

Facilitative use of grammatical gender: Comparing heritage speaker groups

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Workshop on gender in heritage languages and grammar change

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Main Goal

To determine whether heritage speakers can use gender agreement within the nominal phrase during online processing to facilitate lexical retrieval.

Background

- Agreement in the nominal domain (aka “concord”) entails that determiners and modifiers in the nominal phrase may inflect for features that match those of the head noun.

Tengo un-a manzana roj-a.
have.1SG a-F apple.F red-F
“I have a red apple.”

Background

- Substantive body of work shows that heritage speakers have difficulty with target-like production and comprehension of concord.
- What do Heritage Speakers *know* about gender in their HL?
 - Their knowledge (not just performance) might be different from the baseline. (Scontras et al. 2015, Scontras et al. 2018)

Background

- Question: Can they use their knowledge during online processing of nominal phrases in a target-like manner?

Background

- Gender inflection on pre-nominal elements that enter into concord may be useful:

Tengo un-a manzana roj-a.
have.1SG a-F apple.F red-F
“I have a red apple.”

Background

- It has been shown that monolingual speakers of several languages can use grammatical gender in this way.
 - Eye-tracking studies using the Visual World Paradigm
Spanish (Lew-Williams & Fernald 2007, 2010; Gruter et al 2012; Dussias et al 2013), **Dutch** (Loerts 2012, Loerts et al. 2013, Bouwer et al. 2018), **German** (Hopp 2013, 2016; Hopp & Lemmerth 2018), **Russian** (Sekerina 2015)

Research questions

- Can heritage speakers use gender to facilitate lexical retrieval?
- ...If so, what properties of the gender feature and/or gender agreement in the heritage language impact this ability?
- ...If so, what properties of the gender feature and/or gender agreement in the dominant language impact this ability?

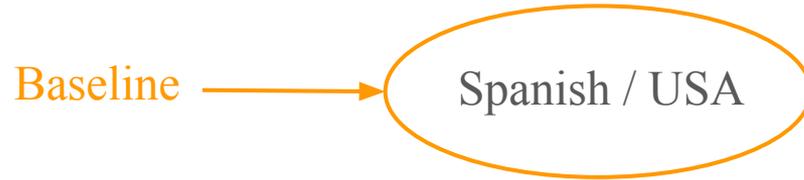
Strategy

Spanish / USA

Spanish / Germany

Polish / USA

Strategy



Spanish / Germany

Polish / USA

Strategy

Spanish / USA

Add gender
in dominant
language



Spanish / Germany

Polish / USA

Strategy

Spanish / USA

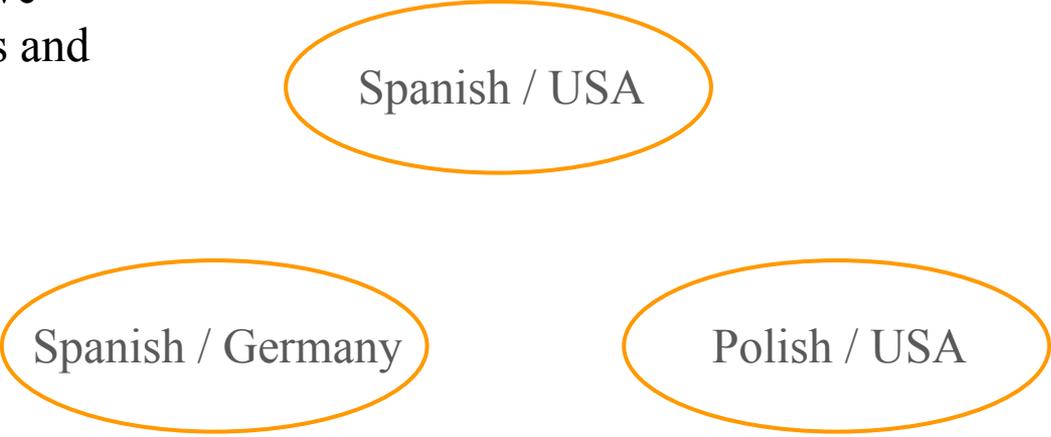
Spanish / Germany

Polish / USA

3-gender
system

Strategy

Each study will have independent results and implications...



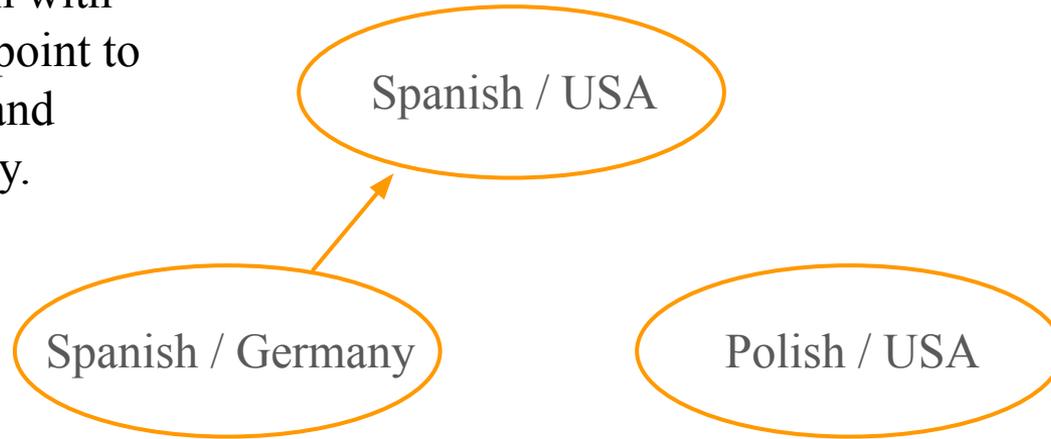
Spanish / USA

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Polish / USA

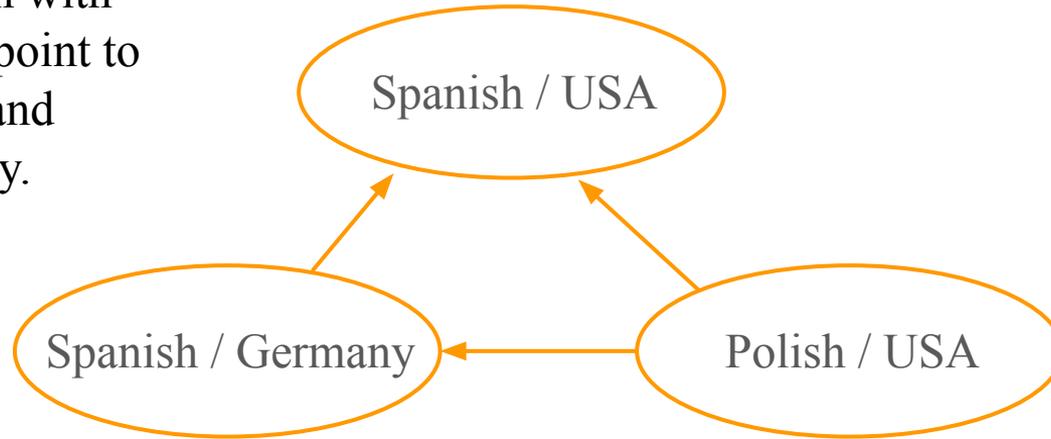
Strategy

... and comparison with other studies will point to further questions and directions for study.



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Outline

- Visual World Paradigm & facilitative use of gender
- Study 1: Heritage Spanish in the USA
- Study 2: Heritage Spanish in Germany
- Study 3: Heritage Polish in the USA
- Next steps

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Methodology

Heritage speaker performance on a task is **dependent on the modality of the task**

- *Oral* picture-naming: HL > L2 (Montrul 2008)
- *Written* recognition / *written* comprehension: HL < L2 (Montrul 2008)
- Grammaticality judgments: HL < L2 (Montrul 2016, Polinsky 2018, etc.)

Recurrent theme: tasks that require **metalinguistic competence and awareness** put heritage speakers at a disadvantage.

Methodology

Low rates of formal schooling and literacy in HL



HS perform poorly on tasks targeting explicit knowledge and/or literacy.

Eye-tracking



ASSUMPTION:

our eye-movement reflects our linguistic processing

ADVANTAGE:

an implicit measure of linguistic ability

Eye-tracking



- Participant views images on a screen while listening to auditory stimuli
 - Optional response such as a click

Methodology

Gender + Eye-tracking = **facilitative use of gender
in the Visual World Paradigm (VWP)**

Spanish -- Lew-Williams & Fernald (2007, 2010), Gruter et al (2012), Dussias et al. (2013)

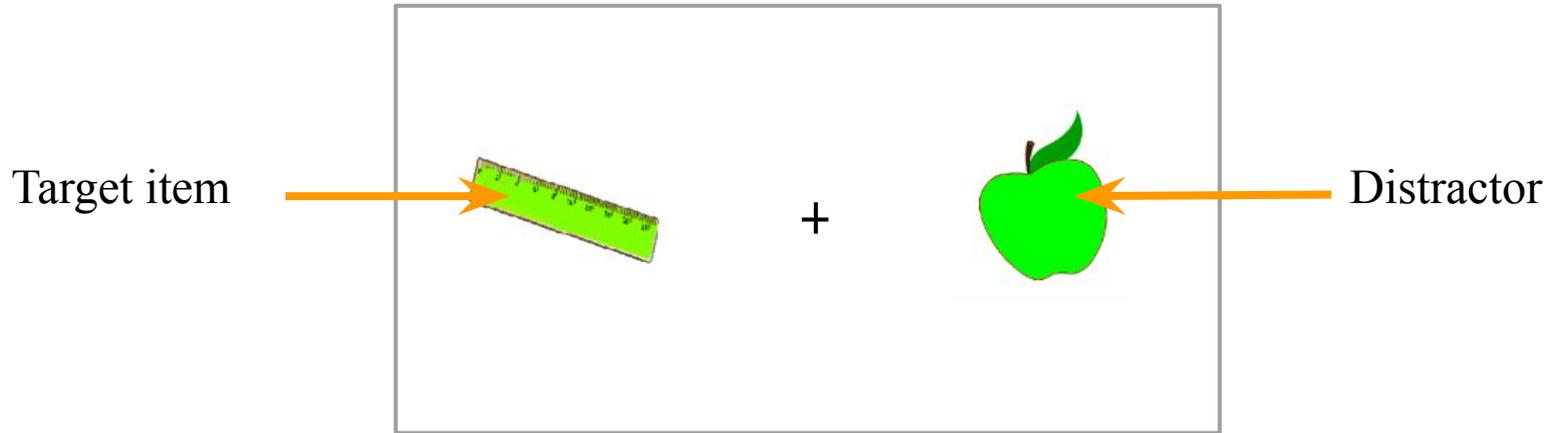
Dutch -- Loerts (2012), Loerts et al (2013), Bouwer et al (2018)

German -- Hopp (2013, 2016), Hopp & Lemmerth (2018)

Among others...

How the VWP works

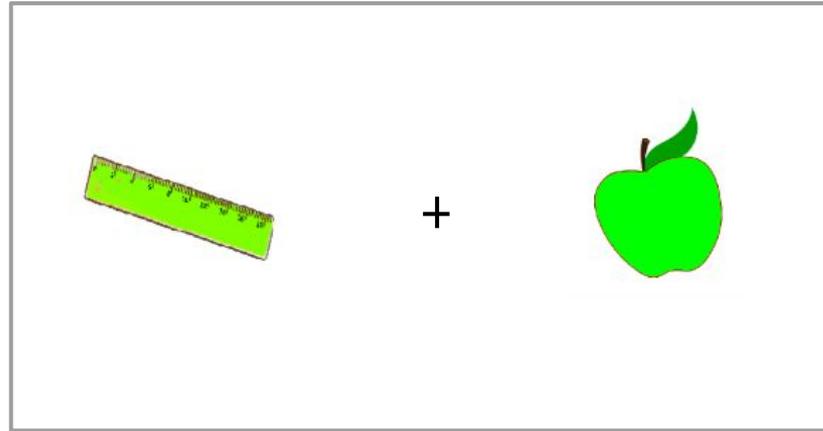
Task: to look at the item that is asked about as quickly as possible.



Match condition

F

F



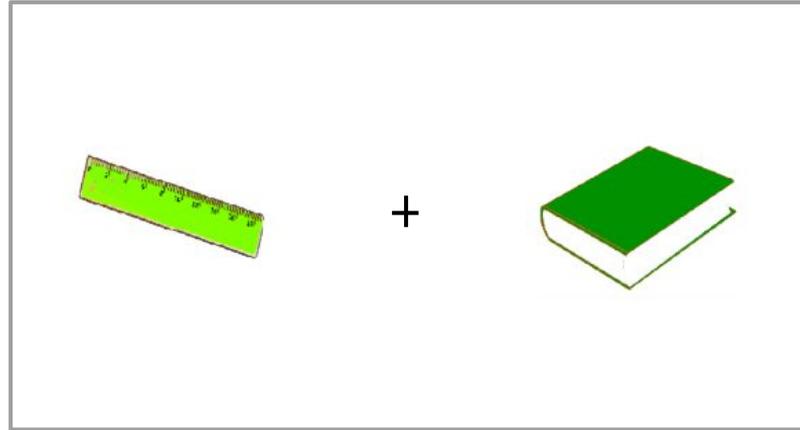
¿Dónde está **la**... ?

Where is the.F ...

Mismatch condition

F

M



¿Dónde está **la**... ?

Where is the.F ...

How it works

- **Dependent measure:**
time of first fixation after the onset of the gender-marked article (reaction time).
- **What we hope to see:**
using the gender information on articles in *mismatch* conditions to fixate on target item *faster* than in *match* conditions.

Previous (monolingual) findings

- Faster fixation times on mismatch conditions than on match conditions
 - Spanish (Lew-Williams & Fernald 2007, 2010; Gruter et al 2012, Dussias et al. 2013)
 - German (Hopp 2013, 2016; Hopp & Lemmerth 2018)
 - Dutch* (Loerts 2012, Loerts et al 2013, Bouwer et al 2018)
 - Russian (Sekerina 2015)

*Some asymmetries between gender features.

Refining the research question

- Can heritage speakers use gender to facilitate lexical retrieval?
In other words: Does **gender information on associated words** help heritage speakers identify the upcoming noun faster in a VWP experimental setting?

Outline

- Visual World Paradigm & facilitative use of gender
- Study 1: Heritage Spanish in the USA
- Study 2: Heritage Spanish in Germany
- Study 3: Heritage Polish in the USA
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Why Spanish?

An ideal candidate for study on use of gender in heritage speakers:

- Spanish gender is relatively well-studied in the theoretical and experimental literature.
- Existing literature on facilitative use of gender among monolinguals, children, and L2
- Accessible population of heritage speakers

Gender in Spanish

Two-gender system: masculine feminine

Morphological correlates: -o -a

(Harris 1991; Kramer 2015)

Gender is marked on determiners and modifiers:

la manzana roja
the.F apple red.F

el libro rojo
the.M book red.M

Previous studies on facilitative use of gender in Spanish

	L1 adults	L1 children	L2 speakers
Use gender to facilitate lexical retrieval?	 (Lew-Williams & Fernald 2007, 2010; Gruter et al 2012; Dussias et al. 2013)	 (Lew-Williams & Fernald 2007)	Varied results (Lew-Williams & Fernald 2010; Gruter et al 2012; Dussias et al. 2013; Halberstadt et al. 2018)

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*L2 factors: proficiency, overlap between L1 and L2, and/or awareness of agreement patterns...

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Language learning experience (“tight link”)			x

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Language learning experience (“tight link”)	✓	✓	✗
Resources	✓	✓	✗

HL “between” L1 and L2

Acquisition is...	L1	Heritage	L2
early	✓	✓	✗
naturalistic	✓	✓	✗
convergent	✓	✗	✗

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Language learning experience (“tight link”)	✓	✓	✓	✗
Resources	✓	✓	✗	✗

Additional evidence of HS advantage

- Support for the “tight link”:
 - Based on a word-repetition task, Montrul et al. (2014) independently argue that heritage speakers of Spanish have an advantage in processing Det+Noun over L2 speakers based on experience with acquisition.
- This study uses a more sensitive measure to test whether HS pattern with L1s, thus lending support to the critical role of early experience.

Spanish conditions

Target gender:

F



M



Experimental design: Spanish

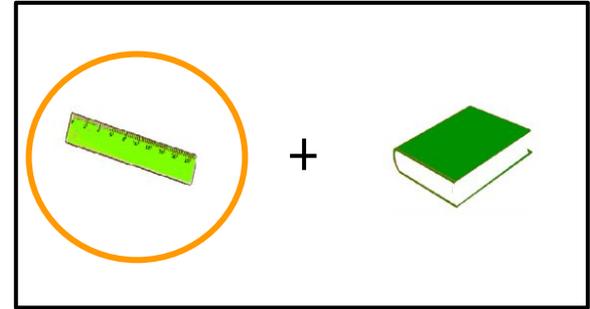
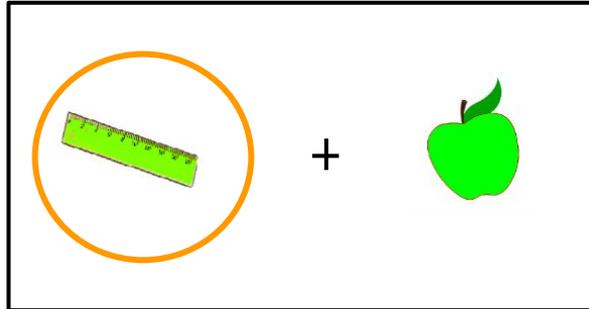
Condition:

Match

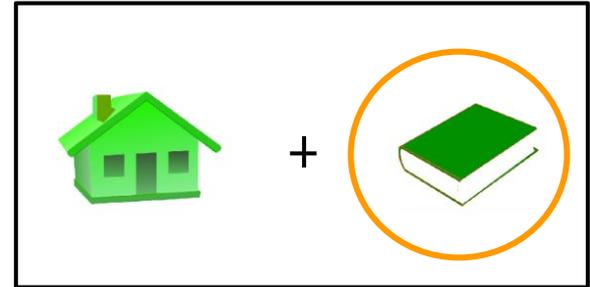
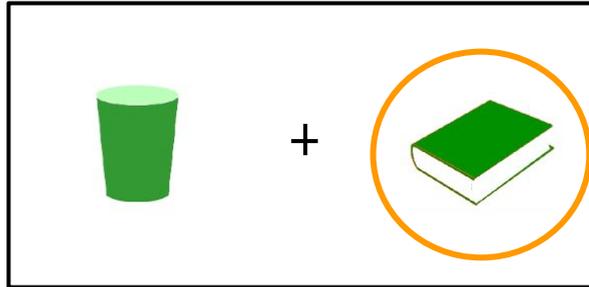
Mismatch

Target
noun:

F



M



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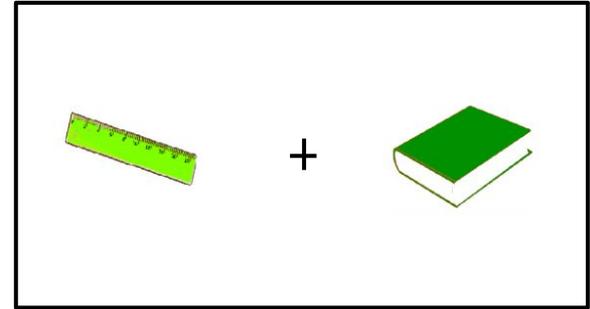
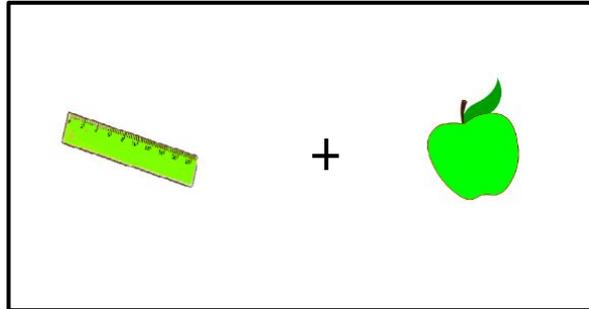
Condition:

Match

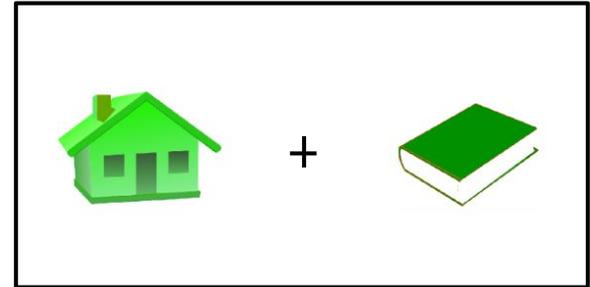
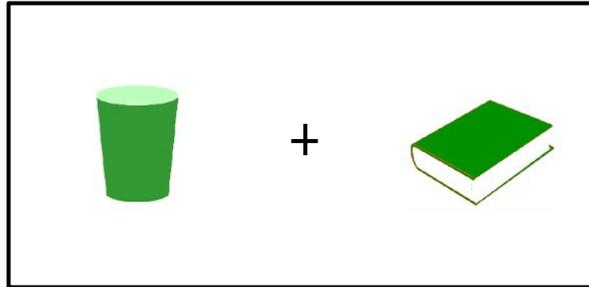
Mismatch

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F



M



Predictions

Predictions:

If gender is facilitative in HL speakers → first fixation on target item will be faster for mismatch condition than match condition

If gender is not facilitative in HL speakers → first fixation on target item will be about equal for mismatch and match conditions

Procedure

Pre-Tasks:

- [LEAP-Q](#) (Language Experience and Proficiency Questionnaire) (Marian, Blumenfeld, & Kaushanskaya 2007)
 - Demographic questions
 - Self-reported proficiency
- [Vocabulary naming task](#)
 - Proxy proficiency measures
 - Cleanliness of data

Eye-tracking task: 2 x 51 trials, unlimited break

Total time: 30-45 minutes, participants were compensated for their time.

