Simon David Stein

LANGUAGE ATTITUDES
ICONICITY OR INDEXICALITY?

THE CASE
OF /x/

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SLE Societas Linguistica Europaea

SLE 2025

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Background

Language attitudes

German is ugly and harsh.

French sounds romantic.

Southern speech sounds uneducated.

If it's weird, it's Welsh.

You can almost hear Scottish people mining in a shaft when they talk.

New York English sounds rude.

Orkish sounds evil.

examples adapted from Stein 2023, Tamasi & Antieau 2015: 2–254, Mooshammer et al. 2023, and Reiterer et al. 2020; also see Silverstein 2003; Irvine & Gal 2000

Language attitudes

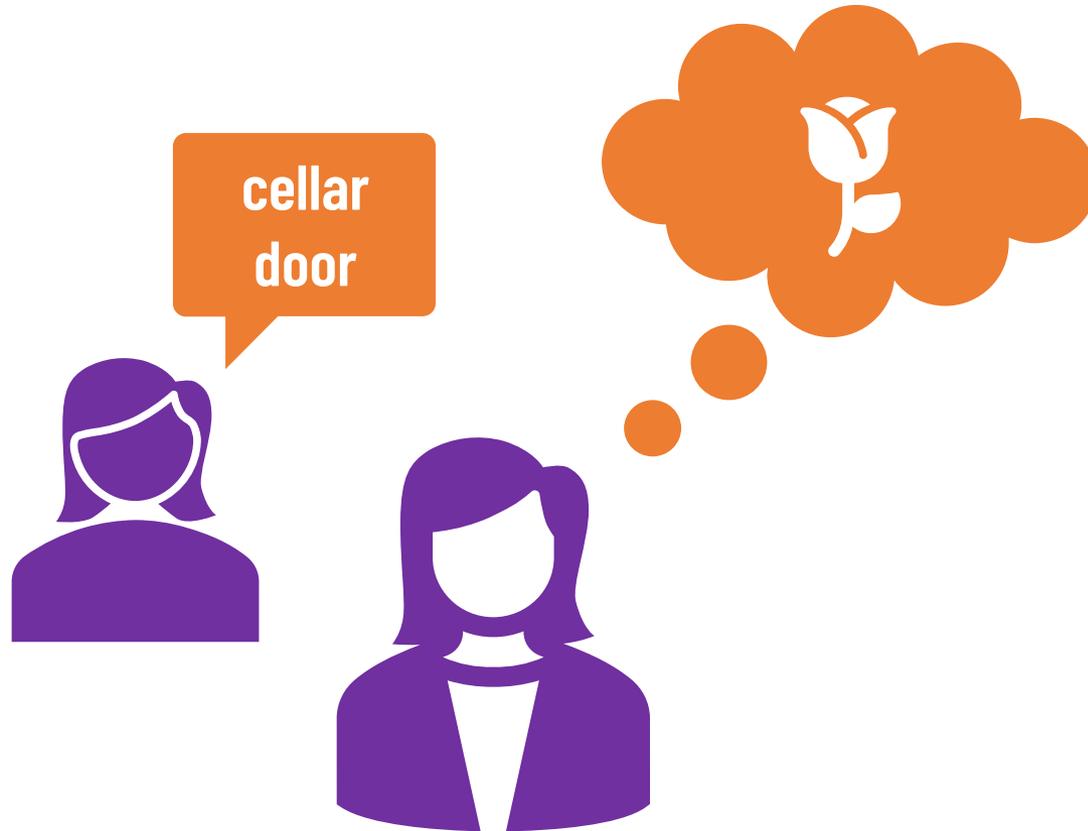## Language attitudes

Language attitudes

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Language attitudes

The big unsolved question

Why attitudes?

Why do listeners have attitudes towards language?

⇩

Two groups of explanations
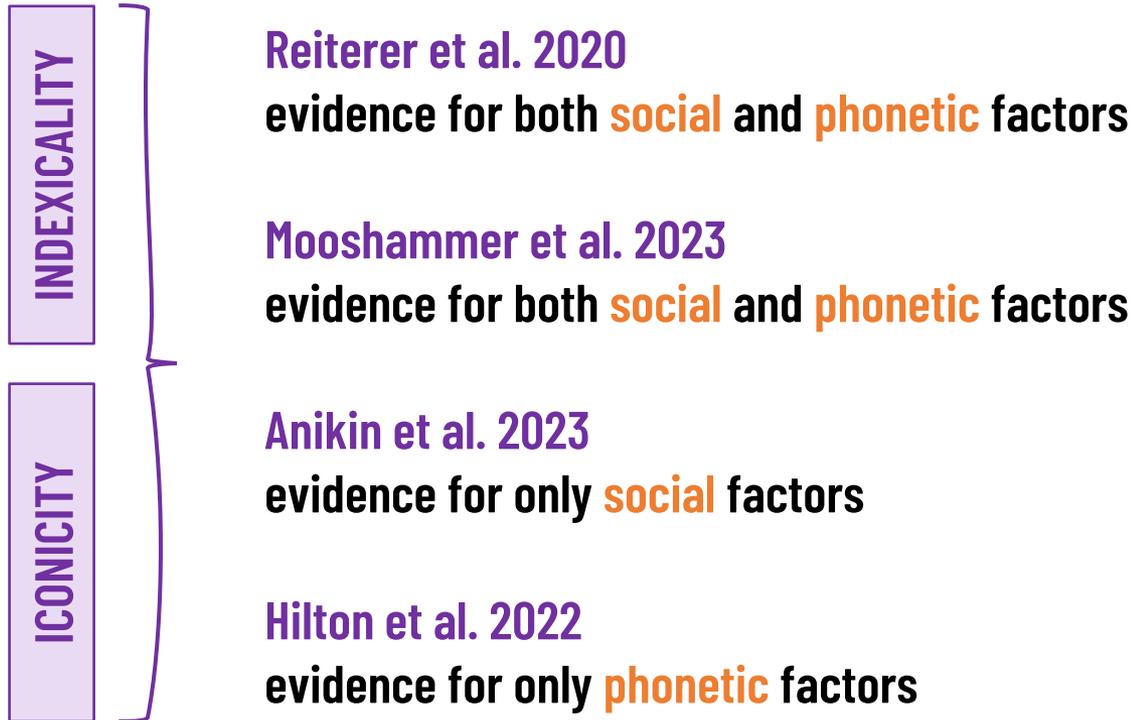
| INDEXICALITY | ICONICITY |

Two groups of explanations

Peirce 1958; Silverstein 2003; Giles and Niedzielski 1998
Kawahara et al. 2021; Winter et al. 2022

Some studies looking at both groups of explanations

INDEXICALITY

ICONICITY

Reiterer et al. 2020
evidence for both social and phonetic factors

Mooshammer et al. 2023
evidence for both social and phonetic factors

Anikin et al. 2023
evidence for only social factors

Hilton et al. 2022
evidence for only phonetic factors

This series of studies:

‣ uses languages never heard before, created from scratch.
‣ can play with sounds and social attributes in a controlled way.
‣ isolates specific, potentially iconic phonetic-phonological features.

