The benefits of networking: Expanding statistical analyses and piloting an ERP study

Tales of a Miccio Travel Award & NSF PIRE Fellowship recipient

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Spanish, Italian, & Portuguese

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Outline

February 2011

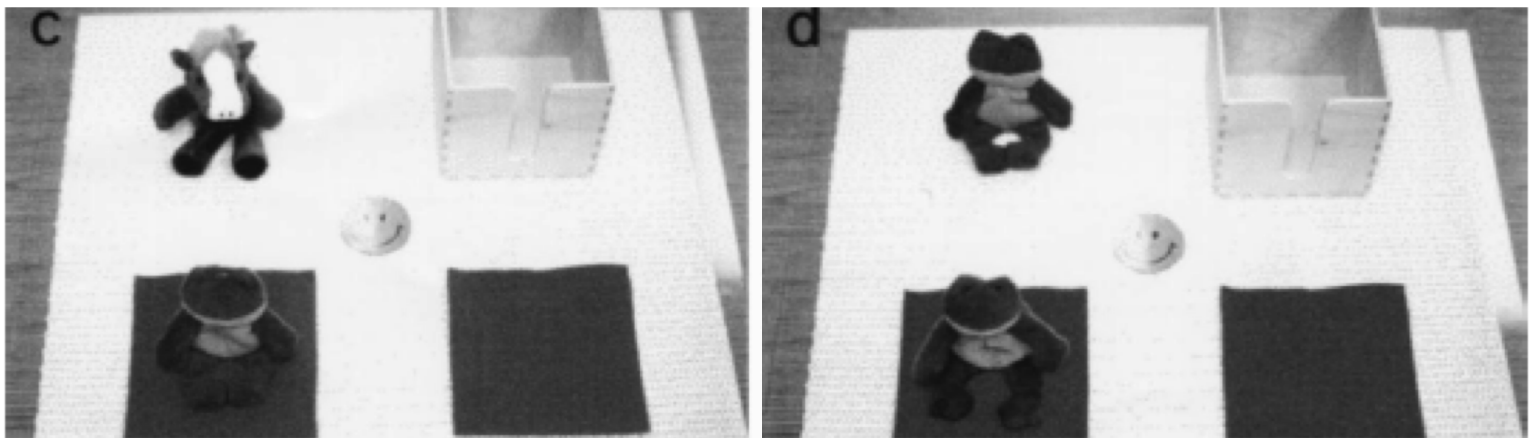
- To visit the lab of John Trueswell at the University of Pennsylvania (Philadelphia) for 3 weeks
- Present my own work and get feedback both from Trueswell and U Penn research community
- Discuss possible future collaborations

Why Dr. Trueswell?

- First met when I took his 4-week class on eye-tracking at LSA Summer Institute in 2007
- Methodology formed the basis of my proposal for NSF Graduate Research Fellowship
- One of the primary architects of **Experience Based Approaches** to sentence processing

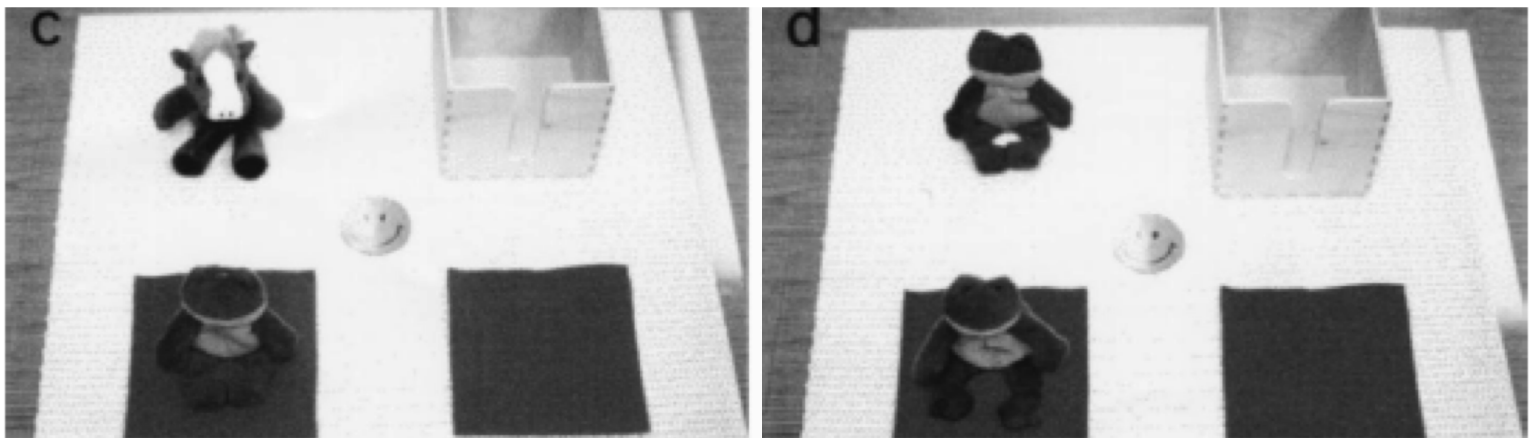
Trueswell et al., 1999

- **Put the frog on the towel...**



Trueswell et al., 1999

- **Put the frog on the towel...**



...in the box

- Adults experience increased looks to the incorrect location in the 1-referent visual scene
- This **garden-path effect** is modulated in the 2-referent visual scene
  - Indicates that referential context guides real-time processing
- However, children fail to show this modulation, experiencing similar garden-path effects in both contexts
  - Suggests a developmental trajectory for learning certain types of cues

Justification of Visit

Methodological

Opportunity to work with the primary architect of applying visual world eye-tracking paradigm to auditory comprehension with children

Theoretical

As a leading proponent of a framework that suggests multiple cues guide online processing, can provide valuable feedback on the central hypothesis that codeswitching is a **learned and emergent** system

Codeswitching in the bilingual context

- Bilinguals in the presence of other known bilinguals will codeswitch
- Bilinguals must maximally have both languages co-active in order to successfully navigate codeswitching
- The very nature of codeswitching as a bilingual linguistic skill suggests incredible flexibility in both the production and comprehension systems

Video

Habla Oscar

From the video

Brother /brode/, Ne Nebraska es un es es un es un . . . [laughs], with all due respect, verdad, esa **es una, es un** factory of blonde, blue-eyed people, viste

Codeswitching Production Data

- Corpus data containing both spoken and written codeswitches indicate that the masculine determiner el can be used with an English noun whose Spanish translation equivalent is either masculine or feminine (Poplack 1980; Poplack & Sankoff 1982; Jake et al. 2002)
  - el_{masc} $\text{book}_{\text{masc}}$
  - el_{masc} $\text{cookie}_{\text{fem}}$
- Thus, el has a default status for codeswitches

- Whereas the feminine determiner la prohibitively appears only with feminine translation equivalents
  - la_{fem} $potato_{fem}$
  - la_{fem} $blender_{fem}$
  - *la_{fem} $candy_{masc}$
  - *la_{fem} car_{masc}
- Resulting in an asymmetric status for grammatical gender in codeswitching whereby feminine gender is more restricted in usage

Research Questions

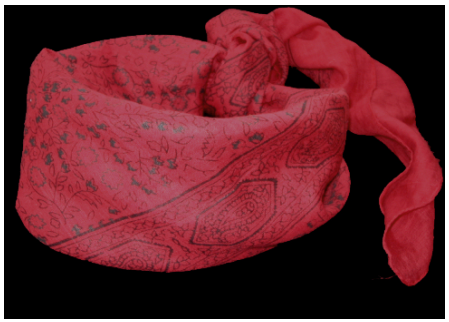
- Will comprehension reflect the production asymmetry?
- Specifically, how are gender cues on the Spanish article processed during codeswitched utterances?
- Do different groups of bilinguals (those who codeswitch v. those who don't) exhibit the same processing strategies?

