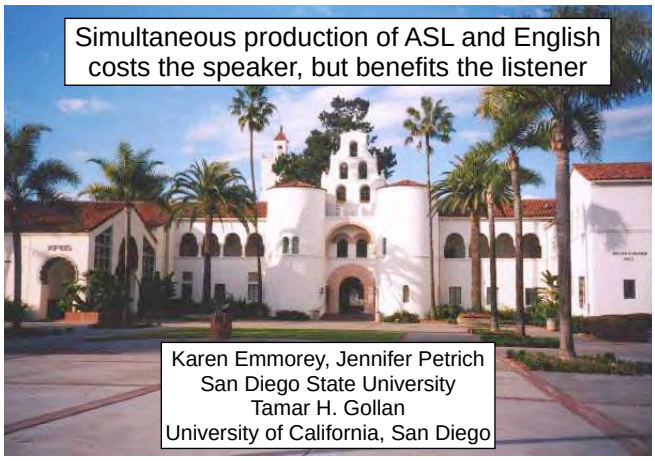


Bimodal bilingualism: focus on hearing signers

Unimodal bilinguals:
Two spoken languages

One linguistic output channel:
Vocal articulation

Bimodal bilinguals:
A signed and a spoken language

Two linguistic output channels:
Vocal and manual articulation

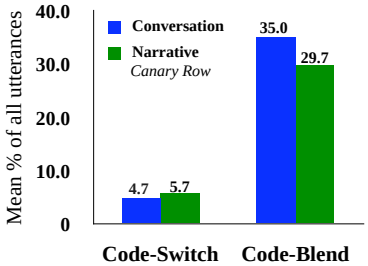
Distinct constraints on language mixing

- Unimodal bilinguals must code-switch between languages
  - Spanish *to* English: "Dame una hamburgesa sin **lettuce** por favor." (Heredia & Altaribba, 2001)
- Bimodal bilinguals can code-blend, producing lexical items in each language at the same time
  - English *and* ASL: Saying "please" while simultaneously signing PLEASE

What are the relative processing costs of dual lexical selection vs. inhibition?

Do bimodal bilinguals prefer code-blending over code-switching?

Bimodal Language Mixing: ASL-English bilinguals prefer to *code-blend*



Emmorey, Borinstein, Thompson, & Gollan, *Bilingualism: Language and Cognition*, 2008

Preference for code-blending suggests that language inhibition is more costly than dual language selection

Unimodal bilinguals exhibit code-switch costs – e.g., picture-naming times are slower when switching between languages

Does code-blending incur any language production cost?

Picture naming methods

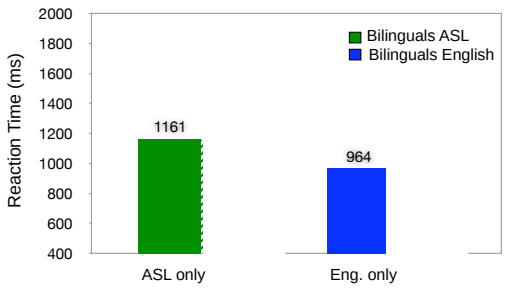
- Task: Name 120 pictures:
  - ASL only (40 pictures)
  - English only (40 pictures)
  - Code-blend (both ASL and English) (40 pictures)
- Participants: 38 highly fluent ASL-English bilinguals (English dominant)
  - 18 were born into deaf signing families ("Codas")
  - 20 were proficient late learners
- Control participants
  - 30 Deaf ASL signers (21 native, 4 early, 5 late signers)
  - 21 Monolingual English speakers

Picture naming in ASL

Picture naming in English

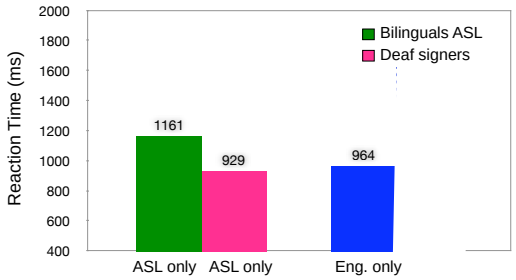
Picture naming with code-blends

Picture naming times were slower for the non-dominant language



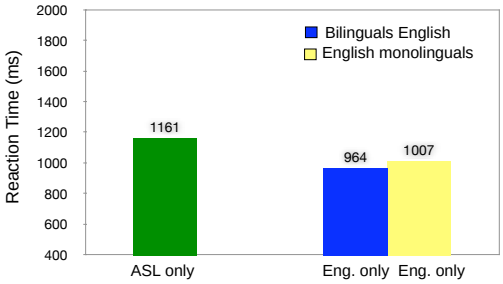
RTs for ASL were slower than for English

