Not all code-switches are costly: Examining semantic v. language unexpectancy

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Code-switching

- Code-switching is the intentional and fluid alternation between languages within conversation
- It is not random as bilinguals also demonstrate the ability to stay in one language when necessary
- It has primarily been studied both from social and structural perspectives

Code-switching as a *complex* speech act

- Both individual and community-level characteristics impact the frequency of code-switching and the type of code-switching

- Individual-level:
  - Proficiency: the higher the proficiency in both languages, the more likely to engage in intra-sentential code-switching (Miccio et al., 2009)

- Community-level:
  - Poplack (1988): French-English bilinguals in Ottawa-Hull region v. Spanish-English bilinguals in New York City

Code-switching as a *complex* speech act

- By comparison, the cognitive and neural processes that support the processing of code-switched speech remain understudied (Altarriba et al., 1999; Dussias, 2003; Guzzardo Tamargo & Dussias, 2013; Fricke et al., 2016; Guzzardo Tamargo et al., 2016; Kootstra et al., 2010, 2012; Li, 1994; Moreno et al., 2002; Valdés Kroff et al., 2016)

- This literature has been informed by three primary threads:
  - Whether code-switching leads to processing costs
  - Relationship to other switching phenomena, i.e. cued language switching and non-linguistic task switching
  - How bilinguals integrate code-switched speech in comprehension

Code-switching as a *complex* speech act

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Real-time integration of CS

- Code-switching presents unique challenges to comprehension
  - Successful comprehension requires integration of two grammars (phonetics/phonology; morpho-syntax; semantics, etc.)

- Whereas production of CS is putatively under the control of the speaker, it is not for comprehension

- If bilinguals a) strongly commit to unilingual processing or b) do not know beforehand what language is coming up, then comprehension might suffer

How does CS compare to other forms of linguistic unexpectancy?

- Even within unilingual processing lexical, structural, and semantic factors affect comprehension
  - lexical: word frequency, neighborhood density
  - structural: grammatical gender, filler-gap dependencies, verb bias
  - **semantic: cloze probability, sentential constraint**

- 2 prior studies have examined some of these factors with CS
  - Altarriba et al. (1996)
  - Moreno et al. (2002)

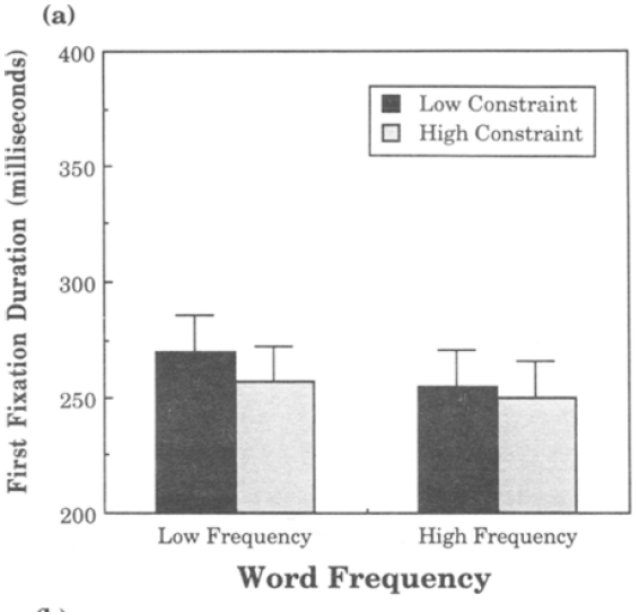
Altarriba et al. (1996)

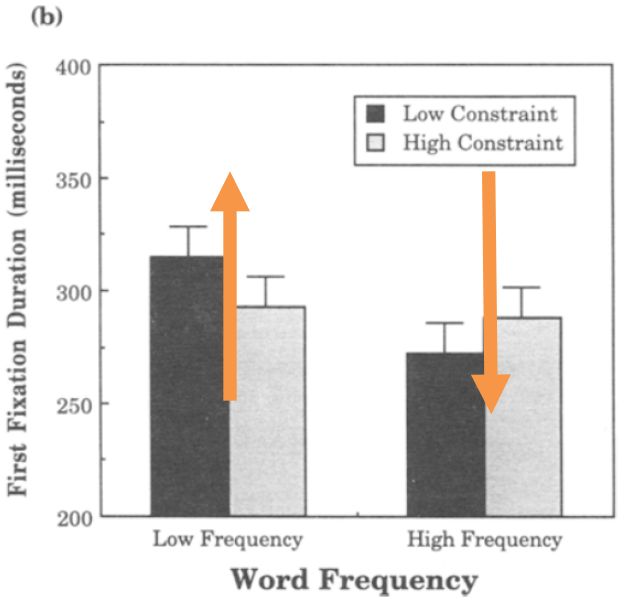
Table 1
Sample High- and Low-Constraint Sentences Used in Experiments 1 and 2

Condition	Sentence
English Target Words	
High constraint	"He wanted to deposit all of his *money* at the credit union."
Low constraint	"He always placed all of his *money* on a silver dish on his dresser."
Spanish Target Words	
High constraint	"He wanted to deposit all of his *dinero* at the credit union."
Low constraint	"He always placed all of his *dinero* on a silver dish on his dresser."