Design

- 24 Spanish-English bilinguals listened to sentences while looking at pairs of images on a computer screen
- Participants were instructed to click on the image that was named in the sentence
- This was a secondary task that was used to ensure looks to target items
- Each trial was followed by a plausibility judgment
- This task was included to mask the primary manipulation

Visual Scene

- La señora told her esposo to find *la* bandage



Codeswitching Block

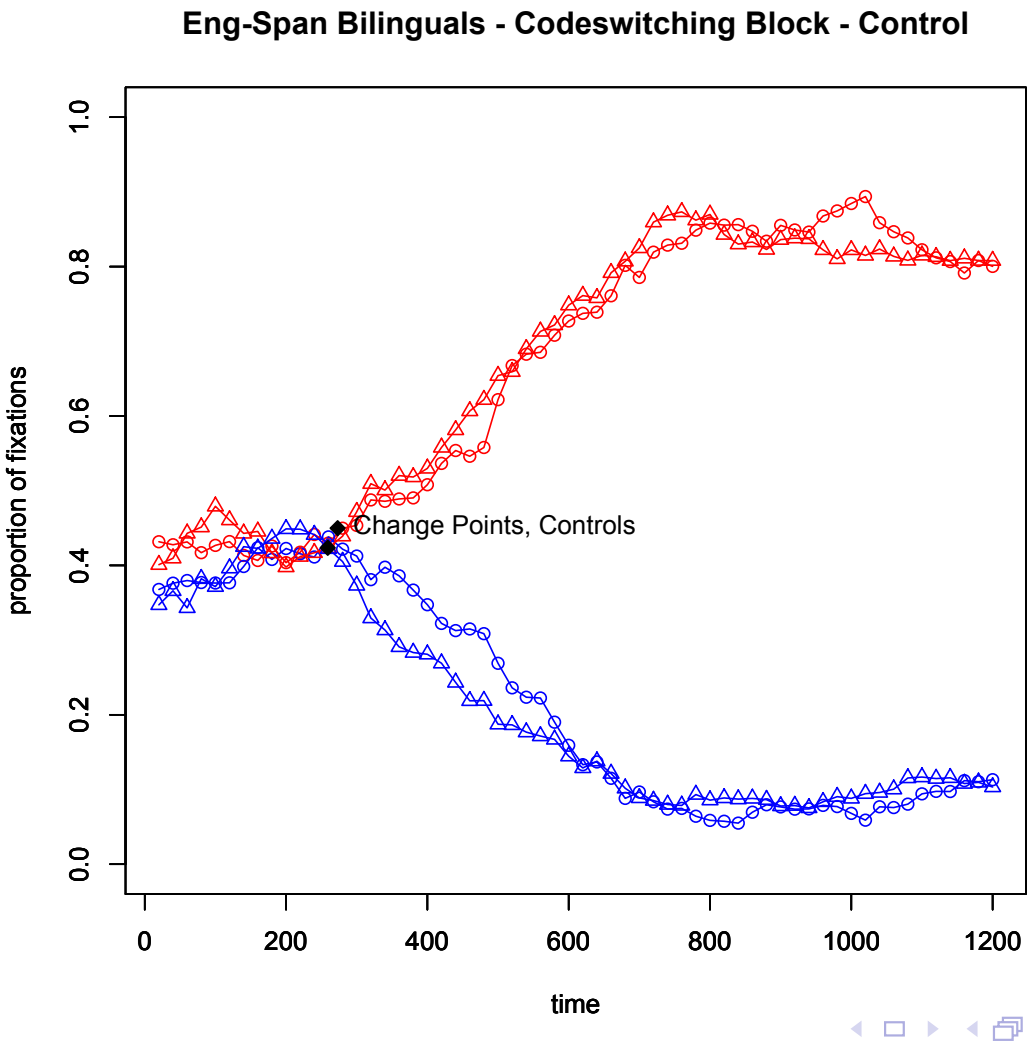
- *La señora* told her *esposo* to find *la* bandage
- 30 critical trials in 6 conditions, 30 fillers

Trial	Article	Target	Non-target
Feminine Control	la	candle (F)	napkin (F)
Feminine Match	**la**	**candle (F)**	**candy (M)**
Feminine Mismatch*	**la**	**candy (M)**	**candle (F)**
Masculine Control	el	candy (M)	funnel (M)
Masculine Match	**el**	**candy (M)**	**candle (F)**
Masculine Mismatch*	**el**	**candle (F)**	**candy (M)**

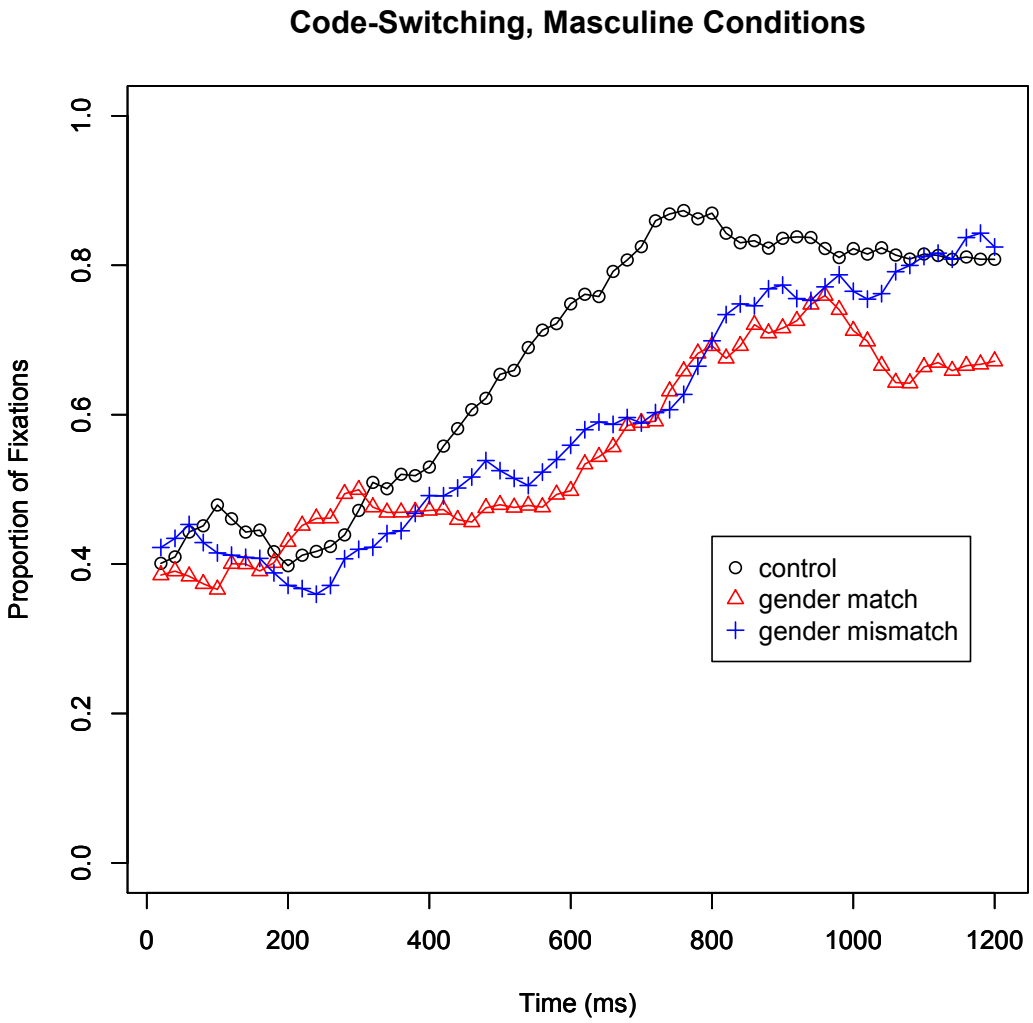
* The gender of the article and the target item mismatch

