Outline

- Bilingual Memory Representations
- Language Competition
- Syntax
- Language Control
- Executive Control
- L2 Language Teaching Techniques
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Goals

• To understand how bilinguals compare to monolinguals

• To understand how conceptual and lexical representations are organized in bilinguals

• To understand how bilingualism affects other aspects of cognitive processing
Bilinguals

- Know and use 2 languages on a regular basis
- Most people in the world are bilingual
  - Majority of Europeans are bilingual
    - 90% of Dutch are bilingual
- Bilinguals have two labels for many concepts

“Those French. They have a different word for everything!” - Steve Martin
Bilingual Representations

• Fundamental question

• How do bilinguals represent knowledge?

• Recall that

• Lexical Knowledge (stored information about words)

• Can be broken down into concepts (meaning) and phonological form (sounds)
Bilingual Representations

• Most theories of bilingualism assume that learning a second language

• DOES NOT require the learner to develop an entirely new set of concepts

• DOES require the learner to develop a new set of phonological forms and labels for lexical concepts
Meaning of "cat"

- English Label: Cat
- Russian Label: Koshka
Bilingual Representations

• How are these labels (cat --> koshka) represented and related to each other in memory?

• WAM (Word Association Model)
• CM (Concept Mediation Model)
• RHM (Revised Hierarchical Model)
WAM
(Word Association Model)

• Words in L2 (second, non-native language) are associated with words in L1 (first, native language)
WAM
(Word Association Model)

meaning of “cat”: mammal, meow, furry, independent, furry, scary, bites, scratches, pet... different from dog
CM
(Concept Mediation Model)

- Words in L1 (native) and L2 (nn-native) are associated with concepts
- But not directly with each other
CM
(Concept Mediation Model)

Concept Mediation Model

First Language Labels
Second Language Labels

Concepts

Images

meaning of “cat”: mammal, meow, furry, independent, furry, scary, bites, scratches, pet... different from dog

cat
koshka
Picture Naming & Translation Experiments

- **cat**
- **koshka**

- meaning of “cat”: mammal, meow, furry, independent, furry, scary, bites, scratches, pet... different from dog

- Translation

- Picture Naming
WAM Predictions

• WAM: Translation in either direction (native to non-native; non-native to native) should be faster than Picture-Naming in non-native.

• Because L2 (non-native) and L1 (native) are linked.

meaning of “cat”: mammal, meow, furry, independent, furry, scary, bites, scratches, pet... different from dog.
CM Predictions

- CM: Native to non-native (L1-L2) translation should take the same amount of time as picture-naming in non-native

- Because L2 (non-native) and L1 (native) are **NOT** linked

```plaintext
meaning of “cat”: mammal, meow, furry, independent, furry, scary, bites, scratches, pet... different from dog
```

```
<table>
<thead>
<tr>
<th>cat</th>
<th>koshka</th>
</tr>
</thead>
</table>
```

```
Grumpy Cat
```

Translating from native (L1) to non-native (L2) takes the same amount of time as naming a picture in non-native (L2)
BUT!

• It is a bit more complicated than the CM proposes

• Bilinguals are capable of forward and backward translation

  • *Forward translation*: starting with L1 and producing L2 (native to non-native)

  • What is the Spanish version of cat? GATO!

  • *Backward translation*: starting with L2 and producing L1 (non-native to native)

  • What is the English word for gato? CAT!
FIG. 3. Revised hierarchical model of lexical and conceptual representation in bilingual memory.
RHM
(Revised Hierarchical Model)

- Developed to handle the forward and backward components of bilingual processing
- Just like the CM model, but directly links L1 & L2 labels

meaning of “cat”: mammal, meow, furry, independent, furry, scary, bites, scratches, pet... different from dog
RHM
(Revised Hierarchical Model)

- L1-concepts are **stronger** than L2 links
- L2-L1 lexical links are **stronger** than L1-L2 lexical links
- L2-L1 (gato --> cat) translations are faster than L1-L2 (cat --> gato) translation
- Semantic interference is greater in L1-L2 translation
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Competition During Production & Comprehension