Altarriba et al. (1996)

- lexical frequency x semantic constraint
  - Bilinguals slower to integrate High freq CS in high constraint sentences
  - Slower processing in low-frequency conditions increases time to potentially solve conflict





Moreno et al. (2002)

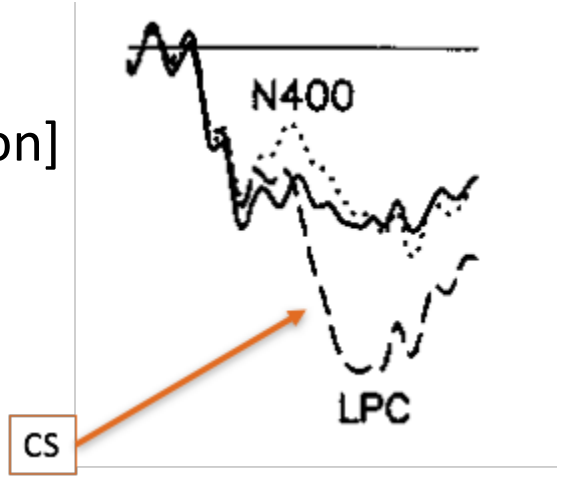
Moreno et al. used ERPs to investigate the relative costs to comprehension of code-switches compared to within-language "switches"

Each night the campers built a _____

fire [hi-cloze expected completion]

blaze [lexical switch]

fuego [code-switch]



CS as linguistic unexpectancy

- We can compare CS as one form of linguistic unexpectancy to other forms such as semantic unexpectancy (*a la* Moreno et al., 2002)

- This design allows us to compare the relative costs to integration of different forms of unexpectancy

- Additionally, we include switches from Spanish to English
  - Our own reading of corpus data is that S → E is more ecologically valid

- We further complete the Moreno et al. exp. design by including CS Unexpected conditions

- Include bilinguals who indicate that they at least moderately code-switch in daily interactions

Questions

- Will we replicate the original Moreno et al. (2002) findings using Spanish to English CS?

- Does semantic unexpectancy influence the integration of the CS word?
  - –May see sensitivity to semantic integration even amongst CS words
  - –May also differ from the non-switched unexpected condition

- Does self-reported CS exposure influence a bilingual's ability to integrate CS words?

Participants

- 22 Spanish/English bilinguals from PSU.

N	Age	AoA (SD)*		Proficiency (SD)		Code-Switching frequency (1-3)
		L1	L2	L1	L2	
22	24 (4.37)	0.95 (0.90)	6.23 (2.99)	9.13 (1.58)	8.63 (1.22)	2.36 (0.49)

- High frequency of code-switching behavior.

Methods

- Expectancy (High vs Low) x Language context (Code-Switched vs Non-code-switched).

	Non code-switched	Code-Switched
Highly expected target	Los jóvenes se reunieron para ver el partido y apoyar al equipo. (*The guys got together to watch the game and to support the team*)	Los jóvenes se reunieron para ver el partido y apoyar al team.
Low expected target	Los jóvenes se reunieron para ver el partido y apoyar al entrenador. (*The guys got together to watch the game and to support the coach*)	Los jóvenes se reunieron para ver el partido y apoyar al coach.

- Spanish to English switches.

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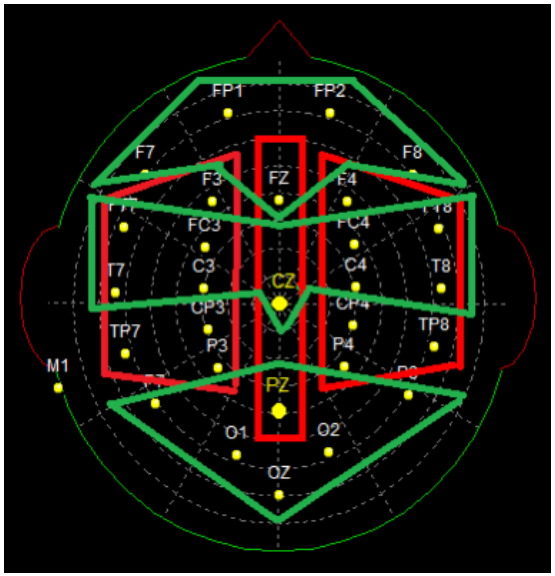
- Spanish to English switches.