SYLLABLE STRUCTURE	MEAN SONORITY	INDIVIDUAL PHONEMES	...
		/x/	
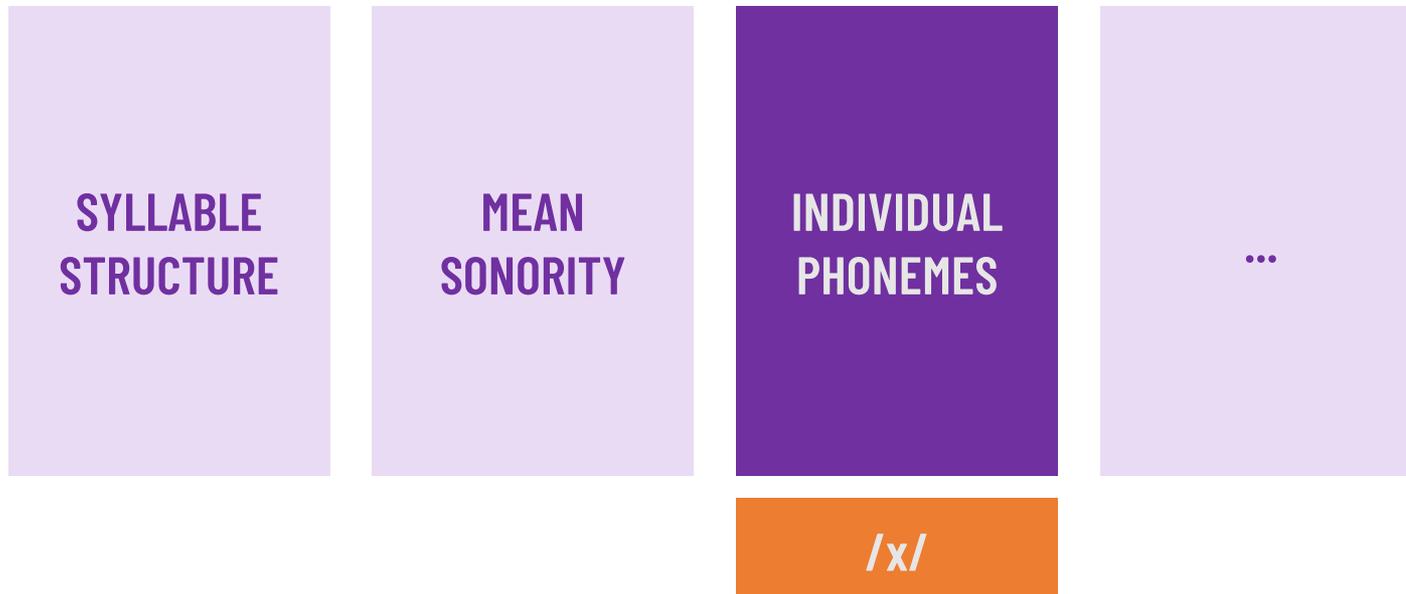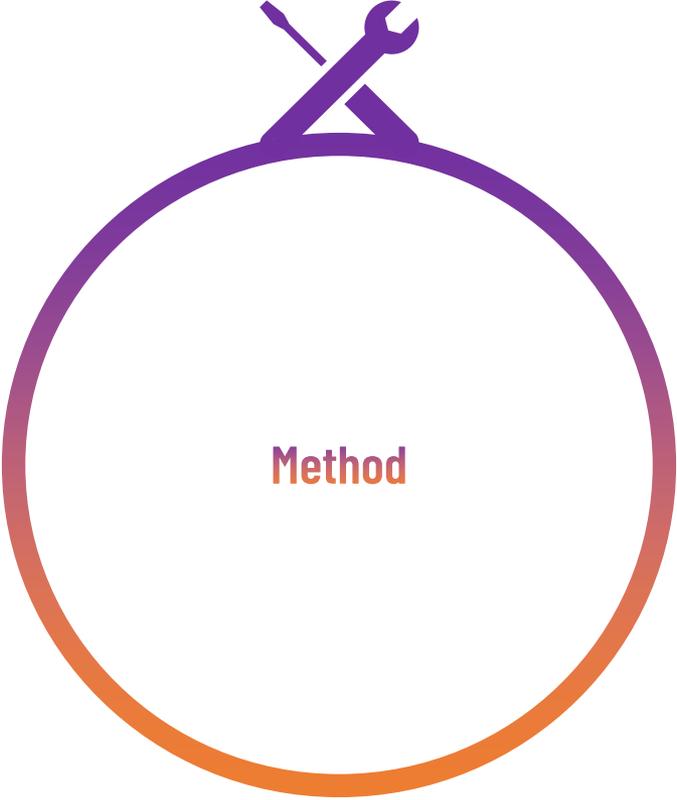
Method

SSPG   Sonority-sensitive pseudotext generator

In development.
GUI is a draft concept.

SSPG   Sonority-sensitive pseudotext generator

Control	Stimulus

Consonants = ['m', 'k', 'j', 'p', 'w', 'n', 't', 'l', 's', 'b']
Vowels = ['i', 'u', 'a', 'e', 'o']

Sounds['SonorityWeight'] = 1

MaxSyllableNumber = 4

SyllableStructures = ['V', 'CV']

SyllableWeights = [1, 9]

TextLength = 100

SenLength = max(1, int(random.gauss(12, 5))

Consonants = ['m', 'k', 'j', 'p', 'w', 'n', 't', 'b', 'x']
Vowels = ['i', 'u', 'a', 'e', 'o']

Sounds['SonorityWeight'] = 1

MaxSyllableNumber = 4

SyllableStructures = ['V', 'CV']

SyllableWeights = [1, 9]

TextLength = 100

SenLength = max(1, int(random.gauss(12, 5))
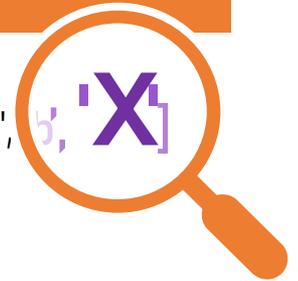
cf. Gordon 2016, Maddieson 2013, Moran et al. 2019, Goodall 2020

SSPG   Sonority-sensitive pseudotext generator

Speaker	Control			Stimulus		
	1	2	3	1	2	3
Mean sonority 1–17	10.91	10.94	10.92	10.94	10.95	10.92
Consonants %	47.62	46.9	47.26	47.33	47.44	47.13
Obstruents %	25.32	23.97	23.73	24.52	26.07	26.43
Vowels %	52.4	53.1	52.7	52.7	52.6	52.9
Voicing %	79.44	80.37	79.51	79.53	78.21	78.28
Syllable structure	CV, V	CV, V	CV, V	CV, V	CV, V	CV, V
Syllable weights 0–1	0.9, 0.1	0.9, 0.1	0.9, 0.1	0.9, 0.1	0.9, 0.1	0.9, 0.1
Number of words in text	100	100	100	100	100	100
Max number of syllables	4	4	4	4	4	4
Sound inventory	base	base	base	base, x	base, x	base, x

SSPG   Sonority-sensitive pseudotext generator

Example for control condition

Mo mutu kima le napo soteoi lubita bisi mabumopi tapesi satiu sue sobabise si painu nopu wupeto je sipawi bu nake muba no pa. Pe ne jako u po munilawi o jetuwi nu mo kuloa wiwiji somawejo. Nosobape juji pu kopopobo waka toajonu mi takeka jabakeja tisu tuelu kepe jewo luwo jesoa wejoniwe kasajo jujianu. Wulusa sa ma mieto ta tojimu motutasa lo we no pika. Nomewiju sau ta seili ni puwoja nase ju lelemi wawamonu bo pukebopo. Wa bakolimu kuuali jiku ke sobi tosisabo kikitebi nitiwusu jupike lipu enibu mopobewa ti iwibaja kinotu wa busu bibuase kuine kosumewe. Toinu.

