French targets (we want to test in the L1-L2 as well as the L2 to L1 directions)
- Low frequency items
- Orthographic primes
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Thank you!