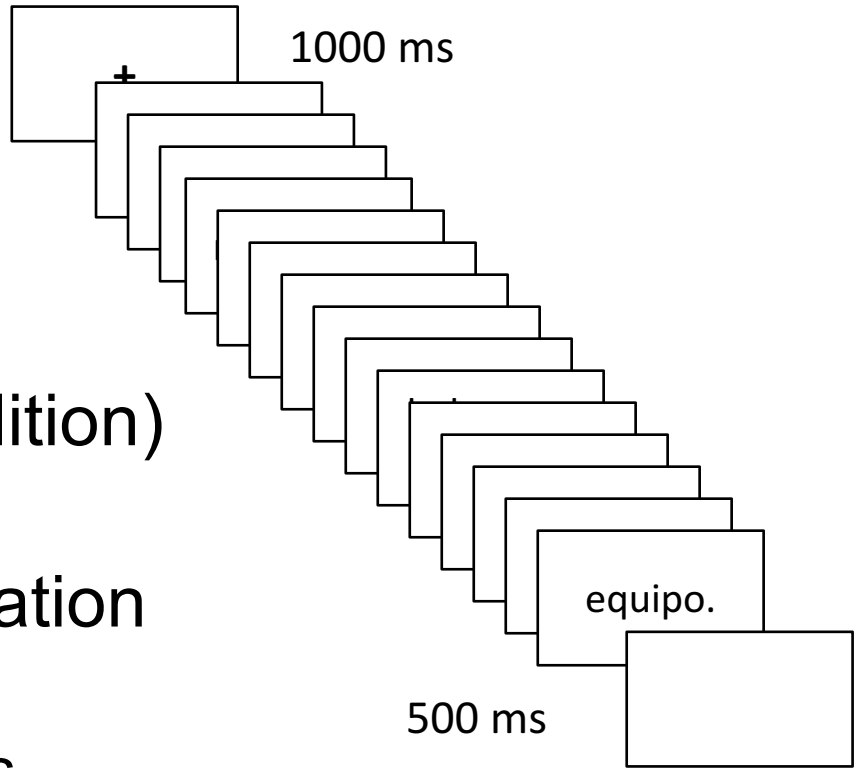
Methods

- Expectancy (High vs Low) x Language context (Code-Switched vs Non-code-switched)

- Spatial distribution of the effect
  - Anterior/Posterior factor (Anterior vs Central vs Posterior)
  - Laterality (Left vs Midline vs Right)



Procedure



- 160 sentences (40 per condition)
- Rapid Serial Visual Presentation
  - Word duration: 450 ms
  - SOA between words: 700 ms
- 20 catch sentences: Horses
  - "Lamentablemente mi tío perdió todo su dinero apostando en las horse races" (Unfortunately my uncle lost all his money betting on horse races".

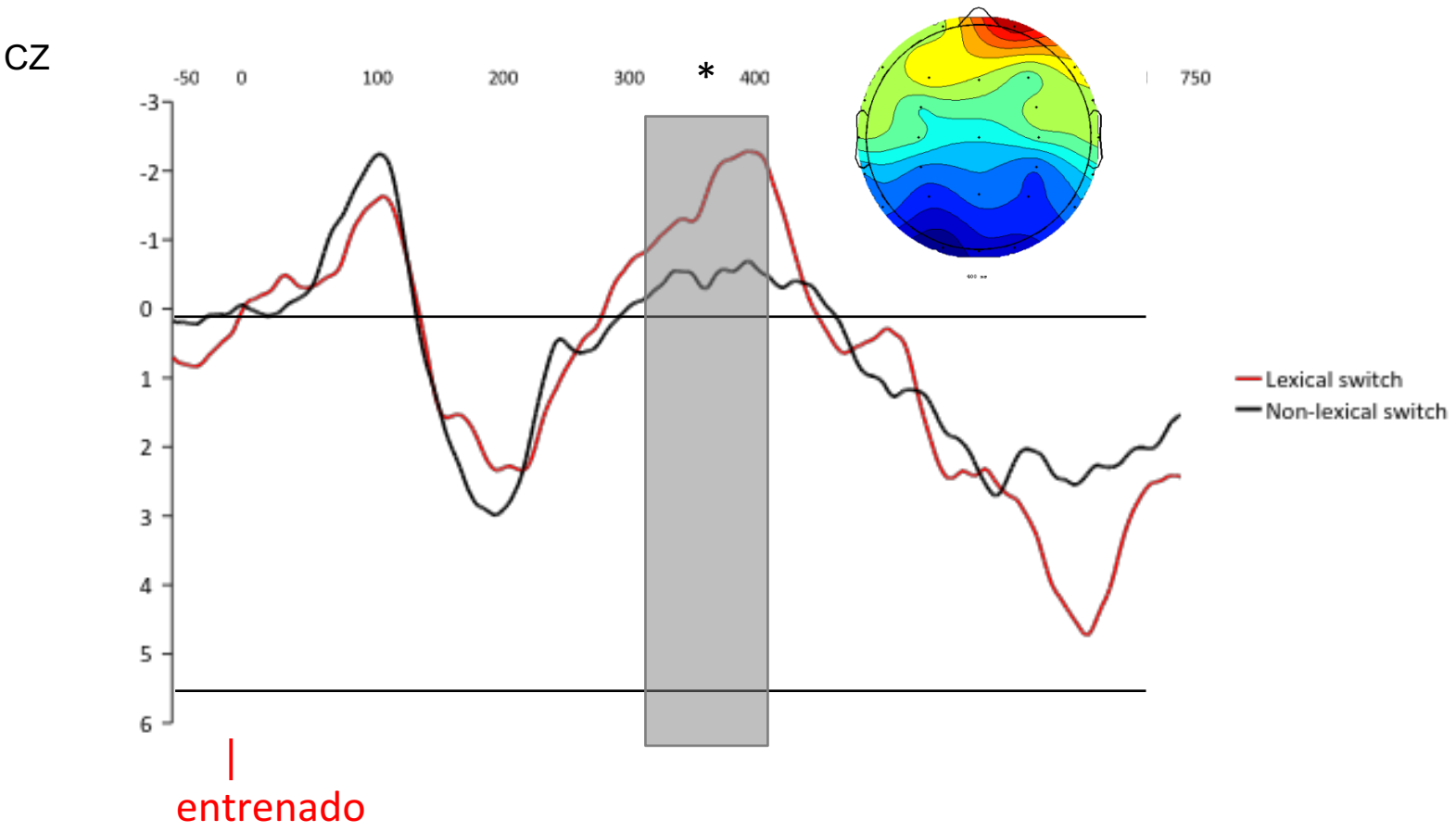
Predictions

- **Expectancy:** Less accessibility for low expected **meanings** = **(N400)**

- **Code-switching:** Less accessibility for low expected **language** = **(Early positivity + LPC,** Moreno et al 2002**)**
  - **Frequent code-switching?**

