Canolfan ESRC Centre
dros Ymchwil i Ddwyieithrwydd
for Research on Bilingualism

PRIFYSGOL BANGOR UNIVERSITY

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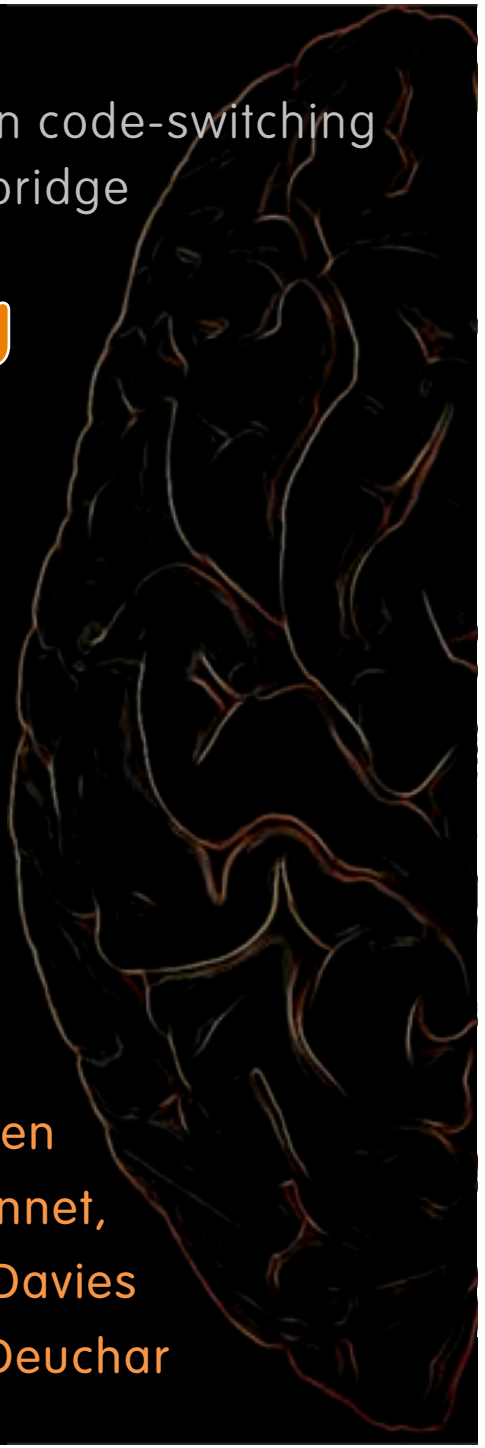
Interdisciplinary perspective on code-switching
3 & 4 October 2016 | Cambridge

Comparing competing accounts of code-switching using predictive neurolinguistics

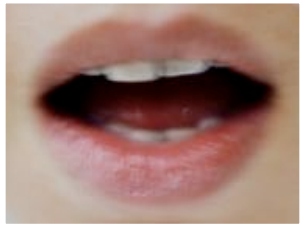


Guillaume Thierry

In collaboration with

Awel Vaughan-Evans, M. Carmen Parafita Couto, Bastien Boutonnet, Noriko Hoshino, Peredur Davies and Margaret Deuchar

Language unfolds in time



Comprehension

Perception → Word forms → Syntax → Meaning

Time

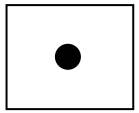
Articulation ← Word forms ← Syntax ← Meaning

Production

Introducing neurolinguistics

We need a tool that can track events in time (fast)

Event

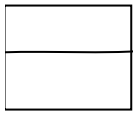


Stimuli presented to participants (or motor responses from participants)