Codeswitching Block—Control Conditions

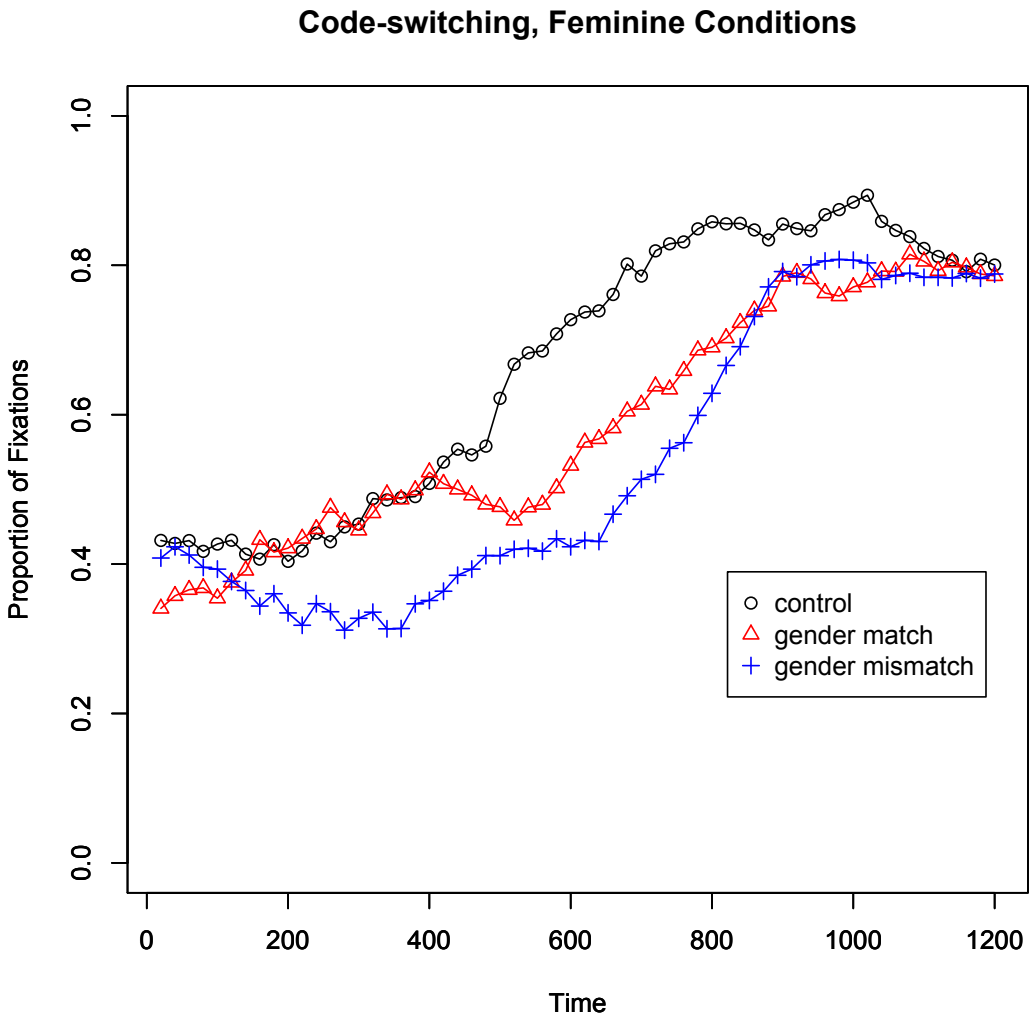
circle = feminine control, triangle = masculine control



Codeswitching Block–Masculine Conditions



Codeswitching Block–Feminine Conditions



Feedback

- Research was well-received. Particularly interested in the feedback from two faculty members:
  - Aravind Joshi (Computational Linguistics)
  - Gillian Sankoff (Sociolinguistics)

Feedback

- Joshi asked a very simple question:

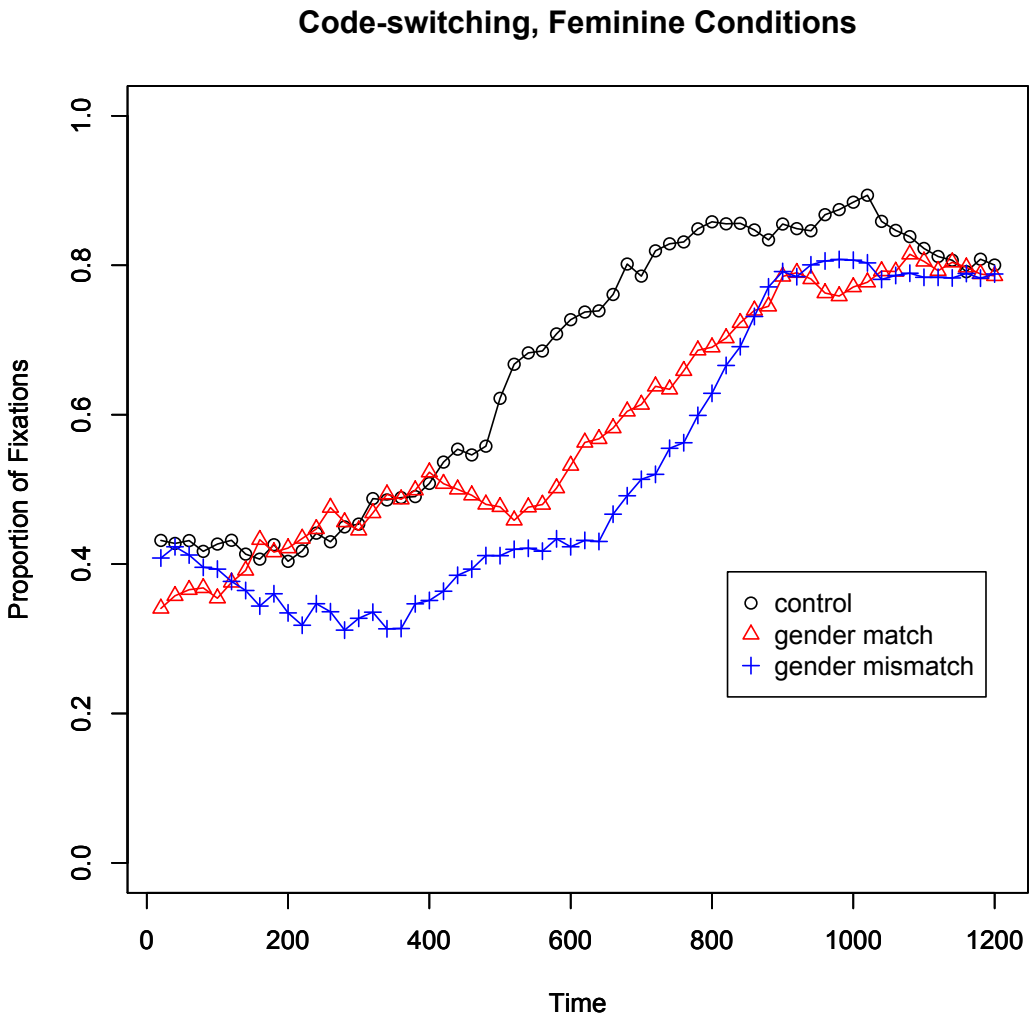
  Did you manipulate the language of the first word?
- This manipulation now included as a factor in dissertation research