- **Modulation of Code-switching by expectancy?**

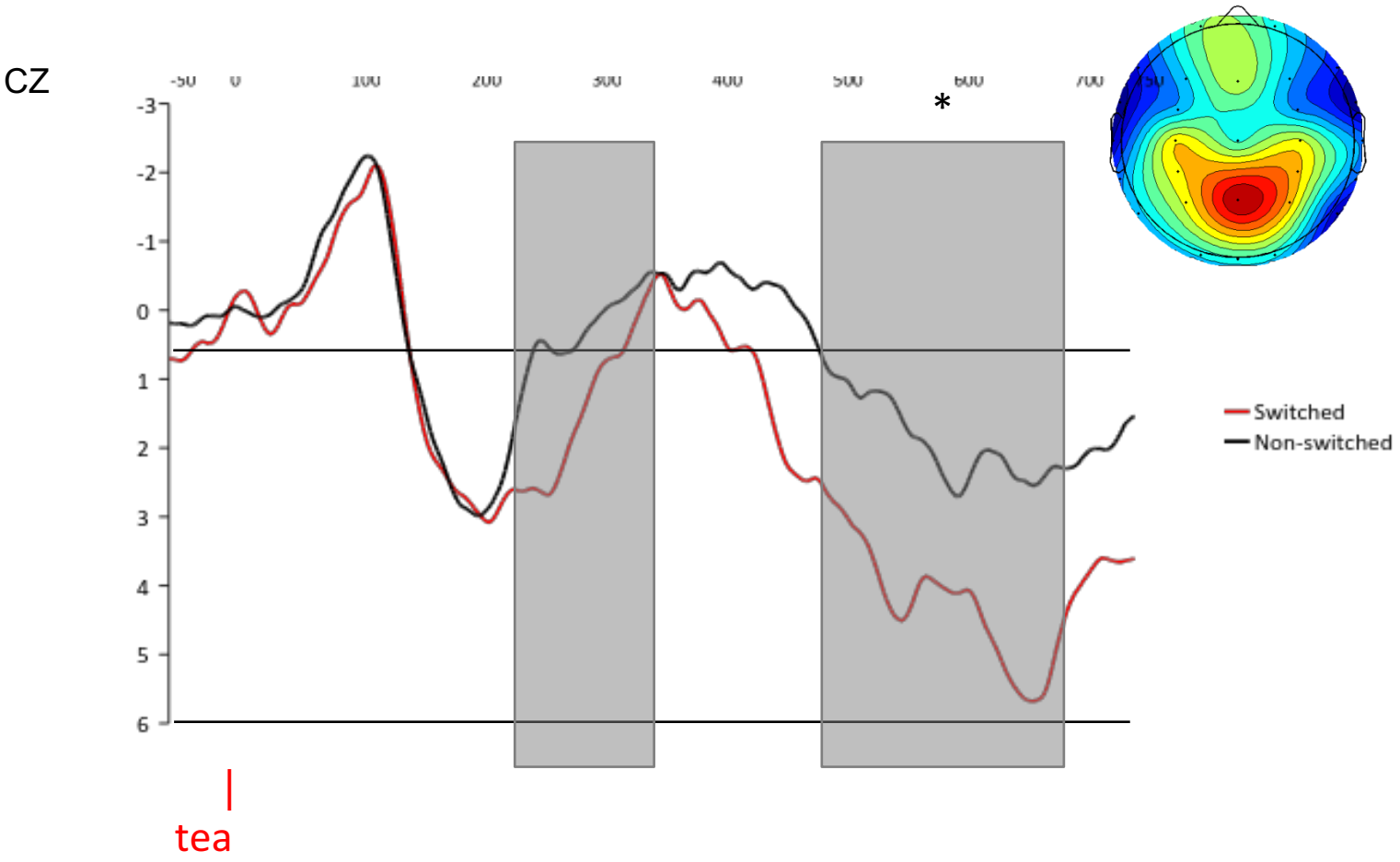
Results: Unilingual expectancy effect



Los jóvenes se reunieron para ver el partido y apoyar al entrenador vs equipo.

(The guys got together to watch the game and to support the coach / team)

Results: Code-switching effect



Los jóvenes se reunieron para ver el partido y apoyar al team vs equipo.