Related

Relationship between events and the signal that is recorded

Potentials



Brain electrical activity measured using electrodes set on the scalp

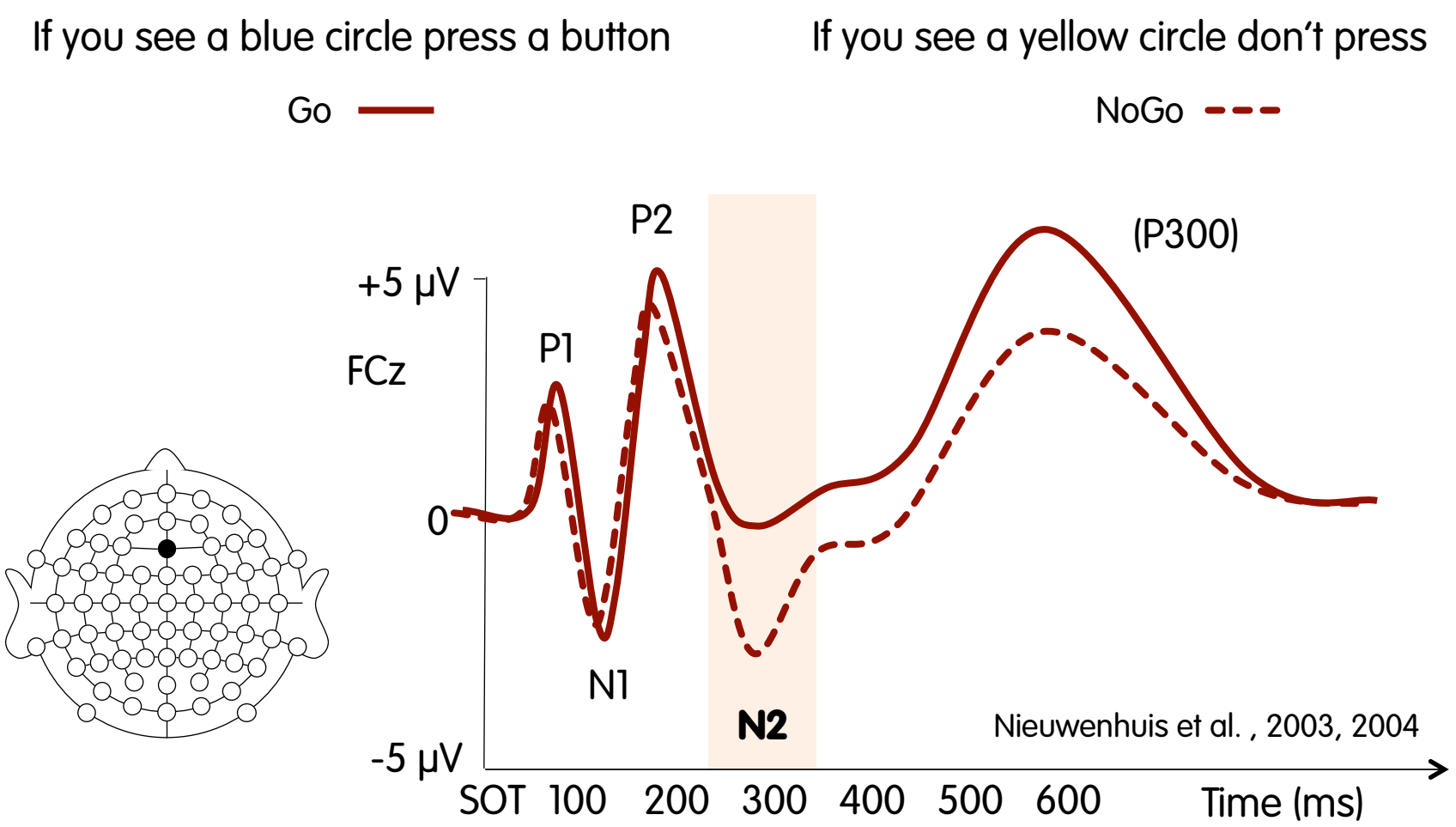
Introducing predictive neurolinguistics

We need a wave that changes under known conditions

Introducing the N2 and inhibition

If you see a blue circle press a button

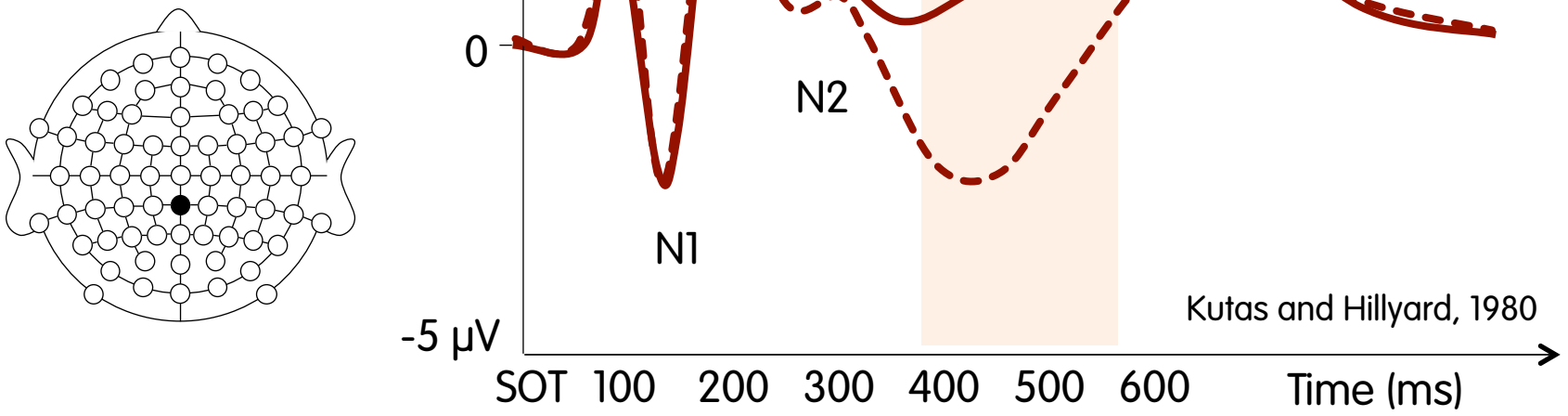
If you see a yellow circle don't press



Introducing the N400

He takes his coffee with sugar and …

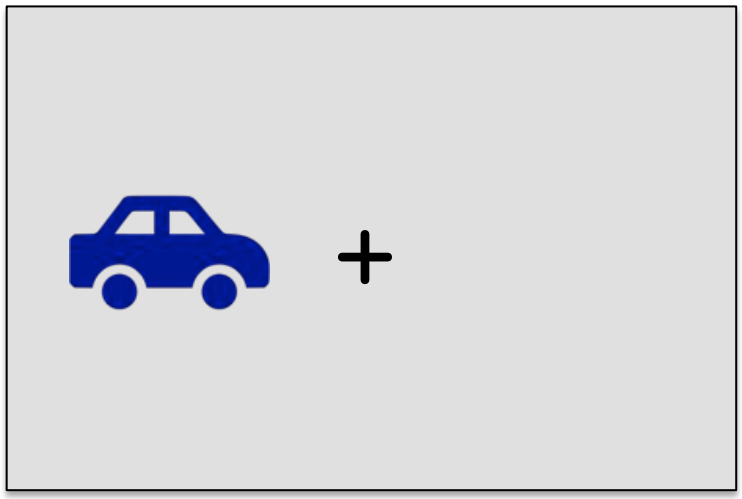
milk
dog



Language non-selective grammatical processing

syntax anomalously transfers between languages

Example 1 | Word order



The blue car was on the left / right

The red car was on the left / right

* The car blue was on the left / right

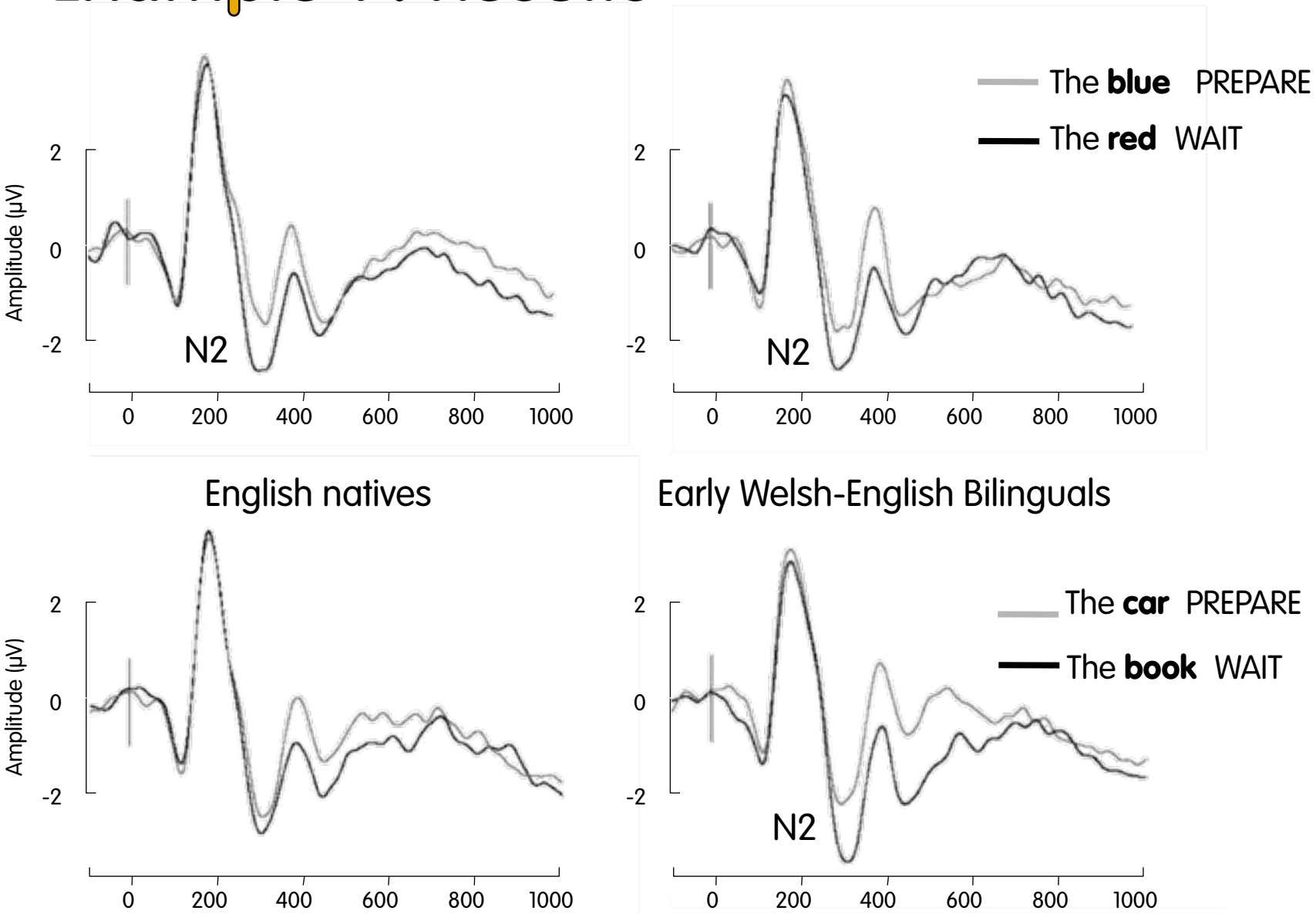
* The car red was on the left / right