SSPG   Sonority-sensitive pseudotext generator

Example for stimulus condition

Sauxi nuopo pu xo boxiliwa limuwua muneu tasasupe banepoku bano jumabise kuta wi pu pa tixu meja tupi tobimo boma. Ku jewia mujaxito li ta. Teloju ana epoo xitexi xotiwo no pexu kuwuto epa muwubu isiju. Wipoxai nubunipe niopawa xane joluxoka xo buipu owilu no pu mile sitokame mupaje. Xine nekosu. Mapejo ja xunujiwi esi si epa naji nuxu to. Ma naemexe beame jesobu betetumu bajotu mioxi lalo. Pibila bi wuneomo nonamito wo pelejiwe xo pa jo. Wokiwabi jopu xia ta masa ne jubuja sunasato ataxibu josakuto buxuwuxu telouna mele ku. Misa monapo ta miwi jeu so jumu enilepe lolami.

SSPG   Sonority-sensitive pseudotext generator

Example for stimulus condition

Sau<u>x</u>i nuopo pu <u>x</u>o bo<u>x</u>iliwa limuwua muneu tasasupe banepoku bano jumabise kuta wi pu pa ti<u>x</u>u meja tupi tobimo boma. Ku jewia muja<u>x</u>ito li ta. Teloju ana epoo <u>x</u>ite<u>x</u>i <u>x</u>otiwo no pe<u>x</u>u kuwuto epa muwubu isiju. Wipo<u>x</u>ai nubunipe niopawa <u>x</u>ane jolu<u>x</u>oka <u>x</u>o buipu owilu no pu mile sitokame mupaje. <u>X</u>ine nekosu. Mapejo ja <u>x</u>unujiwi esi si epa naji nu<u>x</u>u to. Ma naeme<u>x</u>e beame jesobu betetumu bajotu mio<u>x</u>i lalo. Pibila bi wuneomo nonamito wo pelejiwe <u>x</u>o pa jo. Wokiwabi jopu <u>x</u>ia ta masa ne jubuja sunasato ata<u>x</u>ibu josakuto bu<u>x</u>uwu<u>x</u>u telouna mele ku. Misa monapo ta miwi jeu so jumu enilepe lolami.
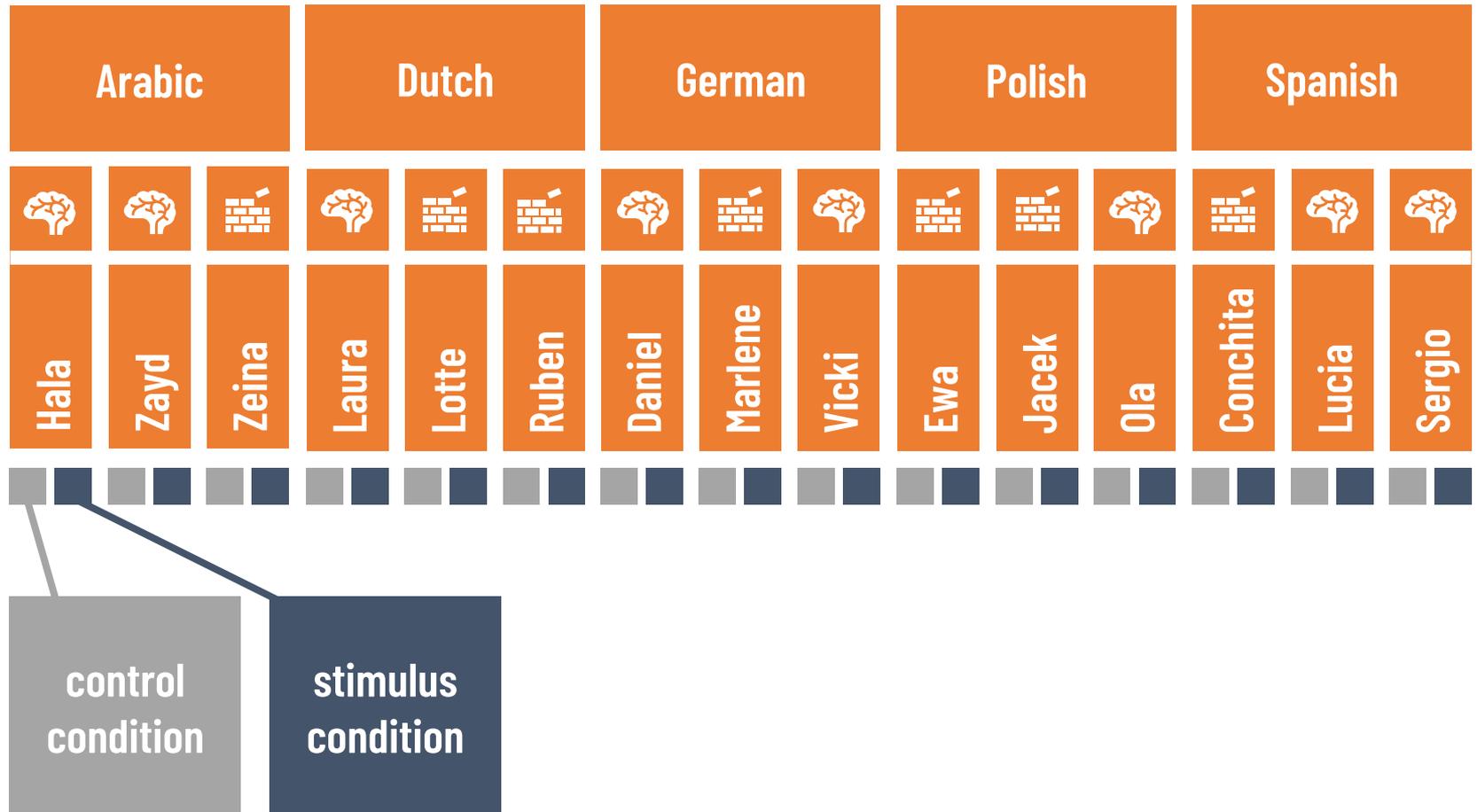
Speech synthesis with Amazon Polly

Arabic			Dutch			German			Polish			Spanish		
Hala	Zayd	Zeina	Laura	Lotte	Ruben	Daniel	Marlene	Vicki	Ewa	Jacek	Ola	Conchita	Lucia	Sergio

control condition

stimulus condition

Participant quota sampling by PRIMARY LANGUAGE

exposed

Arabic	Dutch	German	Polish	Spanish
10 %	10 %	10 %	10 %	10 %
50	50	50	50	50

less exposed

English	Italian	Japanese		Prolific
17 %	17 %	16 %		= 100 %
86	85	80		= 500

Response variables

SCALE	NEGATIVE VALENCE	1	POSITIVE VALENCE	100
PLEASANTNESS	unpleasant	—	pleasant	
BEAUTY	ugly	—	beautiful	
SOFTNESS	hard	—	soft	
SHAPE	spiky	—	round	
EDUCATION	uneducated	—	educated	
INTELLIGENCE	stupid	—	intelligent	
FRIENDLINESS	unfriendly	—	friendly	
ORDINARINESS	strange	—	normal	
GOODNESS	evil	—	good	
EROTICISM	unerotic	—	erotic	

Questionnaire

Rate speech

In the far future, you encounter a colony of human-like robots on a distant planet. Your task on this expedition is to try to understand robot society and communication.

Every individual robot speaks in a different language, accent, or dialect, but they can all understand each other by using internal translation programs. Some of the robots sound very similar, for example because they happened to get a similar voice program when they were built, or because their dialects happen to be close to each other. But you quickly notice that just like humans, every robot is unique.