Experimental materials

42 lexical items (chosen based on norming study)

2 genders x 2 conditions x 21 displays = 84 displays

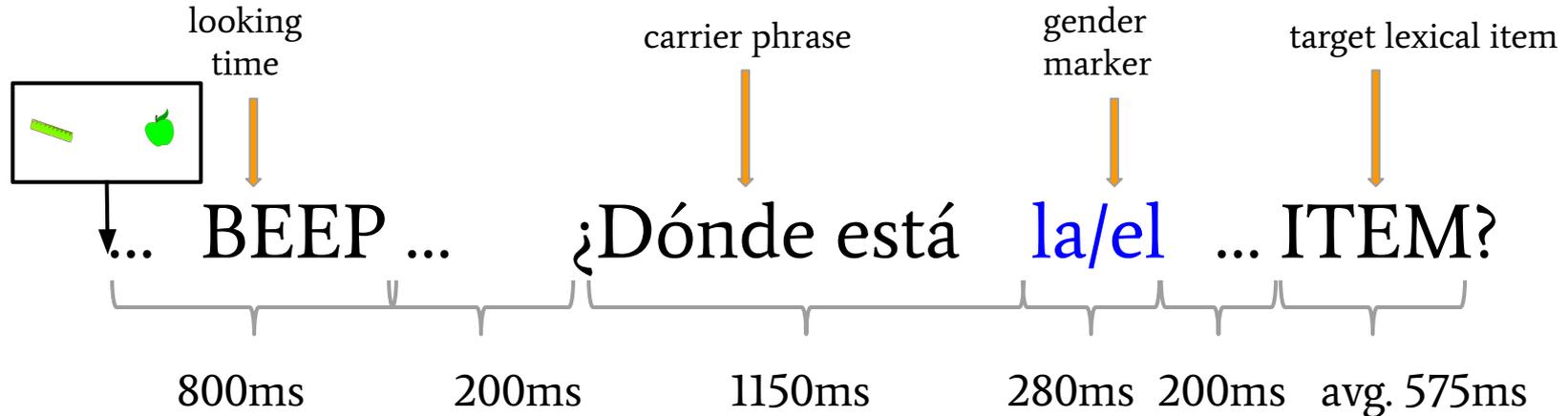
(+ 18 bonus = 102 displays)

- 4 different colors
- Controlled for:
 - Different phoneme at the onset of the lexical item
 - No lexical item started with a vowel
 - 2+ syllables
 - Inanimate
 - Canonical -o/-a endings
 - Randomized side of target item

Experimental materials

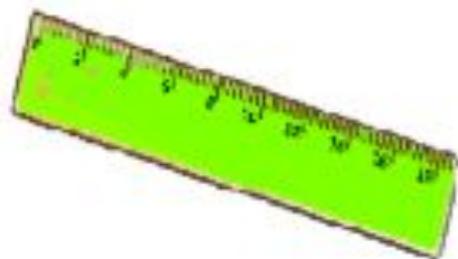
- Auditory stimuli recorded by male Spanish speaker, recently immigrated from Colombia
- Then spliced bits and pieces together in Praat
 - Eliminates possibility of co-articulation effects
 - Ensured ease of statistical analysis
 - Facilitates comparison with any follow-up studies

Experimental materials

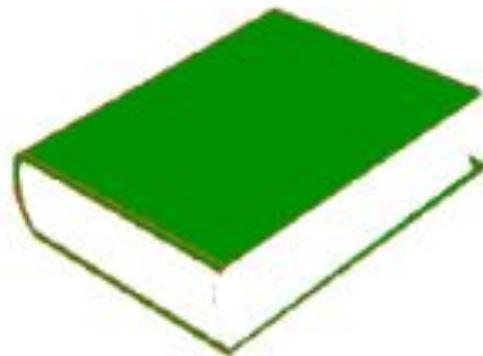


Each trial lasted 5 seconds, with 1 second in between.

+



+



+

Participants: Spanish

45 participants:

10 controls

18+ years in country of origin

21 heritage

< 8 years in country of origin

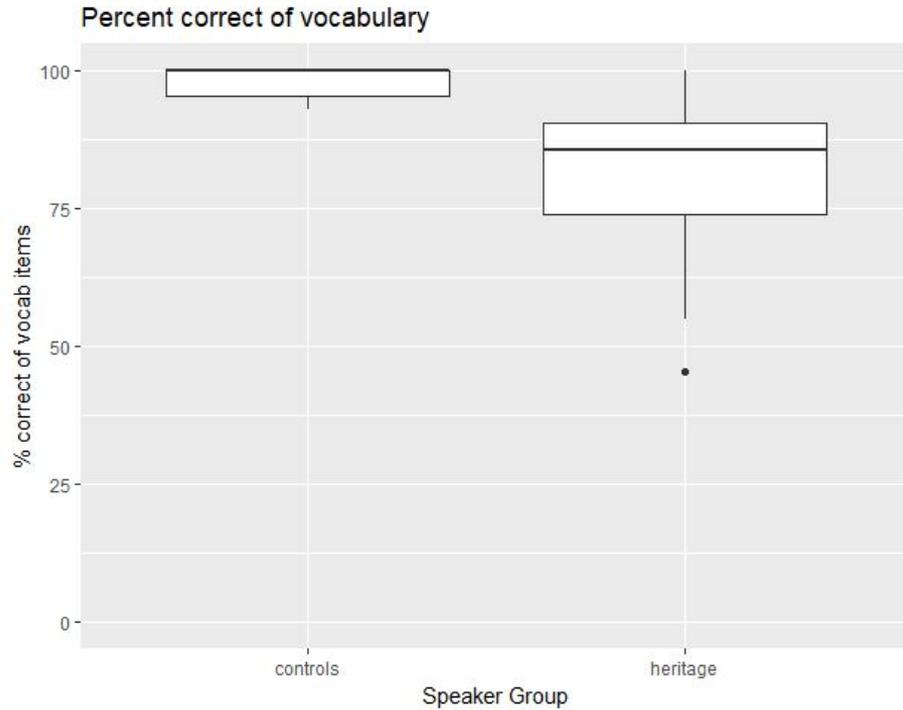
(14 not useable)

	<i>n</i>	Age	Years in Spanish-speaking environment			
			Country	Family	Work/School	
Controls	10	26.4 (4.0)	23.3 (4.5)	20.9 (8.2)	20.2 (8.6)	
Heritage	21	22.3 (3.2)	1.9 (2.8)	16.0 (9.6)	3.0 (4.8)	
	Education level					
	High school	Some college	College	Some graduate	Masters	PhD
Controls	1	1	2	1	4	1
Heritage	0	10	6	3	1	1

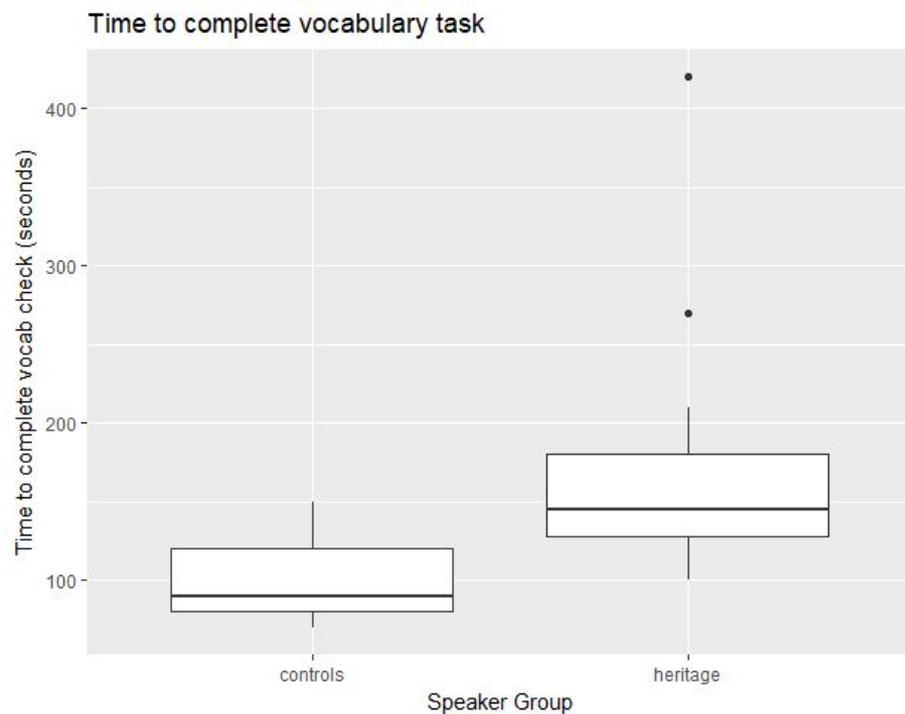
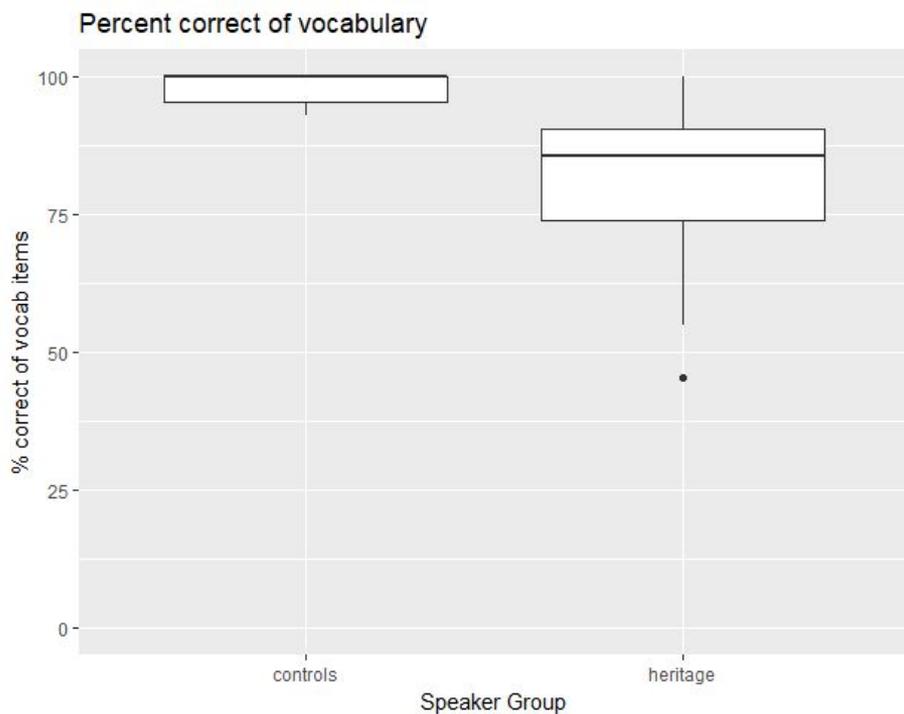
Assessing heritage speaker proficiency

- Notoriously tricky...
- Self-assessment often reflects degree to which heritage speaker identifies with a culture or ethnicity, not necessarily linguistic ability (Kim & Kang 2012)
- Collected self-assessment in LEAP-Q, but...
- Need other measures.

Proxy proficiency measures



Proxy proficiency measures

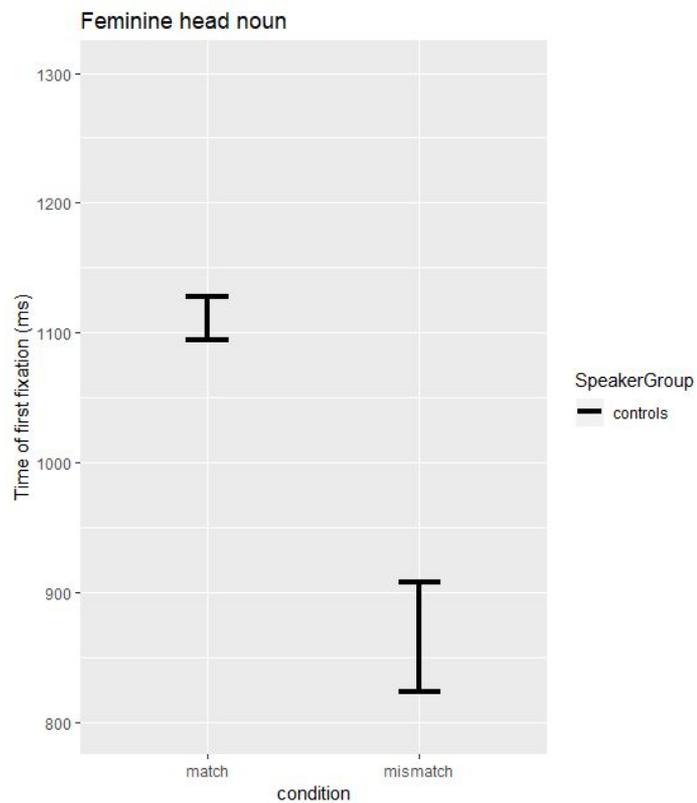
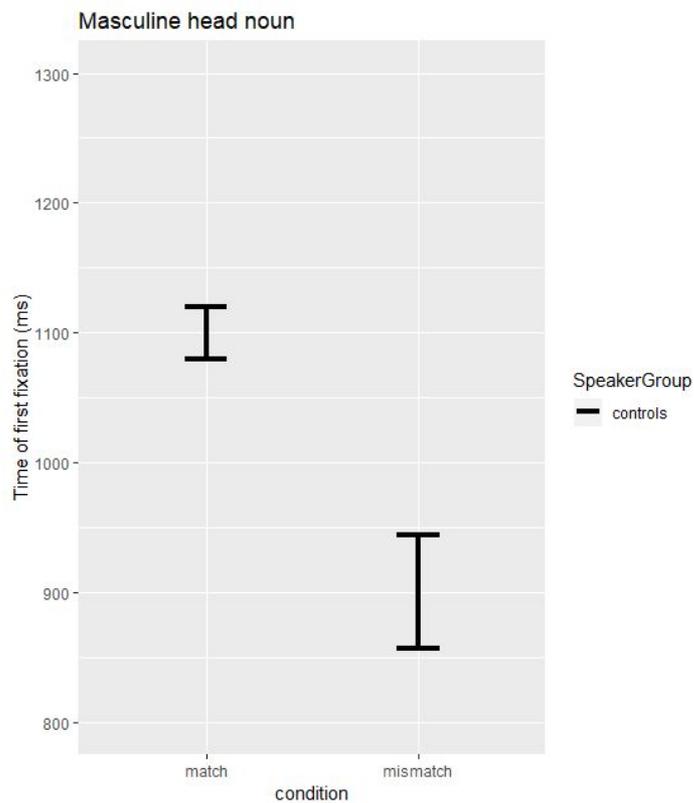


Data cleaning

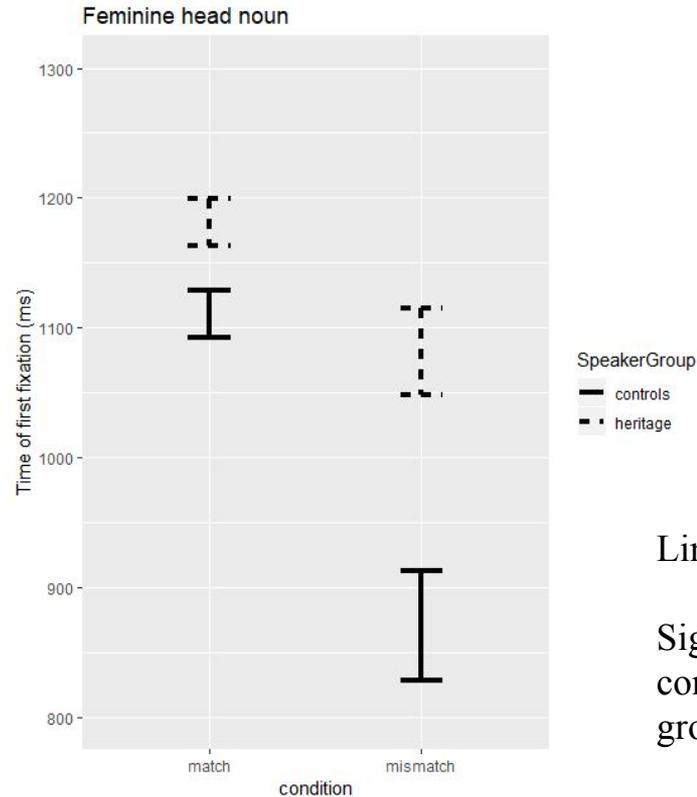
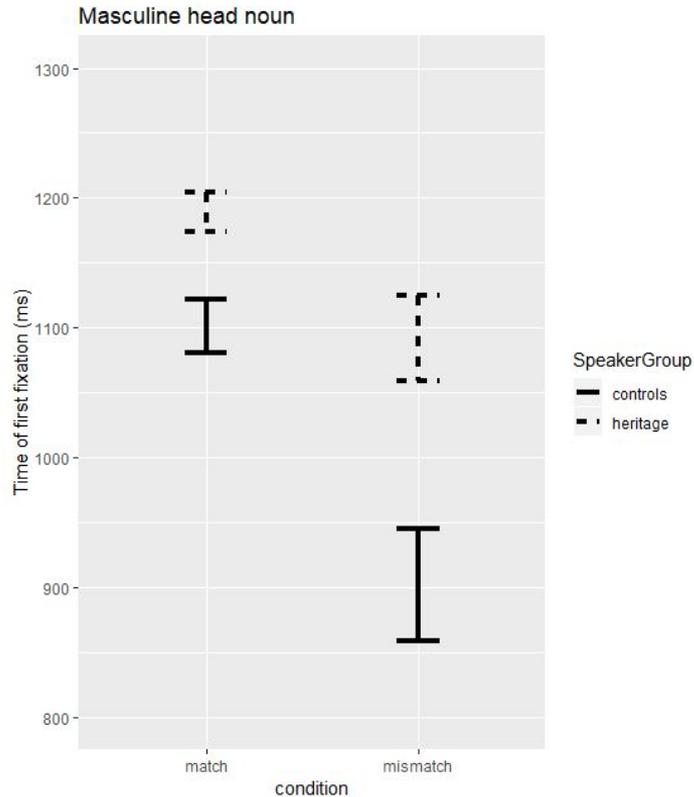
- For each participant, eliminated those trials for which participant did not know a lexical item or their responses did not match the intended lexical item.
- Trimmed fixation times outside of 2SD of the mean.