The car was on the left / right

The book was on the left / right

If either the object or its colour is consistent with picture, then make accuracy judgment

Example 1 | Results



Example 2 | Soft Mutation

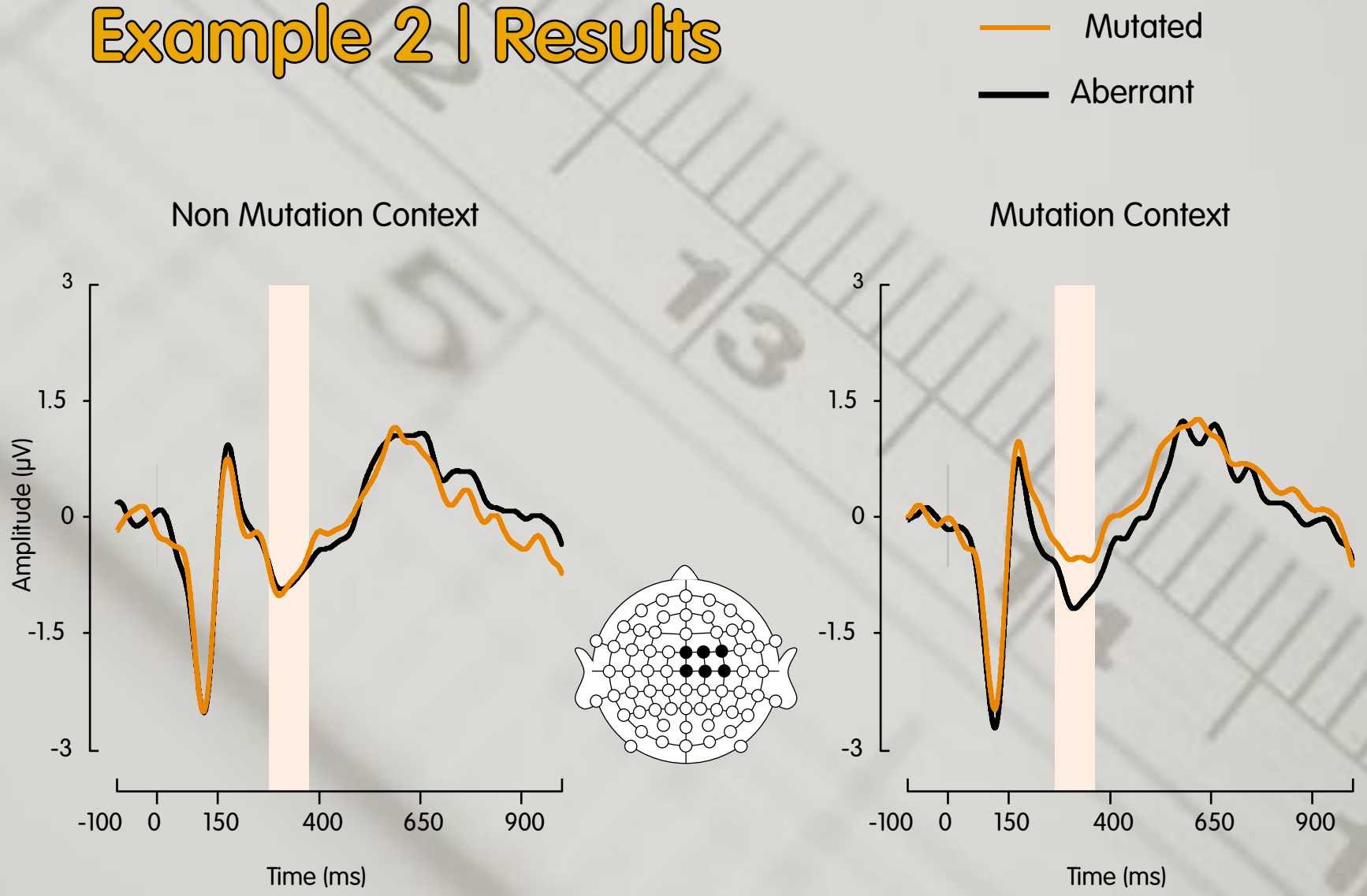
Phoneme Overlap

Mutation Context	**Correct**	**Mutated**	**Aberrant**
Each book starts with a page listing its	contents	gontents	dontents
"Dechreuir pob llyfr â thudalen yn rhestru ei	gynnwys"		
No Mutation Context			
The lid was lifted to examine the	contents	gontents	dontents
"Codwyd y caead er mwyn archwilio'r	cynnwys"		

No Phoneme Overlap

Mutation Context	**Correct**	**Mutated**	**Aberrant**
As a doctor she saw a lot of	patients	batients	datients
"Fel meddyg, roedd hi'n gweld nifer o	gleifion"		
No Mutation Context			
At the hospital he would read to the	patients	batients	datients
"Yn yr ysbyty, byddai'n darllen i'r	cleifion"		