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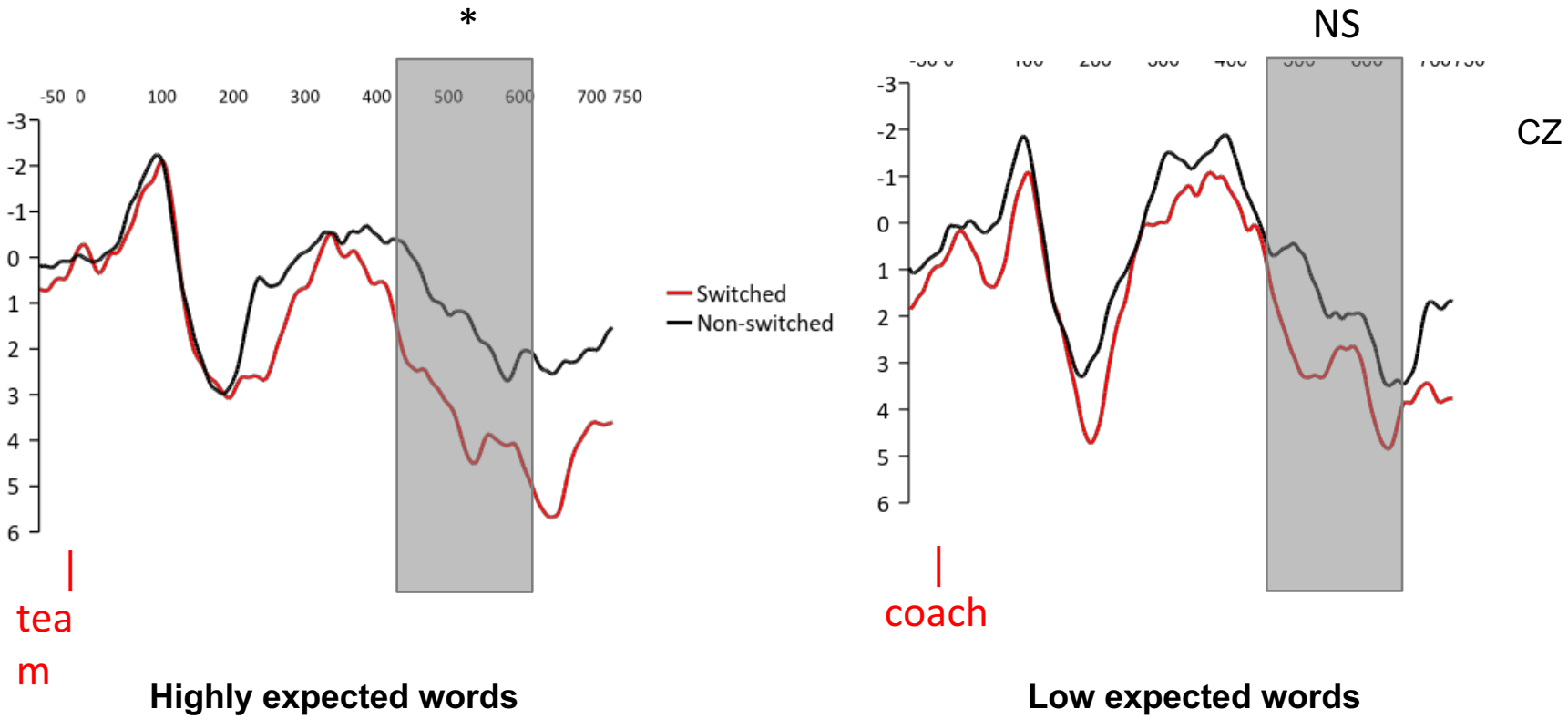
Results:



Los jóvenes se reunieron para ver el partido y apoyar al coach vs entrenador.
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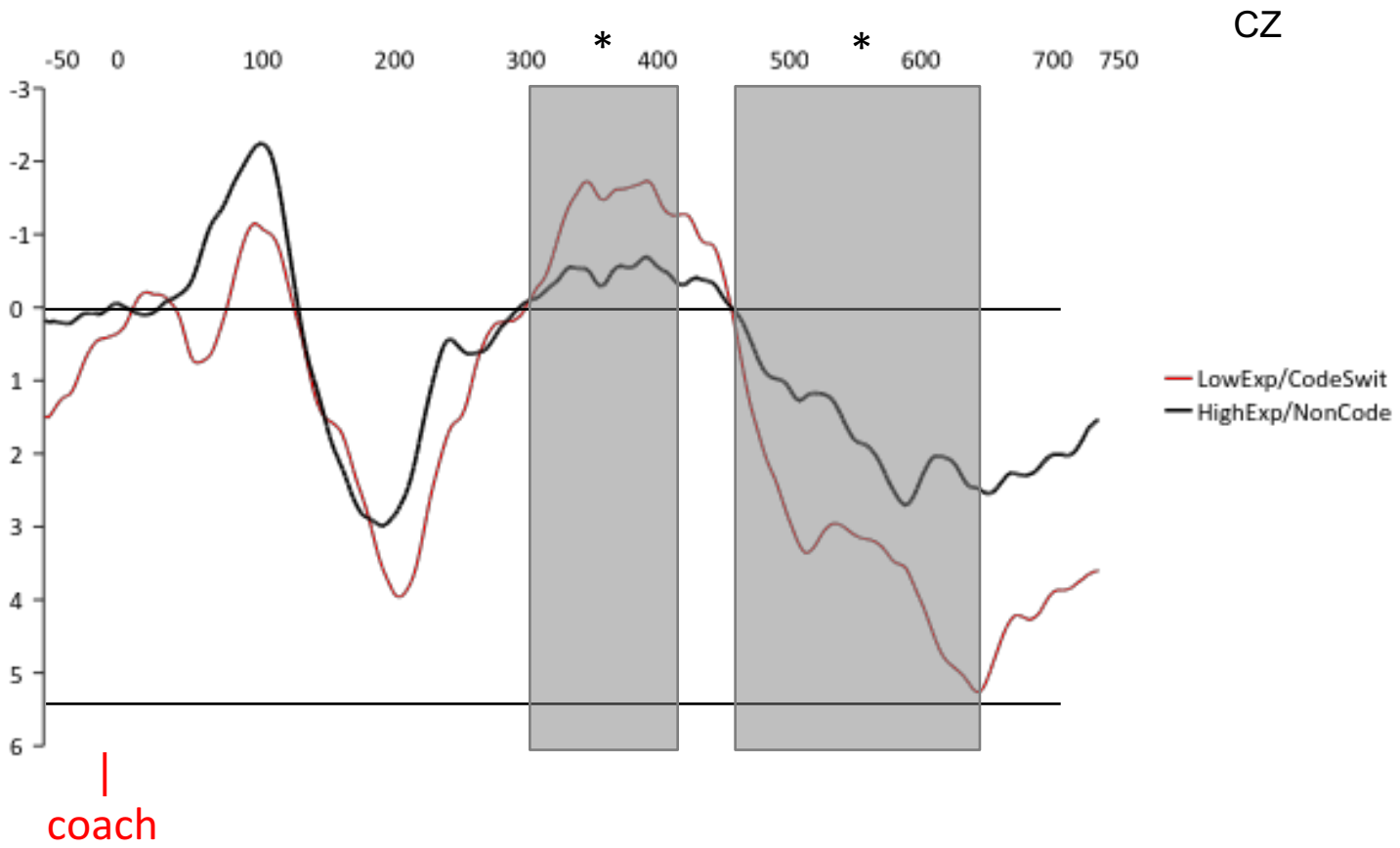
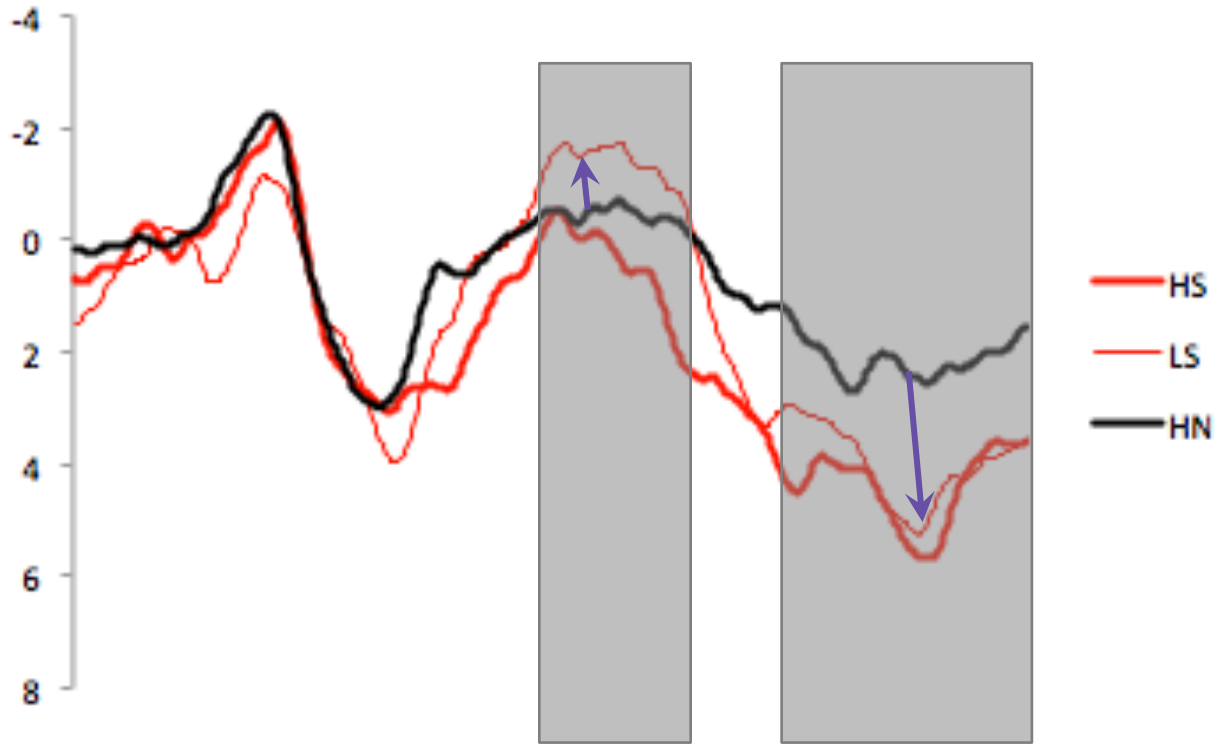


Los jóvenes se reunieron para ver el partido y apoyar al coach vs equipo.

