



When grammar and parsing momentarily disagree:

evidence from grammatical illusions in monolingual and bilingual comprehension

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ROADMAP

1. The study of grammatical illusions
2. Agreement attraction (accounts and evidence)
3. Greek data *monolingual and bilingual comprehension (gender and number)*
Paspali & Marinis, in preparation; Paspali & Marinis, 2020; Paspali, in preparation; Paspali, 2019a, b; Paspali, 2017)
4. Future directions

The study of grammatical illusions

Introduction

More people have been to Russia than I have.

Comparative illusion

The key to the cabinets are rusty.

Agreement Attraction

The bills that no senators voted for will ever become law.

NPI licensing

People (tend to fleetingly) accept these sentences due to interference.

The study of grammatical illusions

Importance

- The parser exhibits **selective** fallibility
 - good at some very complex syntactic constraints (islands, filler-gap dependencies)
 - but strikingly bad at some simple constraints (susceptible to grammatical illusions)
- Studying this fallibility shows us how structural relations are encoded in memory
- How we encode and navigate linguistic representations

The study of grammatical illusions⁵

On the relation between parsing and grammar

(Phillips, Wagers, & Lau, 2011)

Computing grammatical relations: 2 ways to **retrieve** structures from memory

Through search (serial)

- strictly structure-sensitive
- avoids interference from syntactically unavailable items

Advantage: high accuracy/successful

Disadvantage: slow especially for longer relations

Through content-addressable access (parallel)

- less structure-sensitive, cue activation
- susceptible to interference from imperfectly matching cues

Advantage: fast

Disadvantage: more prone to errors/failure

highly accurate parser

selective fallibility

Grammatical illusions

agreement attraction

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The key	to the cabinets	are	rusty.
Sing Head	PI attractor	PI target	

- Common errors in production
- Failure to notice them in online comprehension
- Surprisingly similar across languages
- Attraction in comprehension occurs with other features too, e.g. gender

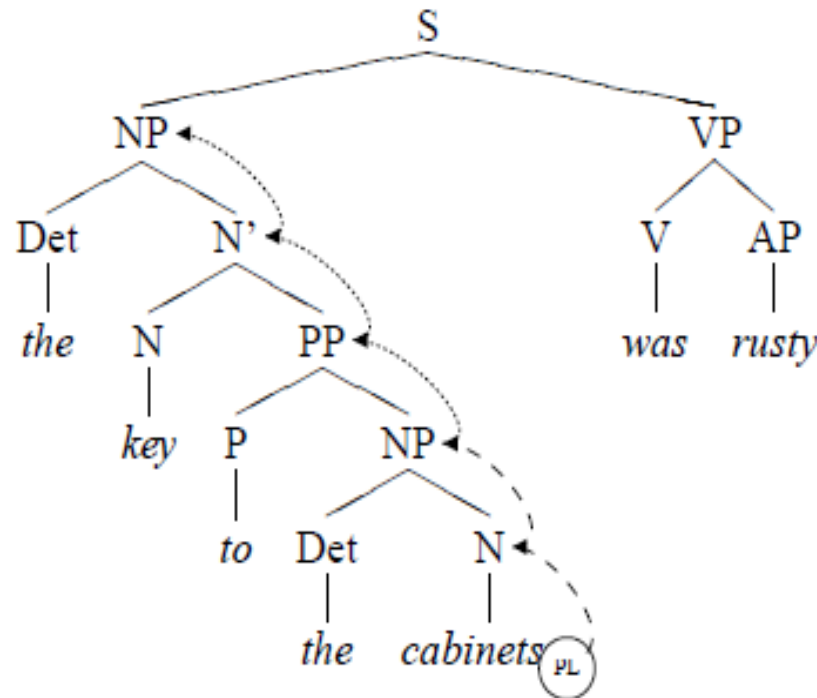
Cunnings et al., 2017; Lago et al. 2015; Reifegerste et al., 2016; Santesteban et al., 2017; Slioussar, 2018; Slioussar & Malko, 2017; Villata & Franck, 2016; Slioussar, 2018; Tucker et al., 2015; Wagers et al., 2009 (among others)

Accounts on agreement attraction

- Representational accounts – Feature percolation/Marking and Morphing

The mental representation is faulty

(Bock and Miller, 1991)



Predictions

1) Attraction with marked (plural) attractors **only**.

*The key to the cabinets are... (attraction expected)

*The keys to the cabinet is... (attraction **not** expected)

2) Attraction in **both** grammatical and ungrammatical sentences.

*The key to the cabinets are ... (attraction expected)

The key to the cabinets is (attraction expected)

Accounts on agreement attraction⁸

Retrieval account – Cue-based parsing (Wagers et al., 2009)

Retrieval is faulty

The key to the cabinets are rusty.

Sing
Head

PI
attractor

PI
target



Predictions

1) Attraction with **both** marked and unmarked attractors.

*The key to the cabinets are... (attraction expected)

*The keys to the cabinet is... (attraction expected)

2) Attraction **only** in ungrammatical sentences.