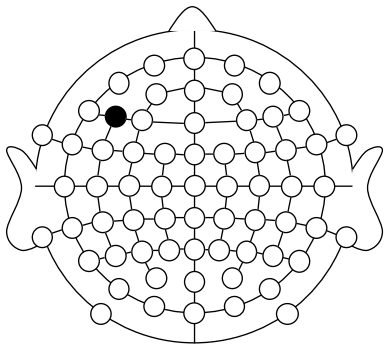
Example 2 | Results

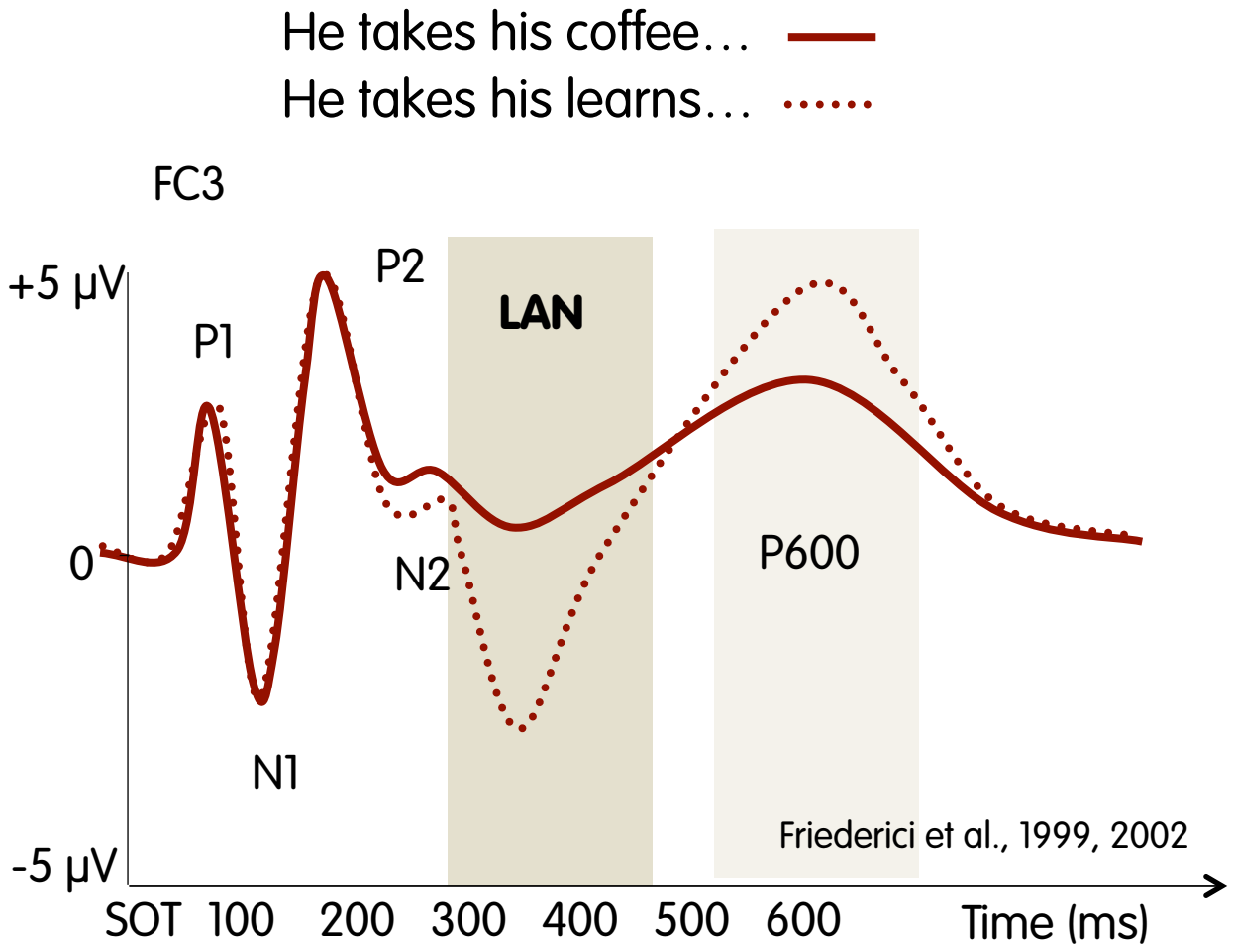


Vaughan-Evans, Kuipers, Thierry and Jones, *J Neurosci* (2014)

And now…
code-switching!

Introducing the Left Anterior Negativity





Research Question

What is the **'natural' word order** in
code-switched nominal constructions?

In other words…
What theoretical model best predicts
code-switching behaviour?

Matrix Language Framework [MLF]
Vs.
Minimalist Program [MP]

The debate

MacSwan, J. (2005). Codeswitching and generative grammar: A critique of the MLF model and some remarks on "modified minimalism." *Bilingualism: Language and Congition* 8 (1): 1-22.

Jake, J., Myers-Scotton, C. & Gross, S. (2005). A response to MacSwan (2005): Keeping the Matrix Language. *Bilingualism: Language and Cognition* 8 (3): 271-276.

The case of Welsh

Y gath fawr	The big cat
The / cat / big	Det / Adj / N
Det / N / Adj	

Predictions

The **language of the adjective** determines whether it appears before or after the noun

(cf. Cantone & McSwan, 2009)

The adjective-noun order will match the **language of the finite verb**.

(cf. Myers-Scotton, 2002)

Experiment 1 | Design

	MLF prediction	MP Prediction
A. The bear chased one **gwyn** horse.	+	-
B. Helodd yr arth un horse **gwyn**.	+	+
C. The bear chased one ceffyl **white**.	-	-
D. Helodd yr arth un **white** ceffyl.	-	+