You want to improve your ability to distinguish the robots and their roles in society based on their speech. To do this, you will listen to three pairs of robots. Each of the two robots in a pair will sound similar, but slightly different. You will try to rate the speech of each robot on different attributes.

When you are ready, click "Next."

Questionnaire

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Questionnaire

You want to improve your ability to distinguish the robots and their roles in society based on their speech. To do this, you will listen to three pairs of robots. Each of the two robots in a pair will sound similar, but slightly different. You will try to rate the speech of each robot on different attributes.

When you are ready, click "Next."

Questionnaire

You will now listen to the first pair of robots.

Please make sure you have sound enabled on your device and click "Next".

Next

Questionnaire

30% completed

Please listen to the recording of the first robot:

To listen, click the play button.

Questionnaire

How does the robot sound?

unpleasant	———————⬤———————	pleasant
ugly	———————⬤———————	beautiful
hard	———————⬤———————	soft
spiky	———————⬤———————	round
uneducated	———————⬤———————	educated
stupid	———————⬤———————	intelligent
unfriendly	———————⬤———————	friendly
strange	———————⬤———————	normal
evil	———————⬤———————	good
unerotic	———————⬤———————	erotic

Questionnaire

How familiar does this language sound to you?

not at all familiar ———————————|——————————— very familiar

Which real language or dialect, do you think, does this language resemble the most?

Questionnaire

Please listen to the recording of the second robot:

To listen, click the play button.

▶ ⬤━━━━━━━ 0:00 / 0:00 🔊 ━━⬤━━

Modeling

cf., e.g.,
Hilton et al. 2022
Anikin et al. 2023
Reiterer et al. 2020
Mooshammer et al. 2023

Modeling   One model with all scales

RATING   ~   CONDITION * EXPOSURE +

RECOGNITION +

FAMILIARITY +

LANGUAGE +

LISTENER GENDER * VOICE GENDER +

POLYGLOT +

AGE + MUSICALITY + LINGUISTICS +

INPUT + OUTPUT + LOCATION +

SCALE +

(1 | PARTICIPANT)

cf., e.g.,
Hilton et al. 2022
Anikin et al. 2023
Reiterer et al. 2020
Mooshammer et al. 2023

Modeling   One model for each scale

PLEASANTNESS   ~   CONDITION * EXPOSURE +

example   RECOGNITION +

FAMILIARITY +

LANGUAGE +

LISTENER GENDER * VOICE GENDER +

POLYGLOT +

AGE + MUSICALITY + LINGUISTICS +

INPUT + OUTPUT + LOCATION +

SCALE +

(1 | PARTICIPANT)

cf., e.g.,
Hilton et al. 2022
Anikin et al. 2023
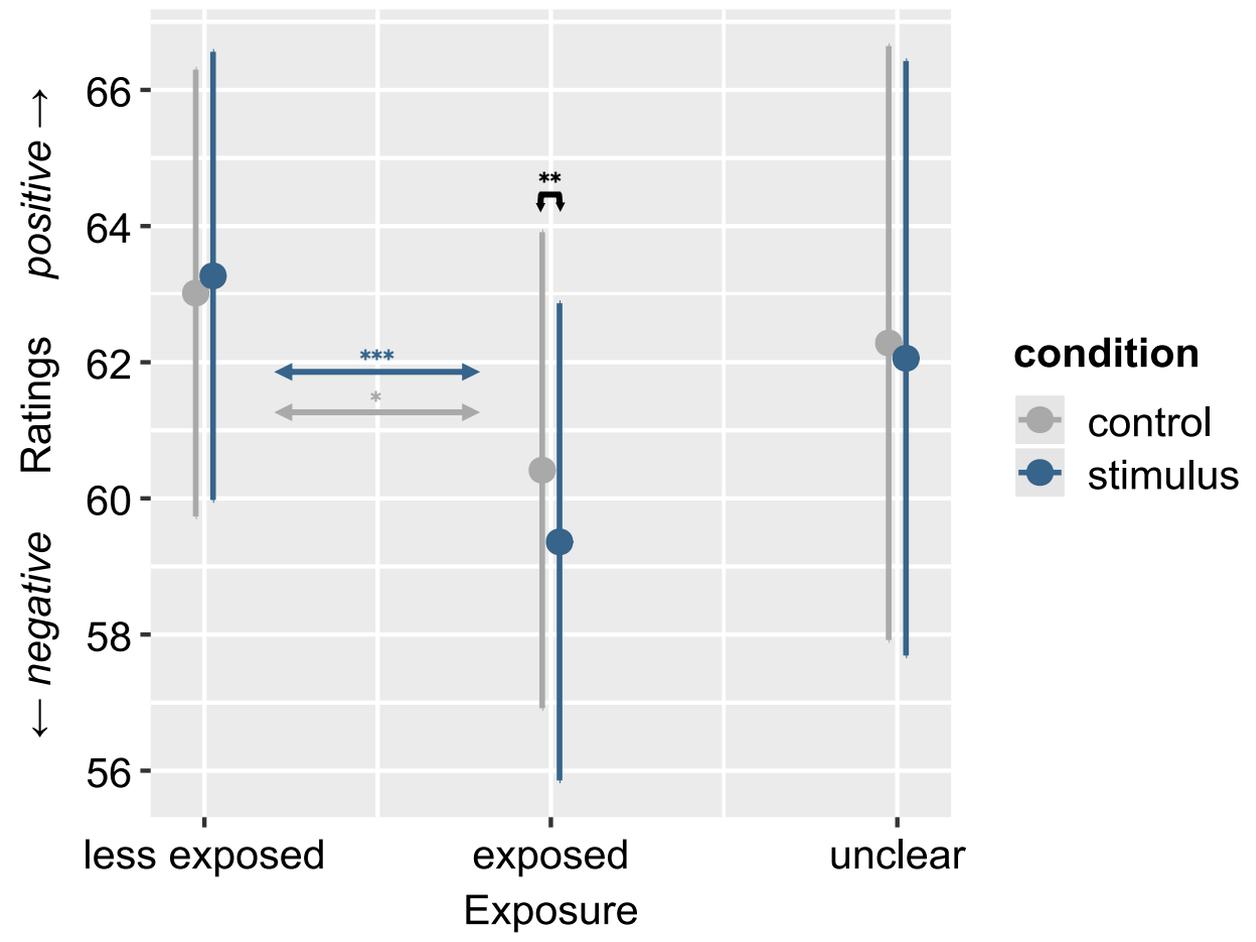Reiterer et al. 2020
Mooshammer et al. 2023