- Sankoff was very enthusiastic about the group comparisons
- Group comparisons between NYC bilinguals and Granada bilinguals to be included in dissertation research

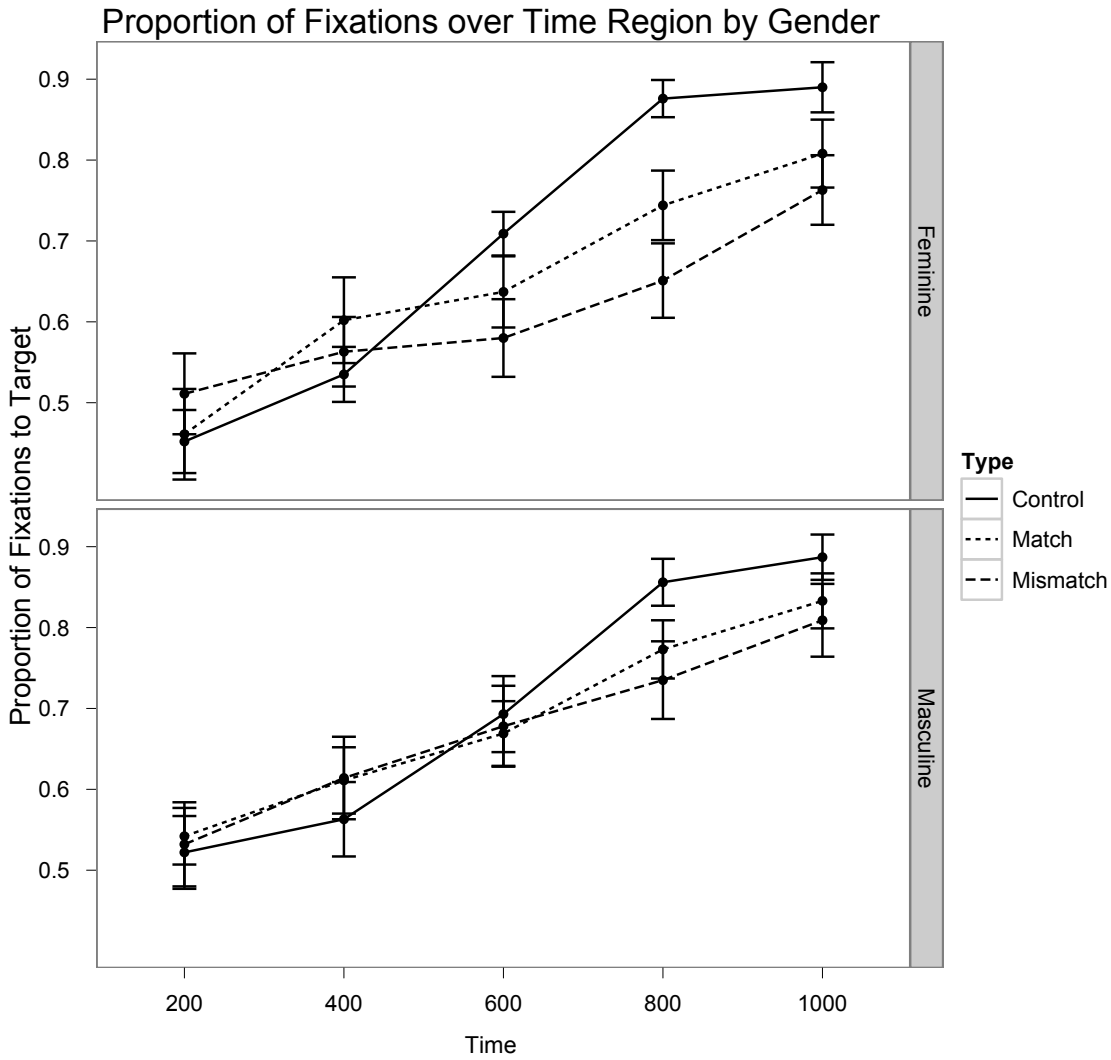
Feedback

- Trueswell encouraged me to not get stuck on analyses, that the work was publishable
- Also provided a different perspective on interpretation of feminine conditions
- Furthermore, had a roundtable with group of researchers more considered with data analysis in eye-tracking
- Was able to discuss pros and cons of **Change Point Analysis** with Dan Mirman, proponent of **growth curve analysis** for visual world eye-tracking data

Codeswitching Block–Feminine Conditions



Updated Graphs



Updated Graphs

- Clearer differentiation between feminine and masculine conditions, driven primarily by dispreference of **feminine mismatch** condition
  - Increased number of participants
  - Removed trials on which participants clicked on incorrect item
  - Removed trials on which total fixations were below 33%
- Learned a new manner to plot data thanks to Josef Fruehwald

Networking

- The most important aspect of the visit
- Met many graduate students and post-docs
  - Most likely to be my peers in the future
  - Were the ones I directly interacted with during 3-week visit
- Career goals
  - We discussed my goals after graduating
  - Very open to supporting me as post-doc
  - Now pursuing three different funding agencies with a post-doc proposal on cognitive control and codeswitching using fMRI together with eye-tracking

PIRE Spring 2011

- Applied to visit the lab of Teresa Bajo at the Universidad de Granada (Spain)
- Visit from 04/2011 through 06/15/2011
- Primary purpose: to collect pilot data on ERP study investigating **verb bias and plausibility** in sentence processing in bilinguals

Primary Questions

- Behavioral studies have revealed an interaction of verb bias and plausibility in monolinguals (Garnsey et al., 1997)
- Will the electrophysiological record provided converging evidence on previous findings?
- Will bilinguals make use of verb bias information in their second language?

Verb Bias

- Verbs can **subcategorize** for different complements, occasionally resulting in syntactic ambiguity

- The historian **read the manuscript** during the trip
- The historian **read the manuscript** had been destroyed by the fire

- Because complementizer *that* expression is optional in English, **the manuscript** is temporarily ambiguous until the comprehender reaches the immediately following word

Verb Bias

- However, verb subcategorization preferences result in clear **verb biases** for certain verbs
  - A verb like **read** is biased towards **direct object** complements
  - A verb like **believe** is biased towards **sentential** complements

Plausibility

- Moreover, **plausibility** may also guide sentence processing
- A **manuscript** is a **readable** item, which may help strengthen its initial interpretation as a direct object complement
  - The historian **read the treasure** had been discovered on the island

Garnsey et al., 1997

- Garnsey et al. examined the interaction of verb bias and plausibility using both self-paced reading times and eye-tracking reading measurements
- Found an interaction such that native speakers prioritize verb bias
- If verbs are weakly biased, i.e. equi-biased, then plausibility modulated comprehension

Bilingual Sentence Processing

- Clahsen & Felser (2006) have argued that second language learners fundamentally process sentences in a different way than native speakers
- Claim that second language processing involves constructing "shallower" syntactic representations, involving less detail than structures computed during L1 sentence processing, i.e. **Shallow Structures Hypothesis**