*The key to the cabinets are ... (attraction expected)

The key to the cabinets is (attraction **not** expected)

AGREEMENT ATTRACTION IN ⁹ **BILINGUAL POPULATIONS**

- What processing strategies do they use in attraction in comprehension?
 - Attraction studies in early bilinguals are scarce
 - Mostly with production or offline comprehension
- Stronger, weaker, or same attraction effects as monolinguals?
 - And consequently, worse, better or same retrieval abilities/representations?
- Similar attraction profiles between monolinguals and bilingual/bidialectal children and adults, L2 learners, HSs (Scontras et al., 2018; Veenstra et al., 2018; Lago et al., 2018, Paspali, 2017)

GREEK DATA

Gender and number agreement attraction in Greek comprehension

In Greek Native Speakers (NSs)

In Greek Heritage Speakers (HSs)



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ORIGINAL RESEARCH ARTICLE

Front. Psychol., 29 April 2020 | <https://doi.org/10.3389/fpsyg.2020.00717>

Gender Agreement Attraction in Greek Comprehension

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Processing gender agreement in Heritage Greek: an attraction study

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ABSTRACT

Ελέγχουμε την επεξεργασία λόγου στη σύμφωνη γραμματική γένους μεταξύ σύνθετης ΟΡ (Ονομαστικής Φράσης) και α) κατηγορούμενου ή β) κλητικού σε ενήλικες φυσικού/ες ομιλήτ/ες της Ελληνικής, μονόγλωσσους/ες και διγλωσσούς/ες κατά την κατανόηση σε πραγματικό χρόνο. Για τους διγλωσσούς/ες ομιλήτ/ες, τα ερωτήματα ήταν εάν οι ακούοντες την διαστροφή με τους/ες μονόγλωσσους/ες κατά την αντίληψη της πληροφορίας του γένους από τη μημή φωνή, και β) οι κλητικοί εισαφίτη στην αντιπαράθεση κατά την προαφική επεξεργασία, δεδομένου του μειωμένου γλωσσικού καταγύγμενου στα Ελληνικά λόγω της διαφυγής τους στη Γερμανία (έκπαιξη γεννά Ελληνικά μεταπολεμικών γεννημένων/ες και μετακλινών/ες στο Γερμανικό). Τόκ συμμετρήτες (βλ. διγλωσσούς) έλαβαν μέρος σε χρονομετρητά πειράματα αυτοαφών/ζωνής ακρόασης (self-paced listening), και σε δραστηριότητες κατηγοριοποίησης γένους και επεξεργασίας συμφωνίας. Τα αποτελέσματα δείχνουν ότι οι διγλωσσού/ες, αφρόνουν την διαστροφή με τους μονόγλωσσους, στο κατηγορούμενο αλλά, χρησάτηκαν περισσότερο χρόνο για να τη χρησάτησουν (πλεονέκτημα της πρότασης), και ότι είχαν μείωση ταφίφης στην αντιπαράθεση στα Ελληνικά. Τα ερωτήματα αυτά στους διγλωσσούς, συνδέονται με δυσκολία στην αντίληψη των μαρφολογικών πληροφοριών του γένους με τα ερμηνεύσιμα συντακτικά χαρακτηριστικά της συμφωνίας στη μαρφορομένη τη (Ελληνική γένος). Στο ούδεριο (μη μαρφορομένη τη), οι διγλωσσού/ες αντίδρασαν ένα τηγμα μετά το κέρμα τηγμα της πρότασης, όπως και οι φυσικοί/ες ομιλήτ/ες. Στη δομή με το κλητικό, οι διαφορές στους διγλωσσούς, δεν ήταν στατιστικά σημαντικές. Η συμφωνία γένους στα κλητικά φαίνεται να είναι περισσότερο προβλεψιμητική συμφωνία με τη συμφωνία γένους στο κατηγορούμενο για τους/ες διγλωσσούς/ες κατά την συνδυαστική επεξεργασία αλλά όχι στην δραστηριότητα επεξεργασίας της συμφωνίας. Ερμηνεύουμε τη δυσκολία αυτή με όρους το κόστος επεξεργασίας στα κλητικά, οι συμμετρήτες πρέπει να αναζητούν πραγματολογικά το αντικείμενο αναφοράς (antecedent) του κλητικού και τη μαρφορομένη πληροφορία του γένους, αντίθετα στο κατηγορούμενο η συνδεση του γένους είναι σημασιολογική τύπου. Αυτή η ερμηνεία αναφέρεται στο το γεγονός ότι και η ομάδα των μονόγλωσσων αντίδρασε μετά το κέρμα τηγμα στη δομή των κλητικών.

1. INTRODUCTION

The study of agreement errors in comprehension can reveal how speakers license grammatical relations in real-time. Although agreement violations have been widely explored within monolingual populations and across different languages (e.g., Silvassan and Mallo 2016; Tucker et al. 2015; Wagers et al. 2009), little is known so far about the online comprehension of agreement in heritage speakers, namely, early bilinguals whose native language is a minority language and differs from the dominant language in the society. Heritage speakers are bilinguals who are exposed to their native (minority) language from birth and sequentially or simultaneously to the language of their host country (majority language) (Scotras et al. 2015). In this study, we test how heritage speakers process gender errors in their native language so that we better describe the strategy underpinning the morphosyntactic computation of gender agreement in this group of individuals. We use the experimental paradigm of agreement attraction (agreement errors due to intervening constituents) between the head noun and the agreement target) as a way to investigate the abilities of heritage speakers to weigh cues and retrieve structures from memory.