Results
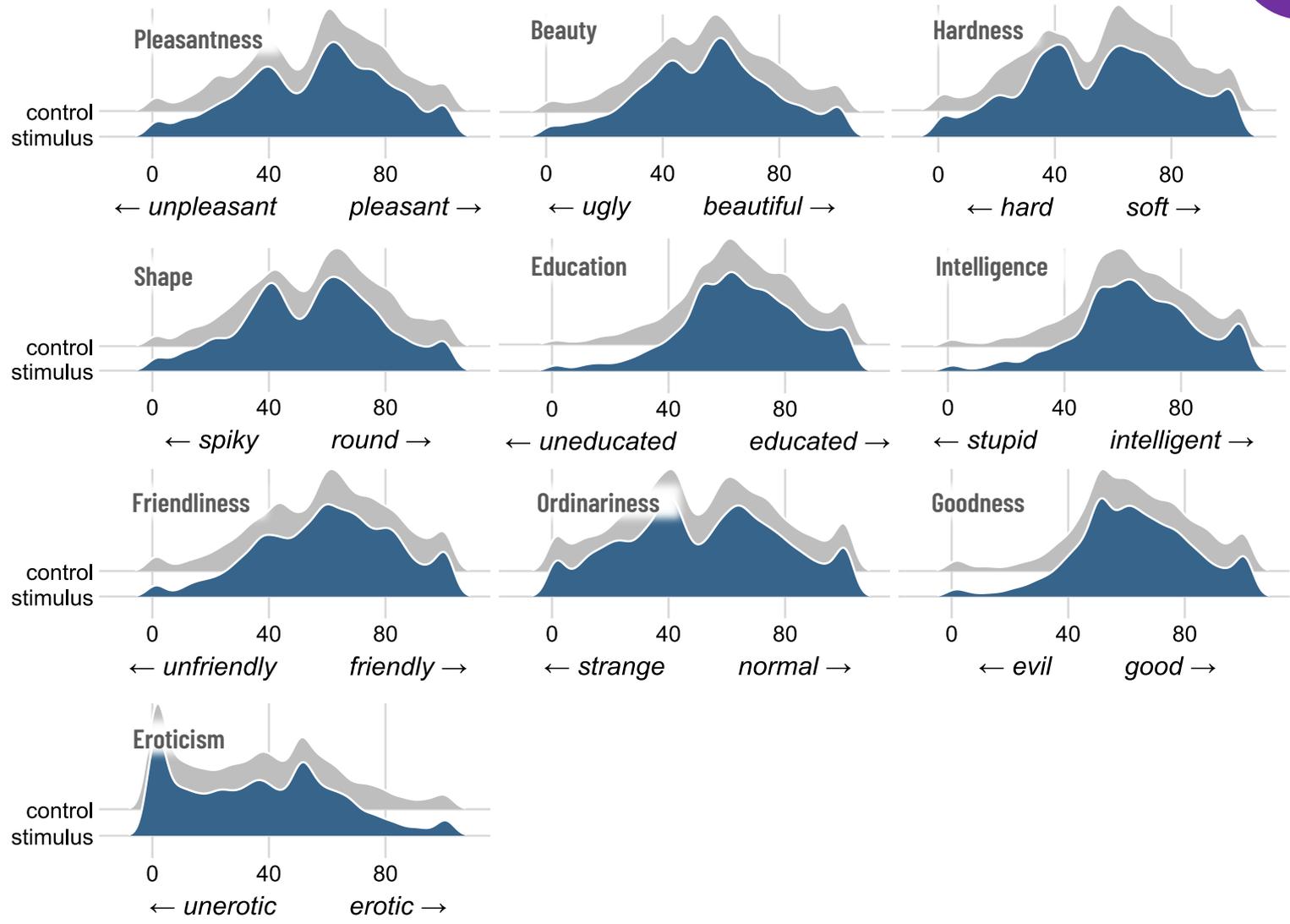
Distribution of ratings by condition for each scale
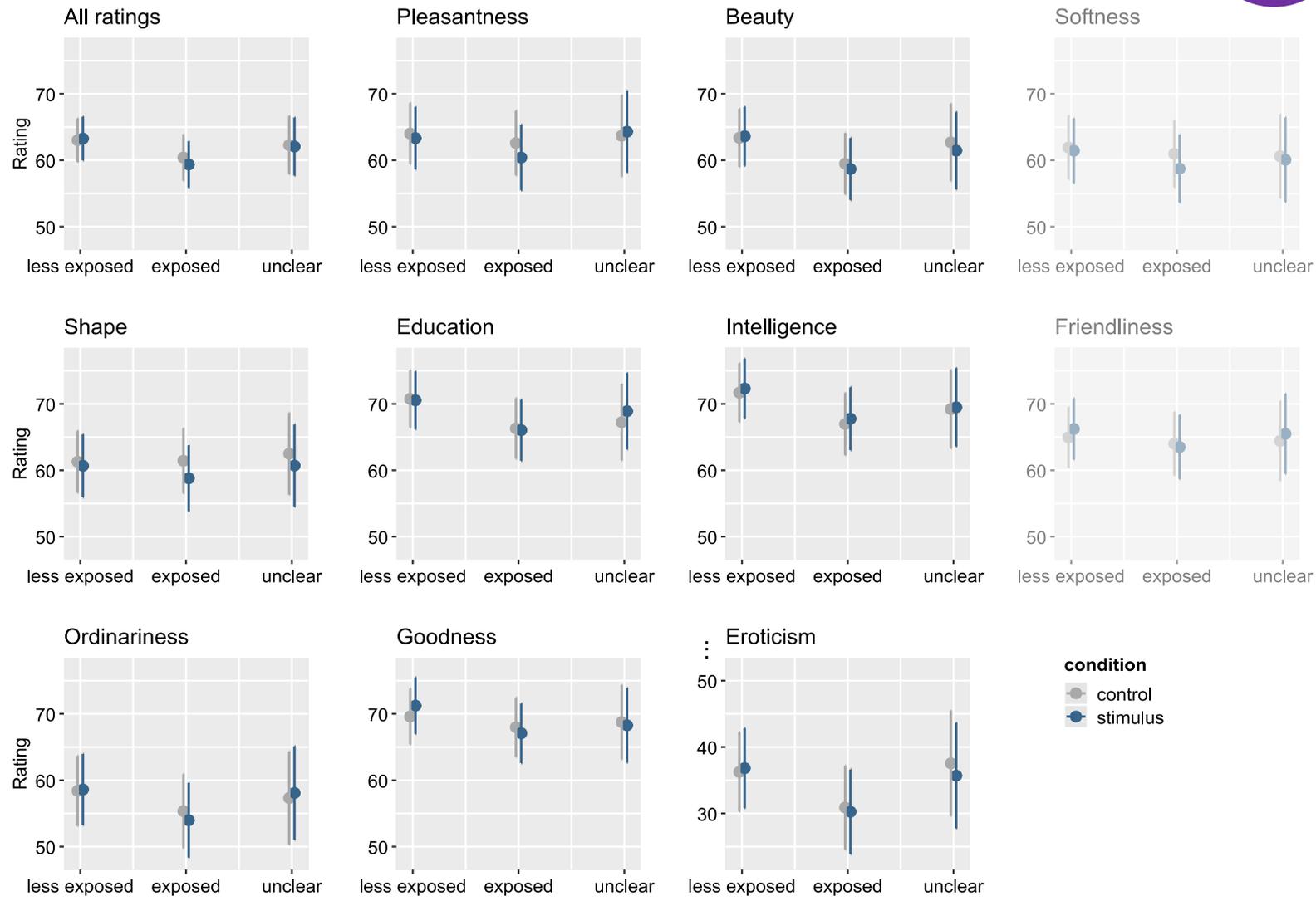
Effects across all rating scales
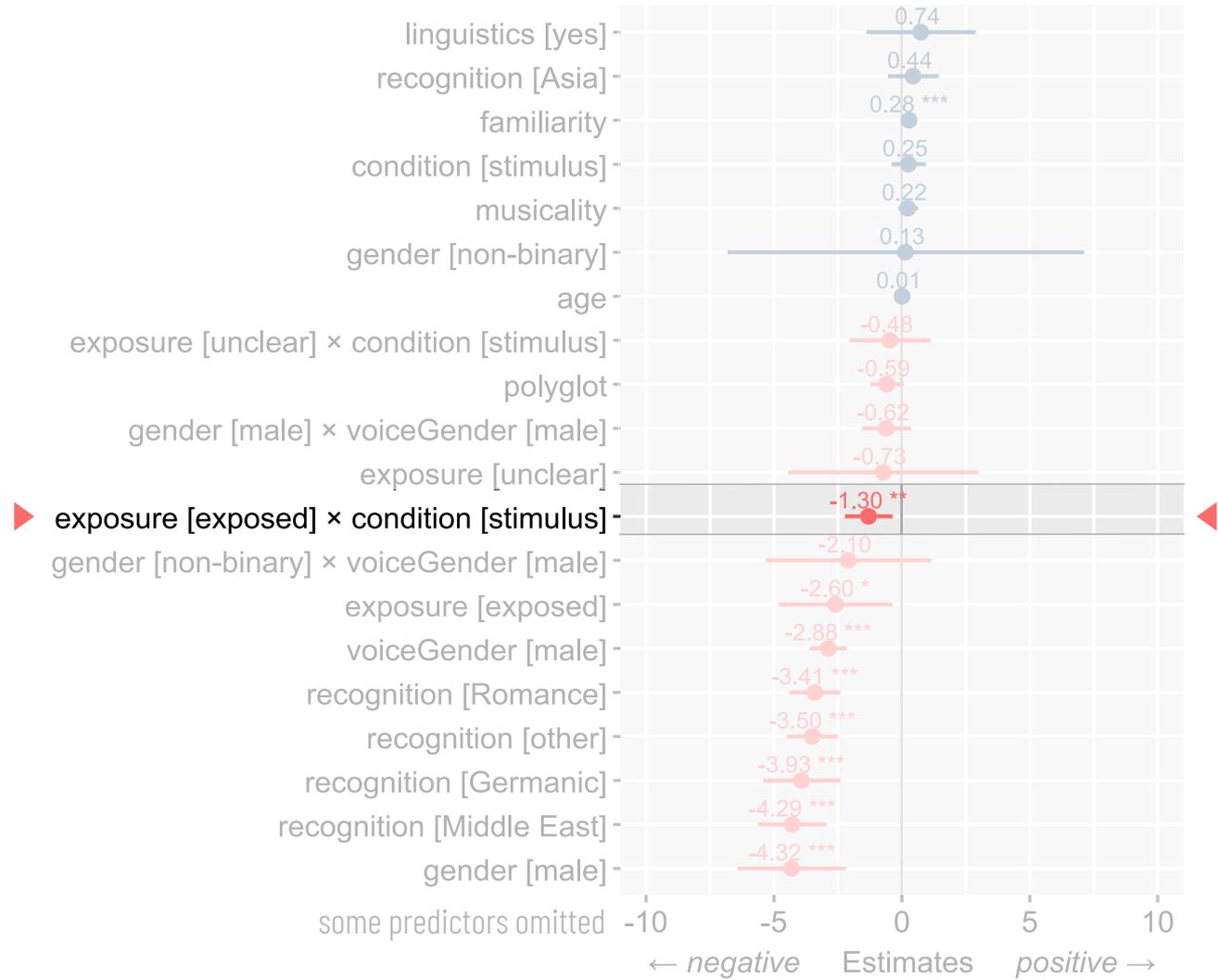
Overview of model with all scales