	Raw	After lexical task	After trimming
Controls	1020	886 (-13%)	824 (-7%)
Heritage	2142	1244 (-42%)	1192 (-4%)

Results: Spanish



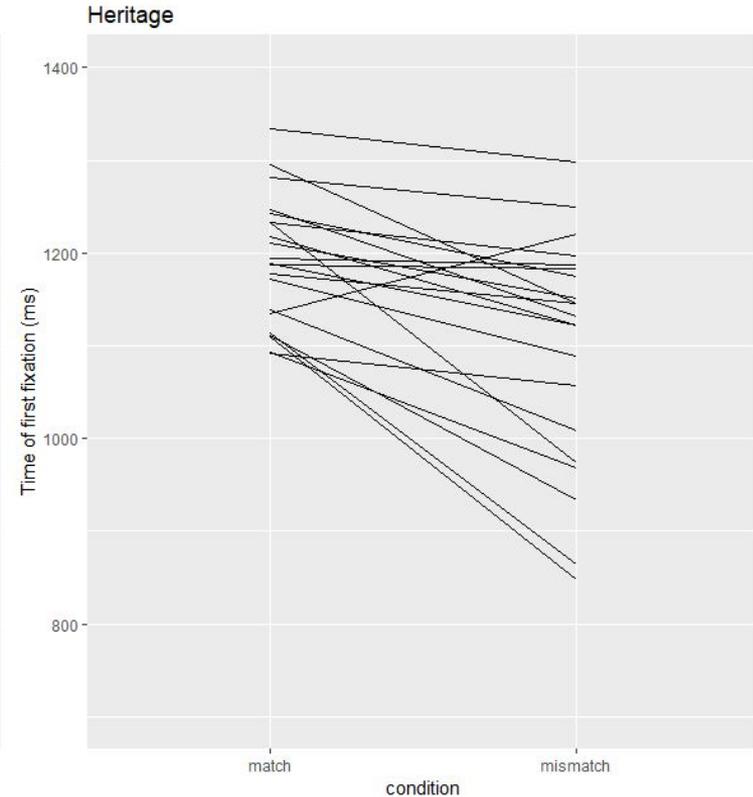
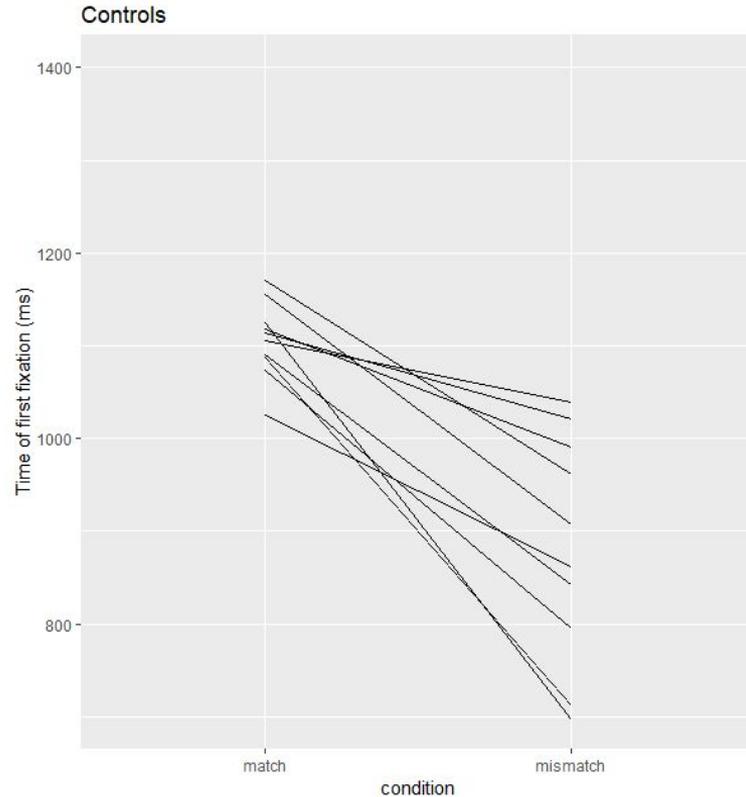
Results: Spanish



Linear mixed effects model:

Significant effect of group,
condition, and interaction of
group and condition.

Results: Interaction between group and condition



Results: Spanish

Predictions:

- If HS can use gender facilitatively → first fixation on target item will be faster for mismatch condition than match condition
- If HS cannot use gender facilitatively → first fixation on target item will be about equal for mismatch and match conditions

Results: Spanish

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- | | |
|--|--|
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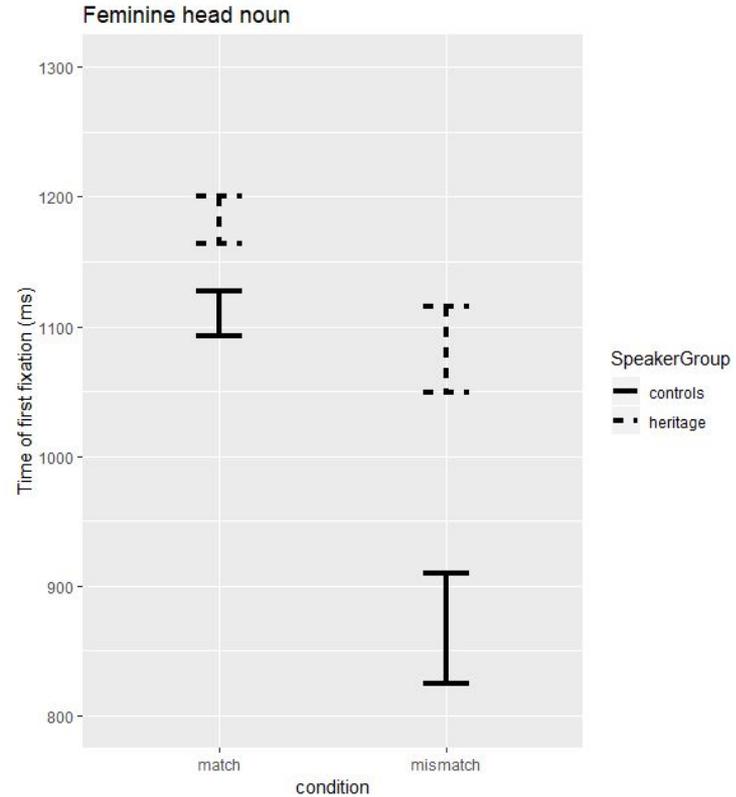
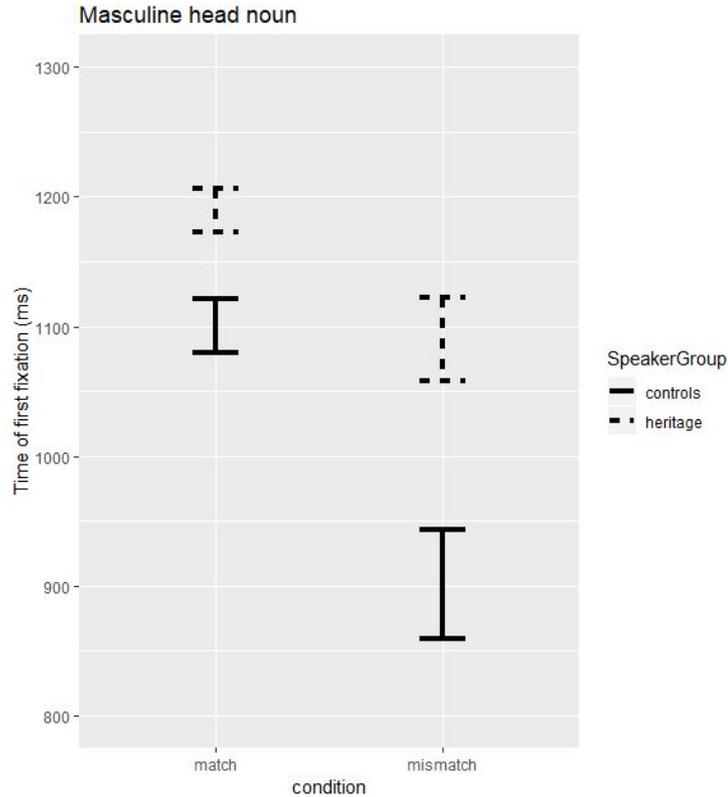
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	L1 adults	L1 children	Heritage	L2 speakers
Use gender to facilitate lexical retrieval?	✓ (Lew-Williams & Fernald 2007, 2010; Gruter et al 2012; Dussias et al. 2013)	✓ (Lew-Williams & Fernald 2007)	✓	Varied results (Lew-Williams & Fernald 2010; Gruter et al 2012; Dussias et al. 2013; Halberstadt et al. 2018)
Language experience (“tight link”)	✓	✓	✓	✗
Resources	✓	✓	✗	✗

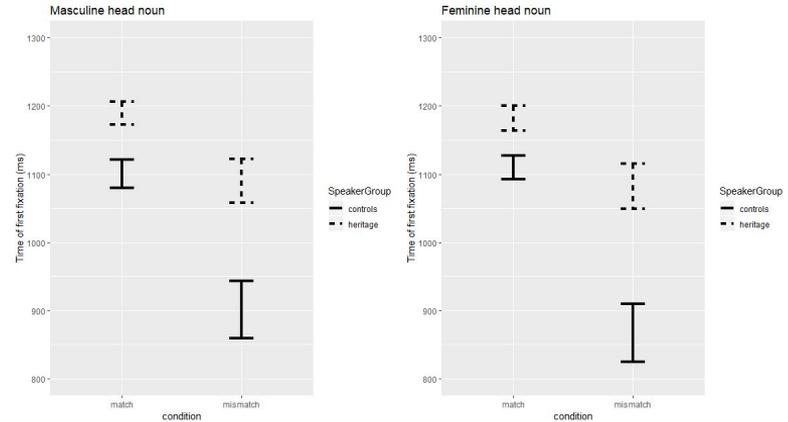
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Language experience (“tight link”)	✓	✓	✓	✗
Resources	✓	✓	✗	✗

Lack of gender asymmetry



Lack of gender asymmetry



	L1 adults	L1 children	L1-English L2-Spanish	L1-Italian L2-Spanish	DL-English HL-Spanish
Gender asymmetry?	✗	✗	✗	✓ (fem only)	✗

Interim Summary: Spanish

- Control population can use gender to facilitate lexical retrieval (replication of earlier findings)
- Heritage speakers also use gender to facilitate lexical retrieval
 - Consistent use of gender in this way gives novel support for the “tight link” hypothesis
 - Effect of gender is slower for heritage speakers than controls

Interim Summary: Spanish

- Can heritage speakers use gender to facilitate lexical retrieval? Yes.

Interim Summary: Spanish

- Can heritage speakers use gender to facilitate lexical retrieval? Yes.
- Here we had the “simplest” case: gender only in the HL, with only 2 noun categories.
- Two ways to introduce complexity and observe effects:
 - Add gender in the dominant language. → Heritage Spanish in Germany
 - A three-valued gender feature. → Heritage Polish in the USA

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Research questions

- Can HS of Spanish with grammatical gender in their dominant language use gender on determiners to facilitate lexical retrieval?
- Is the gender of the equivalent word in the DL co-activated with the gender of the word in the HL?

Maintaining two gender systems

If experience with noun categories in the DL boosts HS ability to use access and use gender categories in the HL, then we may see faster performance on the task than in the USA.

Why German?

	English	German	Spanish
Grammatical gender	no	yes	yes
Number of gender classes	--	3	2
Gender encoded on determiners	--	yes	yes
Syncretism of concord forms	--	yes	no
Gender assignment highly predictable from the form of a noun	--	no	no

Maintaining two gender systems

If gender of equivalent lexical items in the DL is co-activated with the lexical items in the HL, then we might see boosts and/or interference effects when we manipulate gender congruency.

(Spivey & Marian 1999, Gubina & Gerwien 2017)

Spanish/Germany conditions

Target gender:

F



M



Spanish/Germany conditions

But the translational equivalent may be...:

- Congruent
- Non-congruent
- Target-congruent

Spanish/Germany conditions

Congruent

Spanish:

|

M

M

|

|

M

F

|

Spanish/Germany conditions

Congruent

Spanish:		M	M				M	F	
German:		(M)	(M)				(M)	(F)	

Spanish/Germany conditions

Non-congruent

Spanish: | M M | | M F |

Spanish/Germany conditions

Non-congruent

Spanish:		M	M			M	F	
German:		(F)	(N)			(N)	(M)	

Spanish/Germany conditions

Target-congruent

Spanish:

|

M

M

|

|

F

F

|

Spanish/Germany conditions

Target-congruent

Spanish:		M	M			F	F	
German:		(M)	(F)			(F)	(N)	

Procedure

Pre-Tasks:

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 - Cleanliness of data

Eye-tracking task: 2 x 51 trials, unlimited break

Total time: 30-45 minutes, participants were compensated for their time.

Participants: Spanish/Germany

28 participants:

15 controls

18+ years in country of origin

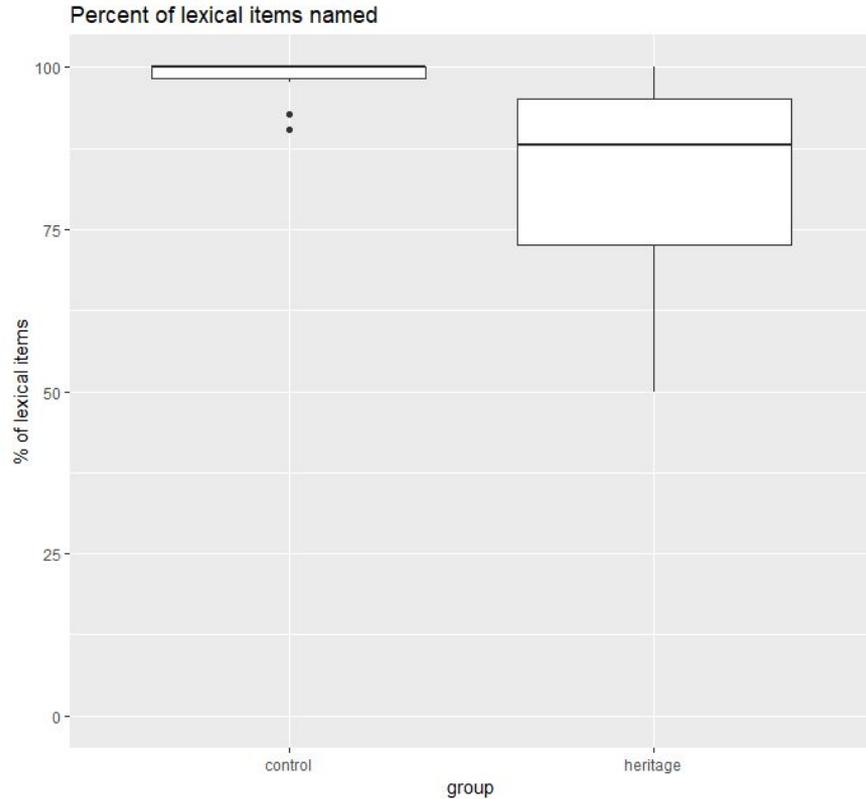
11 heritage

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(2 not useable)

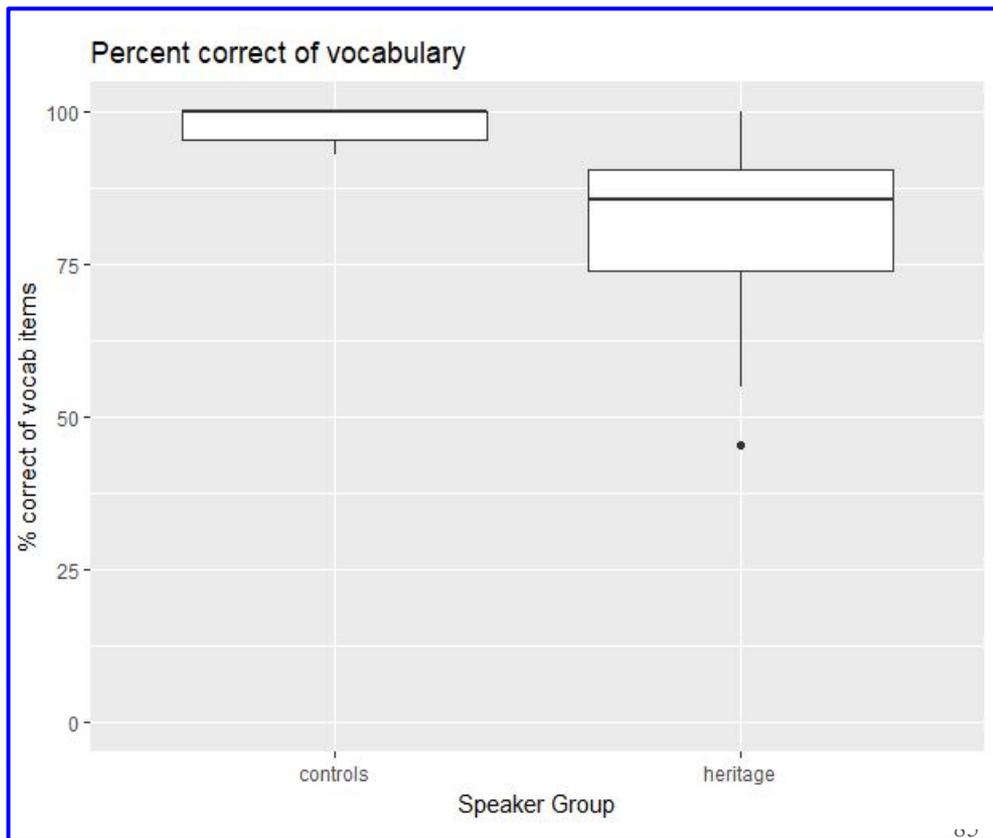
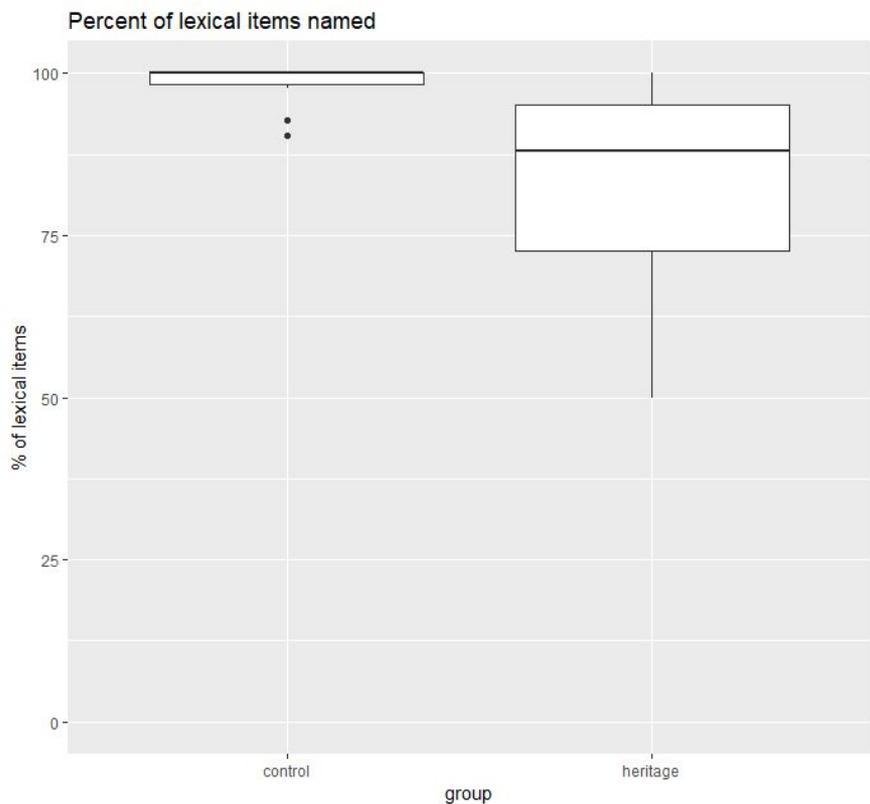
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	Education level						
	None	High school	Some college	College	Some graduate	Masters	PhD
Controls	0	1	3	5	1	2	3
Heritage	1	0	3	4	0	3	0