It has been shown by means of offline comprehension and production tasks that gender agreement is vulnerable in certain groups of heritage speakers. In particular, there are studies which found variability on gender agreement (e.g., Morin, Foote, and Perpiñán 2008). However, in languages with rich inflectional morphology, heritage speakers perform well or on par with the

Gender agreement in Native and Heritage Greek: an attraction study

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2nd International Symposium on
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Technische Universität Braunschweig
Bernhard Weg 14, D 38104
May 24 - 25, 2018



RT Experiments

	Heritage speakers	Native Speakers
N	52	52
Age	21.6 (19-27)	23.2 (18-33)
Gender	19 males	23 males
Born and raised	Berlin, Germany	Thessaloniki and Giannitsa, Greece
Age of Onset to Greek	From birth	From birth
Age of Onset to German	1.7 (0-4)	-
Families (parent-language combinations)	22 participants: both parents 1 st generation immigrants 17 participants: 1 HS parent & 1 st generation immigrant parent 13 participants: 1 German parent & 1 1 st generation immigrant parent	Both parents Greek (born and raised in Greece and they have never lived abroad)
Higher education (University)	26 participants	29 participants
Formal bilingual education	43 participants (primary schools and/or secondary schools) mean years of bilingual education: 7 years (0-13)	no
Self-ratings in Greek	72% (40-100)	-
Self-ratings in German	92% (70-100)	-
Speech rate in Greek (words/minute)	91 (26-180)	116 (47-164)
Speech rate in German	115 (57-185)	-

PARTICIPANTS

Speeded judgements

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	Heritage speakers	Native Speakers
N	25	40
Age	24 (18-35)	22.7 (18-30)
Gender	18 females	24 females
Born and raised	Berlin, Germany	Thessaloniki & Giannitsa, Greece
Age of Onset to Greek	From birth	From birth
Age of Onset to German	2.1 (0-6)	-
Families(parent-languagecombination)	9 participants: both parents 1 st generation immigrants 6 participants: 1 HS parent & 1 st generation immigrant parent 10 participants: 1 German parent & 1 1 st generation immigrant parent	Both parents Greek (born and raised in Greece and they have never lived abroad)
Higher education (University)	14 participants	18 participants
Formal bilingual education	17 participants (primary schools and/or secondary schools) mean years of bilingual education: 6.4 years	no
Self-ratings in Greek	67% (40-93)	-
Self-ratings in German	94% (80-100)	-

MEASUREMENTS

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Attraction experiments (similar materials & manipulations tested across experiments)

Measure	Methodology	Feature	Agreement target	Group
RTs (x2)	self-paced listening	gender	predication, object-clitics	NSs, HSs
Accuracy (x3)	speeded grammaticality	gender, number	predication, object-clitics, verb	NSs, HSs
Acceptability score	scaled judgements	gender, number	predication, object-clitics, verb	NSs

Baseline tasks

- Gender assignment and agreement task
- Oral narration task: grammatical accuracy, speech rate, agreement with number and gender
- Forwards and Backwards digit span task (phonological and working memory)
- Language background questionnaire (current & past input, literacy, education...)

EXPERIMENTAL MATERIALS **GENDER**

Adjectival predication: Όταν ο Γιάννης μπήκε στην κουζίνα βρήκε ... πάνω στο τραπέζι της κουζίνας

Feminine Heads

	Head	Attractor	Target
Grammatical match	τη συνταγή	για την πίτσα	σκισμένη
Ungrammatical match	τη συνταγή	για την πίτσα	*σκισμένο
Grammatical mismatch	τη συνταγή	για το ψωμί	σκισμένη
Ungrammatical mismatch	τη συνταγή	για το ψωμί	*σκισμένο

“When John went into the kitchen he found the recipe for the pizza/bread torn on the kitchen table.”

Neuter heads

Head	Attractor	Target
το κουτάλι	για το γλυκό	λερωμένο
το κουτάλι	για το γλυκό	*λερωμένη
το κουτάλι	για τη σούπα	λερωμένο
το κουτάλι	για τη σούπα	*λερωμένη

“When John went into the kitchen he found the the spoon for the dessert/soup stained on the kitchen table”.

Object-clitic: Ο Γιάννης έψαχνε ... πάνω στο τραπέζι της κουζίνας

Feminine Heads

	Head	Attractor	Target
Grammatical match	τη συνταγή	για την πίτσα	και τη βρήκε
Ungrammatical match	τη συνταγή	για την πίτσα	*και το βρήκε
Grammatical mismatch	τη συνταγή	για το ψωμί	και τη βρήκε
Ungrammatical mismatch	τη συνταγή	για το ψωμί	*και το βρήκε

“John went was looking for the recipe for the pizza/bread and he found it on the kitchen table.”

Neuter heads

Head	Attractor	Target
το κουτάλι	για το γλυκό	και το βρήκε
το κουτάλι	για το γλυκό	*και τη βρήκε
το κουτάλι	για τη σούπα	και το βρήκε
το κουτάλι	για τη σούπα	*και τη βρήκε

“When John was looking for the spoon for the dessert/soup and he found it on the kitchen table”

EXPERIMENTAL MATERIALS NUMBER

Number

	Singular Heads		
	Head	Attractor	Target
Grammatical match	το πρόβλημα	στο σχολείο	παραμένει
Ungrammatical match	το πρόβλημα	στο σχολείο	*παραμένουν
Grammatical mismatch	το πρόβλημα	στα σχολεία	παραμένει
Ungrammatical mismatch	το πρόβλημα	στα σχολεία	*παραμένουν

„The problem in the school/schools remains/*remain“.