Picture naming times were slower for the non-dominant language



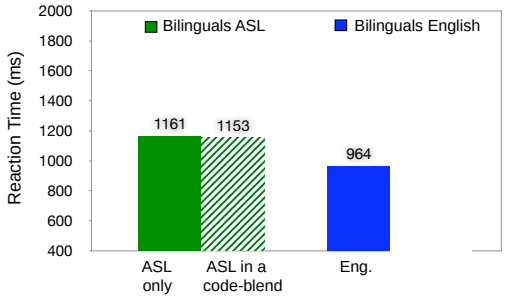
RTs were faster for Deaf ASL signers (ASL dominant) than for bimodal bilinguals ($p < .001$)

Picture naming times in the dominant language (English)



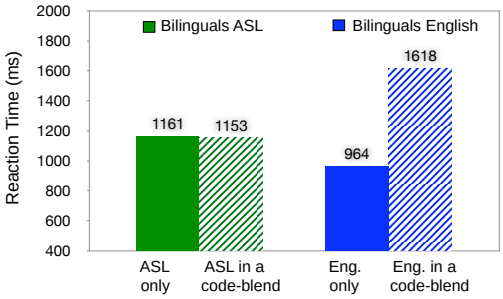
RTs for English did not differ from monolinguals

No cost to ASL when produced with English



RTs for ASL were not significantly different when ASL was produced within a code-blend

A LARGE cost to English when produced simultaneously with ASL

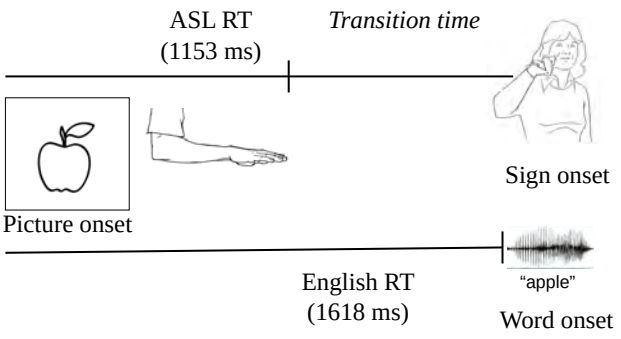


RTs for English were much slower when English was produced within a code-blend ($p < .001$)

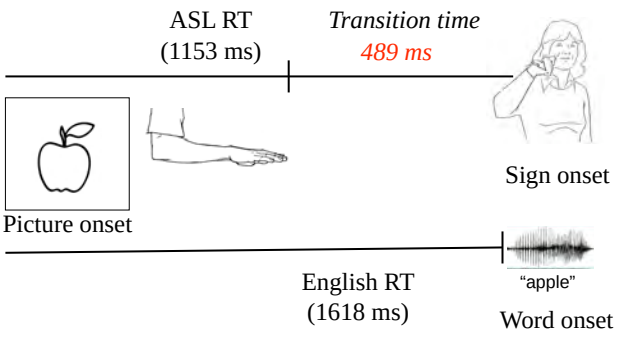
Bilinguals wait until the onset of the ASL sign before producing the English word

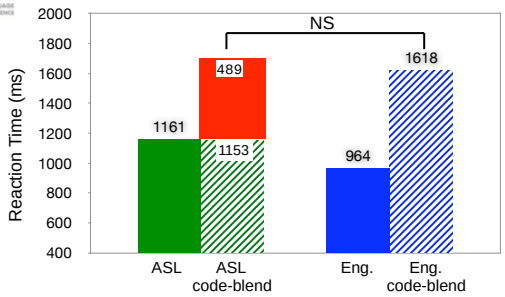
Code-Blend in Slow Motion

Response time measures within an ASL-English Code-Blend



We measured transition time between response release to onset of the ASL sign





A language coordination cost accounts for the size of the code-blend cost for English

No speech delay for spontaneous code-blending

- Picture naming: Dual lexical retrieval initiated as soon as the concept is recognized
  - The hands are slower articulators, speech onset is delayed
- Natural code-blending: An ASL sign can be retrieved prior to articulation of its English translation equivalent
  - Implies ASL signs are retrieved at a relatively early stage of utterance planning

Does code-blending incur a language production cost?