Proxy proficiency measures

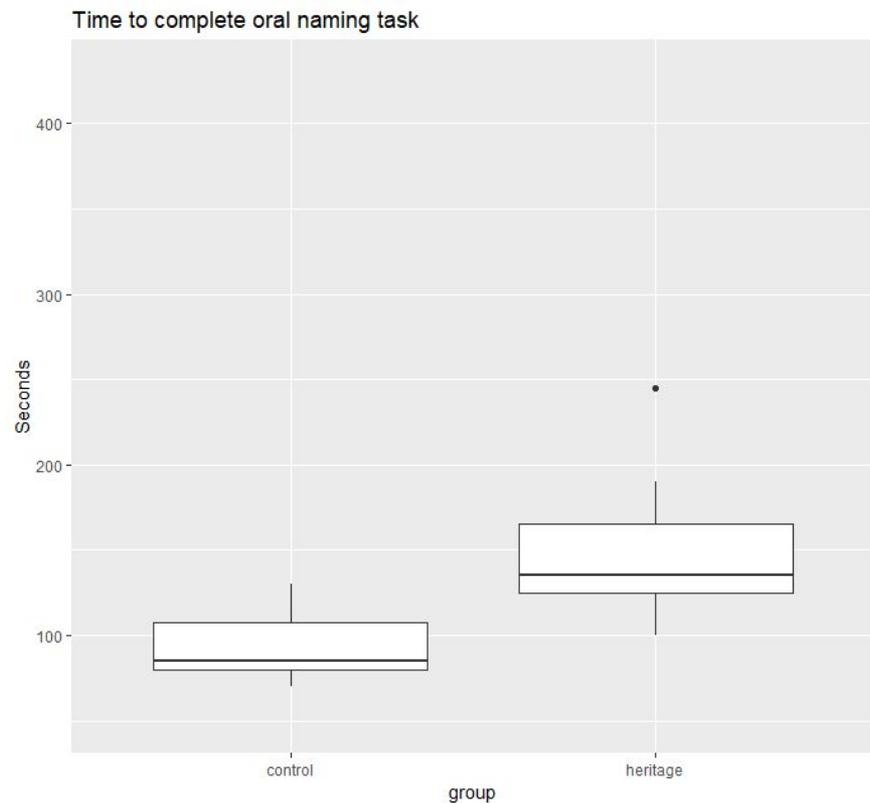
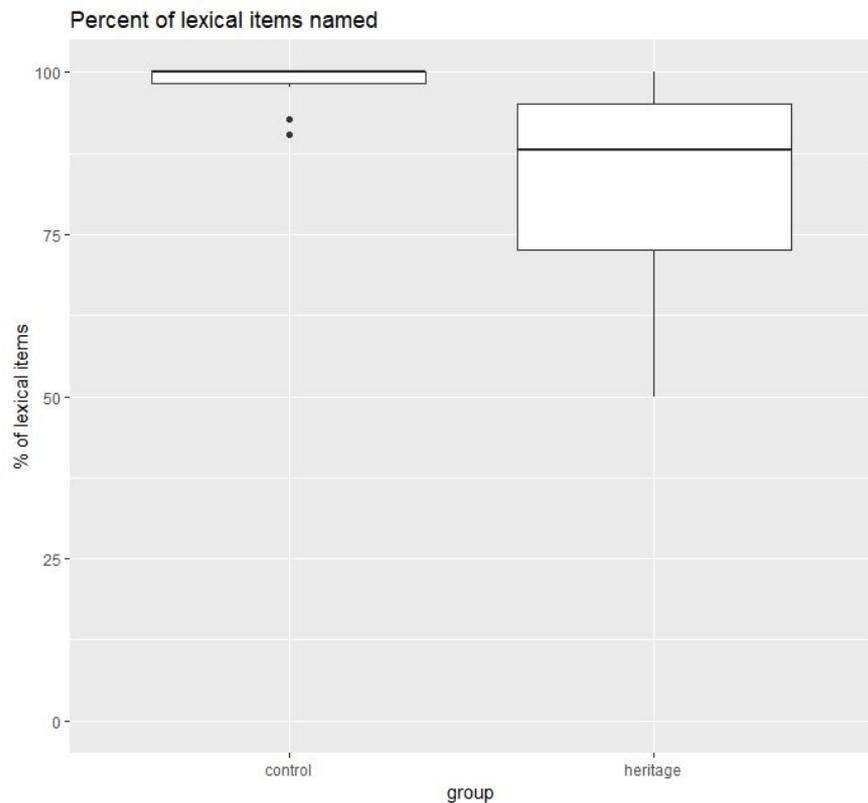


Proxy proficiency measures

USA



Proxy proficiency measures

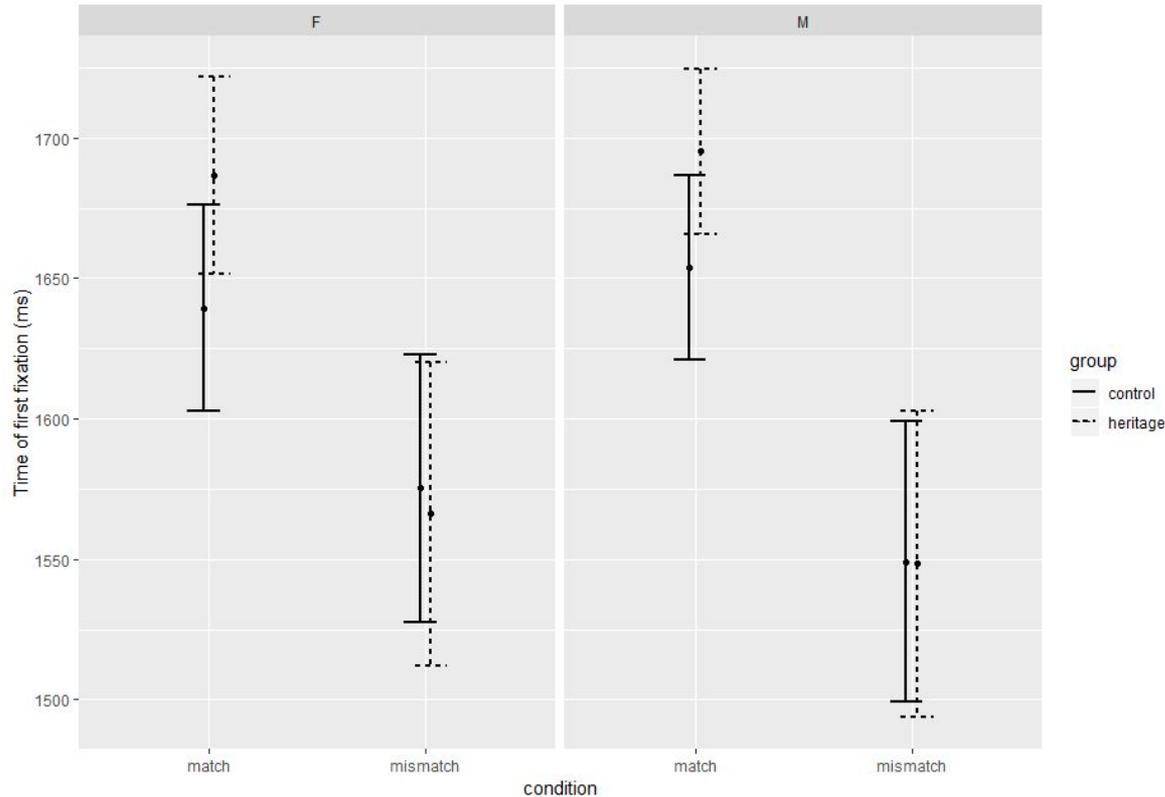


Data cleaning

- For each participant, eliminated those trials for which participant did not know a lexical item or their responses did not match the intended lexical item.
- Trimmed fixation times outside of 2SD of the mean.

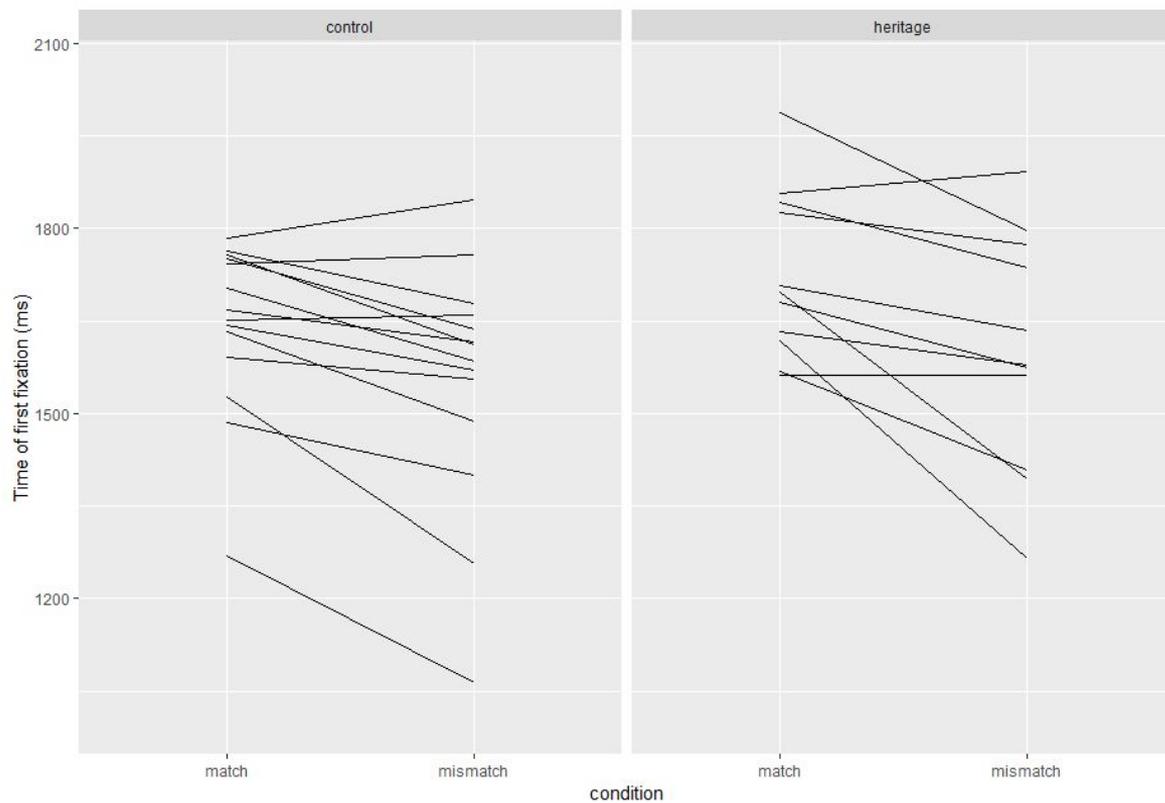
	Raw	After lexical task	After trimming
Controls	1,428	1,272 (-11%)	1,114 (-11%)
Heritage	1,122	649 (-42%)	625 (-2%)

First Fixation



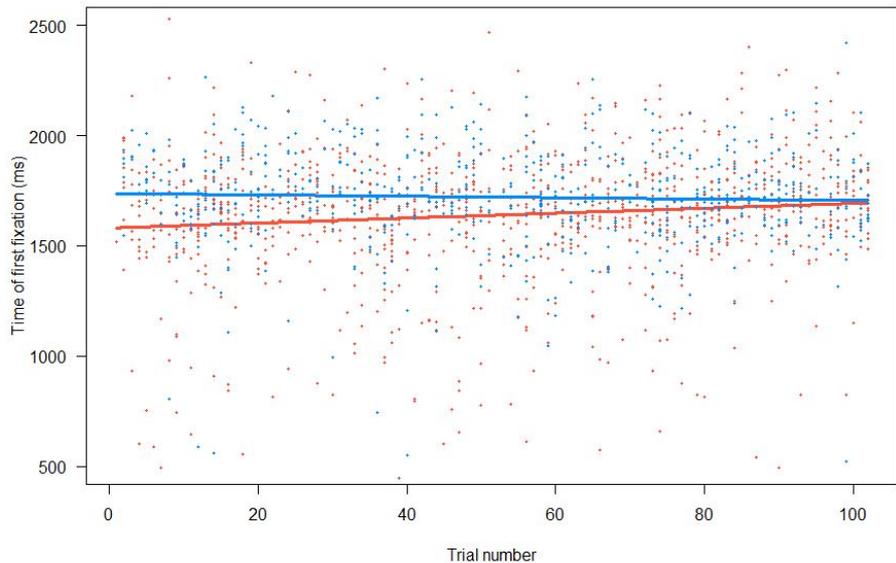
- Significant effect of condition and of trial number
- No main effect of group but...
- Significant interaction of group, condition, and trial number

First Fixation: Slopes

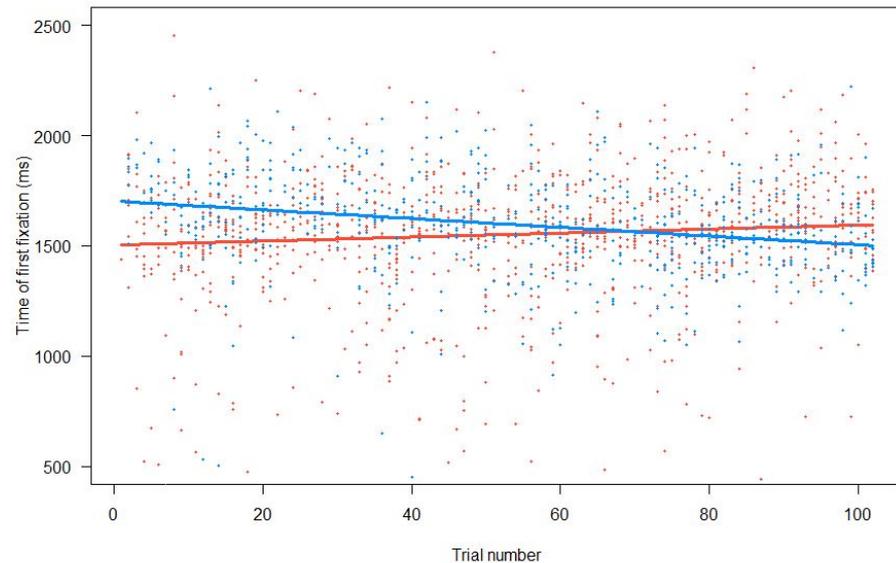


Interaction effect

Match conditions



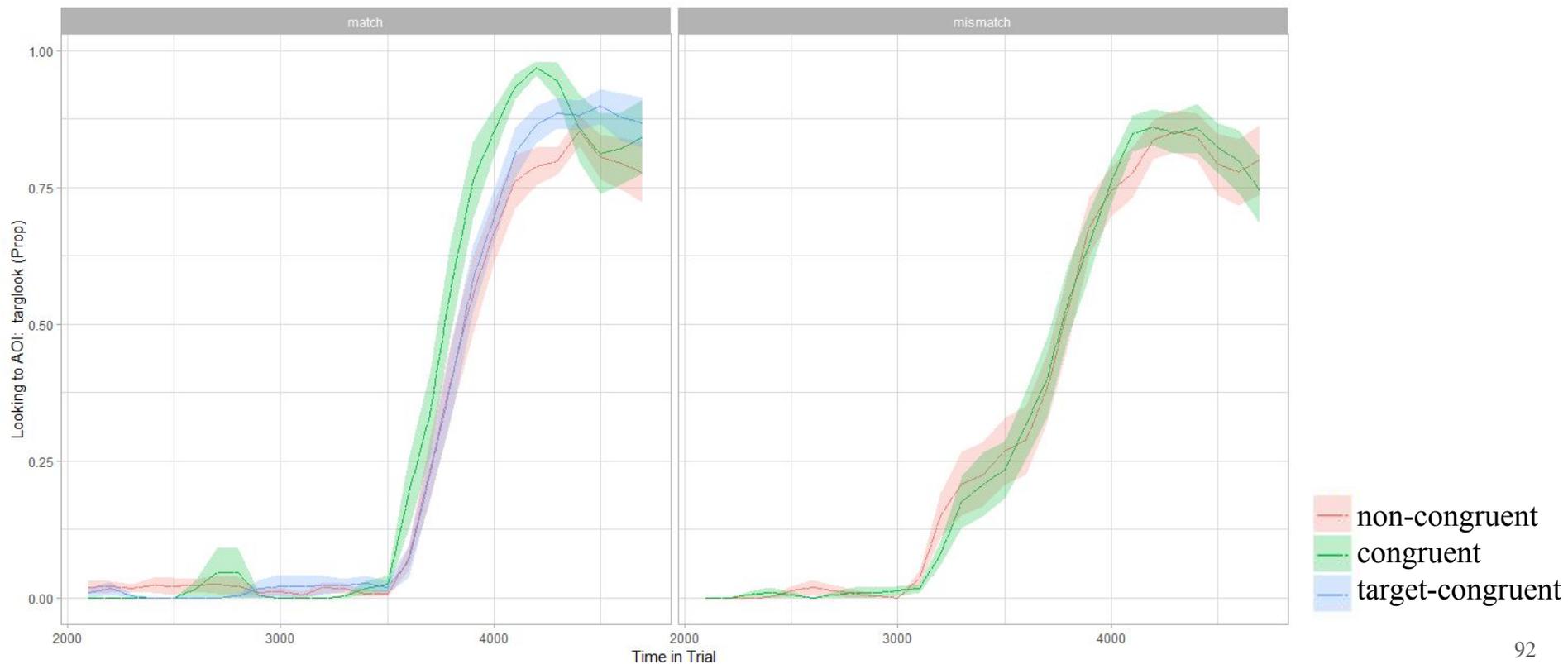
Mismatch conditions



Interaction effect

- There is a difference between HS and controls.
- The HSs in Germany “catch up” quicker than HSs in the USA.
- Tentative explanation: they have experience with using gender on articles in their dominant language (cf. facilitative use of gender in German controls, Hopp 2013, 2016; Hopp & Lemmerth 2018)

Proportion of looks: Heritage Speakers



Interference?

- In mismatch conditions, no significant difference between gender congruency conditions
- In match conditions, congruent conditions are faster than both non-congruent and target-congruent conditions.

Implications

Spanish / USA

Spanish / Germany

Polish / USA

Implications

- Can HS of Spanish with grammatical gender in their dominant language use gender to facilitate lexical retrieval? **Yes.**
- Does the gender of the German translational equivalent play a role?
Yes, in the match conditions when no Spanish cues are available, overlap in gender for both target and distractor eases lexical processing.

Implications

- Gender congruency impacts looking times for HS in match conditions.
- Suggests co-activation of gender of lexical items in both HL and DL.

Gubina & Gerwien (2017): co-activation and shared gender nodes

- Assumption: In the L1, all nouns of the same gender are linked to the same abstract gender node.
- L1-Russian L2-German speakers were able to use articles in German to facilitate lexical retrieval.
- However, there were interference effects in non-congruent competitor conditions:

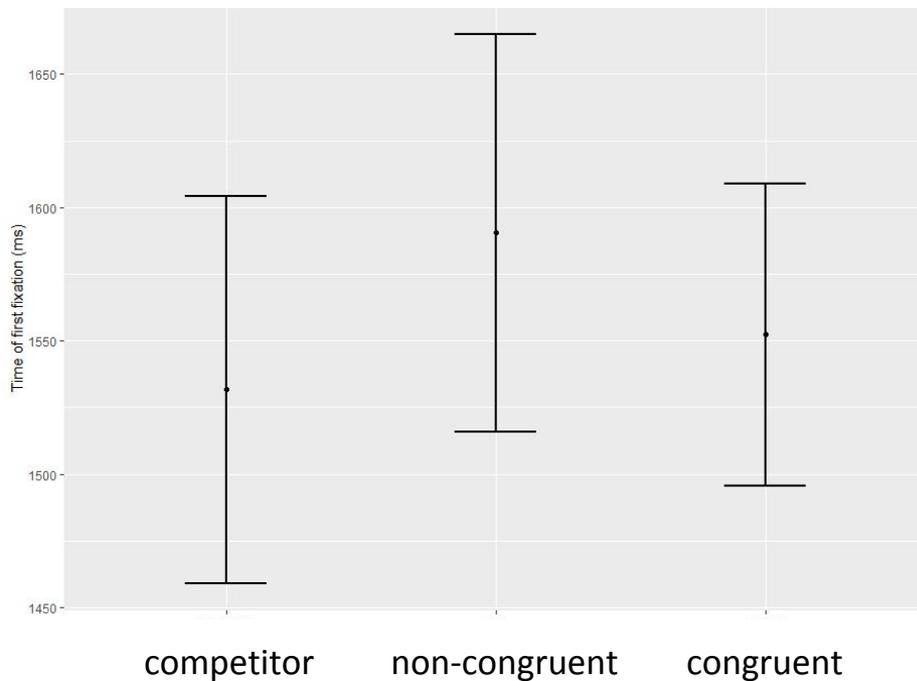
German:	M	F
Russian:	N	M
- Implication: co-activation of both genders
- Suggestion: bilinguals have shared gender nodes between the L1 and the L2

This study

- Congruency impacts fixation times in match conditions.
- Supports co-activation of genders in HS.
- Competition?