- However, Dussias & Cramer Scaltz (2008) found that second language processing can involve the use of verb bias, reflecting similar processing strategies as monolinguals

Predictions

- Plausibility is semantically driven and is computed across constituents
- Verb bias is lexically encoded
- If second language speakers privilege plausibility over verb bias, then provides support for Shallow Structures Hypothesis
- On the other hand, if second language speakers make use of verb bias, then second language processing may involve similar strategies to monolingual sentence processing

Procedure

- 320 sentences (160 filler) were presented to participants split equally across 4 blocks
- Sentences were presented word by word in RSVP
- On 40% of total trials, participants answered a comprehension question using a button box
- Participants' EEG activity was recorded while they read sentences

Design

- 4 conditions in **2 x 2 design**, verb bias x plausibility

Plausibility **Verb Bias**	Plausible	Implausible
Direct Object	DO Plausible (1a) **accepted**	DO Implausible (1b) **heard**
Sentential Complement	SC Plausible (2a) **claimed**	SC Implausible (2b) **figured**

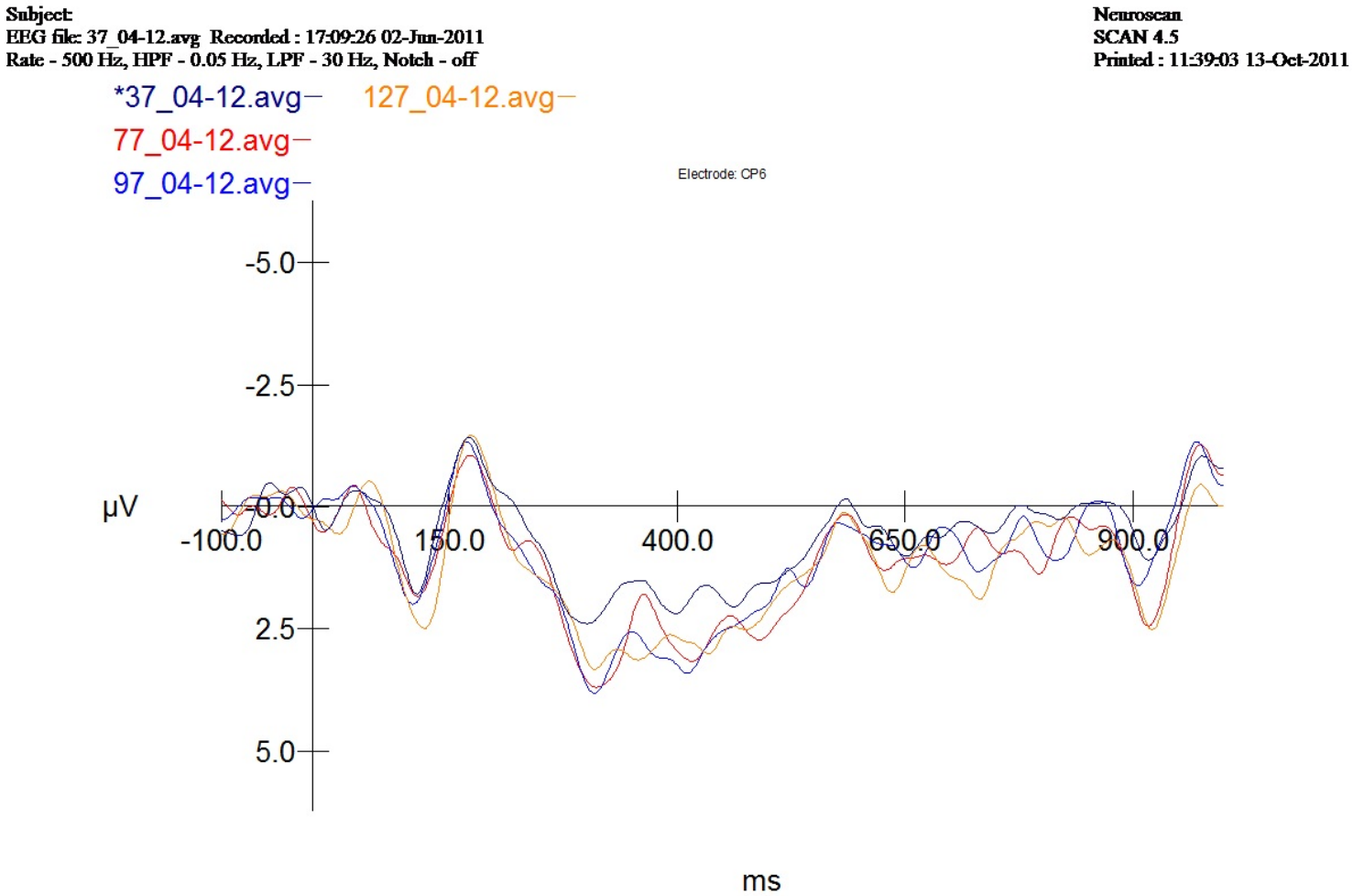
Design

- *Sentential Frame*
- The talented photographer _____ the money could not be spent yet
  1a. **accepted**
  1b. **heard**
  2a. **claimed**
  2b. **figured**