	Plural heads		
	Head	Attractor	Target
	τα προβλήματα	στα σχολεία	παραμένουν
	τα προβλήματα	στα σχολεία	*παραμένει
	τα προβλήματα	στο σχολείο	παραμένουν
	τα προβλήματα	στο σχολείο	*παραμένει

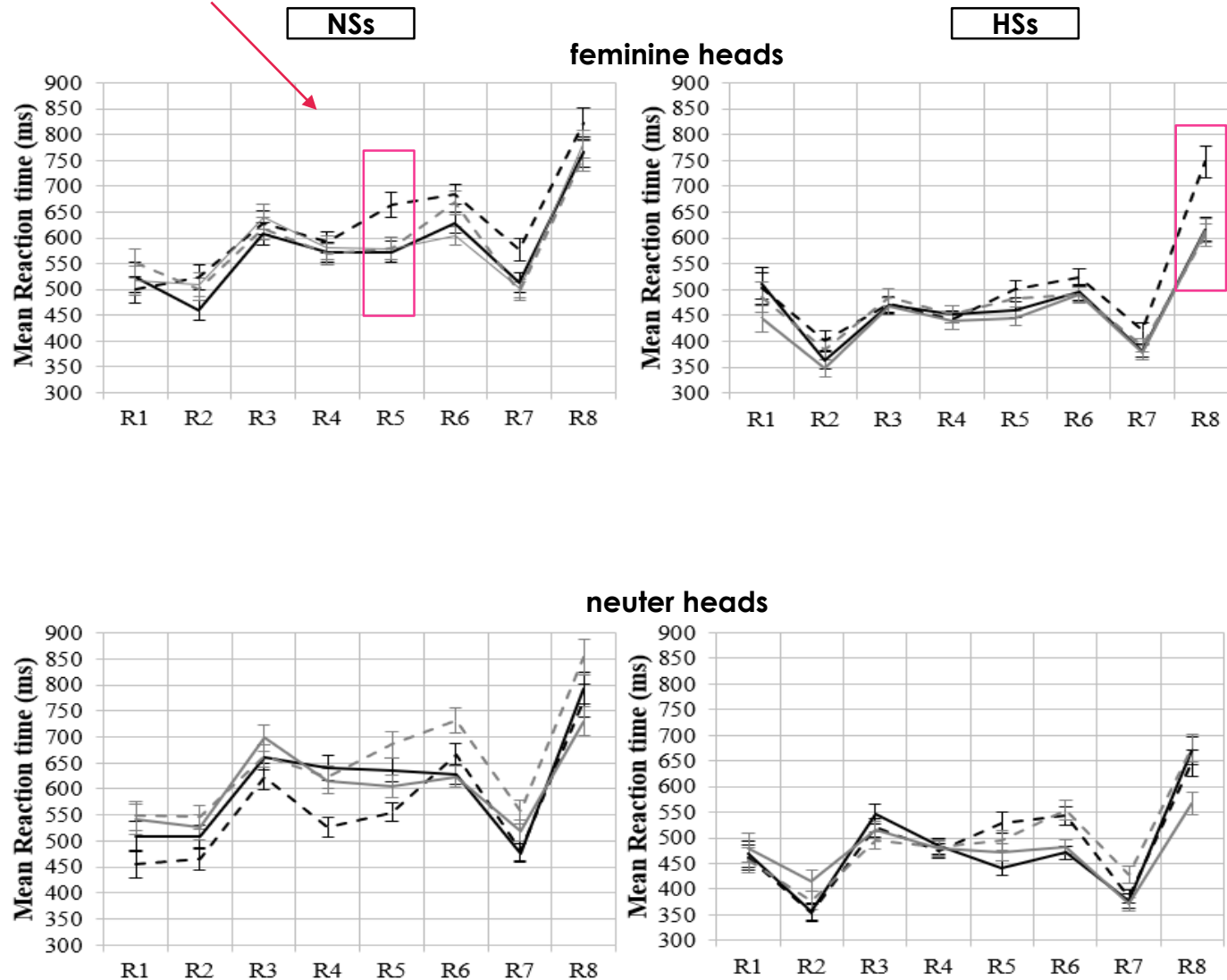
„The problems in the schools/school remain/*remains“

RESULTS SELF-PACED LISTENING 15

GENDER:ADJECTIVAL PREDICATION)

Significant attraction effects
(in ungrammatical sentences only)

— grammatical match
- - - ungrammatical match
— grammatical mismatch
- - - ungrammatical mismatch



Region 5 and 8:

By group: no differences in
the strength of attraction

Region 6: HSs weaker
grammaticality effects

No attraction overall

Region 6: similar
grammaticality effects for
both groups

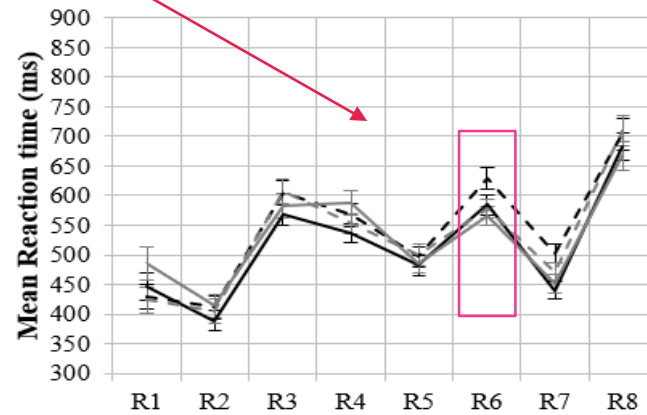
RESULTS SELF-PACED LISTENING

GENDER: OBJECT-CLITICS

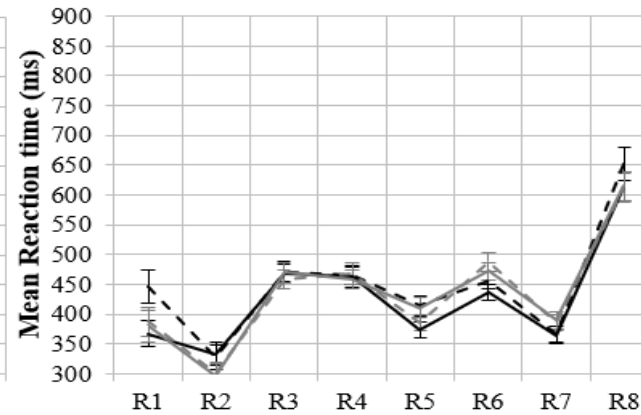
Significant attraction effects
(in ungrammatical sentences only)