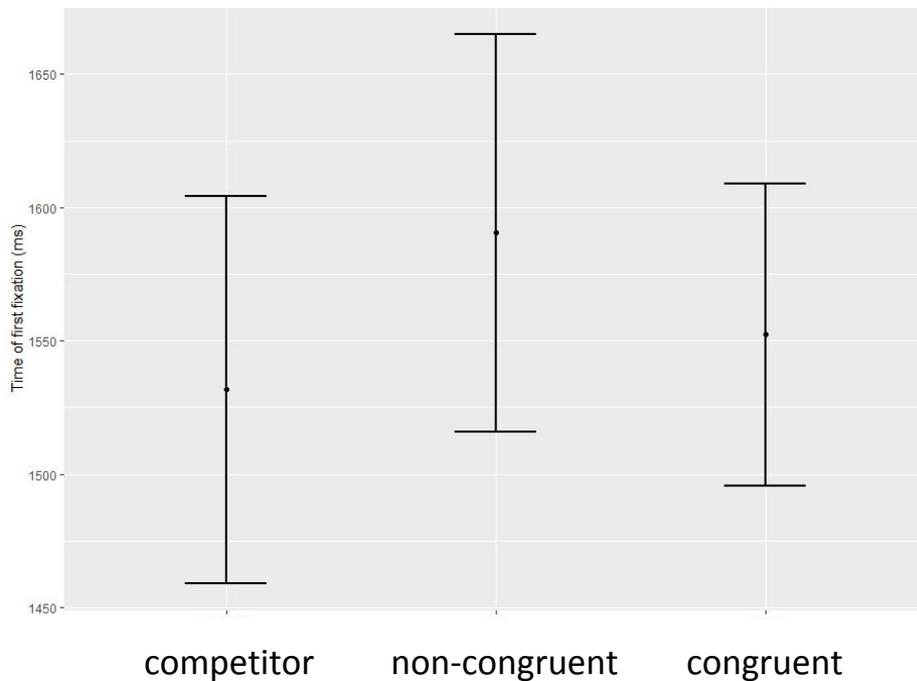
This study

- Congruency impacts fixation times in match conditions.
- Supports co-activation of genders in HS.
- Competition?



This study

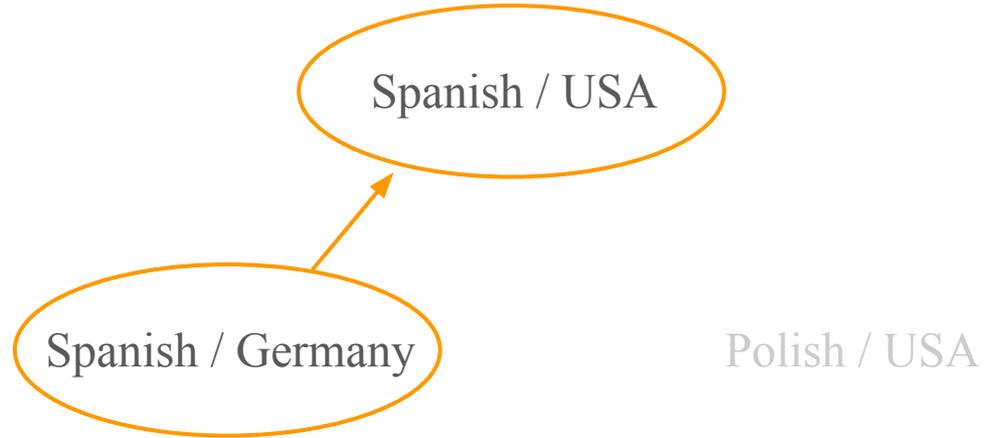
- Congruency impacts fixation times in match conditions.
- Supports co-activation of genders in HS.
- No significant effects.



Open questions

- Why does congruency only impact match conditions for HS?
- Why no competitor effect?

Implications



Implications

- HS of Spanish in the US were overall slower than the controls in the US.
- Did we see the same phenomenon in Germany?
At the beginning of the study, yes, but HS of Spanish in Germany appear to “catch up” quicker.
- Tentative explanation: experience with gender and with using gender on articles in their dominant language may make this easier.
 - German monolinguals use gender on articles to facilitate lexical retrieval (Hopp 2013, 2016; Hopp & Lemmerth 2017)

Interim Summary: Spanish

- In the US we had the “simplest” case: gender only in the HL, with only 2 noun categories.
- Two ways to introduce complexity and observe effects:
 - Add gender in the dominant language. → Heritage Spanish in Germany
 - Add gender value in the heritage language.

Interim Summary: Spanish

- In the US we had the “simplest” case: gender only in the HL, with only 2 noun categories.
- Two ways to introduce complexity and observe effects:
 - Add gender in the dominant language. → Heritage Spanish in Germany
 - A three-valued gender feature. → Heritage Polish in the USA

Outline

- Visual World Paradigm & facilitative use of gender
- Study 1: Heritage Spanish in the USA
- Study 2: Heritage Spanish in Germany
- Study 3: Heritage Polish in the USA
- Next steps

From Spanish to Polish

	Spanish	Polish
# genders	2	3
Overt determiners	yes	no
Order of constituents in the noun phrase	N-Adj	Adj-N*

*N-Adj order also possible, but marked

Gender in Polish

Three genders:	feminine	masculine	neuter
Morphological correlates on noun:	-a	C	-o
On adjectives:	-a	-i/-y	-ie/-e

(6-case system)

Gender in Polish

Concord in the noun phrase:

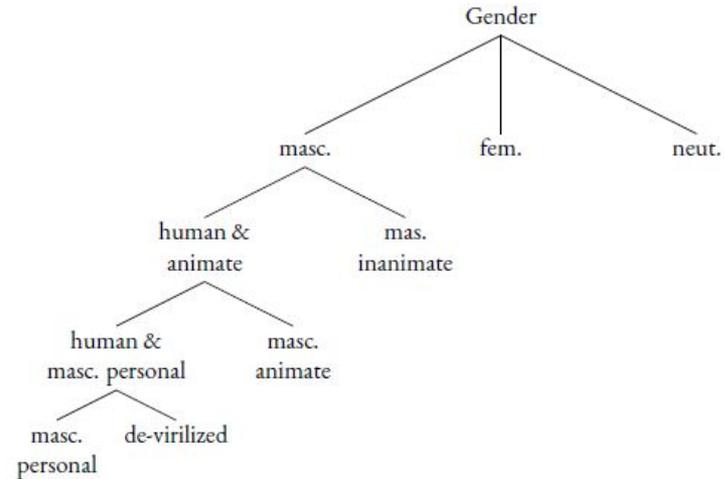
stara	czzerwona	książka
old.F	red.F	book.F

stary	czzerwony	stół
old.M	red.M	table.M

stare	czzerwone	jabłko
old.N	red.N	apple.N

Formal investigations of Polish gender

- Formal investigations: 3 - 9 genders
- Corbett (1983):
 - 3 global genders
 - masculine divided into four subgenders



Formal investigations of Polish gender

- In the nominative (used in this study), only M, F, and N.
 - Subgenders of M only appear in other morphological cases
- I focus only on 3 global genders (following Brehmer & Rothweiler 2012).

- First ever psycholinguistic study of Polish gender in L1 adult grammar.

Gender in Polish acquisition

- Children acquire initial gender distinctions by age 2;0 (Smoczyńska 1985)
- F vs M acquired earlier, N takes longer (Dąbrowska 2006)
- At initial stages of acquisition, children have 3 global genders, only subsequently learn subgenders (Krajewski 2005)

Research questions for Polish experiment

- Can **control speakers** use grammatical gender on adjectives to facilitate lexical retrieval?
- Can **heritage speakers** use grammatical gender on adjectives to facilitate lexical retrieval?

Predictions

Predictions:

If speaker can use gender facilitatively → first fixation on target item will be faster for mismatch condition than match condition

If speaker cannot use gender facilitatively → first fixation on target item will be about equal for mismatch and match conditions

Predictions

Predictions:

If speaker can use gender facilitatively → first fixation on target item will be faster for mismatch condition than match condition*

If speaker cannot use gender facilitatively → first fixation on target item will be about equal for mismatch and match conditions

*Mismatch conditions need not be equal to each other!

Experimental design: Polish

match



F

match



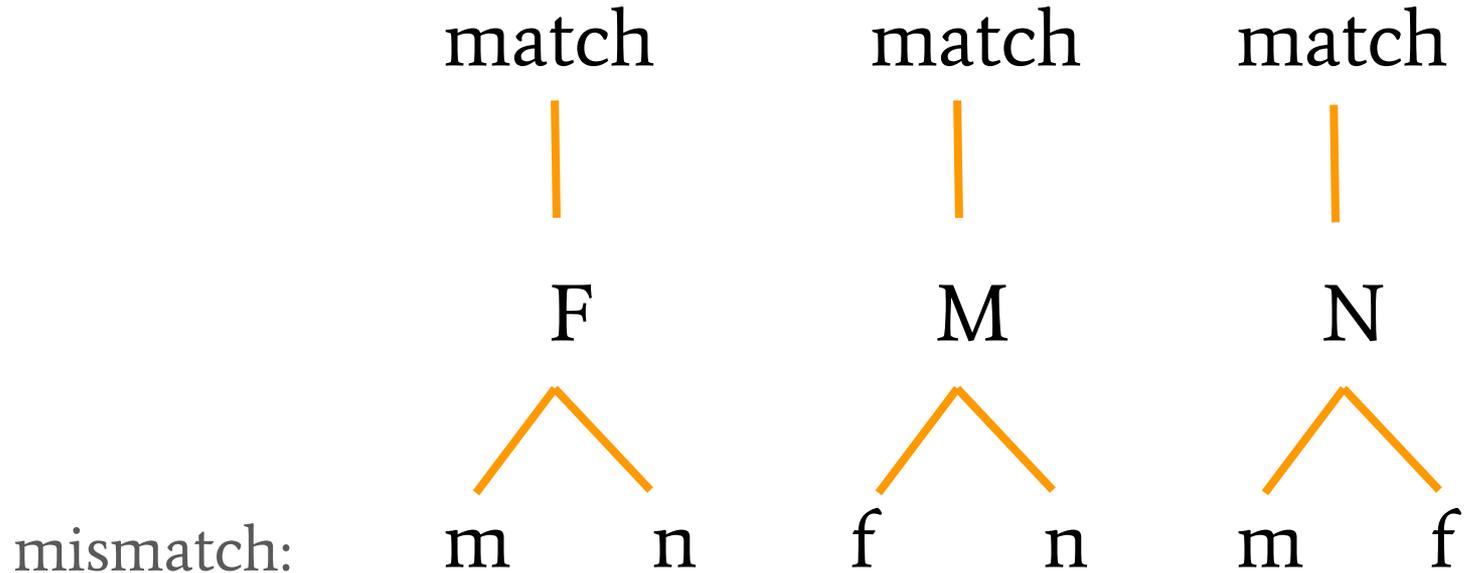
M

match



N

Experimental design: Polish



Procedure: Polish

Pre-tasks

- LEAP-Q (translated into Polish by Ewa Brzezińska)
- Vocabulary task

Eye-tracking task

- 2 x 54 trials
- Unlimited break

Total time: ~45 minutes

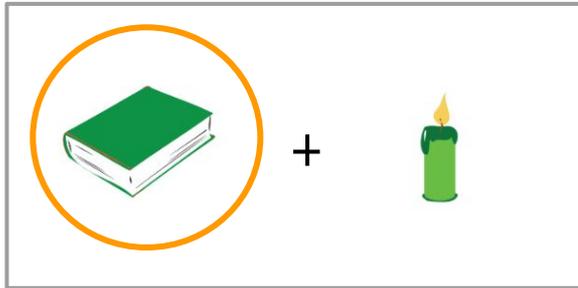
Participants were compensated for their time

Experimental design: Polish

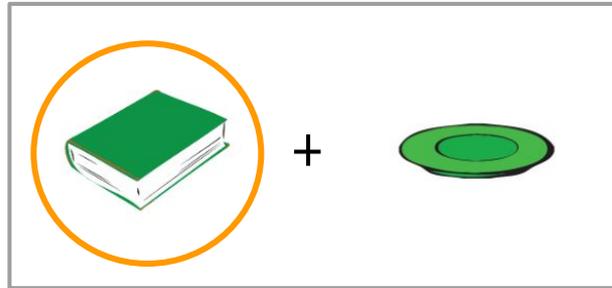
Gdzie jest zieloną książka? [feminine, nominative singular]

Where is green.F book.F

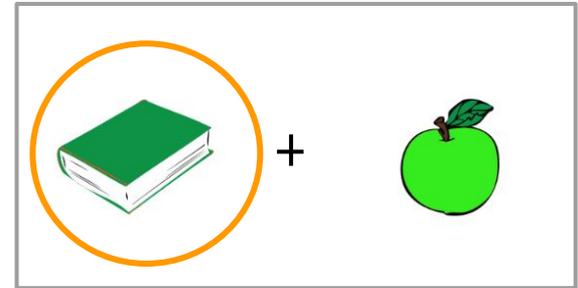
“Where is (the) green book?”



Match



MismatchM



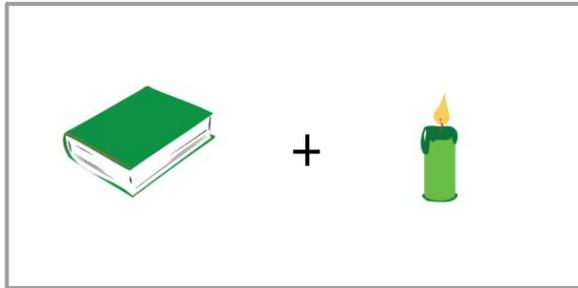
MismatchN

Experimental design: Polish

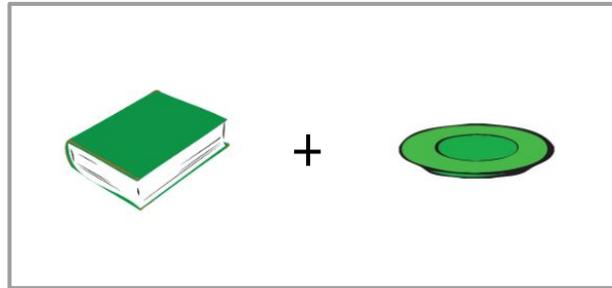
Gdzie jest zieloną książka? [feminine, nominative singular]

Where is green.F book.F

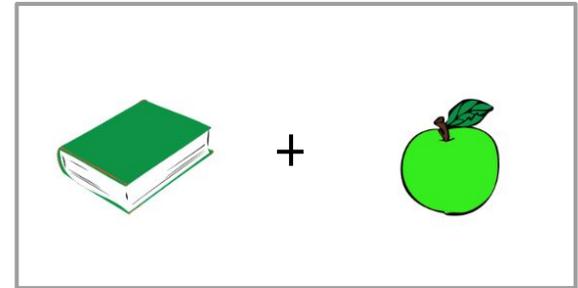
“Where is (the) green book?”



Match



MismatchM



MismatchN

Experimental design: Polish

Gdzie jest czerwony czajnik?
Where is red.M teapot.M
“Where is (the) red teapot?”

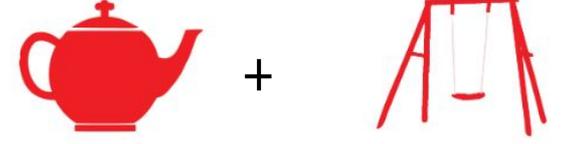
[masculine, nominative singular]



Match



MismatchN



MismatchF

Experimental design: Polish

Gdzie jest niebieskie mydło? [neuter, nominative singular]
Where is blue.N soap.N
“Where is the blue soap?”



Match



MismatchM



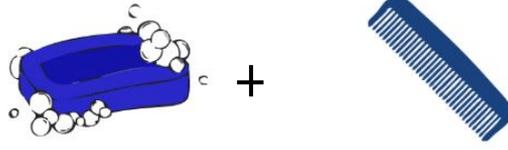
MismatchF

Experimental design: Polish

Gdzie jest niebieskie mydło? [neuter, nominative singular]
Where is blue.N soap.N
“Where is the blue soap?”



Match



MismatchM



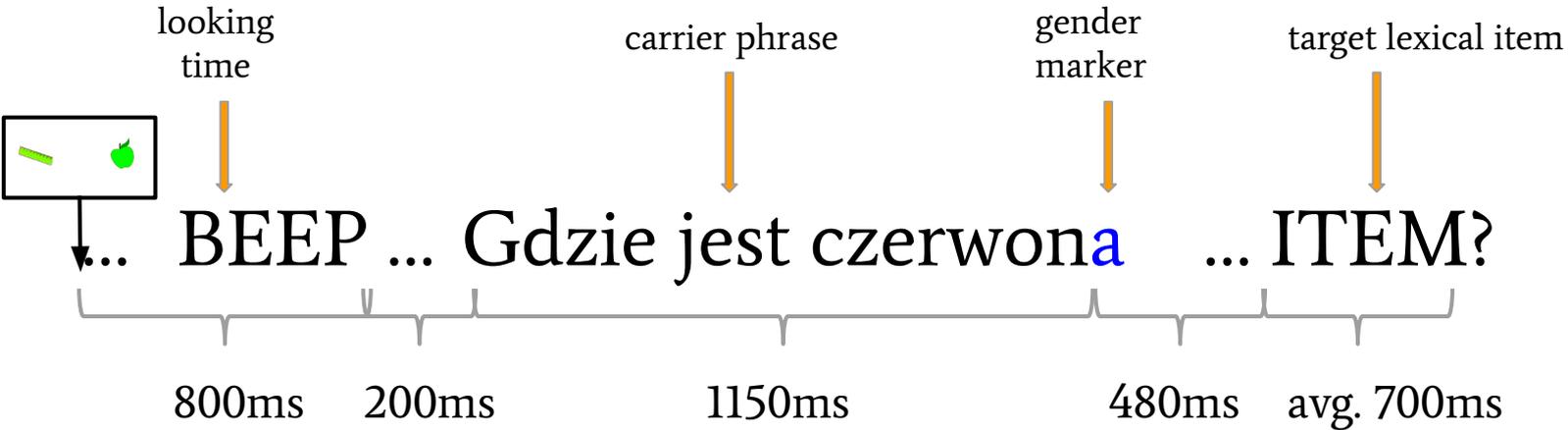
MismatchF

9 conditions x 12 lexical items per gender = 108 trials

Experimental materials: Polish

- auditory recorded by male speaker of Polish, immigrated from Poland in the last year
- spliced to match the timing of the Spanish sentences
 - Eliminated possible effects of co-articulation
 - Ease in statistical analysis
 - Allows for future comparisons and follow-ups

Experimental materials: Polish



Each trial lasted 6 seconds, with 1 second in between.