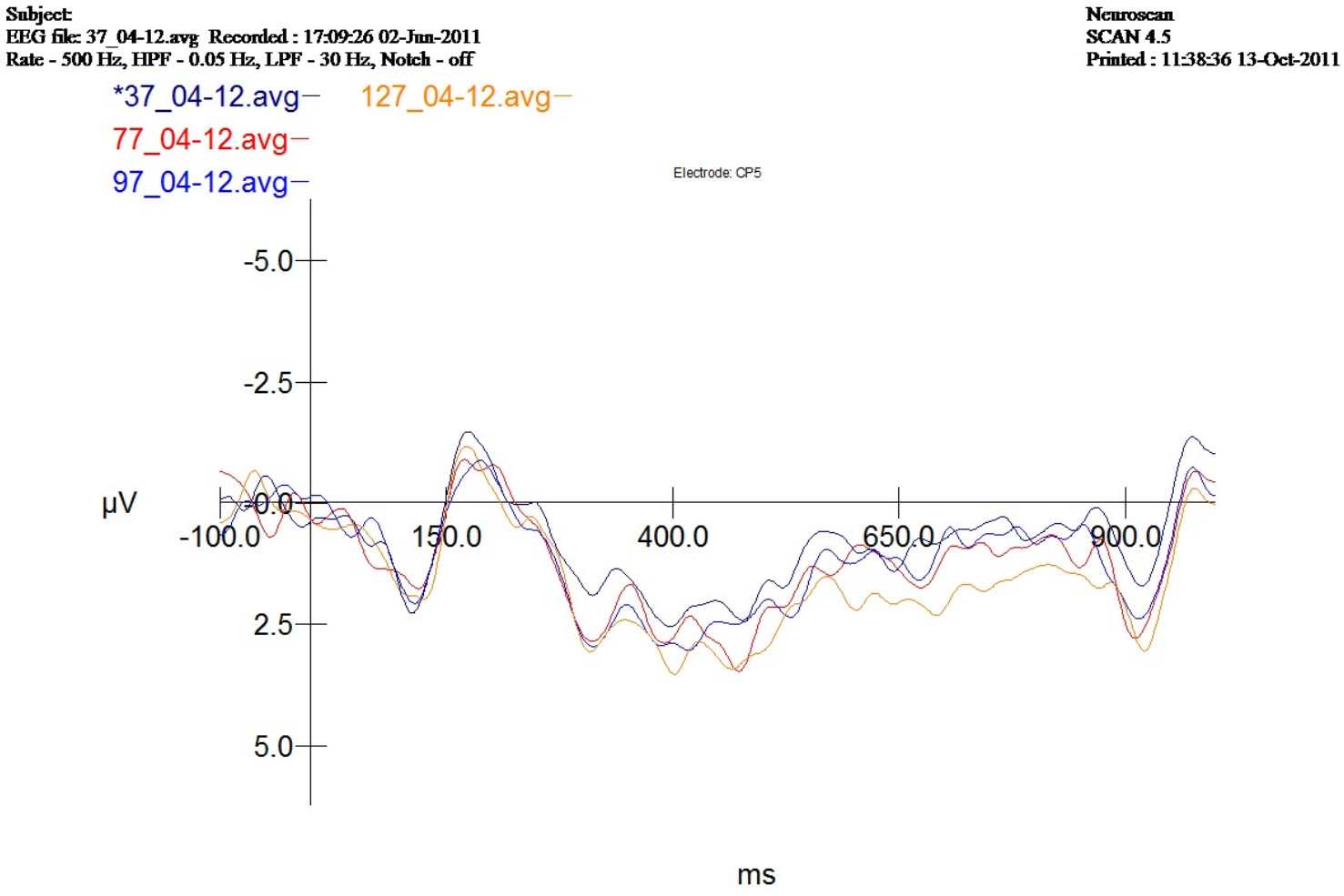
Results

- 12 participants recruited for pilot study, but graphs are from 9 participants
- 2 critical regions of 800 ms epochs
  - site of direct object
  - directly following word, disambiguating region
- 2 electrodes shown: CP5 & CP6