NSs

feminine heads



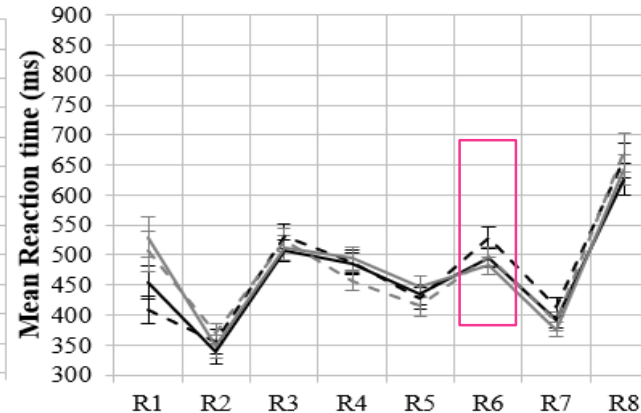
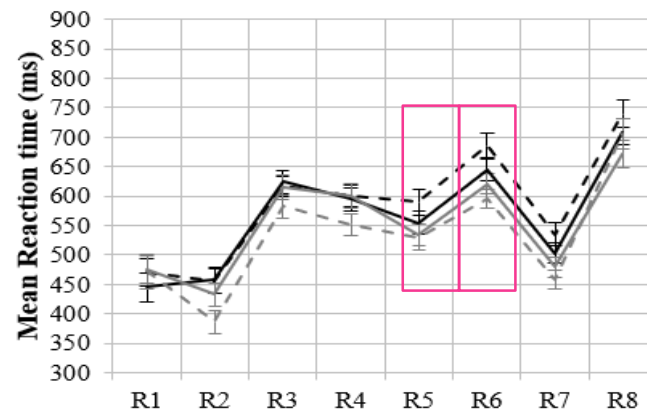
HSs



Region 6:

HSs any distinctive
pattern at all

neuter heads

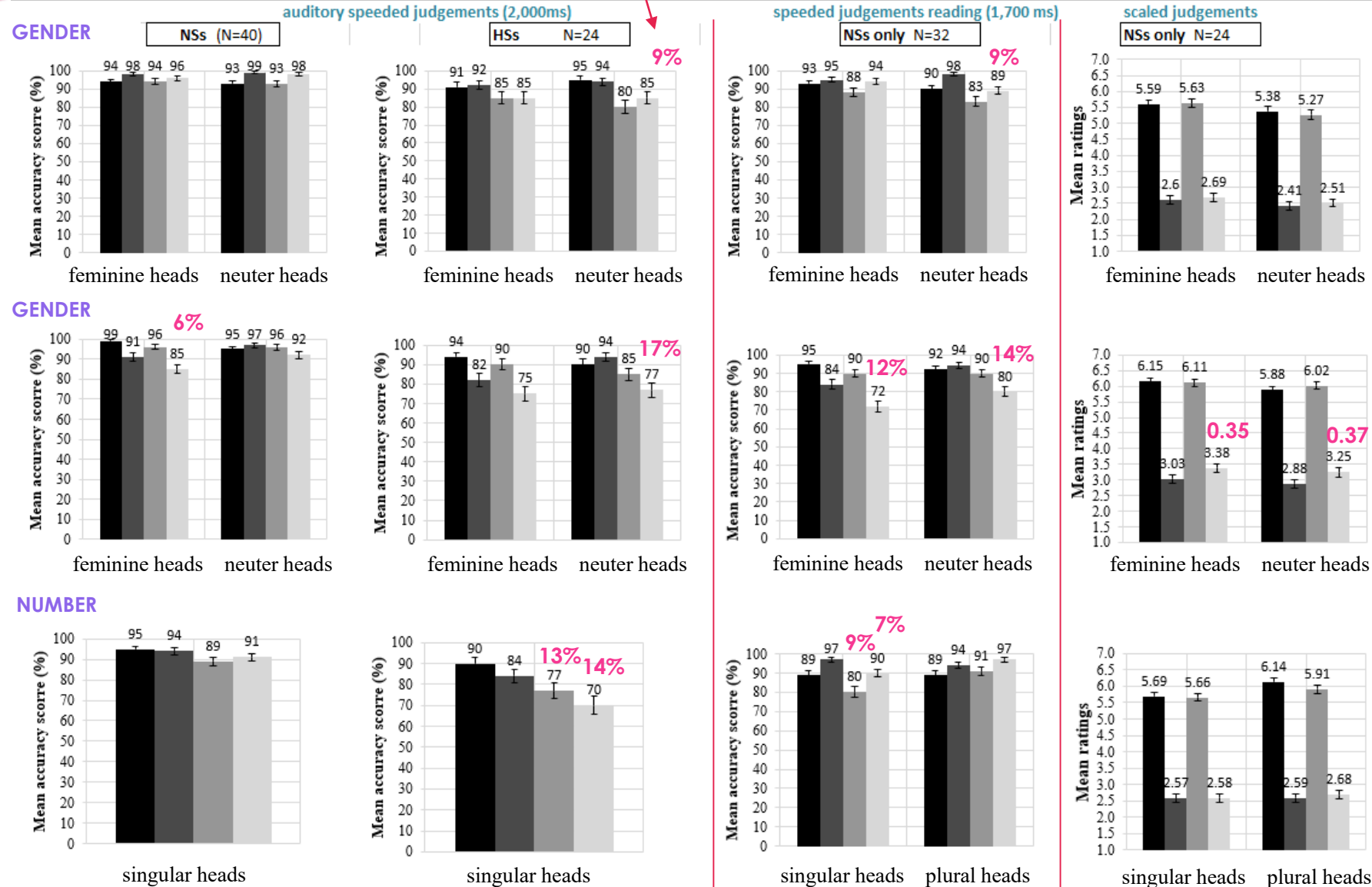


RESULTS: JUDGEMENTS

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Attraction penalty when significant
(match - mismatch)

■ grammatical match ■ ungrammatical match
■ grammatical mismatch ■ ungrammatical mismatch



Attraction Error rates
similar to other
studies with gender/
number (Turkish,
Spanish, Russian)

Attraction Error rates
15%, 11%

Attraction Error rates
15%, 23%, 28%, 20%

Attraction Error rates
23%, 30%, 20%, 10%

Agreement target
adjectival predicate

Agreement target
object-clitic

Agreement target
verb

DISCUSSION

- Empirical evidence for the presence of Attraction in Greek:
 - gender attraction, number attraction
 - agreement targets: adjectival predicates, object-clitics, verb
- Different mechanisms/strategies employed for each feature
 - **Representational** accounts seem to better account for **number** attraction
 - **Retrieval** accounts seem to better account for **gender** attraction
- Across all measurements, the same patterns of attraction
- Online measures capture attraction to a greater extent, while in scaled judgements certain agreement targets resist attraction (object-clitics **vs.** verb, adjectival predicate)

DISCUSSION

Heritage speakers

- No evidence of stronger or weaker attraction effects.
 - Retrieval and representations work similarly in both groups **in attraction** configurations.
- Issues with **feminine** heads exhibited as: reduced or no reaction to ungrammatical sentences when the head is feminine even in the control conditions
 - **They are morphosyntactically different** with ***feminine heads-neuter agreement** in online processing

FUTURE DIRECTIONS

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TOPIC: Attraction and...	INFLUENTIAL PUBS
...bilingualism children and adults	Veenstra et al., 2018; Lago et al., 2018; Scontras et al., 2018; Lanoë et al., 2107
...second language acquisition	Lago & Felser, 2018; Cunnings, 2017 and references therein
...aging	Reifergerste et al., 2017
...working memory differences	Veenstra et al., 2018; Reifegerste et al., 2017; Slevc & Martin, 2016
...neural language models	Linzen and Leonard, 2018; Arehalli & Linzen, 2020
...pronouns	Santesteban et al., 2018; Dillon et al., 2013; Parker & Phillips, 2017; Patil, Vasishth & Lewis 2016
...agreement targets	Santesteban et al., 2017
...the locus of attraction (semantics vs syntax)	Franck et al., 2002; Vigliocco & Nicol, 1998
...syncretism vs morphological disambiguation	Slioussar, 2018; Hartsuiker et al., 2003
...position of attractor and embeddings (modifiers vs relative clauses)	Bock and Cutting, 1992; Solomon & Pearlmutter, 2004; Franck et al., 2002; Lago and Felser, 2018
...attraction and feature geometry and organization	Scontras et al., 2018
attraction during production	Eberhard, Cutting & Bock, 2005; Eberhard, 1997; Staub, 2009, 2010

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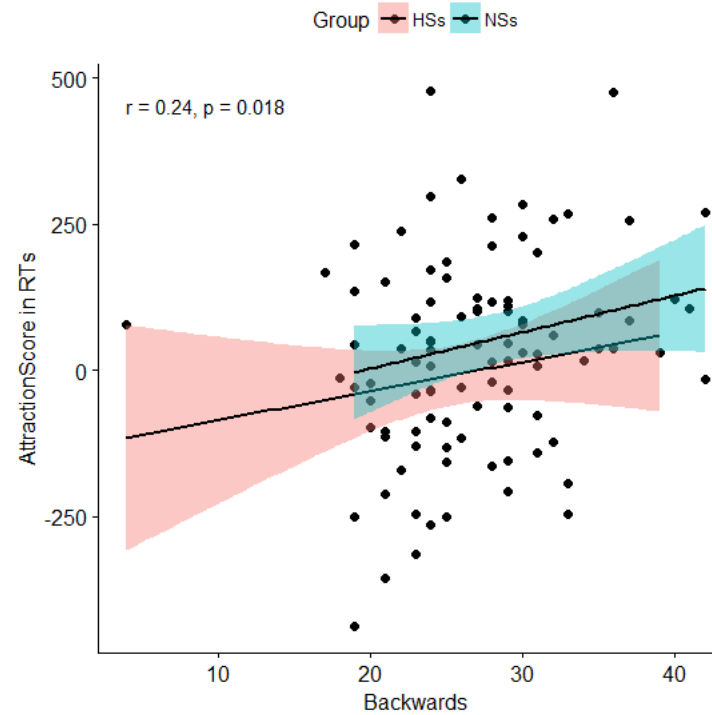
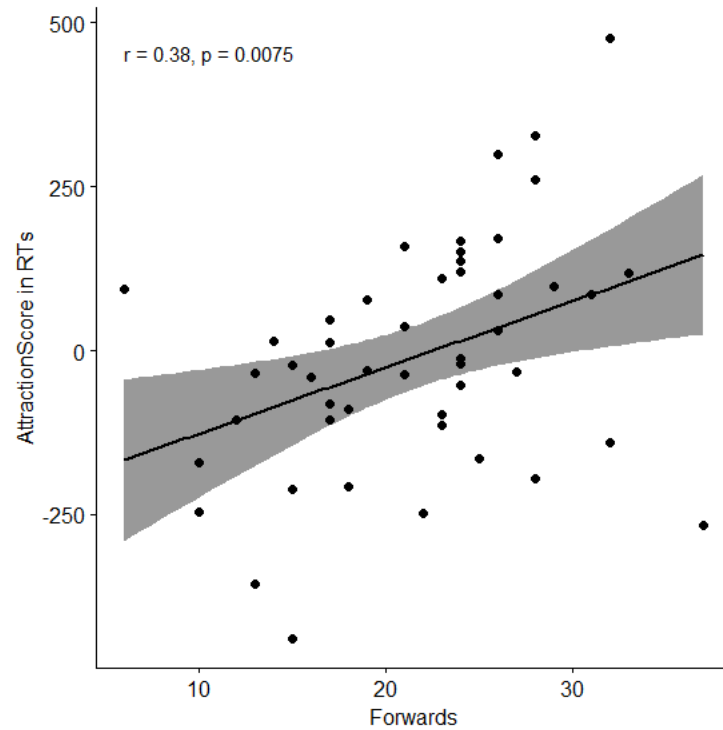
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THANK YOU!