All ratings by condition and exposure
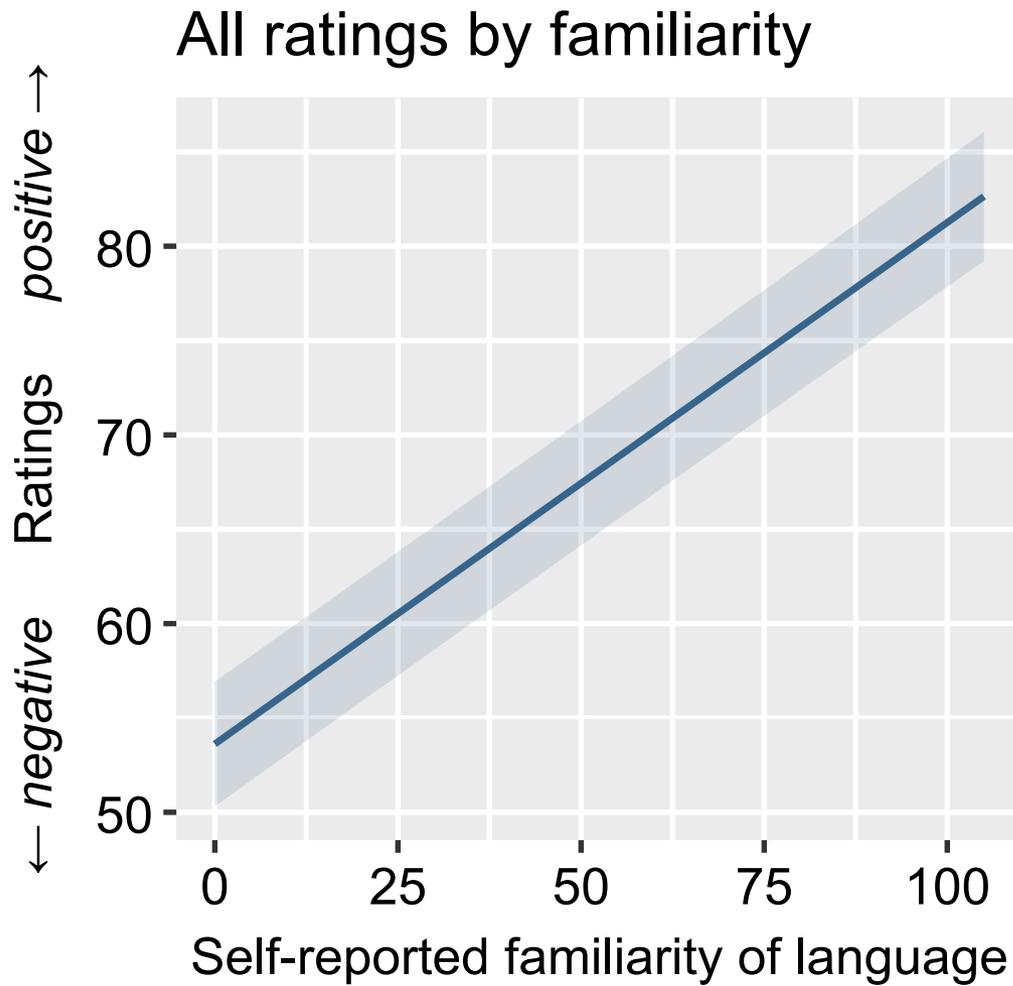
Overview of condition by exposure