Results, Plausibility CP6



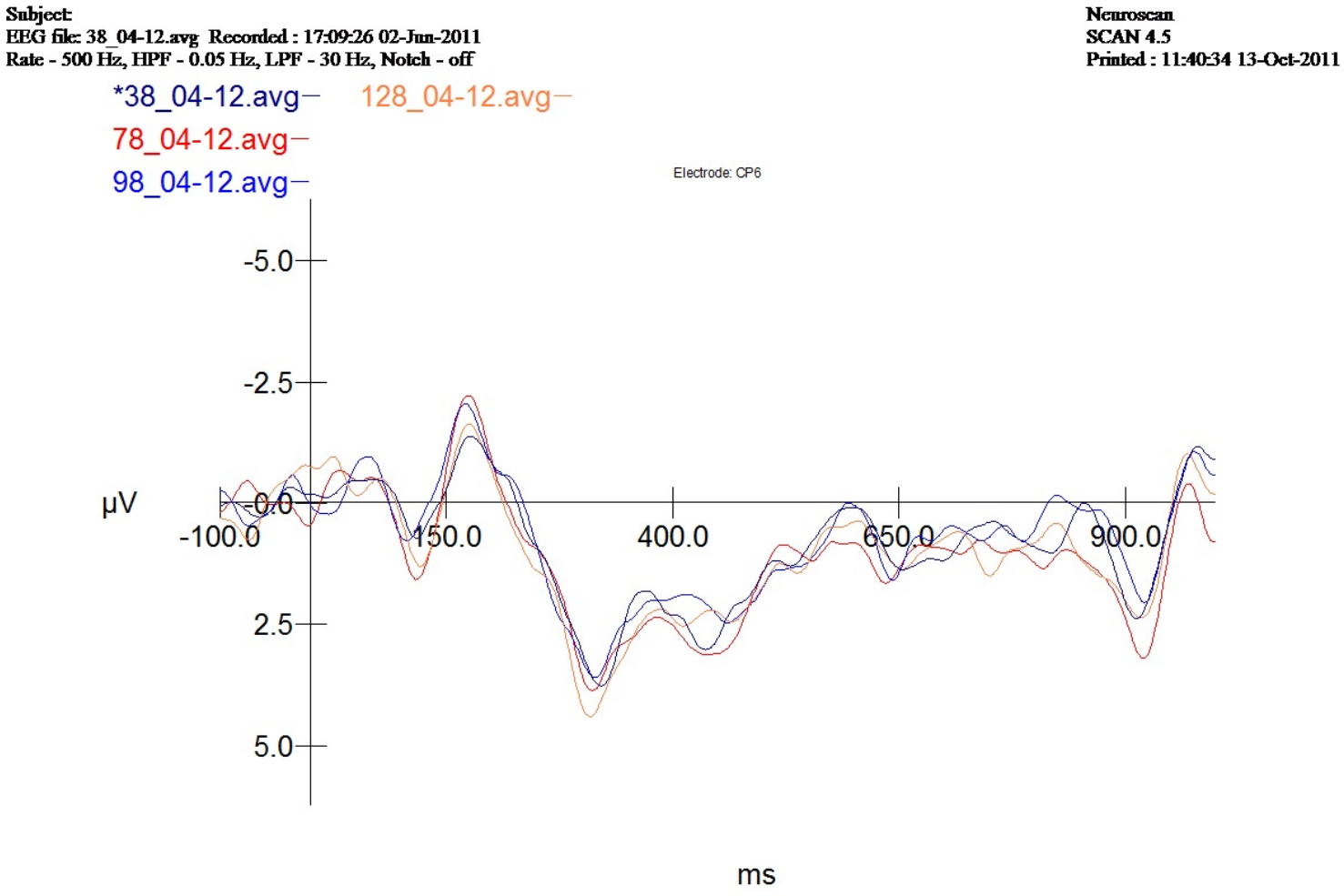
Results, Plausibility CP5



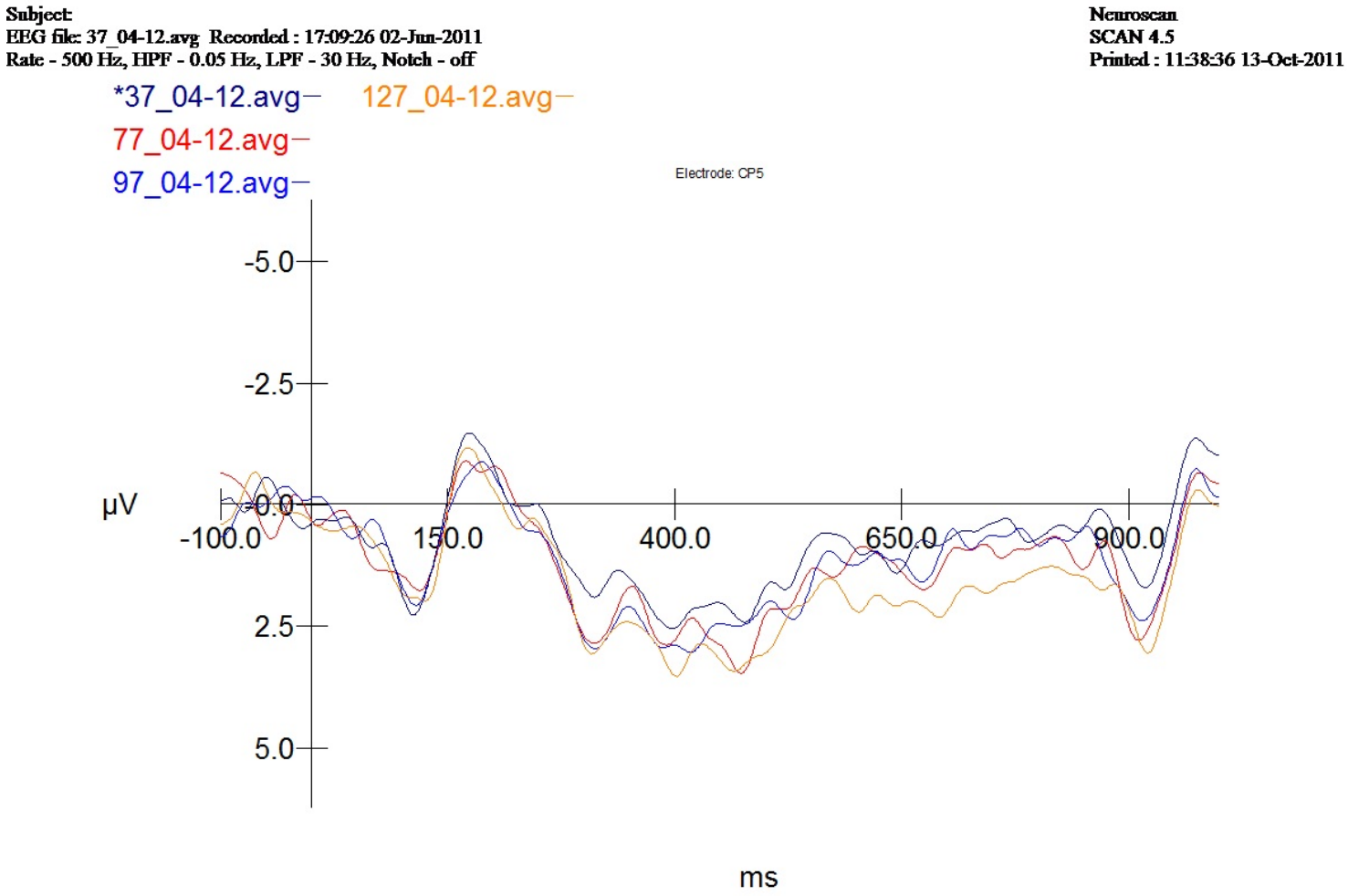
Plausibility

- In CP6, DOPDO stands out – but not in a predicted manner
- In CP5, SCIDO stands out – also not predicted but perhaps more explainable
- The interaction of verb bias and plausibility would indicate that SCIDO should be the hardest of the 4 conditions to integrate as a direct object

Results, Verb Bias CP6



Results, Verb Bias CP5



Verb Bias

- In CP6, there is little difference between the 4 conditions
- In CP5, there is indication yet again that SCIDO stands out
- Verb bias does not appear to influence processing for these bilinguals

Discussion

- At this point, the data appear to be too noisy to reach any substantial conclusions
- However, possible suggestion that sentence complement biased verbs that have implausible direct objects may be the hardest to process for these bilinguals
- Lends support to the claim that these bilinguals may be attempting to form direct object complements regardless of plausibility OR verb bias
- Proficiency?

Future Directions

- Re-examine the pilot data more carefully
- Begin data collection for English monolinguals
- Begin data collection for Spanish-English bilinguals in U.S.