+ two monolingual sentences, i.e., 40 sets of 6 sentences

Experiment 1 | Participants and Task

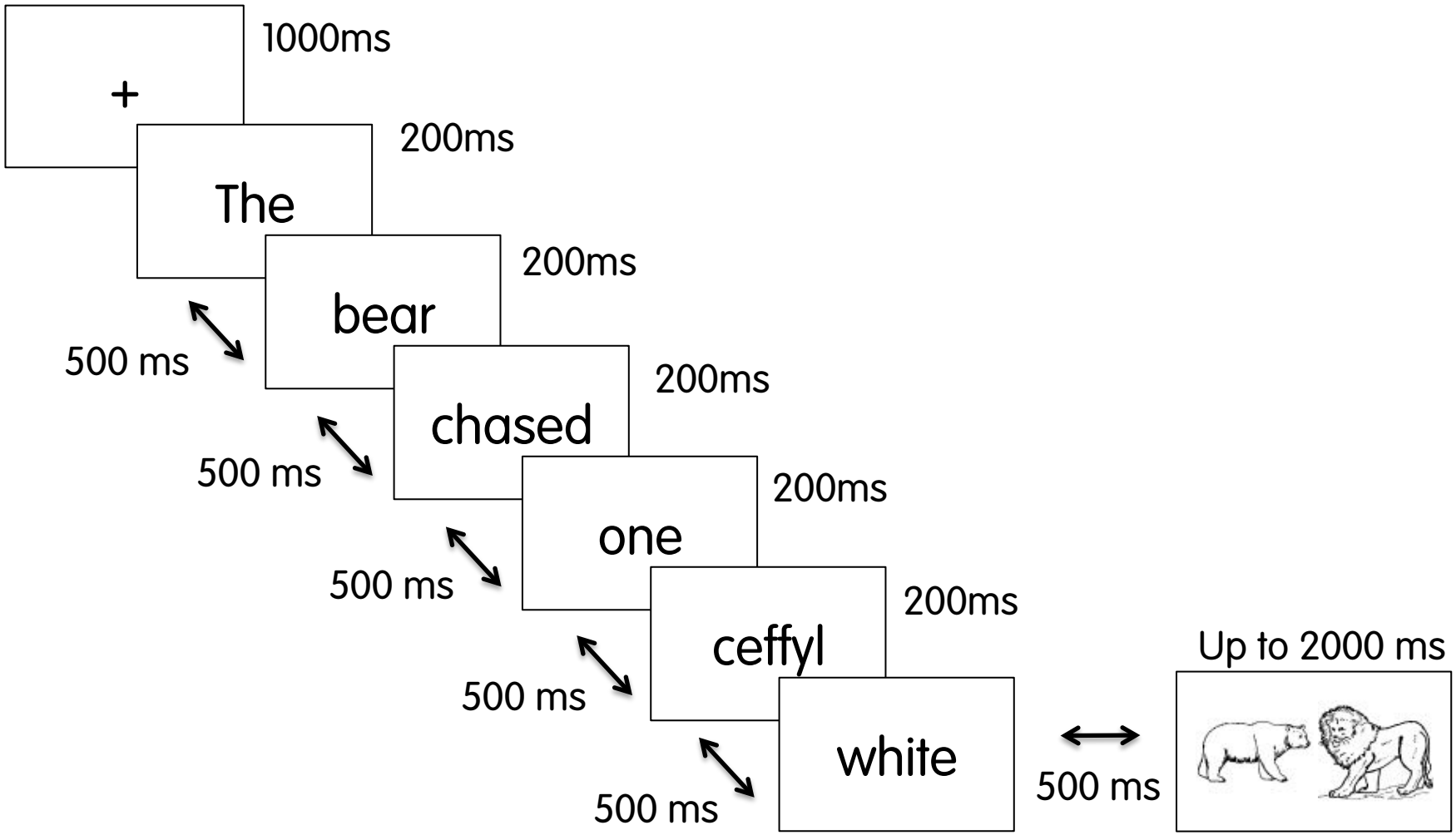
Participants

- 20 highly-proficient Welsh-English bilinguals (mean age: 26, 8 male, 12 female)
- Born in Wales or moved to Wales within the first five years of life
- Balanced use of the two languages in everyday life (Mean usage of Welsh 56%)

Task

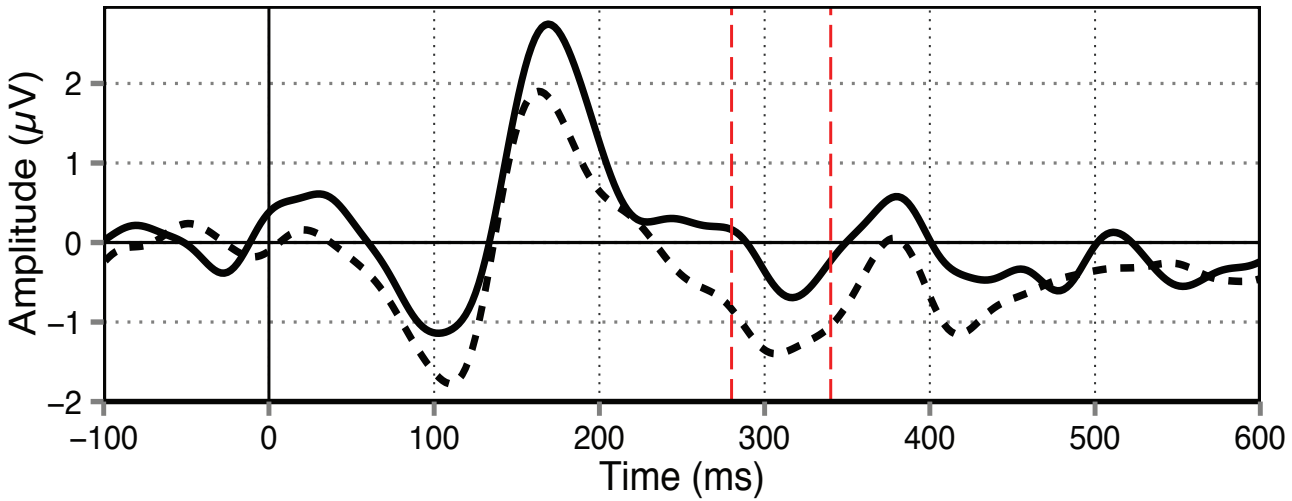
At the end of each sentence, chose picture that matches the character presented in sentence.

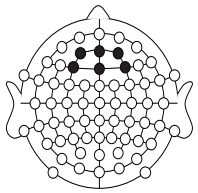
Experiment 1 | Procedure



Experiment 1 | Results

A. Sentences for which both models make orthogonal predictions (A vs. D).





ROI:
AF3, AFz, AF4
F3, Fz, F4

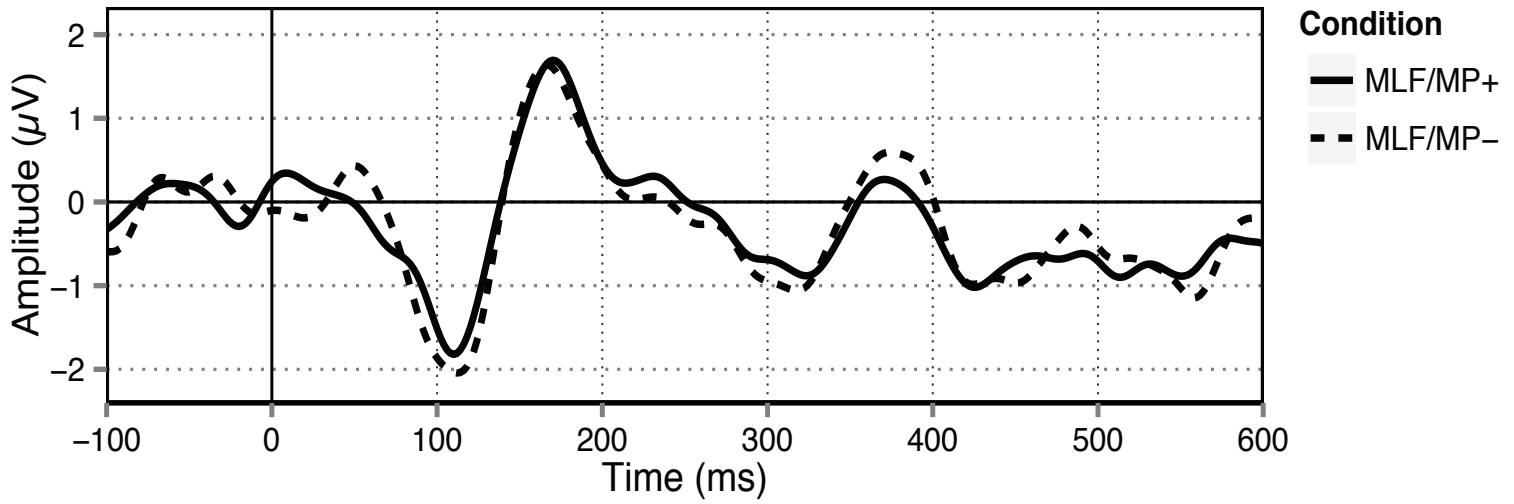
$p < .05$

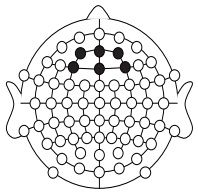
— The bear chased one **gwyn** horse.

- - Helodd yr arth un **white** ceffyl.