Effects across all rating scales

Overview of model with all scales

All ratings by familiarity

Familiarity for model with all scales
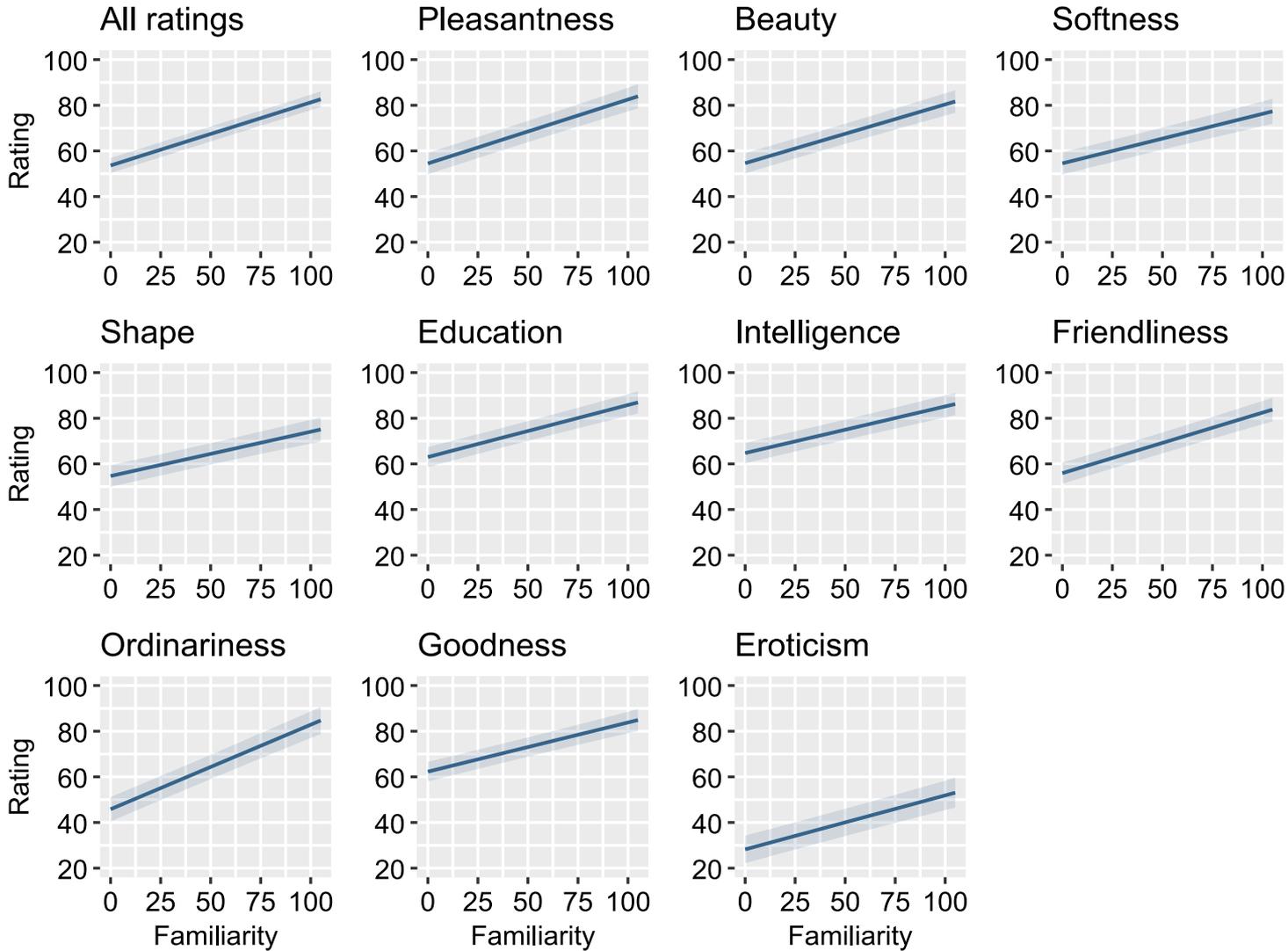
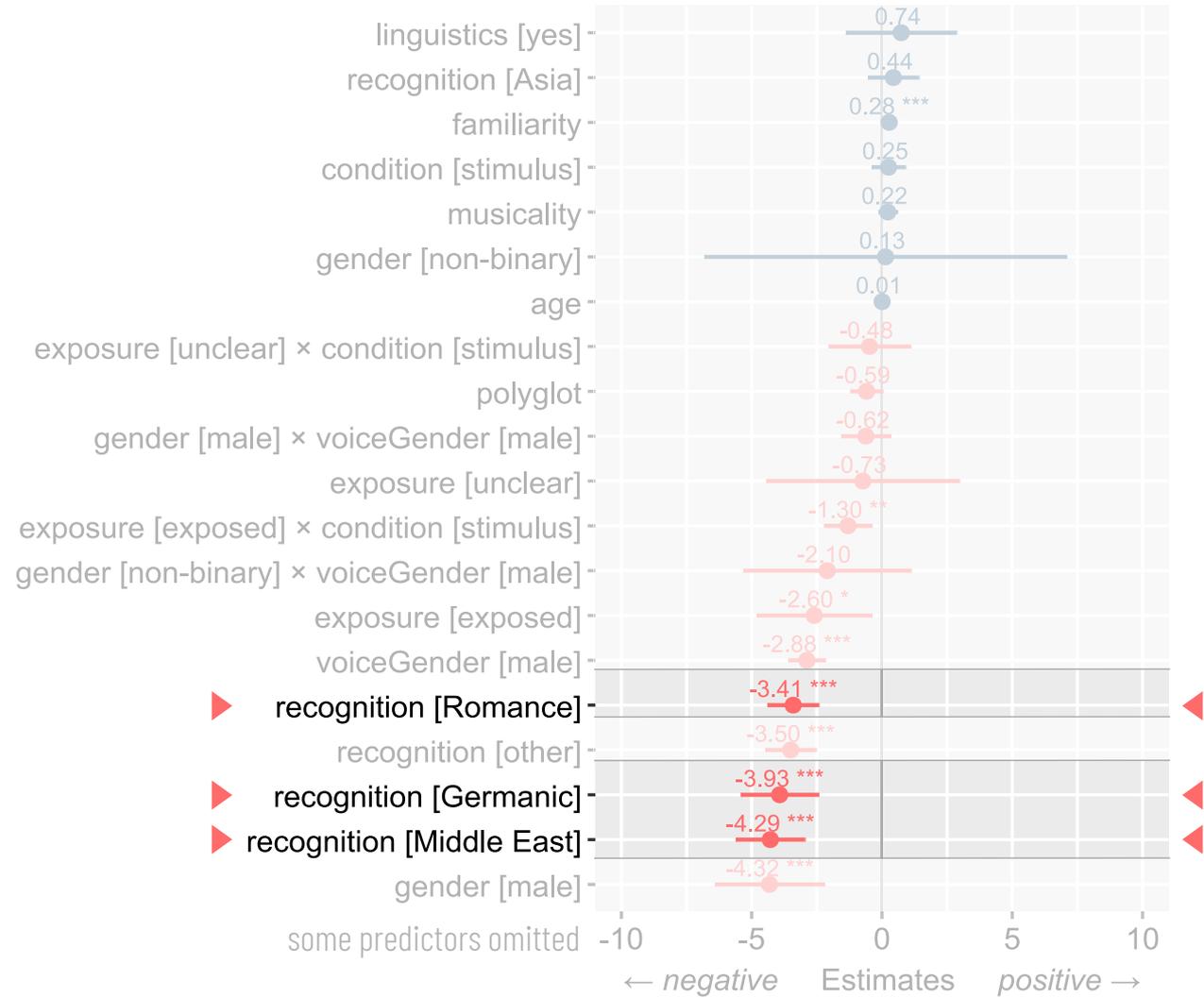**Overview of familiarity**