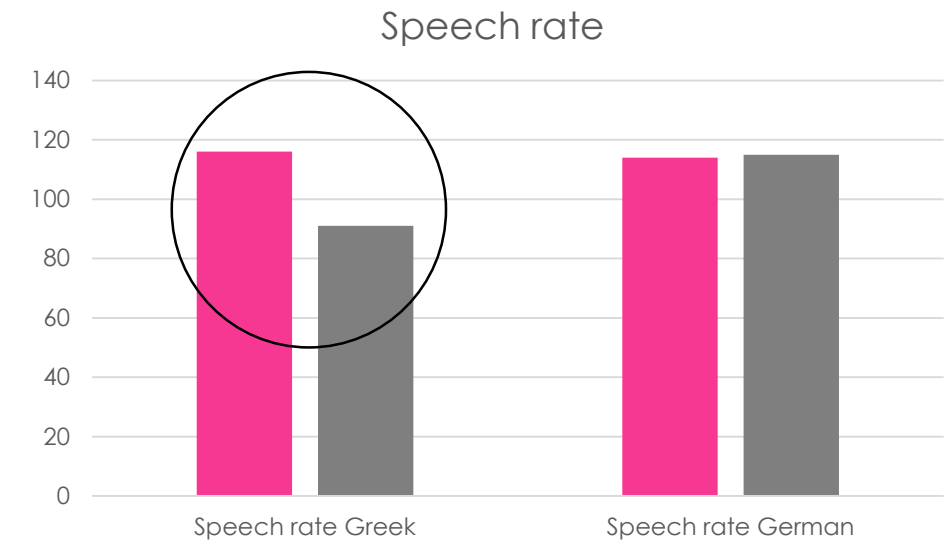
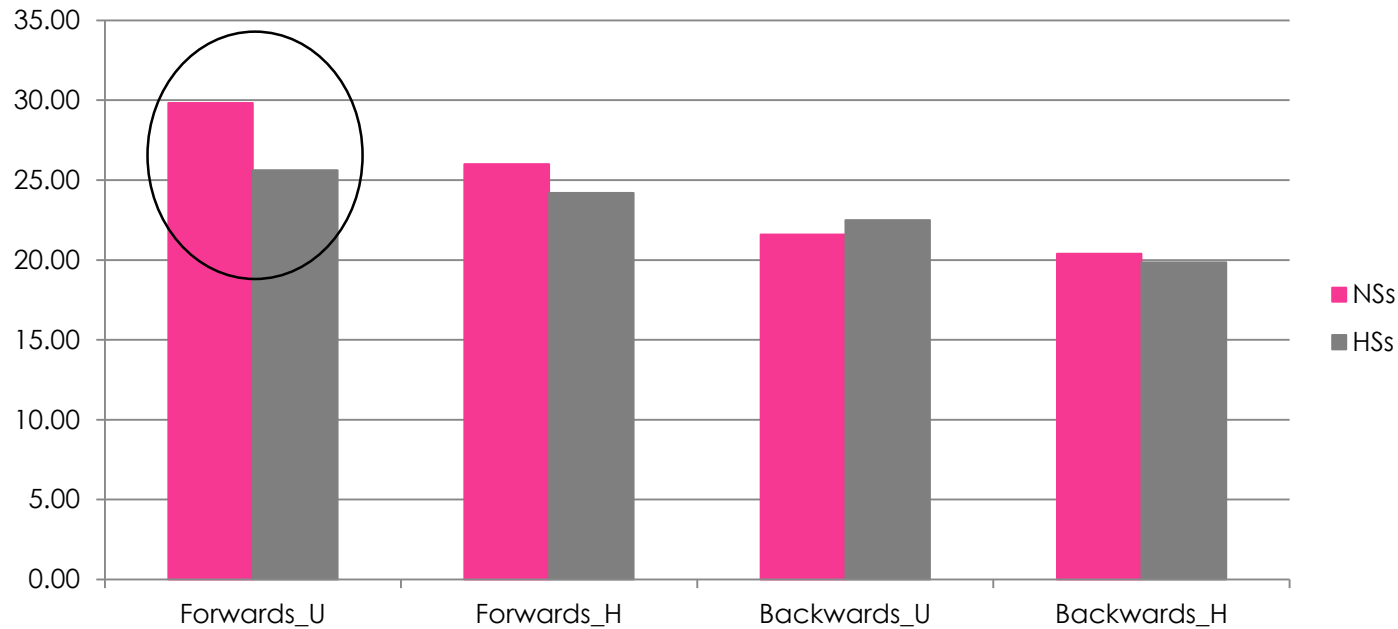
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INDIVIDUAL DIFFERENCES REGION 6, OBJECT-CLITICS