Experiment 1 | Results

B. Sentences for which both model make parallel predictions (B and C.)





ROI:
AF3, AFz, AF4
F3, Fz, F4

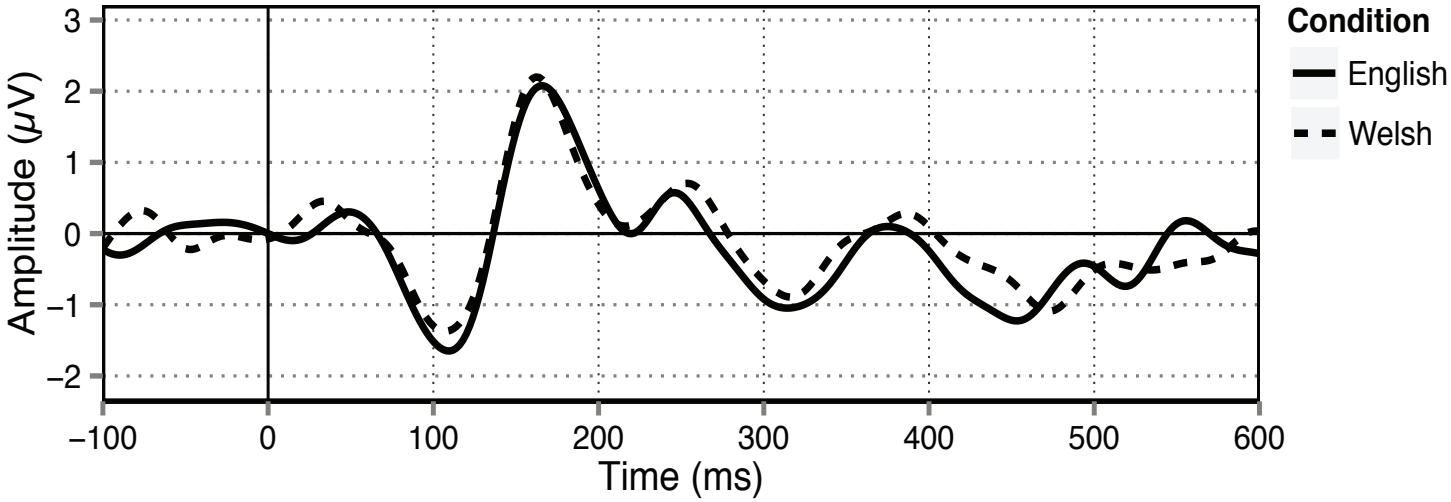
$p < .05$

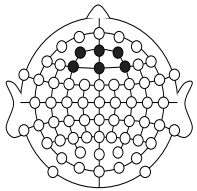
— Helodd yr arth un horse **gwyn**.

- - The bear chased one ceffyl **white**.

Experiment 1 | Results

C. No effect of language on adjective processing.





ROI:
AF3, AFz, AF4
F3, Fz, F4

$p < .05$

Experiment 1 | Discussion

Some support for MLF predictions

But no difference in control MLF/MP+ vs MLF-/MP-

Why?

Narrow focus of attention on nouns due to task?

Wrap up processes at the end of sentence altering processing of adjective in sentence final position?

Experiment 2 | Design

	MLF	MP
The bear chased one horse **cyflym** around the galaxy.	-	+
The bear chased one **fast** ceffyl through the forest.	+	+
The bear chased one ceffyl **fast** in the morning.	-	+
The bear chased one **cyflym** horse down the winding road.	+	-
Helodd yr arth un horse **cyflym** drwy gydol y nos.	+	+
Helodd yr arth un **fast** ceffyl yn y goedwig dywyll.	-	+
Helodd yr arth un ceffyl **fast** ar hyd y mynydd mawr.	+	-
Helodd yr arth un **cyflym** horse er mwyn ei fwyta.	-	-

32 sets of 8 sentences

Experiment 2 | Participants and Task

Participants

- 7 highly-proficient Welsh-English bilinguals (data collection is ongoing – **preliminary data**)
- Born in Wales or moved to Wales within the first five years of life
- Balanced use of the two languages in everyday life

Task

At the end of each sentence, **indicate whether or not it made sense.**

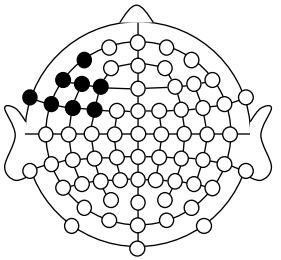
Experiment 2 | Conditions in more detail

The bear chased one	horse	MLF+MP+	**cyflym**	**MLF-MP+**	…
	fast	**MLF+MP+**	ceffyl	MLF+MP-	
	ceffyl	MLF+MP+	**fast**	**MLF-MP-**	
	cyflym	**MLF+MP-**	horse	MLF+MP-	
Helodd yr arth un	horse	MLF+MP+	**cyflym**	**MLF+MP+**	…
	fast	**MLF-MP+**	ceffyl	MLF-MP-	
	ceffyl	MLF+MP+	**fast**	**MLF+MP-**	
	***cyflym**	**MLF-MP-**	horse	MLF-MP-	

Noun	XXX	No CS	XXX	1 CS	XXX	2 CS
Adjective	**XXX**	No CS	**XXX**	1 CS	**XXX**	2 CS