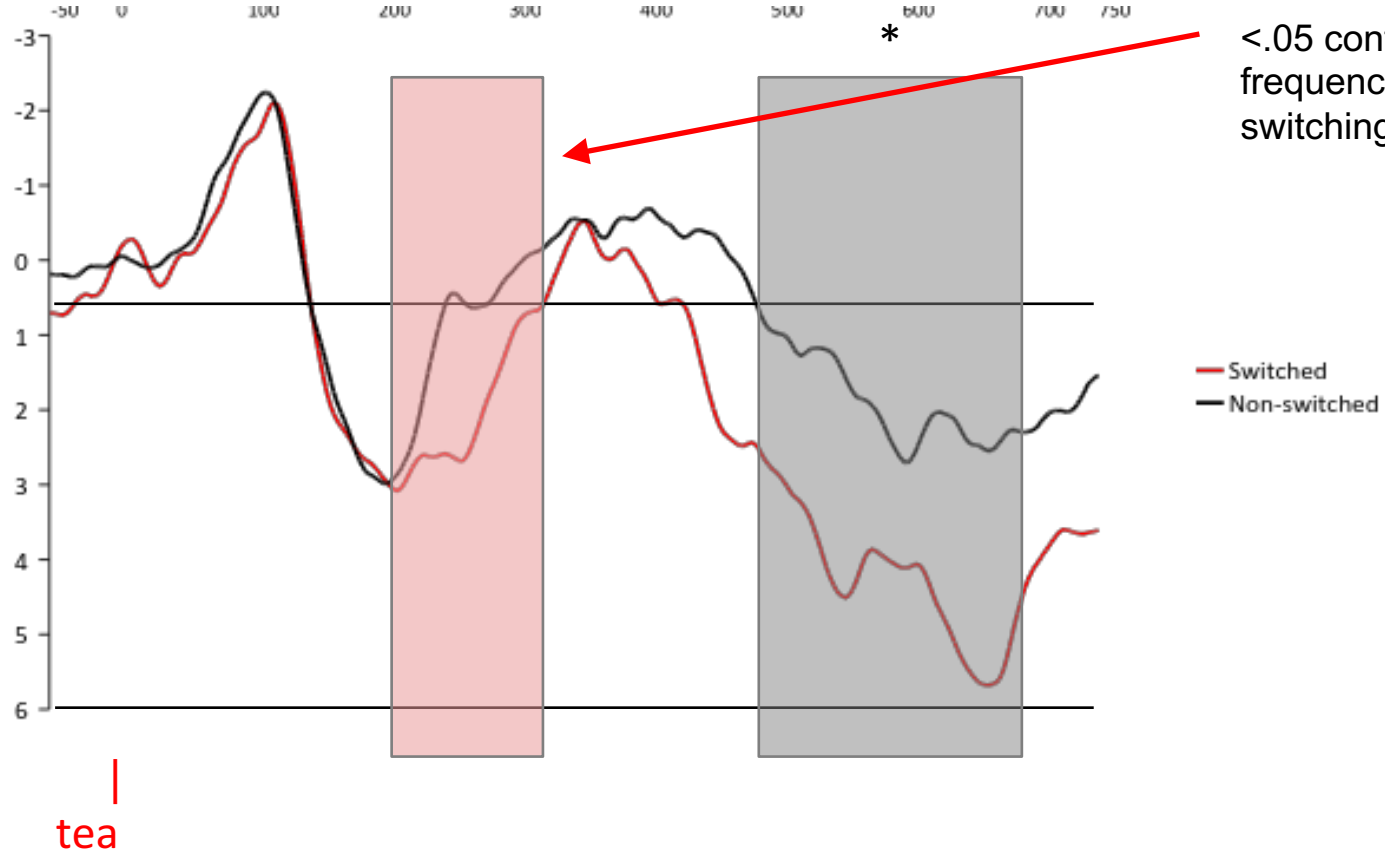
(The guys got together to watch the game and to support the coach vs team)

Results: Ex x Cs



Lexical access effect independent of code-switching effect.

Frequency of code-switching behavior



<.05 controlling by frequency of code-switching behavior

Los jóvenes se reunieron para ver el partido y apoyar al team vs equipo.

(The guys got together to watch the game and to support the team)

Summary of results

- Low expectancy associated with an N400
- Code-switching elicits an Late positivity.
- Early positivity effect modulated by frequency in CS behavior.
- Expectancy modulates code-switching effects (reduced LP).

Summary of results

		Moreno et al. 2002	Present study
Results	UW	• N400	• N400
	CS	• LAN? • LPC	• Early positivity in non-habitual code-switchers • Late positivity to CS • Reduced late positivity in low expected words
Material		English to Spanish	Spanish to English
Participants		• English/Spanish bilinguals • No code-switching frequency reported	• Spanish/English bilinguals • Frequent code-switching

Discussion: N400

- Code switching does not impair lexical/semantic access.
  - Different to language switching tasks (e.g. Meuter and Allport, 1999)
  - Frequent code-switchers may not recruit inhibition to code-switches: The adaptative hypothesis (Green & Abutalebi, 2013)
    - Dense code-switching context: Participants reporting to frequently code-switch.

Discussion: Early Positivity

- Early positivity between 200-300 ms modulated by code-switching habits.
- Associated with failure in prediction. Form prediction?

Discussion: LPC

- Late positivity: context updating/sentence integration

- No modulation by distributional factors that affect lexical access
  - –Code-switching habit

- Experience-based model

Discussion

- Production-Distribution-Comprehension model (MacDonald, 2013).
  - Valdes-Kroff et al (in press): Gender processing in comprehension mirrors production frequency.
  - Roman & Dussias (in prep): Reduced code-switching cost depending on structure and location of code switching matching production patterns.

Discussion (cont. II)

- Semantic fit modulating code-switching
  - Altarriba et al (1996): Slower processing in low-frequency conditions increases time to solve the conflict.