Participants: Polish

55 Participants

23 controls

18+ years in country of origin

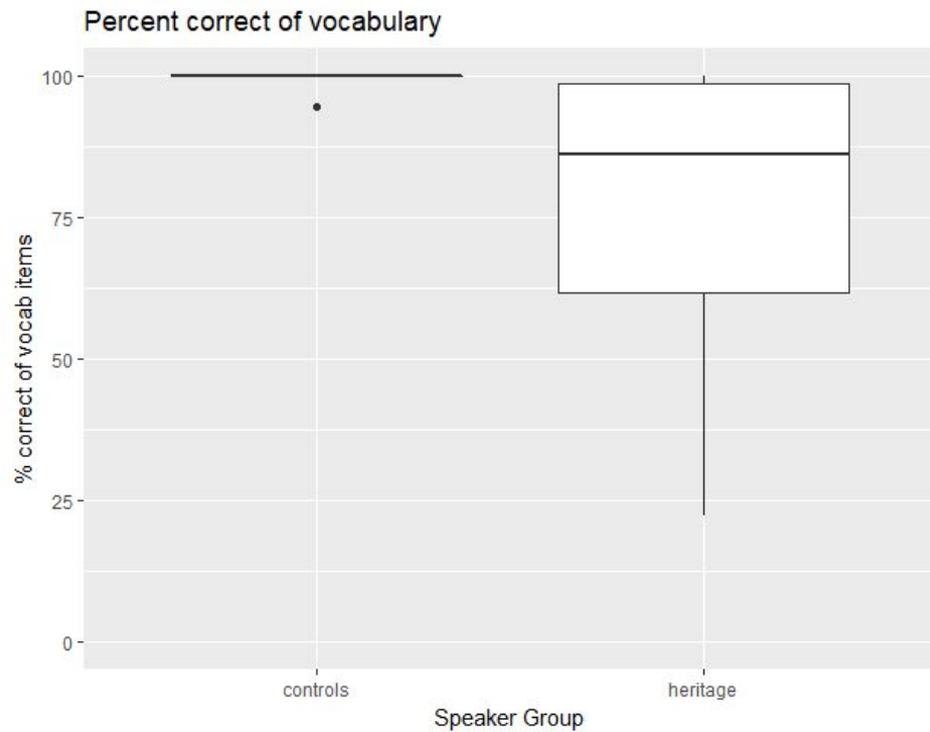
18 heritage

<8 years in country of origin

(14 not usable)

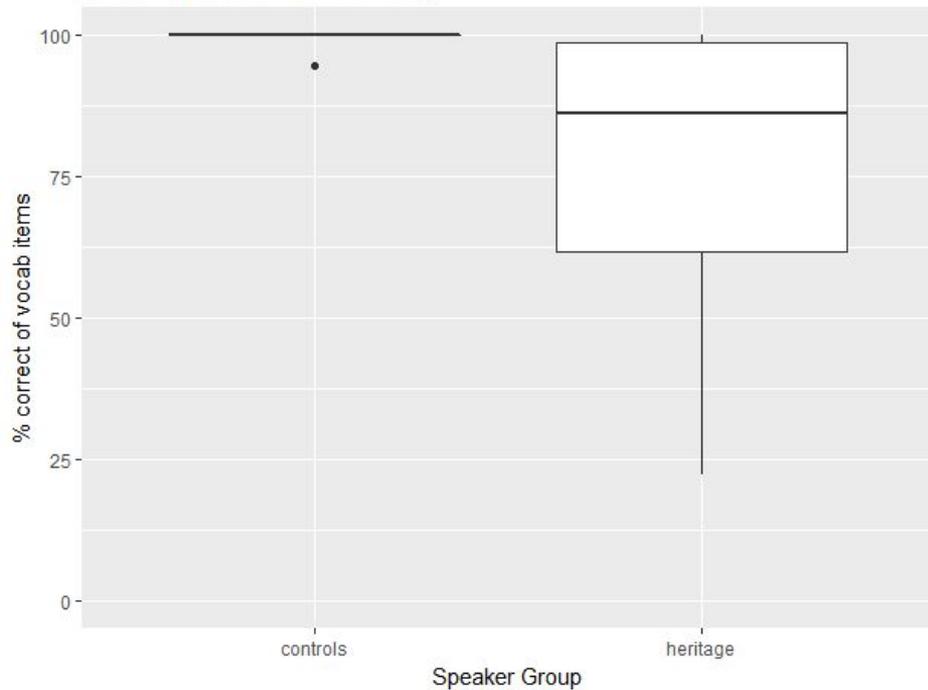
	<i>n</i>	Age	Years in Polish-speaking environment			
			Country	Family	Work/ School	
Controls	23	31.8 (8.7)	25.0 (8.7)	24.2 (10.8)	19.8 (9.7)	
Heritage	18	26.1 (9.9)	0.8 (1.0)	14.4 (12.5)	1.7 (3.1)	
	Education level					
	High school	Some college	College	Some graduate	Masters	PhD
Controls	1	2	3	0	9	8
Heritage	2	3	8	1	3	1

Proxy measures of proficiency

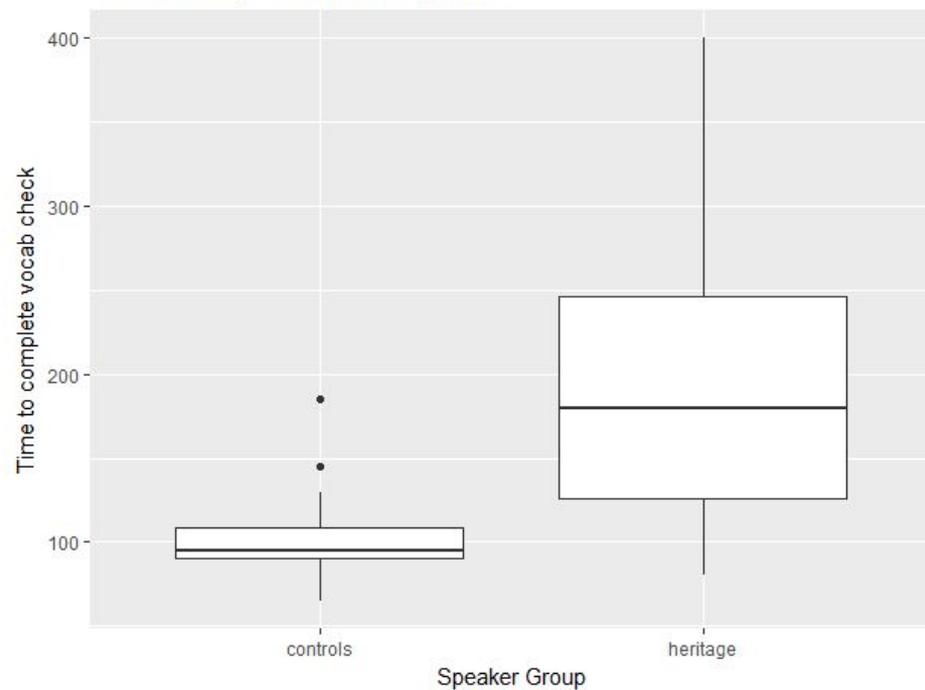


Proxy measures of proficiency

Percent correct of vocabulary



Time to complete vocabulary task

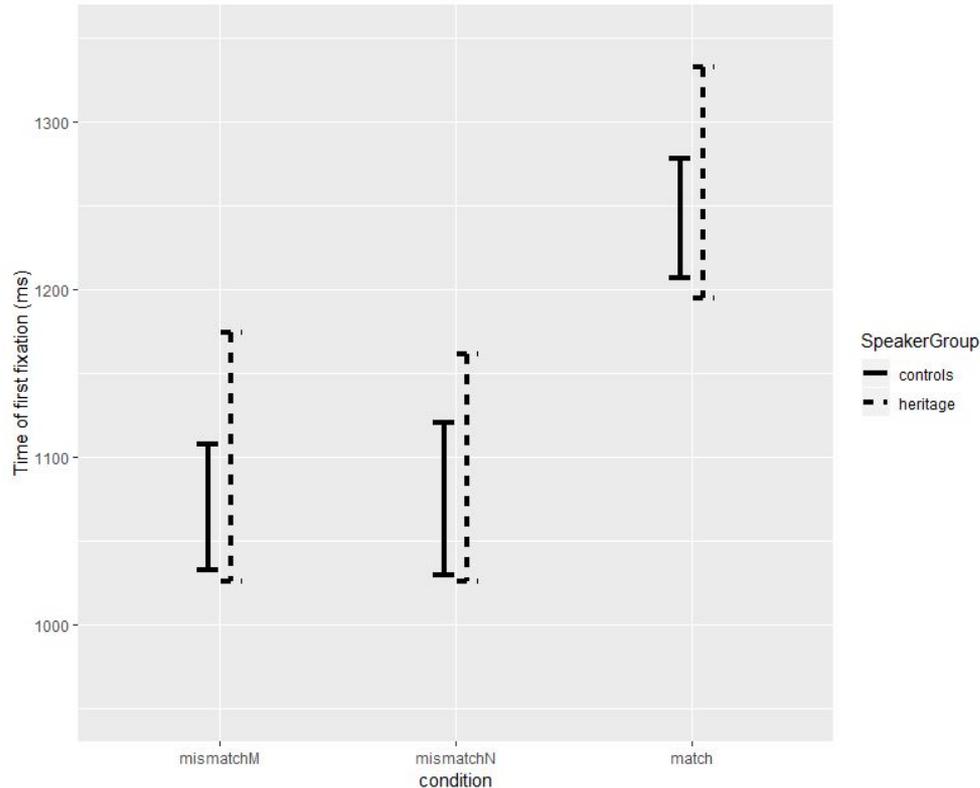


Data cleaning: Polish

- For each participant, eliminated those trials for which participant did not know a lexical item or their responses did not match the intended lexical item.
- Trimmed data points 2SD outside the mean.

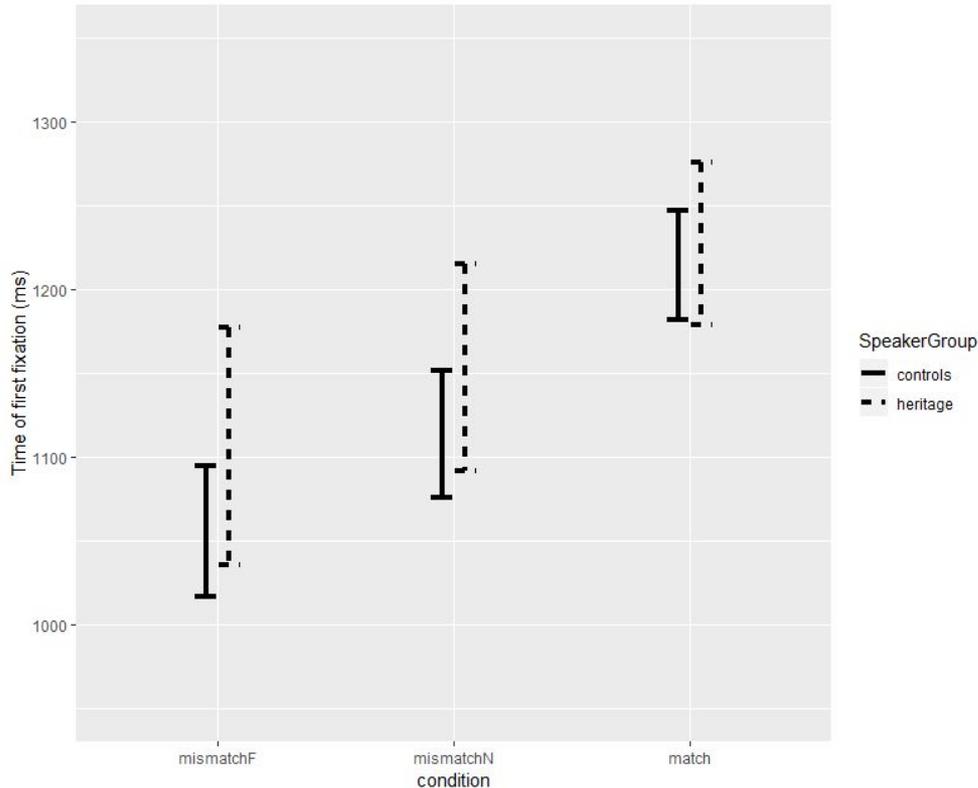
	Raw	After lexical task	After trimming
Controls	2481	2341 (-6%)	2248 (-7%)
Heritage	1918	1145 (-40%)	1076 (-4%)

Results: Feminine target item



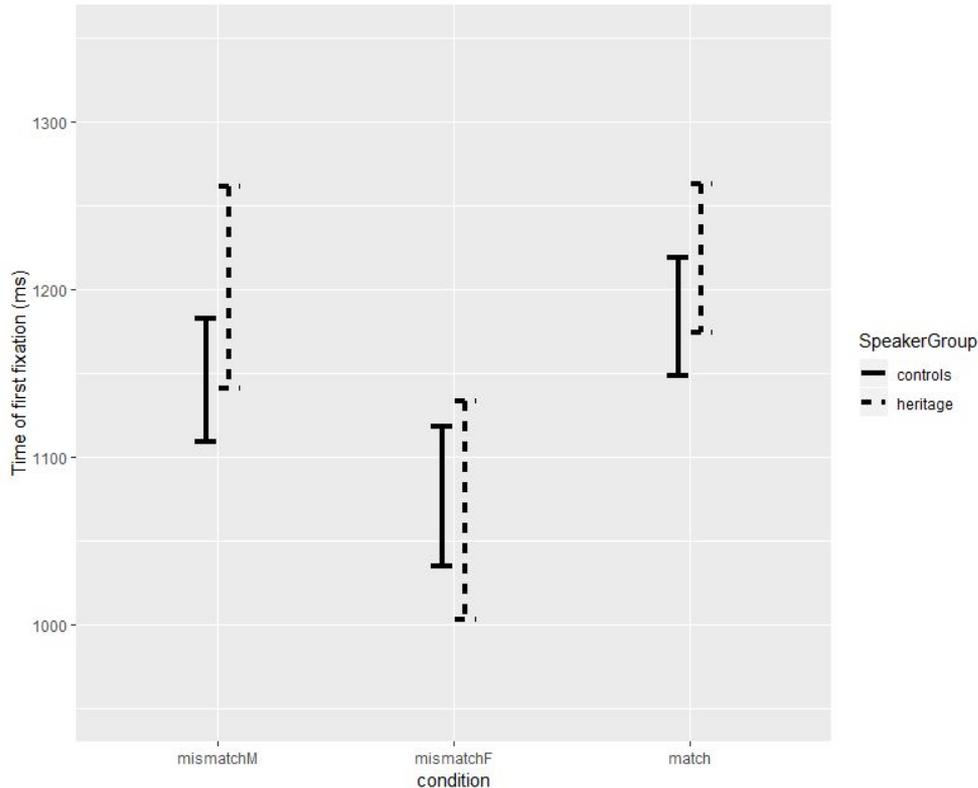
- Both groups use gender to facilitate lexical retrieval (no significant difference).
- No significant difference between mismatch conditions.

Results: Masculine target item



- Use gender to facilitate lexical retrieval.
- This process is slowed in the presence of a neuter distractor.

Results: Neuter target item



- Participants can use neuter to facilitate lexical retrieval if the distractor is feminine...
- ... but not if the distractor is masculine.

Putting it all together

- F is “on its own”, so the main contrast is between F and “everything else”
- N slightly interferes with M.
- However, M interferes with N.

Putting it all together

- F is “on its own”, so the main contrast is between F and “everything else”
- N slightly interferes with M.
- However, M interferes with N.



N is accessed after M

Implications

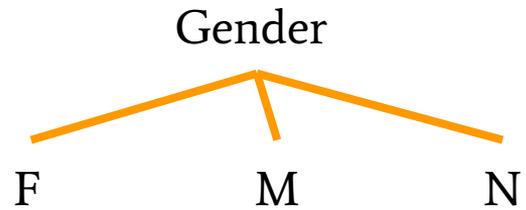
Spanish / USA

Spanish / Germany

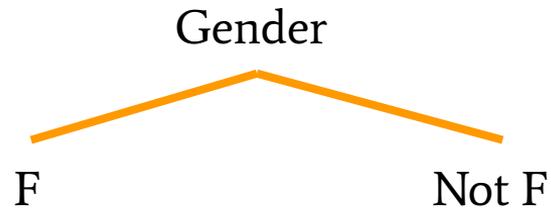
Polish / USA



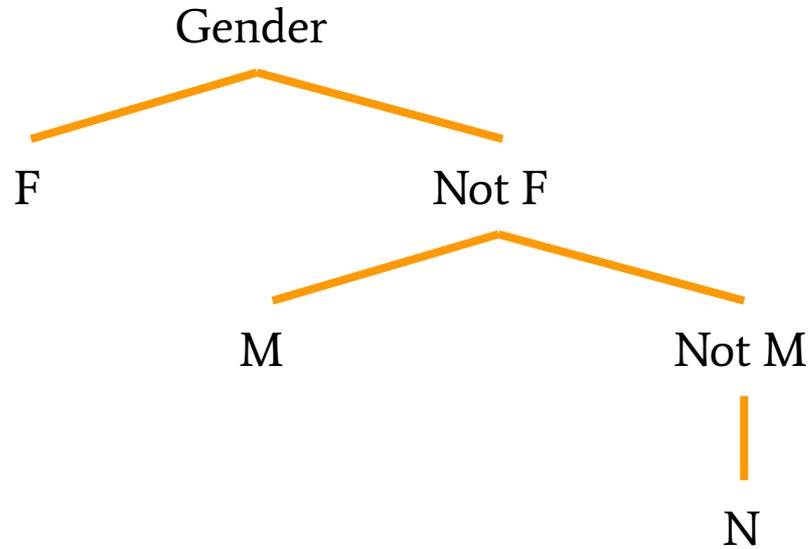
Hierarchical geometry of Polish gender



Hierarchical geometry of Polish gender



Hierarchical geometry of Polish gender



Additional support

	masc.	neut.	fem.
nom.	dobry	dobrze	dobrze
gen.	dobrego	dobrego	dobrzej
dat.	dobremu	dobremu	dobrzej
acc.	dobry	dobrze	dobrze
inst.	dobrym	dobrym	dobrze
loc.	dobrym	dobrym	dobrze

- Adjectival morphology distinguishes between F and M&N ...
- But M&N are only different in Nom/Acc (which are identical to each other).

- Recall acquisition evidence that children learn to distinguish F from M by around 2;0, but neuter later.

An explanation in terms of defaults?

- Neuter is the default (inanimate) gender in Polish:

*pro*_{+Neut} był-o zimm-o.
 be-PST.3SG.N cold-N

“It was cold.”

[impersonal construction, no overt controller]

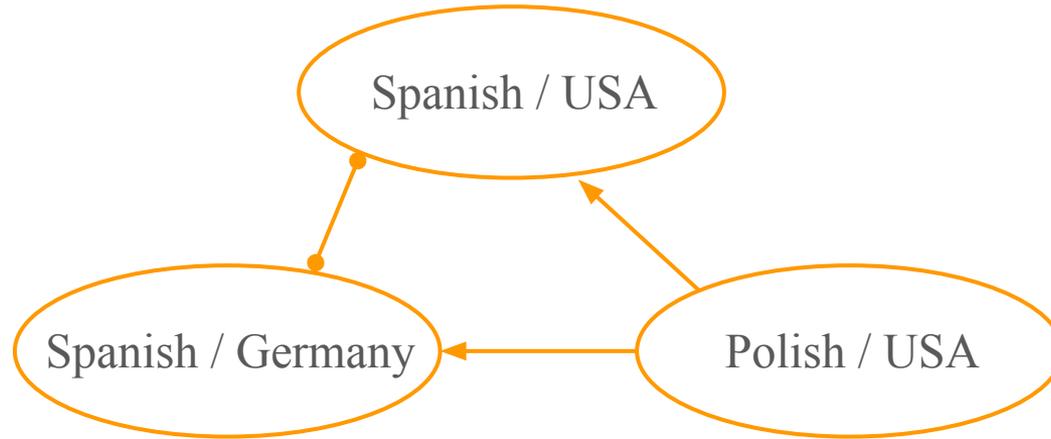
An explanation in terms of defaults?

- Can we use this to explain the patterns we see here?
- Insufficient: would predict patterns we do not see here,
ex. M&F vs N, rather than F vs M&N
- Instead we have binary system that makes Polish more comparable to Spanish.

Interim Summary: Polish

- Polish controls can use gender on prenominal adjectives facilitatively.
- HS can also use gender facilitatively, on par with controls.
- Asymmetrical interference between M and N gives psycholinguistic evidence for notion that Polish genders are organized hierarchically, not as a flat set of categories.

Implications



Observation

- Spanish experiment: Effect of facilitating lexical retrieval is **slower** for heritage speakers than for controls.
- Polish experiment: No significant difference between heritage speakers and controls.

Not a perfect comparison...

- Polish is not Spanish (ideally we would test Heritage German or Amharic).
- Always tricky to interpret a null result (Vasishth & Nicenboim 2015)
- Different speaker groups, but appear to be proficiency-matched

... but potentially meaningful

- Spanish: access gender on DET
- Polish: access gender on ADJ

... but potentially meaningful

Independent evidence for ADJ vs DET, from Hopp & Lemmerth 2018:

A) Wo ist der/die/das gelbe NOUN?
where is the.M/the.F/the.N yellow noun
'Where is the yellow NOUN?'

B) Wo ist ein kleine-r/-s gelbe-r/-s NOUN?
where is a small-M/-N yellow-M/-N noun
'Where is a small yellow NOUN?'

Effect stronger for adjectives than for determiners within L1 German adults.

... but potentially meaningful

Independent evidence for ADJ vs DET:

- **Acquisition:** Spanish children learn agreement on determiners *before* agreement on adjectives (Mariscal 2009)
- **Heritage languages:** Adjectives are prime targets for attrition and loss (Polinsky 2005)

At the root of the difference

(more difficult) DET

ADJ

- Non-domain-specific possibilities: probability, entropy
- Linguistic answers: functional load, lexical/functional

At the root of the difference

(more difficult) DET 

ADJ 

Probability

(more difficult)

DET



DET + NOUN is high frequency chunk, “using gender” is **accessing probability**

ADJ



ADJ + NOUN is low frequency, “using gender” is accessing syntax

Probability

(more difficult)

DET

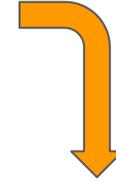


DET + NOUN is high frequency chunk, “using gender” is **accessing probability**

ADJ



ADJ + NOUN is low frequency, “using gender” is accessing syntax



Children, who also have low experience with the language, are also generally slower at this task (Lew-Williams & Fernald 2007)

Entropy

(more difficult)

DET



Obligatory, very frequent,
speakers attend to them
less.