INDIVIDUAL DIFFERENCES

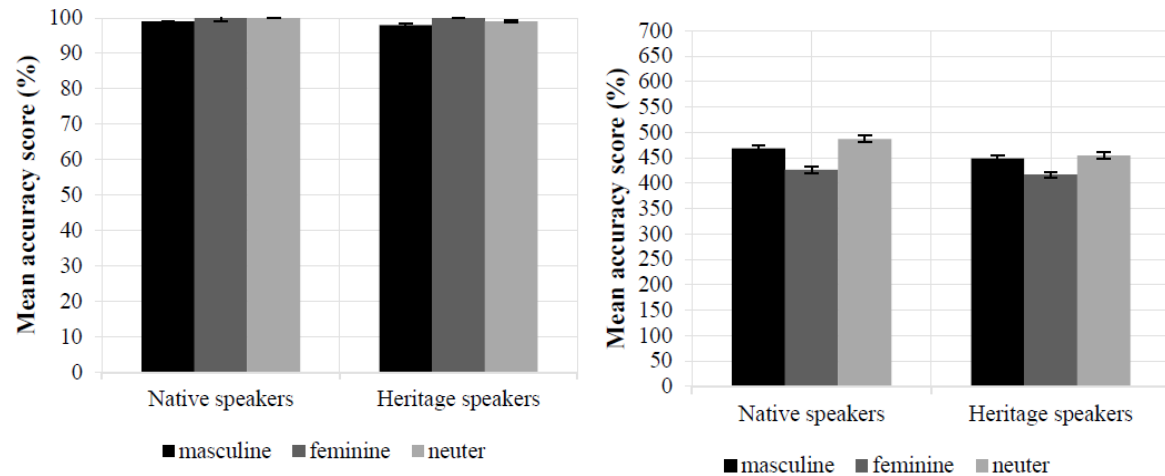
MEMORY AND EDUCATION, SPEECH RATE



BASELINE TASKS FINDINGS

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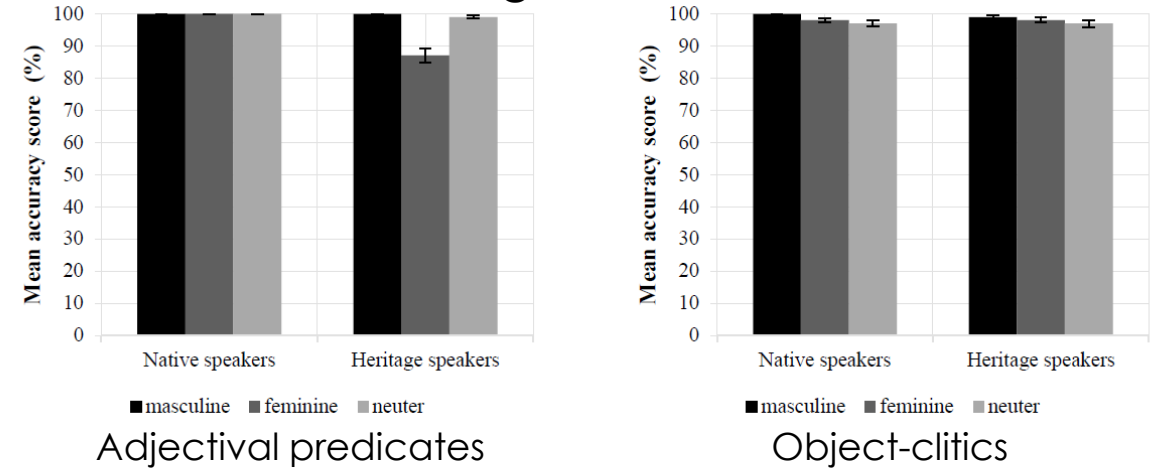
Lexical decision task: gender assignment



Oral elicitation task: gender agreement

Group	Correct	(%)	Incorrect	(%)	Total
HSs	633	89	78	11	711
NSs	854	93	60	7	914

Gender Agreement elicitation task



HSs' correct and incorrect instances of gender agreement with animate and inanimate nouns by gender value. Number of observations is included in parenthesis.

	Correct % (n)			Incorrect % (n)		
	masculine	feminine	neuter	masculine	feminine	neuter
animate	96 (344)	38 (20)	80 (88)	4 (16)	62 (33)	20 (22)
inanimate	100 (1)	91 (47)	99 (133)	0 (0)	9 (5)	1 (2)

NSs' correct and incorrect instances of gender agreement with animate and inanimate nouns. Number of observations in parenthesis.

	Correct % (n)			Incorrect % (n)		
	masculine	feminine	neuter	masculine	feminine	neuter
animate	99.8 (552)	43 (34)	88 (87)	0.2 (1)	57 (45)	12 (12)
inanimate	93 (14)	100 (53)	100 (113)	7 (1)	0 (0)	0 (0)