- Yes
- Production of English is delayed within a code-blend
  - Vocal and manual articulators are not independent
- The cost is asymmetric
  - ASL production times are not affected by code-blending
- BUT we don't know whether the lexical retrieval cost is greater for English within a code-blend
  - Slower ASL retrieval and the co-ordination cost masks possible retrieval costs for English

Does code-blending facilitate or delay lexical recognition?

Comprehension of Code-Blends

- Task: Determine whether item is edible or not
  - ASL only (30 signs)
  - English only (30 words)
  - Code-blend (both ASL and English) (30 code-blends)
- Participants: 43 highly fluent ASL-English bilinguals
  - 18 were born into deaf signing families (Early Bilinguals)
  - 25 were proficient late learners (Late bilinguals)
- Control Participants:
  - 25 Deaf fluent signers (12 native, 4 early, 9 late signers)
  - 21 monolingual English speakers

ASL examples

+

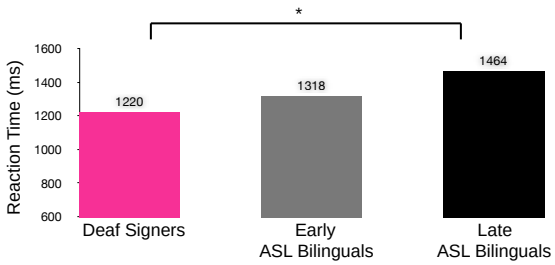
English examples

+

Code-blend examples

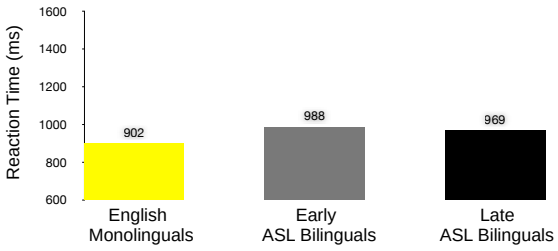
+

ASL Comprehension



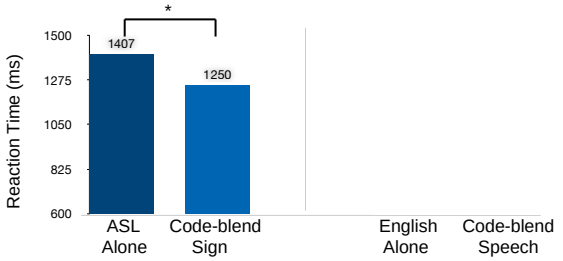
Late bilinguals were slower to recognize ASL signs than Deaf signers

English Comprehension



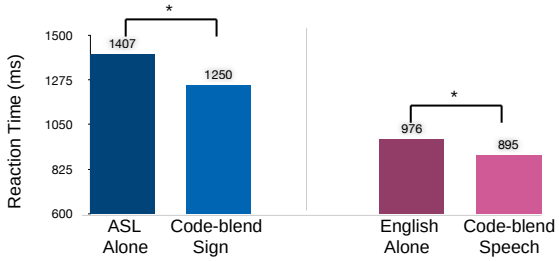
No differences between English monolinguals and ASL-English bilinguals

Code-blend Comprehension



Code-blending facilitated recognition of ASL signs

Code-blend Comprehension



Code-blending also facilitated recognition of English words

Summary

- Code-blending is preferred over code-switching
  - Dual lexical selection is less costly than lexical inhibition of one language
- Code-blend production incurs a language coordination cost
  - ASL is selected early in sentence planning
- Code-blend perception benefits the perceiver
  - English words and ASL signs may mutually prime each other during comprehension

Thank you!

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- Danielle Lucien

• All our bimodal bilingual participants!