Experiment 2 | Results

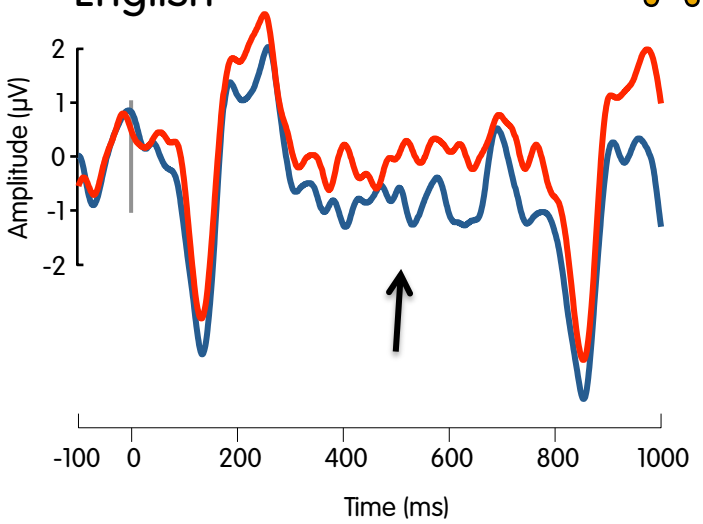
Adjectives



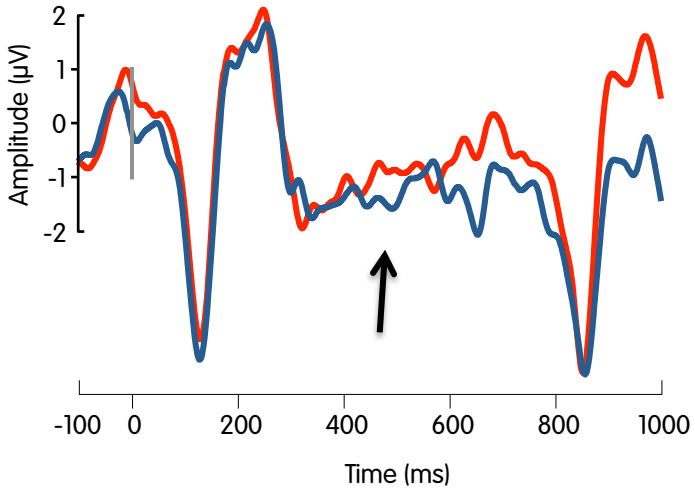
MLF+MP-

MLF-MP+

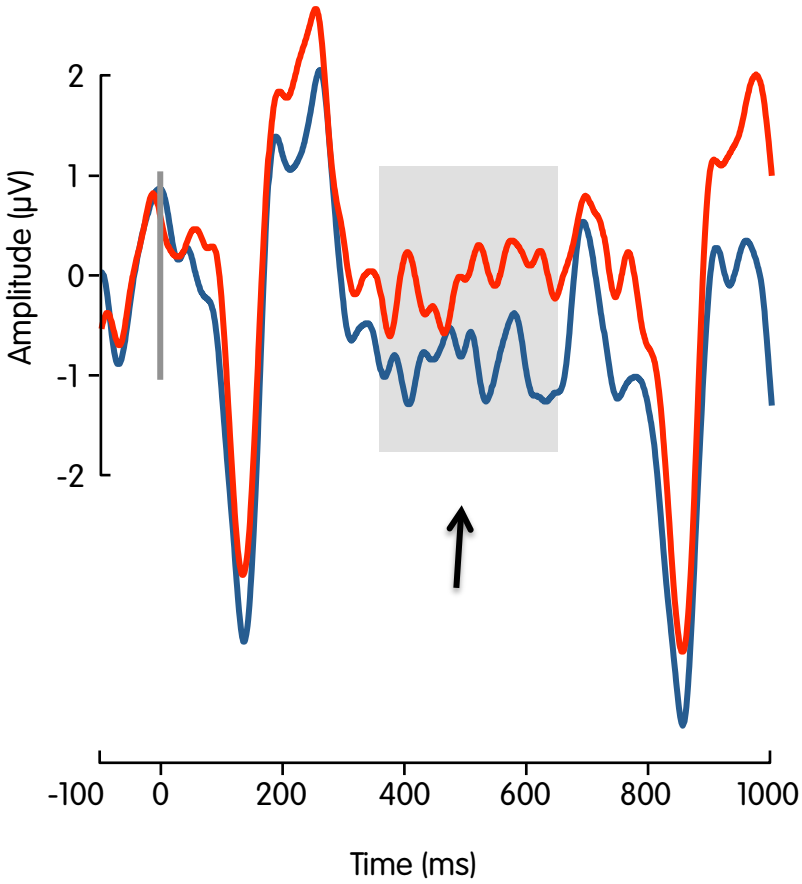
English



Welsh

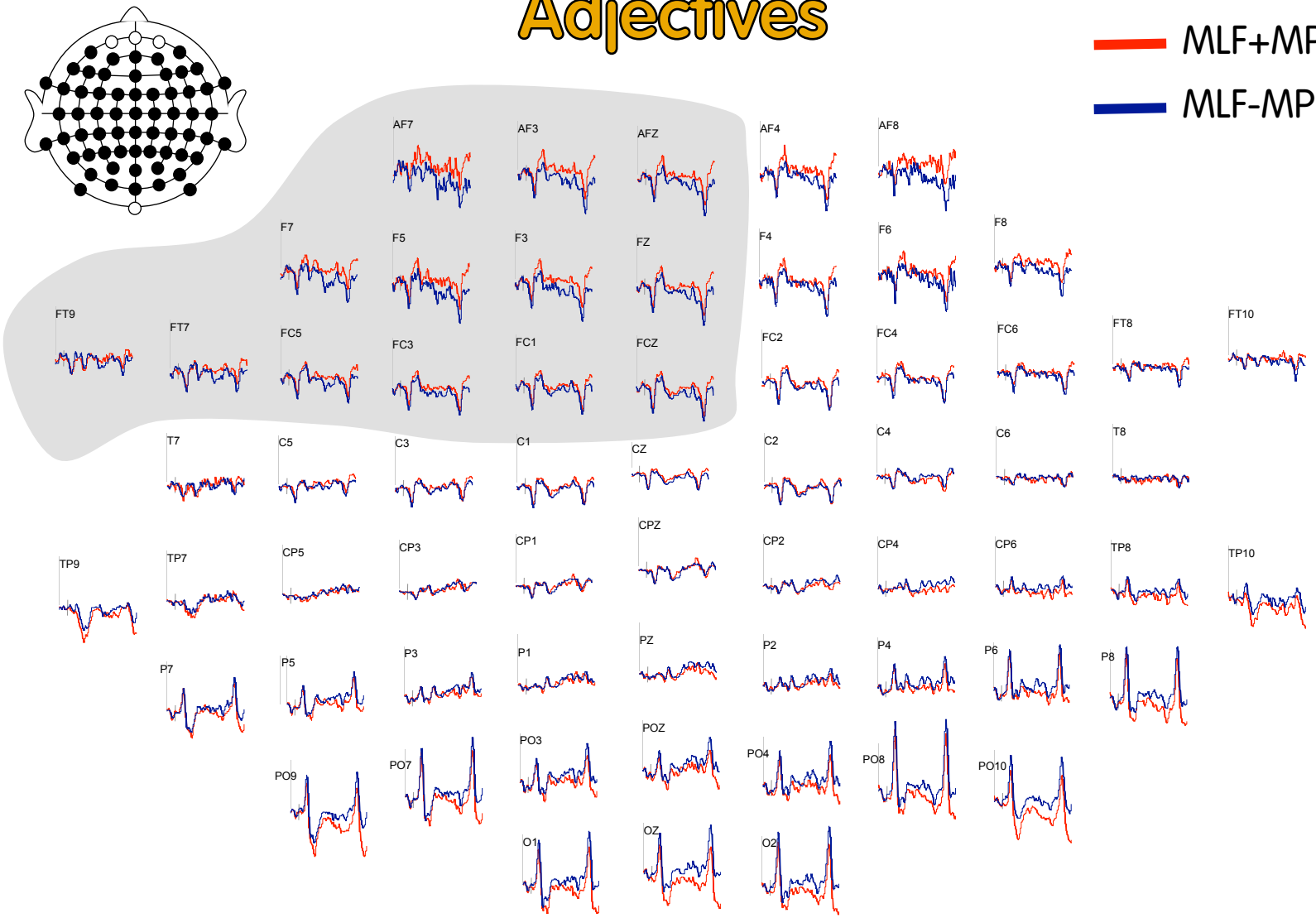


Overall



Experiment 2 | Results

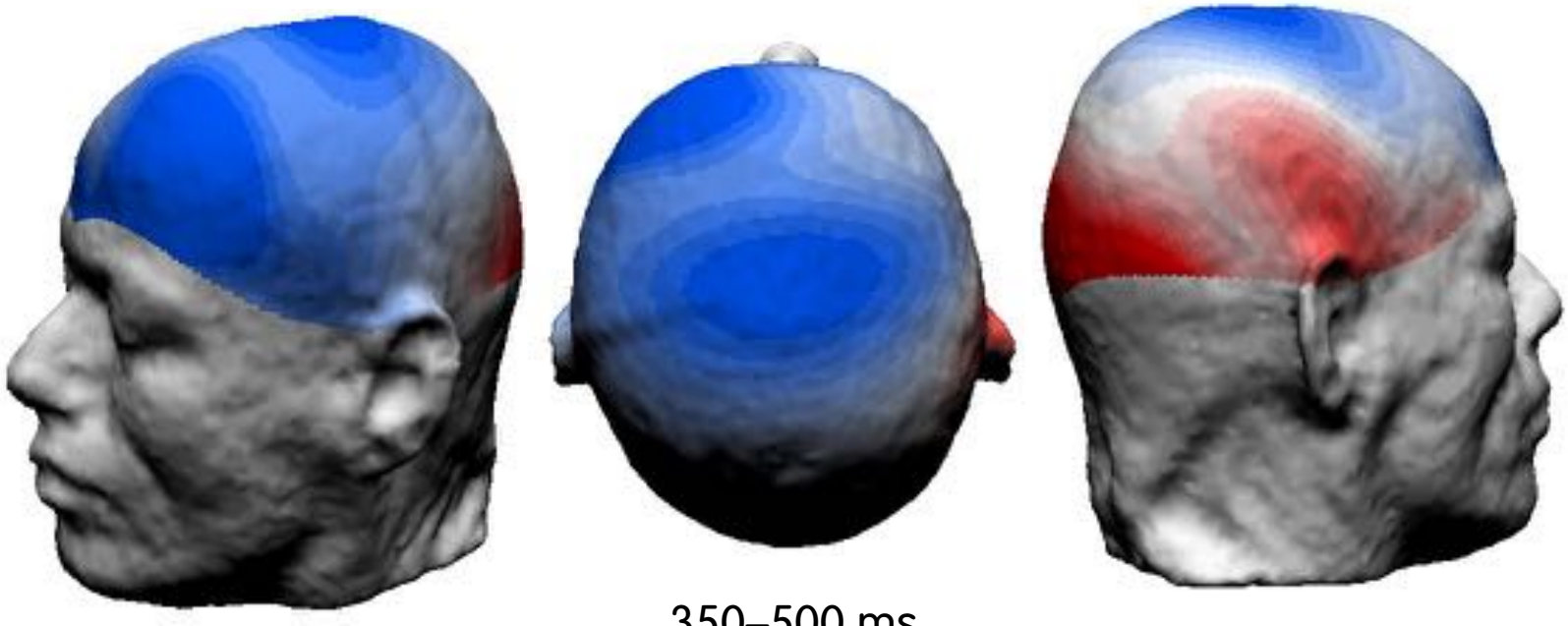
Adjectives



Experiment 2 | Results

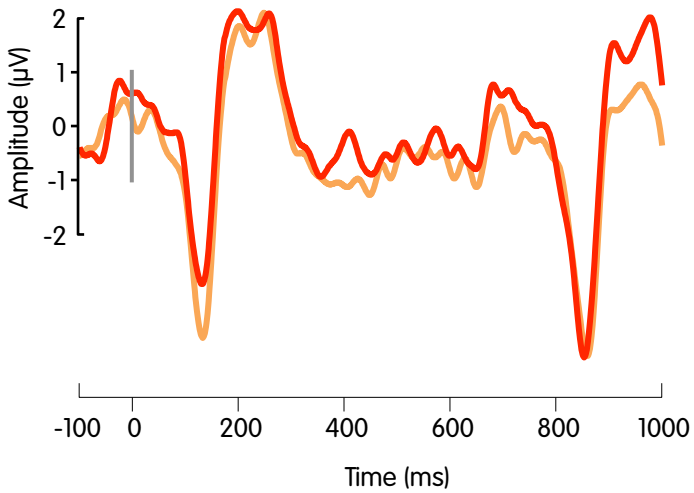
Adjectives

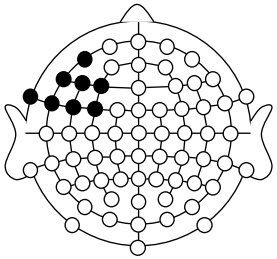
[MLF-MP+] – [MLF+MP-]



Experiment 2 | Results Nouns

English

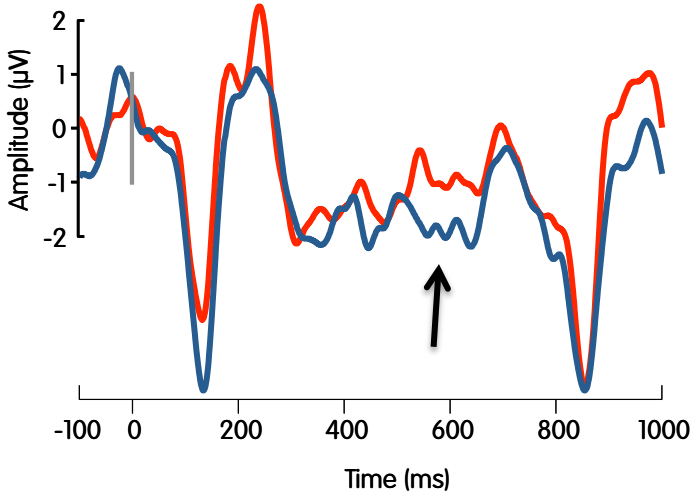


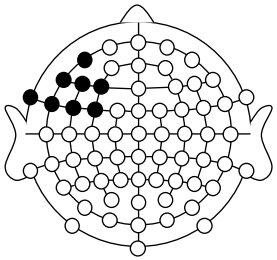


MLF+MP+

MLF+MP-

Welsh





MLF+MP+

MLF-MP-

*Watch out
Contaminated

Experiment 2 | Discussion

Some support for MLF predictions

- But effect appears stronger for MLF English than Welsh:

  Combined effect of predictability? (very strong in this experiment)

- Warning: These are only trends for the moment

  We need to await statistical validation

Some Limitations (amongst many…)

- Cannot consider double switches as similar to single switches
- Is the task good enough – would a syntactic decision task increase sensitivity?
- Imperfect control: MLF-/MP- for Welsh nouns is contaminated by preceding syntactic violation
- What about syntactic co-activation?

Interdisciplinary perspective on code-switching
3 & 4 October 2016 | Cambridge

Diolch yn big

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Matrix Language Frame (MLF)

(Myers-Scotton 1993, 2002)

The matrix language guides the morphosyntactic construction of code switching

→ In the case of English and Welsh, the matrix language determines whether an adjective will appear in pre- or post-nominal position, irrespective of its language

Evidence from corpus analyses: Herring, Deuchar, Parafita & Moro (2010), Parafita Couto M.C., Fusser M. & Deuchar M. (2015)

Minimalist Program (MP) Approach

(Cantone & MacSwan 2009)

The language of the adjective determines whether it appears before or after the noun

→ If the adjective is in English it should appear in pre-nominal position, if it is in Welsh, it should appear in post-nominal position