Acknowledgements

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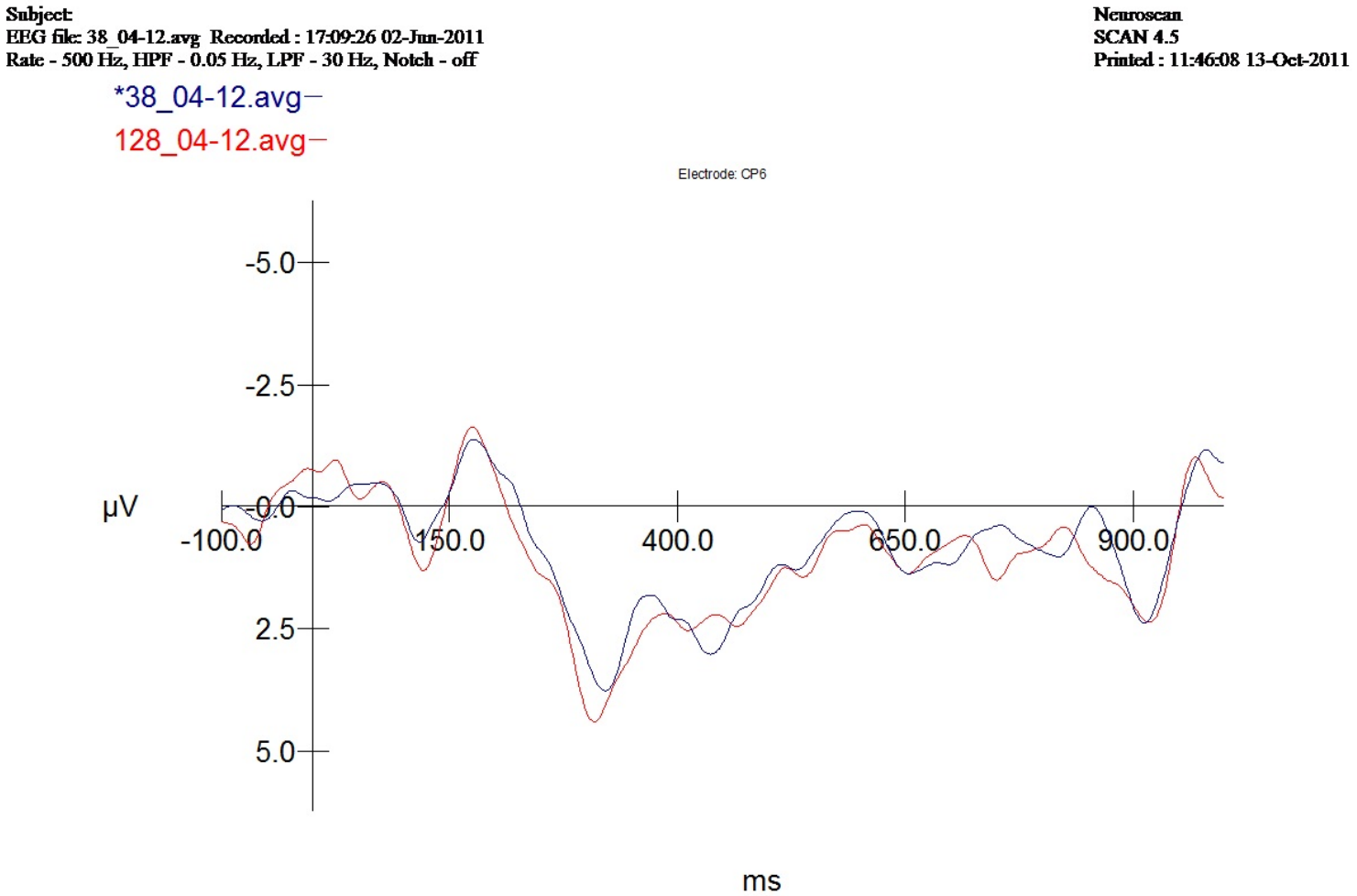
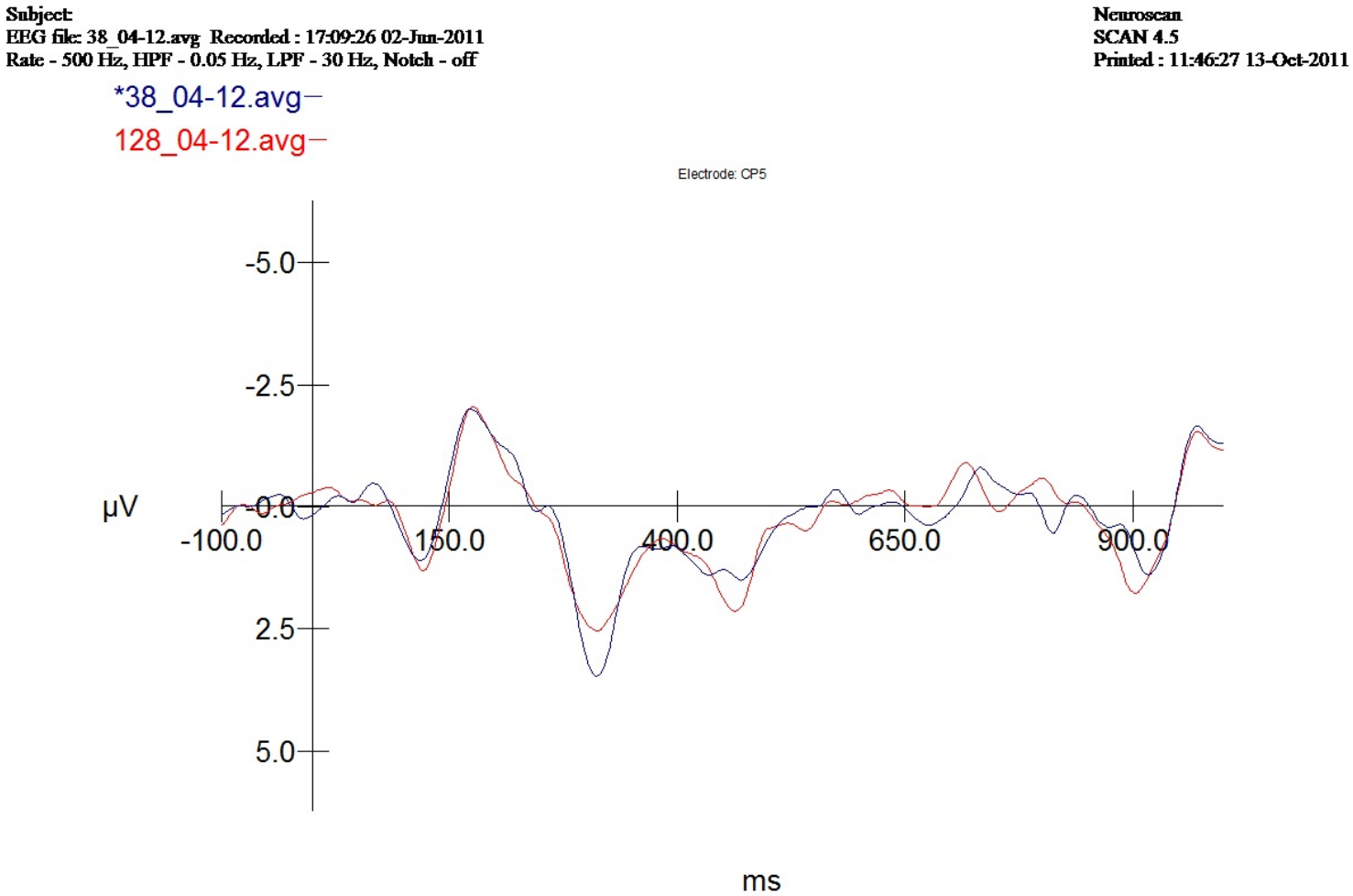
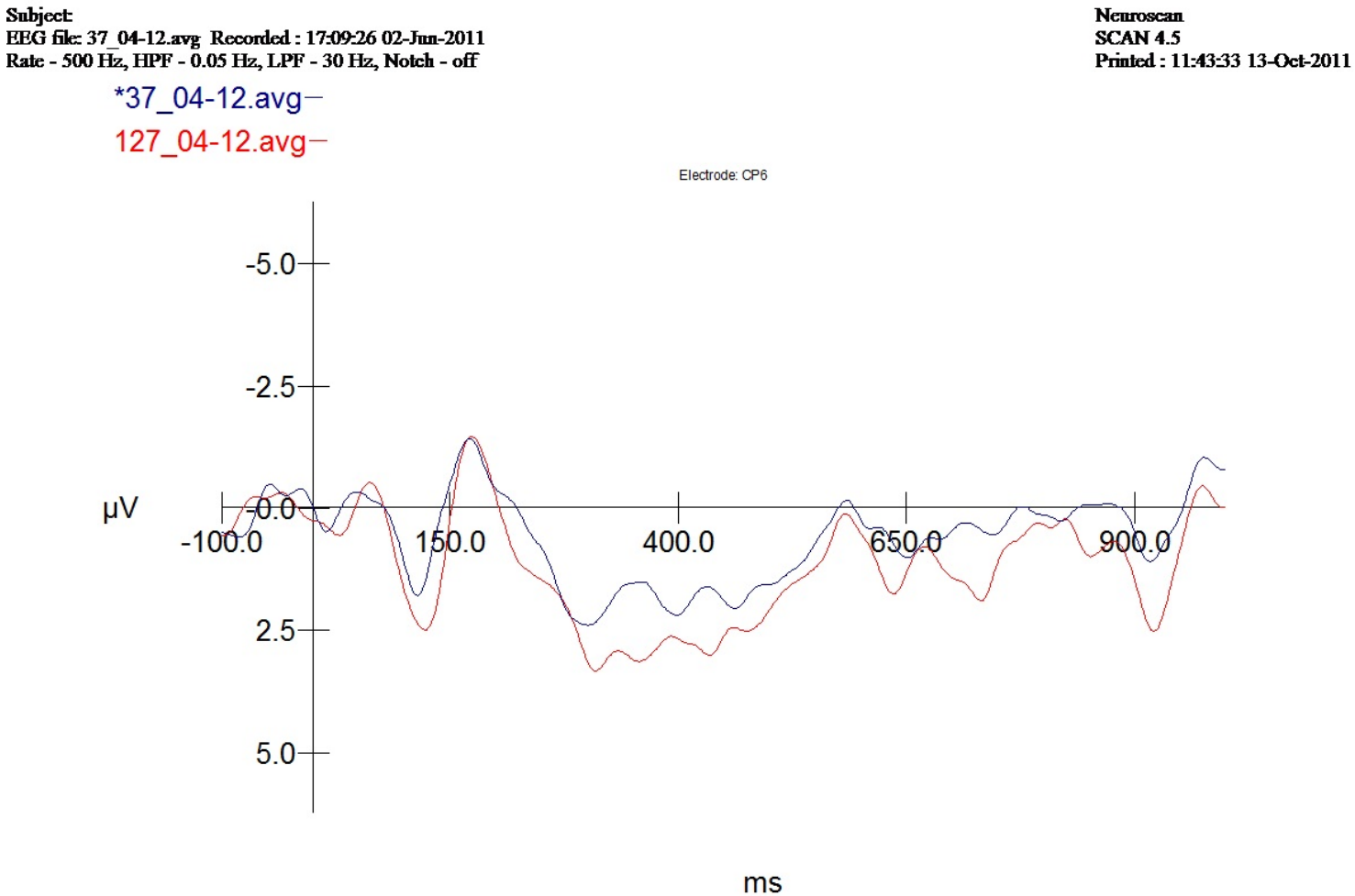
DOPDO, SCIDO, Bias CP6



DOPDO, SCIDO, Bias CP5



DOPDO, SCIDO, Plausibility CP6



DOPDO, SCIDO, Plausibility CP5