- First rule of bilingualism
  - 2 Languages compete for (lexical & semantic representation) selection and activation in the speech apparatus (output mechanism)
  - Resulting in multiple activations at once
  - With relatively few or rare mistakes occurring
    - Except under stress, time pressure and fatigue
    - L2 is unpracticed and less-dominant
Competition During Production & Comprehension

- Evidence for simultaneous activation of L1 and L2
- *Cognate advantage:* words that sound alike and mean the same thing are produced and comprehended faster than other words
  - *piano* (English and Spanish)
  - in bilingual and monolingual modes
  - fewer tip-of-tongue states
- *Interlingual homograph disadvantage:*
  - words sound and look alike, mean different things
  - *-chef = cook* (English) and *boss* (German)
Competition During Production & Comprehension

- Listening activates conceptual representations associated with both L1 and L2 words

- marker activates marka (stamp) in Russian-English bilingualism

Monolinguals
Competition During Production & Comprehension

- Listening activates conceptual representations associated with both L1 and L2 words
- Marker activates marka (stamp) in Russian-English bilingualism

Bilinguals

Click on the marker.
Competition During Production & Comprehension

- Listening activates conceptual representations associated with both L1 and L2 words
- Marker activates marka (stamp) in Russian-English bilingualism
- Neighborhood effects: L1 competitors interfere with target naming in progressive de-masking experiments

Amount of time it takes a bilingual to respond depends on: word length, frequency, neighborhood density

Response times low: in L2, L1 neighbors are more frequent than L2
Competition During Production & Comprehension

- Listening activates conceptual representations associated with both L1 and L2 words
  - marker activates marka (stamp) in Russian-English bilingualism
- Neighborhood effects: L1 competitors interfere with target naming in *progressive de-masking* experiments
- Pseudohomophone priming: roap (“rope”) primes touw (“rope”) in Dutch-English bilinguals
Competition During Production & Comprehension

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• In picture-word interference experiments, phonological experiments help (mouw, mouth, mountain); semantic distractors hurt (valley, dal, mountain)
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valley slows you down
Competition During Production & Comprehension

- Listening activates conceptual representations associated with both L1 and L2 words
- Output-language semantic distractors interfere with input-language distractors in translation task
- Possible exceptions to competition
  - Highly proficient Catalan-Spanish/Spanish-Catalan bilinguals
  - Do not show interference in picture-naming or translation
  - Have symmetrical switch costs
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Syntactic Priming

- Occurs when producing one syntactic structure for one sentence, making it more likely that you will produce the same structure for a subsequent sentence.
Shared Syntactic Structure Representations

• (1) The truck is chased by the taxi.
• (2) El camion es perseguido por el taxi.

*passive form of English and Spanish*

• Shared syntax account: bilinguals re-use as much of their syntax of their first language as possible when learning and using a second language
Shared Syntax

• Bilinguals who hear a syntactic structure in one language are more likely to respond with that structure in the other language

• Syntactic priming effects are just as large when bilingual switches between languages as when they produce consecutive utterances in the same language

• Syntactic priming persists across brief lags

• Bilinguals are likely to recall previously-studied sentences using the same syntactic form as a sentence they have recently comprehended
Review

• Bilinguals don’t have two separate stores for their languages
  • WAM links labels
  • CM links labels to concepts
  • RHM links labels and concepts
• Competition occurs, resulting in simultaneous activation of L1 and L2 representations
• Factors such as cognate advantage help, but interlingual homophones hurt activation patterns
• Syntactic priming occurs between languages if they share the same syntactic structure
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Language Control in Bilinguals

• Most theories assume that in bilinguals, both labels become active at the same time
  • The labels compete for activation

• Bilinguals must possess cognitive mechanisms that allow them to activate and suppress the relevant label

• How do bilinguals do this?
Language Control in Bilinguals

• Early theories suggest that...
  • Selective access is responsible
    • bilinguals possess the mental equivalent of a light switch that can be set to activate or deactivate an individual language

• More recent evidence against selective access
  • Paradoxical Switch Cost
Language Control in Bilinguals

- Paradoxical switch cost: asymmetric cost of switching between languages
  - change from L2-L1 is costlier than switching from L1-L2 (in a continuous manner)
    - Harder to switch from non-native to native, than native to non-native