ADJ



Optional, less frequent,
carry more meaningful
information, speakers
attend to them more.

Entropy

(more difficult)

DET



Obligatory, very frequent,
speakers attend to them
less.

ADJ



Optional, less frequent,
carry more meaningful
information, speakers
attend to them more.



Independent evidence that
information content of linguistic
items contributes to processing
(Xu & Tenenbaum 2007; Levy et
al. 2009, Piantadosi et al. 2017,
etc.)

Functional Load

(more difficult)

DET



Gender on DET-like elements in Spanish is also used in direct object clitics.

ADJ



Gender on ADJ is used in Polish in noun-less constructions: clitics, left-branch extraction, split nominals, substantivization

Functional Load

(more difficult)

DET

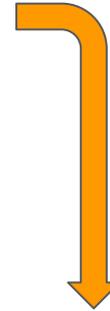


Gender on DET-like elements in Spanish is also used in direct object clitics.

ADJ

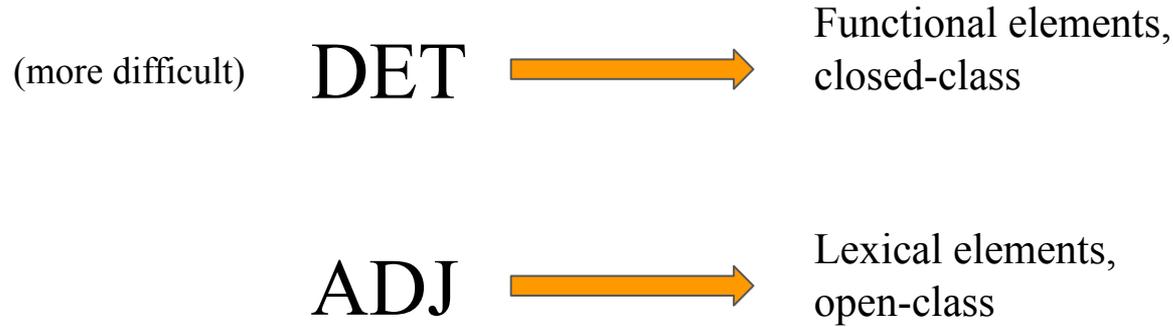


Gender on ADJ is used in Polish in noun-less constructions: clitics, left-branch extraction, split nominals, substantivization



Spanish children are bad at accessing gender on direct object clitics (Grüter et al. 2012b)

Lexical vs Functional



Outline

- Visual World Paradigm & facilitative use of gender
- Study 1: Heritage Spanish in the USA
- Study 2: Heritage Spanish in Germany
- Study 3: Heritage Polish in the USA
- Next steps

Testing Probability vs Lexical/Functional

	SPANISH Dónde está algún/alguna ITEM?	
	quantifier	

Testing Probability vs Lexical/Functional

	SPANISH Dónde está algún/alguna ITEM?	POLISH Gdzie jest mój/moja/moje ITEM?
	quantifier	possessor

Testing Probability vs Lexical/Functional

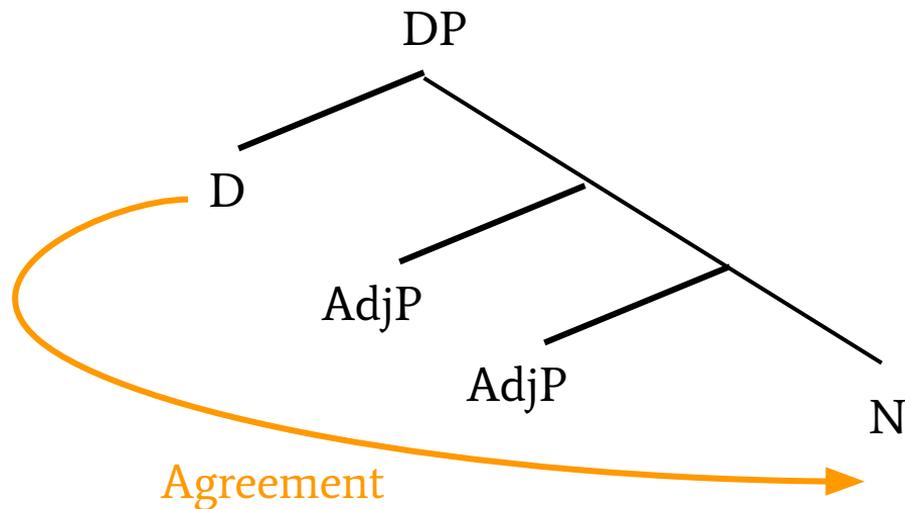
	SPANISH Dónde está algún/alguna ITEM?	POLISH Gdzie jest mój/moja/moje ITEM?
	quantifier	possessor
Probability	No slowdown	No slowdown

Testing Probability vs Lexical/Functional

	SPANISH Dónde está algún/alguna ITEM?	POLISH Gdzie jest mój/moja/moje ITEM?
		quantifier
Probability	No slowdown	No slowdown
Lexical/functional	Slowdown	Slowdown

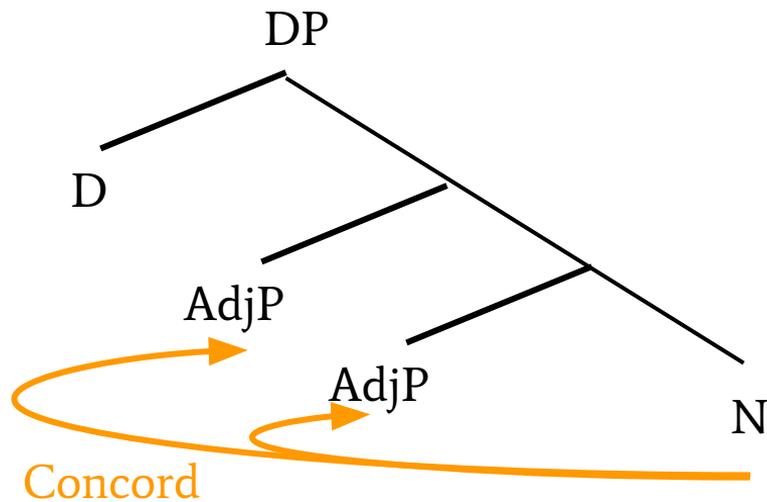
Syntax?

It is possible that “concord” could be a different syntactic process from agreement (Chomsky 2001, Chung 2013, Norris 2014). If so...



Syntax?

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Testing Probability vs Lexical/Functional

	SPANISH Dónde está algún/alguna ITEM?	POLISH Gdzie jest mój/moja/moje ITEM?
		quantifier
Probability	No slowdown	No slowdown
Lexical/functional	Slowdown	Slowdown

Testing Probability vs Lexical/Functional

	SPANISH Dónde está algún/alguna ITEM?	POLISH Gdzie jest mój/moja/moje ITEM?
	quantifier	possessor
Probability	No slowdown	No slowdown
Concord/ Agreement	Slowdown	Slowdown

Testing Probability vs Lexical/Functional

	SPANISH Dónde está algún/alguna ITEM?	POLISH Gdzie jest mój/moja/moje ITEM?
	quantifier	possessor
Probability	No slowdown	No slowdown
Concord/ Agreement*	Slowdown	Slowdown

*Test gender on predicative adjectives (agreement) vs modifying adjectives (concord).

Heritage Polish in Germany

- Stay tuned for analysis!

Wrap up

Experimental work

Theory construction

Heritage languages



a more comprehensive linguistic theory

Wrap up

Experimental work

Theory construction

Heritage languages



Eye-tracking
studies

Wrap up

Experimental work



Eye-tracking
studies

Theory construction

Heritage languages



Heritage Spanish
&
Heritage Polish

Wrap up

Experimental work



Eye-tracking studies

Theory construction



Support for HL as closer to L1
Hierarchical structure of Polish gender
Implications for mental representation
of two gender systems
Evidence for difference between
determiners and modifiers

Heritage languages



Heritage Spanish
&
Heritage Polish

Thank you!

Bonus slides

Sample LEAP-Q

Last name		First name		Today's Date	
Age		Date of Birth		Male <input type="checkbox"/>	Female <input type="checkbox"/>

(1) Please list all the languages you know **in order of dominance**:

1	2	3	4	5
---	---	---	---	---

(2) Please list all the languages you know **in order of acquisition** (your native language first):

1	2	3	4	5
---	---	---	---	---

(3) Please list what percentage of the time you are *currently* and *on average* exposed to each language.
(Your percentages should add up to 100%):

List language here:					
List percentage here:					

(4) When choosing to read a text available in all your languages, in what percentage of cases would you choose to read it in each of your languages? Assume that the original was written in another language, which is unknown to you. *(Your percentages should add up to 100%):*

List language here:					
List percentage here:					

(5) When choosing a language to speak with a person who is equally fluent in all your languages, what percentage of time would you choose to speak each language? Please report percent of total time.

(Your percentages should add up to 100%):

List language here					
List percentage here:					

(6) How many years of formal education do you have? _____

Please check your highest education level (or the approximate US equivalent to a degree obtained in another country):

- Less than High School
- High School
- Professional Training

- Some College
- College
- Some Graduate School

- Masters
- Ph.D./M.D./J.D.
- Other:

(7) Date of immigration to the USA, if applicable _____ 188 _____

If you have ever immigrated to another country, please provide name of country and date of immigration here.

(8) Have you ever had a vision problem , hearing impairment , language disability , or learning disability ?
(Check all applicable).

If yes, please explain (including any corrections):

Language: SPANISH

This is my (**native** **second** **third** **fourth** **fifth**) language.

(1) Age when you...

<i>began acquiring this language:</i>	<i>became fluent in this language:</i>	<i>began reading in this language:</i>	<i>became fluent reading in this language:</i>

(2) Please list the number of years and months you spent in each language environment:

	Years	Months
A country where this language is spoken		
A family where this language is spoken		
A school and/or working environment where this language is spoken		

(3) Please circle your *level of proficiency* in speaking, understanding, and reading in this language:

Speaking

0	1	2	3	4	5	6	7	8	9	10
None	Very low	Low	Fair	Slightly less than adequate	Adequate	Slightly more than adequate	Good	Very good	Excellent	Perfect

Understanding spoken language

0	1	2	3	4	5	6	7	8	9	10
None	Very low	Low	Fair	Slightly less than adequate	Adequate	Slightly more than adequate	Good	Very good	Excellent	Perfect

Reading

0	1	2	3	4	5	6	7	8	9	10
None	Very low	Low	Fair	Slightly less than adequate	Adequate	Slightly more than adequate	Good	Very good	Excellent	Perfect

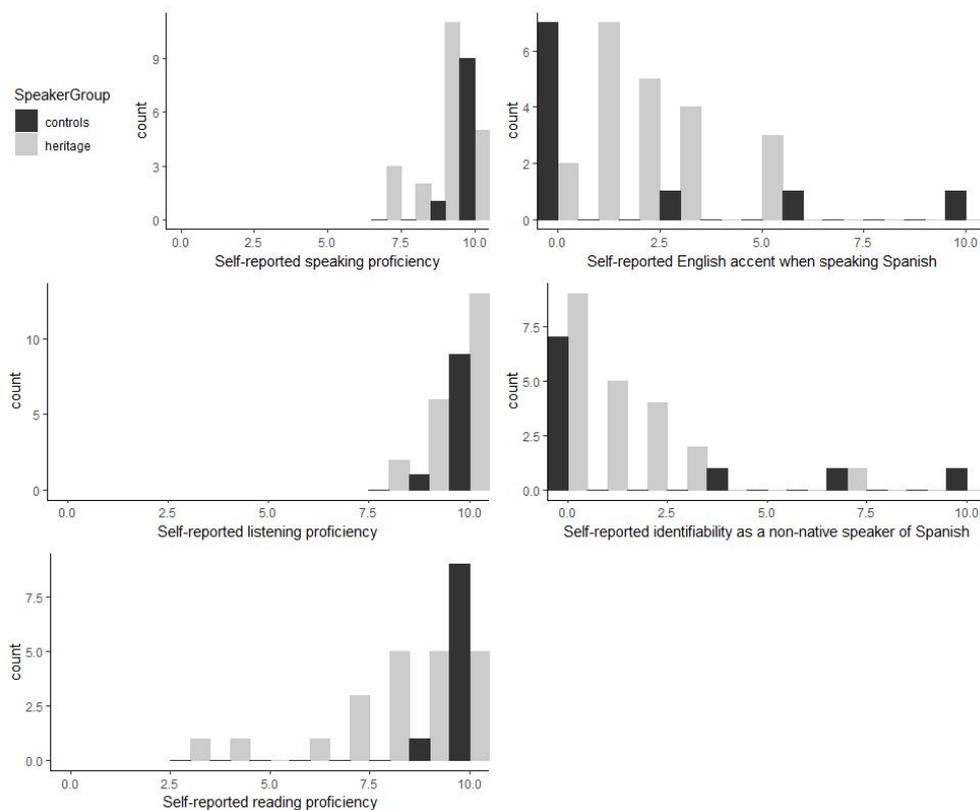
(4) In your perception, how much of an English accent do you have in Spanish?

0	1	2	3	4	5	6	7	8	9	10
None	Almost none	Very light	Light	Some	Moderate	Considerable	Heavy	Very heavy	Extremely heavy	Pervasive

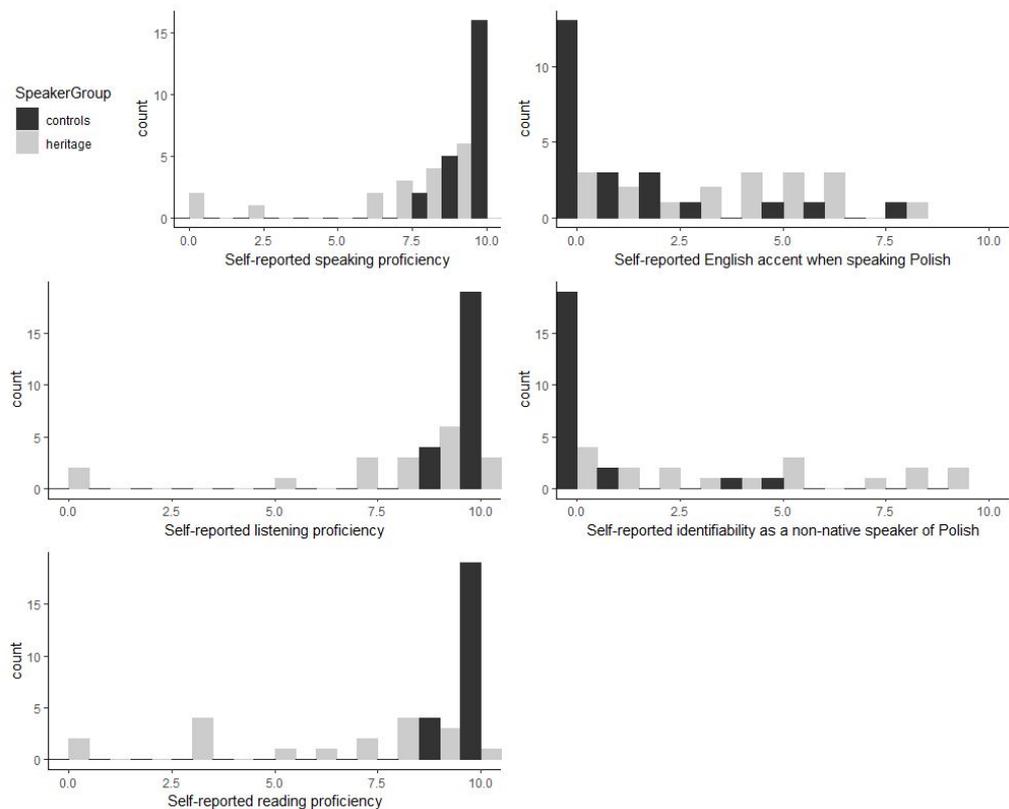
(5) Please circle how frequently others identify you as a ¹⁸⁹non-native speaker of Spanish based on your accent in Spanish:

0	1	2	3	4	5	6	7	8	9	10
Never	Almost Never				Half of the time					Always

Self-reported proficiency: Spanish



Self-reported proficiency: Polish



Full statistical models & Other plots

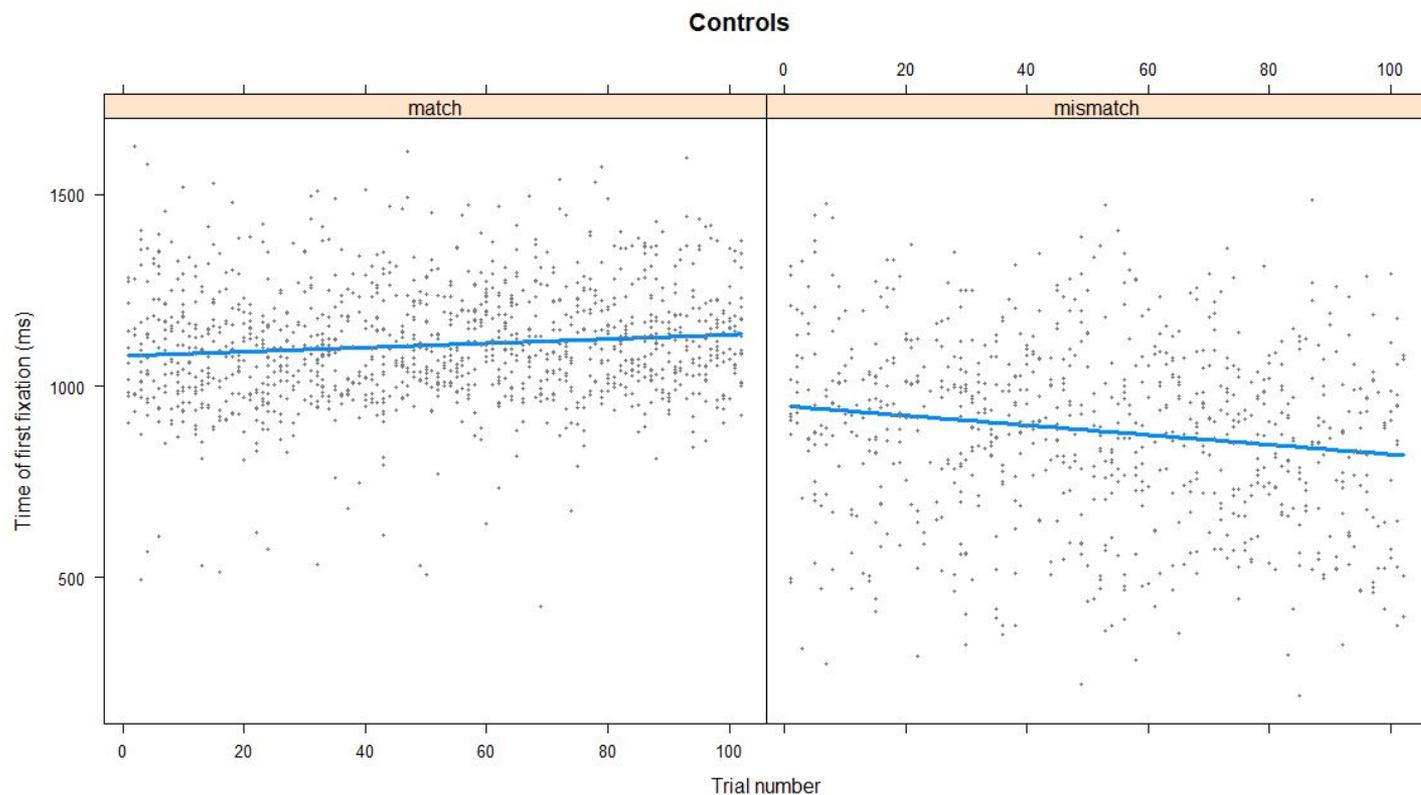
Spanish overall model

	<i>Dependent variable:</i>		
	<i>Time of first fixation</i>		
group	82.453	(22.091)	***
condition	-223.140	(30.834)	***
trial number	16.168	(8.314)	*
group : condition	127.493	(38.110)	***
group : trial number	-10.084	(10.973)	
condition : trial number	-53.089	(13.696)	***
group : condition : trial number	11.054	(17.845)	
constant	1,107.369	(17.768)	***
Observations	2,016		
Log Likelihood	-13,454.150		
Akaike Inf. Crit.	26,932.310		
Bayesian Inf. Crit.	26,999.610		