Conclusion

- Code-switching does not always incur a switching cost in comprehension: **Not so unexpected.**
- Factors that mirror natural patterns of code-switching in production influences this cost.

Thank you!

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Discussion

	Moreno et al. 2002	Present study
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Green and Abutalebi, 2013

TABLE 1
Demands on language control processes in bilingual speakers as a function of the interactional context relative to demands on the processes in monolingual speakers in a monolingual context

	Interactional contexts		
Control processes	*Single language*	*Dual language*	*Dense code-switching*
Goal maintenance	+	**+**	=
Interference control: conflict monitoring and interference suppression	+	**+**	=
Salient cue detection	=	+	=
Selective response inhibition	=	+	=
Task disengagement	=	+	=
Task engagement	=	+	=
Opportunistic planning	=	=	**+**

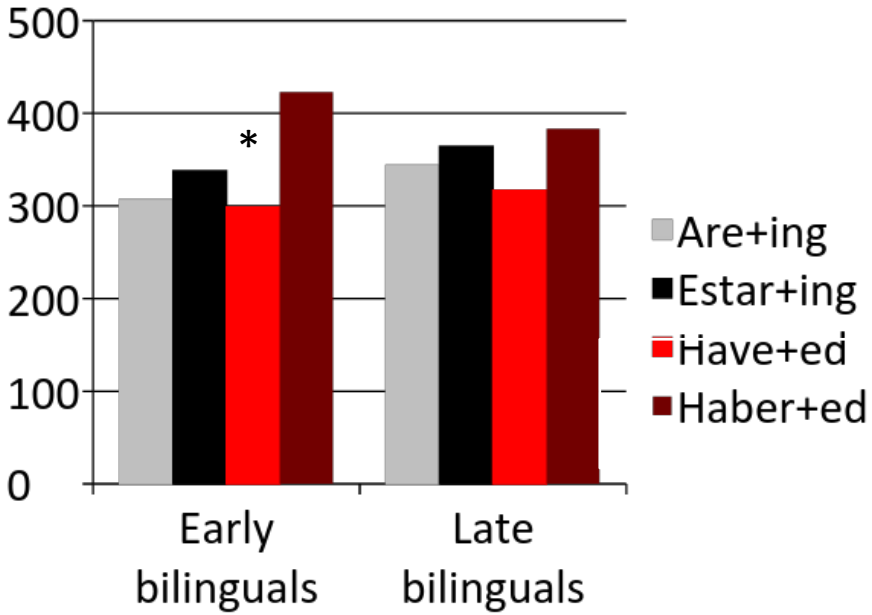
+indicates the context increases the demand on that control process (more so if bolded); =indicates that the context is neutral in its effects. Please see main text for explanation of the control processes.

- Comprehension follows production patterns.

El director confirmó que los actores están rehearsing their lines for the movie.
The director confirmed that the actors have rehearsed their lines for the movie.

CODE-SWITCHERS

NON CODE-SWITCHERS

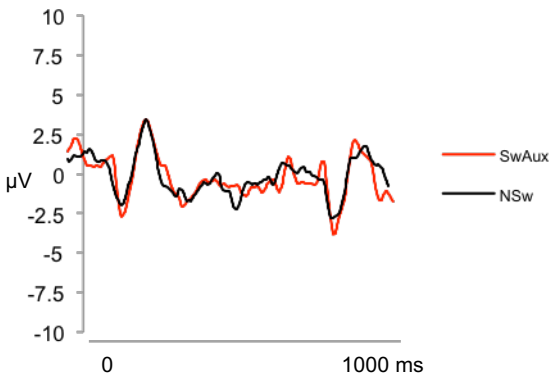


Guzzardo-Tamargo 2008

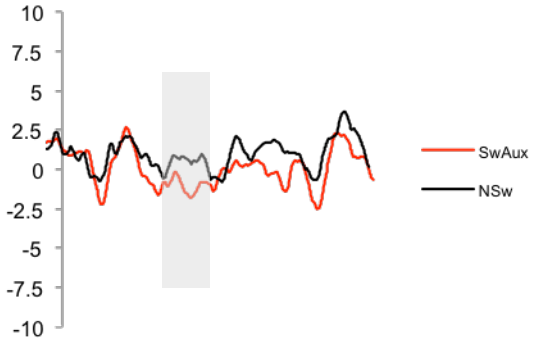
ERPs in code-switching

	Switch		Non-switch
	At Auxiliary	At Participle	
Progressive	La reina y el rey *are* granting the soldier his request.	La reina y el rey están *granting* the soldier his request.	The queen and king are granting the soldier his request.
Perfect	La reina y el rey *have* granted the soldier his request.	La reina y el rey have *granted* the soldier his request.	The queen and king have granted the soldier his request.

Progressive estructure



Perfect estructure



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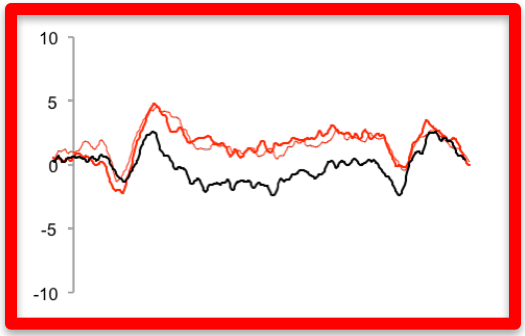
Progressive structure



Perfect structure