- Because...
  - Non-dominant language is weaker than the dominant language
  - Bilingual speakers suppress words in the dominant language in order to speak the less dominant language
Models of Bilingual Word Processing

• BIA+: based on TRACE
  • Incorporates feature, letter (or phoneme), and word levels
  • Modifies trace by adding a level or representation that codes the “language” level
Figure 1. A sketch of some of the processing levels involved in visual and auditory word perception, with interconnections.
Models of Bilingual Word Processing

- Multiple candidates will become activated
- Competition within and across languages
- Language node: allows us to switch between languages at the higher level processing
- Nicely fits into the explanation of monolingual word processing
Inhibitory Control Model

- A set of language-specific and general cognitive skills determine how bilinguals process language
  - Goal monitoring mechanism
  - Supervisory attention system
    - Switch costs are incurred because of the changes in goal status or language task
    - Resulting in unwanted intrusions from the context-inappropriate language at the Supervisory Attention System
  - Allows voluntary, consciously willed changes in the language task
    - (e.g., consciously switching to English from Spanish when you don’t have a word in Spanish)
Inhibitory Control Model

• Advantages:
  • Helps explain switch costs, unwanted language intrusions, and selective loss of language abilities (via TBI or TMS)
  • Helps explain that new word meanings are like learning new kinds of facts due to the support of the declarative memory system (goal and concept monitoring)
  • Learning syntax and grammar is harder because it is supported by the procedural memory system
“Zooming In”

• Is language control easier in some situations than in others?
  • YES: recent experience affects the way bilingual speakers access the lexicon
  • For example:
    • When German-English bilinguals watched a 20 min video that was narrated in English, there was no evidence that the L1 meaning of “gift” (meaning poison in German) affected the English interpretation after performing an English lexical decision task
    • Also, highly constraining contexts eliminate the cognate advantage
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Executive Control

• Executive Control: the set of skills that allows us to manage our thought processes effectively
  • Bilinguals have superior executive control and attentional abilities
    • In fact, children as young as 3 years of age show stronger executive control than matched monolingual children
  • Bilinguals outperform monolinguals in tasks that require an individual to ignore task-irrelevant information
    • Interference suppression (ignoring distracting information)
    • Response inhibition (bypassing a stronger but incorrect response in order to execute a weaker but correct response)
Executive Control

• BUT: Bilinguals are **NOT** better at all executive control tasks

  • Phonological perception is about the same in monolinguals and bilinguals

  • Bimodal bilinguals (ASL) resemble monolinguals on executive control tasks
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Second Language Teaching Techniques

• Adult second language learning is complicated by the critical period/sensitive phase
  • Because of loss of plasticity in procedural memory systems and/or entrenchment in L1
Second Language Teaching Techniques

- Applying the RHM to L2 learning
  - L1 labels compete with L2 labels
  - This can be reduced by providing unique visual cues to L2 labels
- Immersion
  - isn’t universally superior to other techniques
  - recent research suggests that having exposure to different talkers should increase your fluency
  - works better for students with greater working memory capacity
- Study abroad
  - enhances fluency
  - does not seem to affect speed of lexical access
Second Language Teaching Techniques

- L2 outcomes and efficacy of instruction methods depends on
  - type of instruction
  - individual learner characteristics
    - working memory
    - phonological memory
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Neural Basis of Bilingualism

- L1 and L2 activate similar brain regions
  - but interlingual homographs lead to greater activation in inferior frontal and anterior cingulate
- L1-L2 switches lead to greater neural activity
- Subtle differences in neural activity in response to L1 vs. L2 may reflect differences in difficulty between the two languages
- In L2 learners
  - brain wave activity changes overt behavior for both semantic and syntactic aspects of L2
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- Competition occurs, resulting in simultaneous activation of L1 and L2 representations
- Factors such as cognate advantage help, but interlingual homophones hurt activation patterns
- Syntactic priming occurs between languages if they share the same syntactic structure
- Word recognition in bilinguals is similar to monolingual processing (BIA+; TRACE)
- Inhibitory control explains how bilinguals can switch between languages
- Bilinguals generally have better executive control than monolinguals
- Using what we know about bilingualism helps us teach a second language
- NO evidence of separate brain regions responsible for L1, being different than L2 (just increased activation)