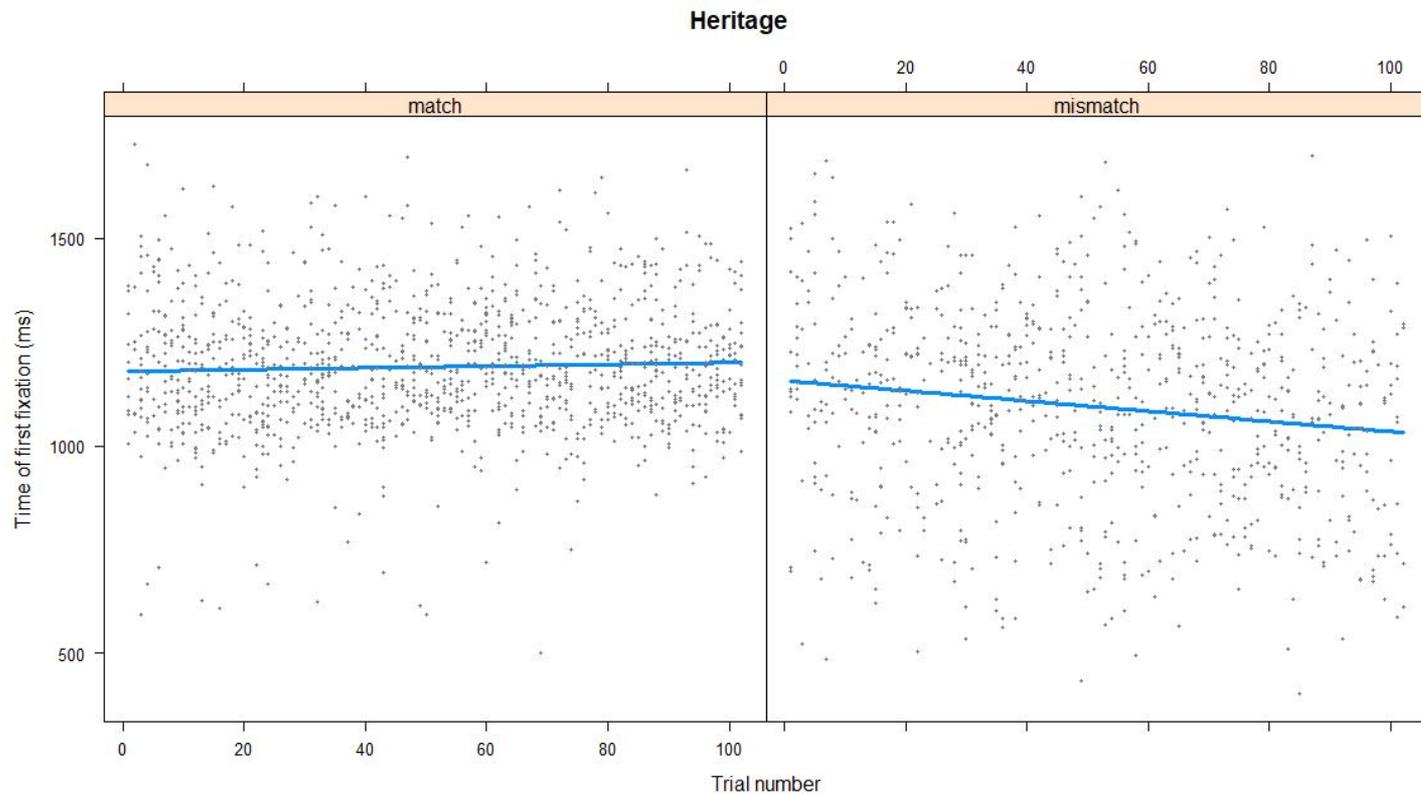
Note:

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Spanish/USA trial effect



Spanish/USA trial effect



Polish F target

	<i>Dependent variable:</i>		
	<i>Time of first fixation</i>		
group	29.476	(35.825)	
condition mismatch M/N	2.035	(13.707)	
condition match	59.278	(11.225)	***
trial number	-46.468	(8.844)	***
group : condition mismatch M/N	3.890	(12.499)	
group : condition match	1.602	(9.710)	
group : trial number	-5.122	(8.842)	
condition mismatch M/N : trial number	14.082	(10.579)	
condition match : trial number	9.956	(6.342)	
group : condition mismatch M/N : trial number	20.567	(10.561)	*
group : condition match : trial number	-2.678	(6.342)	
constant	1,156.308	(35.825)	***
Observations	1,046		
Log Likelihood	-7,290.061		
Akaike Inf. Crit.	14,618.120		
Bayesian Inf. Crit.	14,712.220		

Note:

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Polish M target

	<i>Dependent variable:</i>		
	<i>Time of first fixation</i>		
group	27.339	(33.126)	
condition mismatch F/N	27.331	(11.929)	**
condition match	38.364	(9.426)	***
trial number	-48.824	(7.139)	***
group : condition mismatch F/N	-2.580	(10.952)	
group : condition match	-6.376	(8.158)	
group : trial number	-6.008	(7.139)	
condition mismatch F/N : trial number	10.440	(8.753)	
condition match : trial number	6.759	(5.080)	
group : condition mismatch F/N : trial number	2.435	(8.726)	
group : condition match : trial number	4.589	(5.078)	
constant	1,155.045	(34.511)	***
Observations	1,162		
Log Likelihood	-7,972.757		
Akaike Inf. Crit.	15,983.510		
Bayesian Inf. Crit.	16,079.610		

Note:

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Polish N target

	<i>Dependent variable:</i>		
	<i>Time of first fixation</i>		
group	23.978	(34.746)	
condition mismatch M/match	-15.711	(10.036)	
condition mismatch F	-38.983	(7.514)	***
trial number	-40.159	(7.164)	***
group : condition mismatch M/match	0.306	(10.036)	
group : condition mismatch F	-7.859	(7.514)	
group : trial number	1.679	(7.164)	
condition mismatch M/match : trial number	-7.603	(8.675)	
condition mismatch F : trial number	-4.128	(5.173)	
group : condition mismatch M/match : trial number	-12.403	(8.675)	
group : condition mismatch F : trial number	-2.910	(5.173)	
constant	1,154.564	(34.765)	***
Observations	1,116		
Log Likelihood	-7,640.000		
Akaike Inf. Crit.	15,318.000		
Bayesian Inf. Crit.	15,413.330		

Note:

*p<0.1; **p<0.05; ***p<0.01

Effect sizes in the literature

Effect sizes in previous studies

Paper	Language	Sample size	Magnitude of (sig.) condition effect
Lew-Williams & Fernald (2007)	Spanish	26 control adults	70ms
		26 monolingual children	70ms
Lew-Williams & Fernald (2010)	Spanish	26 control adults	90ms
		26 L2 adults	not sig.
Grüter et al. (2012)	Spanish	19 control adults	60ms
		19 L2 adults	not sig.
Dussias et al. (2013)	Spanish	16 control adults	120-130ms
		9 L1-English, L2 Spanish	90-170ms
		15 L1-Italian, L2 Spanish	200ms
Hopp (2013)	German	20 monolingual adults	450
		9 consistent German L2	410ms
		11 variable German L2	210ms
Hopp (2016)	German	18 consistent German L2	600ms
		16 variable German L2	not sig.
Hopp & Lemmerth (2018)	German	15 control adults	210-350ms
		24 L1-Russian, L2-German	150ms
[this study]	Spanish	10 control adults	200ms
		21 heritage adults	100ms
[this study]	Polish	23 control adults	150-200ms
		18 heritage adults	150-200ms

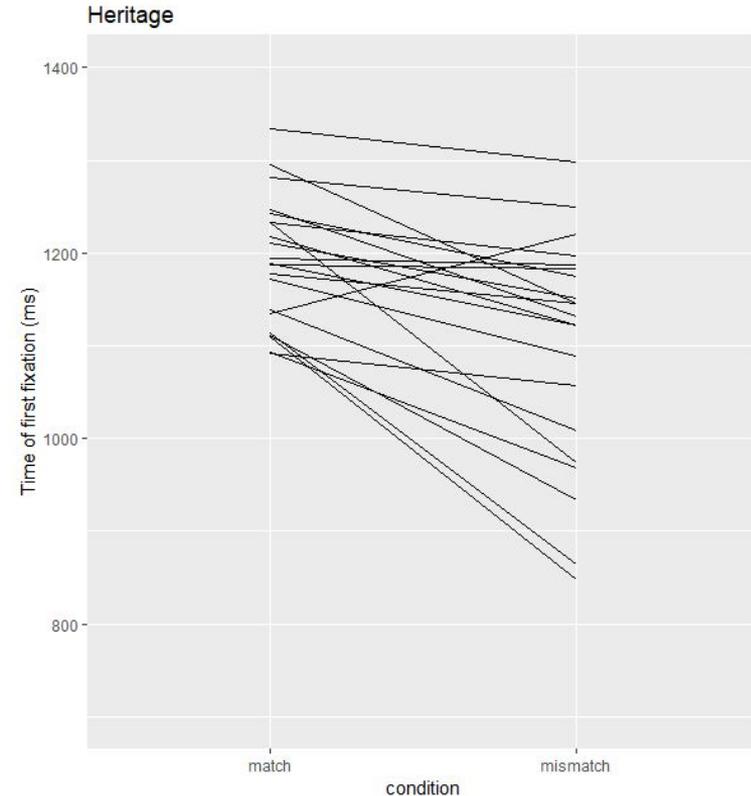
Proficiency tests

Spanish Results: Proficiency?

Proficiency or demographic variables?

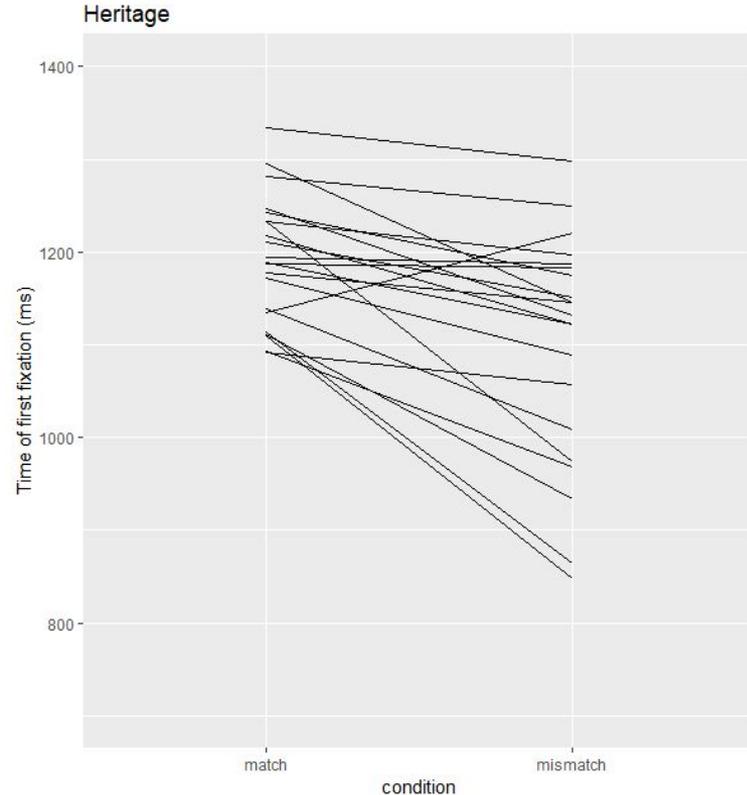
- Vocabulary measures
- Age of onset of bilingualism
- # years in Spanish-speaking school
- # years in Spanish-speaking family

... none of these correlate.



Spanish Results: Proficiency?

Important: introducing a more sensitive measure (eye-tracking) identifies variation that is intrinsic to the HS population rather than correlated with an extrinsic factor.



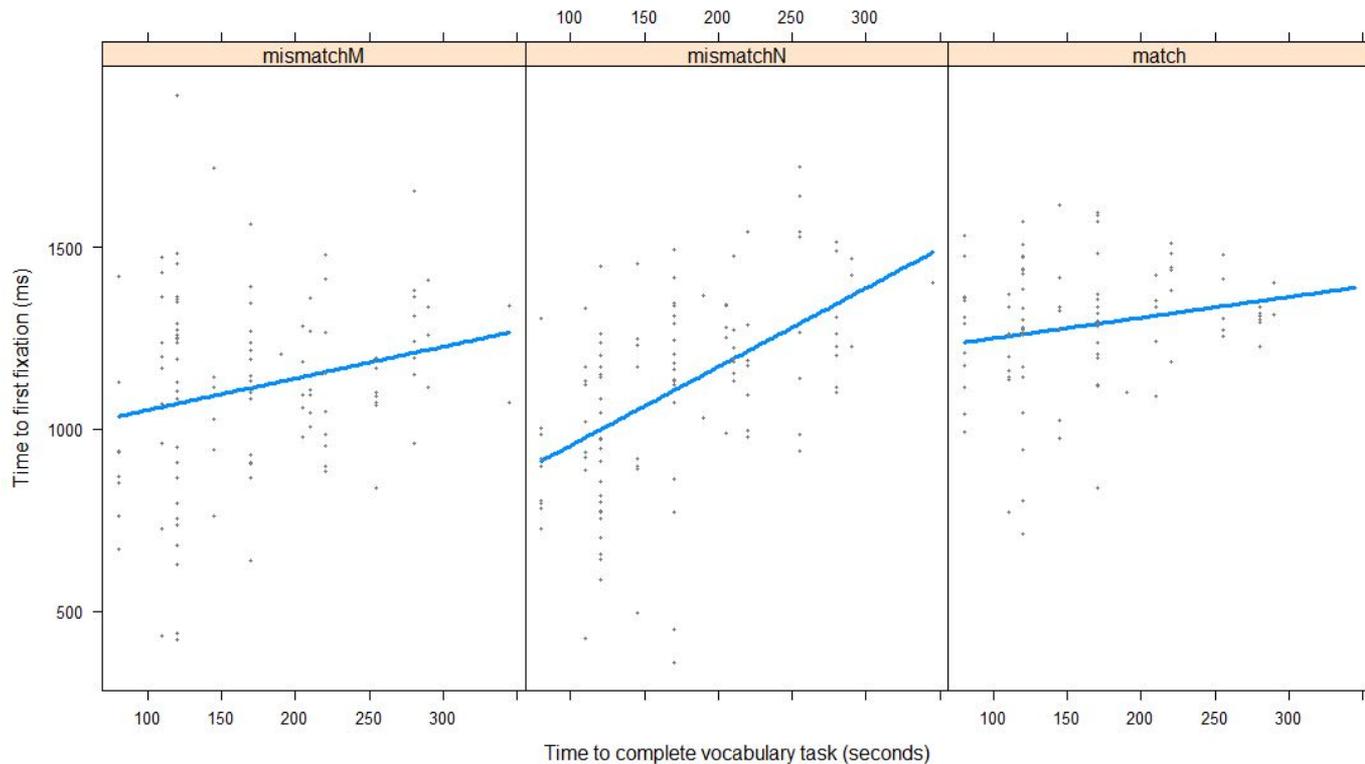
Polish results: proficiency in F target

	<i>Dependent variable:</i>		
	<i>Time of first fixation</i>		
condition mismatch M/N	-103.961	(58.881)	*
condition match	109.029	(47.957)	**
vocab time	1.190	(0.922)	
trial number	-23.306	(40.661)	
condition mismatch M/N : vocab time	0.608	(0.309)	**
condition match : vocab time	-0.285	(0.261)	
condition mismatch M/N : trial number	107.089	(50.022)	**
condition match : trial number	-52.799	(28.919)	*
vocab time : trial number	-0.140	(0.231)	
condition mismatch M/N : vocab time : trial number	-0.443	(0.277)	
condition match : vocab time : trial number	0.361	(0.171)	**
constant	963.375	(182.911)	***
Observations	315		
Log Likelihood	-2,177.631		
Akaike Inf. Crit.	4,393.263		
Bayesian Inf. Crit.	4,464.561		

Note:

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Polish results: proficiency in F target



Experimental target items

Spanish

	Spanish	Gender	English	CDE-NOW	CHILDES
1.	el casco	masc.	helmet	30	41
2.	el martillo	masc.	hammer	4	29
3.	el gancho	masc.	hook	4	10
4.	el pozo	masc.	well	35	39
5.	el brazo	masc.	arm	62	84
6.	el queso	masc.	cheese	20	412
7.	el sombrero	masc.	hat	11	214
8.	el faro	masc.	lighthouse	9	35
9.	el dado	masc.	dice	2	375
10.	la campana	fem.	bell	10	58
11.	la vela	fem.	candle	17	164
12.	la pala	fem.	shovel	4	47
13.	la bandera	fem.	flag	74	23
14.	la cadena	fem.	chain	129	7
15.	la muñeca	fem.	doll	14	160
16.	la pluma	fem.	feather	10	24
17.	la tetera	fem.	tea kettle	0.2	11
18.	la fresa	fem.	strawberry	4	82
19.	el puño	masc.	fist	9	4
20.	el cerebro	masc.	brain	37	0
21.	el cuchillo	masc.	knife	18	55

22.	el candado	masc.	lock	5	0
23.	el semáforo	masc.	light	13	17
24.	el chaleco	masc.	vest	12	9
25.	el vaso	masc.	cup	16	128
26.	el libro	masc.	book	220	271
27.	el columpio	masc.	swing	1	736
28.	el nido	masc.	nest	7	51
29.	el techo	masc.	roof	43	48
30.	el cuerno	masc.	horn	2	91
31.	la flecha	fem.	arrow	5	10
32.	la rueda	fem.	wheel	98	100
33.	la camisa	fem.	shirt	15	54
34.	la cuchara	fem.	spoon	3	199
35.	la jaula	fem.	cage	6	13
36.	la manzana	fem.	apple	20	237
37.	la regla	fem.	ruler	24	9
38.	la casa	fem.	house	661	2484
39.	la bufanda	fem.	scarf	2	44
40.	la carta	fem.	letter	138	61
41.	la mesa	fem.	table	171	880
42.	la cama	fem.	bed	36	1408

Polish

	Polish	Gender	English	NKJP-FDC	CHILDES						
1.	koło	neut.	wheel	266	122	19.	talerz	masc.	plate	24	129
2.	pudło	neut.	box	12	239	20.	widelec	masc.	fork	2	39
3.	mydło	neut.	soap	18	94	21.	dzbanek	masc.	kettle	4	21
4.	wiadro	neut.	bucket	6	101	22.	szalik	masc.	scarf	4	27
5.	lustro	neut.	mirror	16	86	23.	młotek	masc.	hammer	10	35
6.	drzewo	neut.	tree	120	632	24.	samolot	masc.	airplane	118	263
7.	jabłko	neut.	apple	12	430	25.	strzała	fem.	arrow	14	57
8.	krzesło	neut.	chair	30	182	26.	koszula	fem.	shirt	6	109
9.	łóżko	neut.	bed	60	634	27.	linijka	fem.	ruler	4	19
10.	gniazdo	neut.	nest	28	64	28.	ręka	fem.	arm	200	669
11.	pióro	neut.	feather	22	134	29.	świeczka	fem.	candle	8	94
12.	jajko	neut.	egg	64	440	30.	książka	fem.	book	173	1097
13.	rower	masc.	bicycle	14	142	31.	łopata	fem.	shovel	10	54
14.	grzebień	masc.	comb	0	31	32.	drabina	fem.	ladder	2	48
15.	namiot	masc.	tent	10	10	33.	huśtawka	fem.	swing	2	55
16.	pasek	masc.	belt	38	103	34.	truskawka	fem.	strawberry	4	49
17.	zegar	masc.	clock	22	193	35.	lalka	fem.	doll	8	595
18.	łańcuch	masc.	chain	18	46	36.	sukienka	fem.	dress	4	213

Noun-less constructions

Noun-less constructions in Poland

Basia trzym-a czerw-on-ą książk-ę, a Kasia (trzym-a) zielon-ą.
Basia hold-PRS.3SG red-ACC.F.SG book-ACC.F.SG CONJ Kasia hold-PRS.3SG green-ACC.F.SG
'Basia is holding the red book, while Kasia is holding the green (one).'

Sukienk-ę mam niebiesk-ą, a spódnic-ę mam
dress-ACC.F.SG have.PRES.ISG blue-ACC.F.SG CONJ skirt-ACC.F.SG have.PRES.ISG
czerw-on-ą.
red-ACC.F.SG
'I have a blue dress but a red skirt.'

Czyj-ą ukrad-łeś książk-ę?
whose-ACC.F.SG steal-PST.3SG.M book-ACC.F.SG
'Whose book did you steal?'

Kupi-łeś ją?
buy-PST.3SG.M CL.DO.ACC.F.SG
'Did you buy it.FEM?'