Effects across all rating scales

Effects across all rating scales

Overview of model with all scales

All ratings by similarity guess
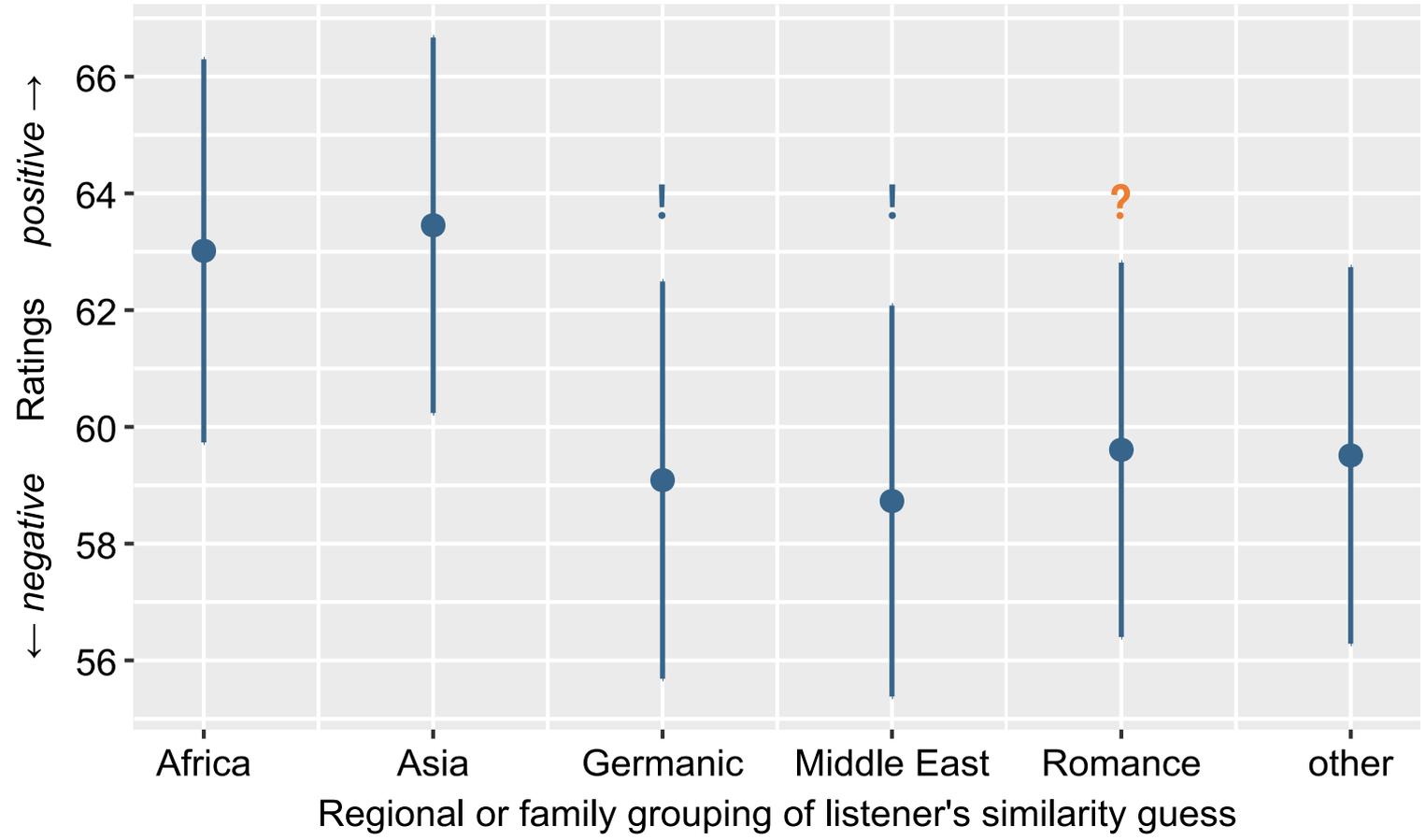
Beauty by similarity guess
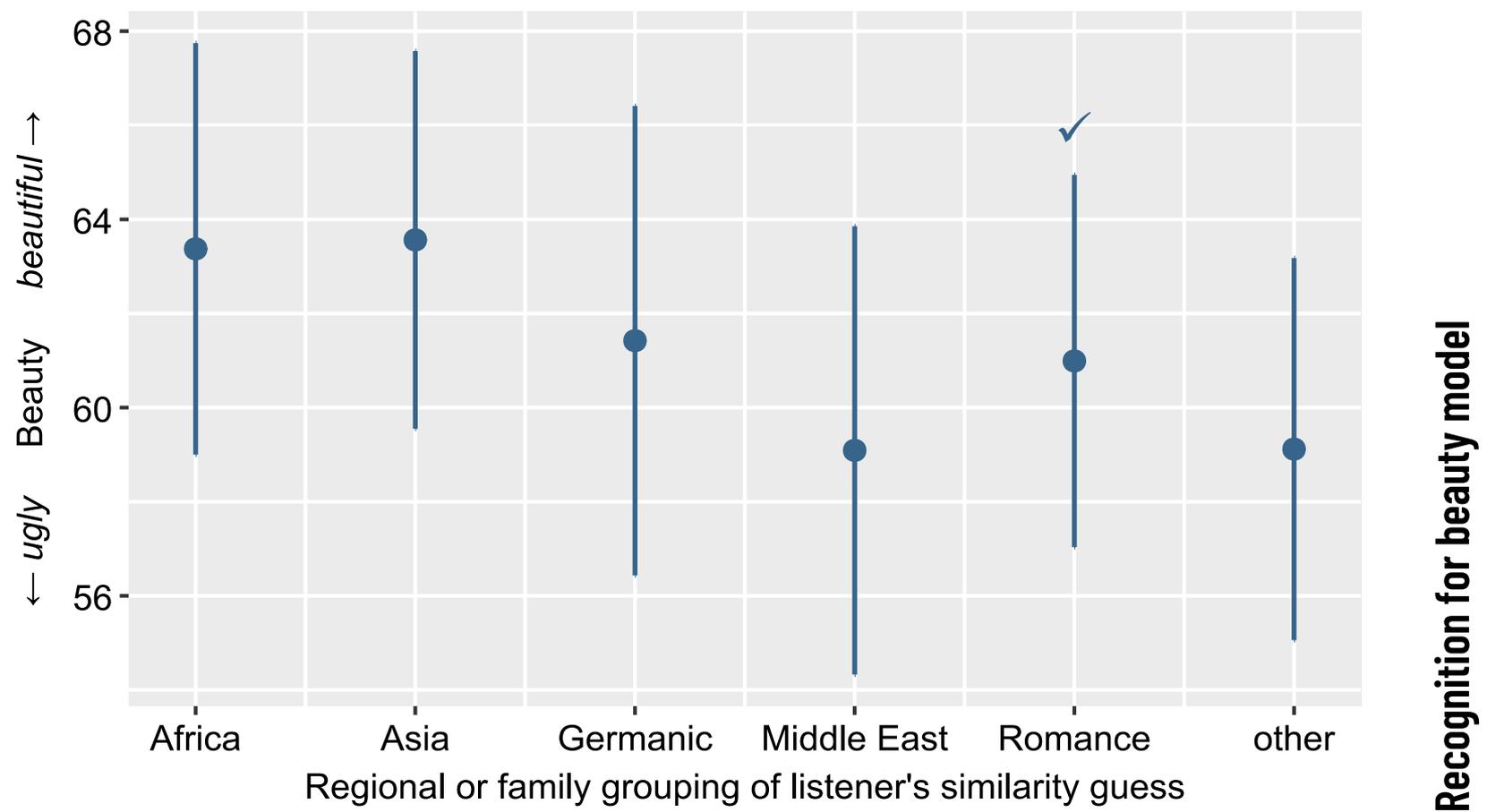
Eroticism by similarity guess

Effects across all rating scales

All ratings by gender
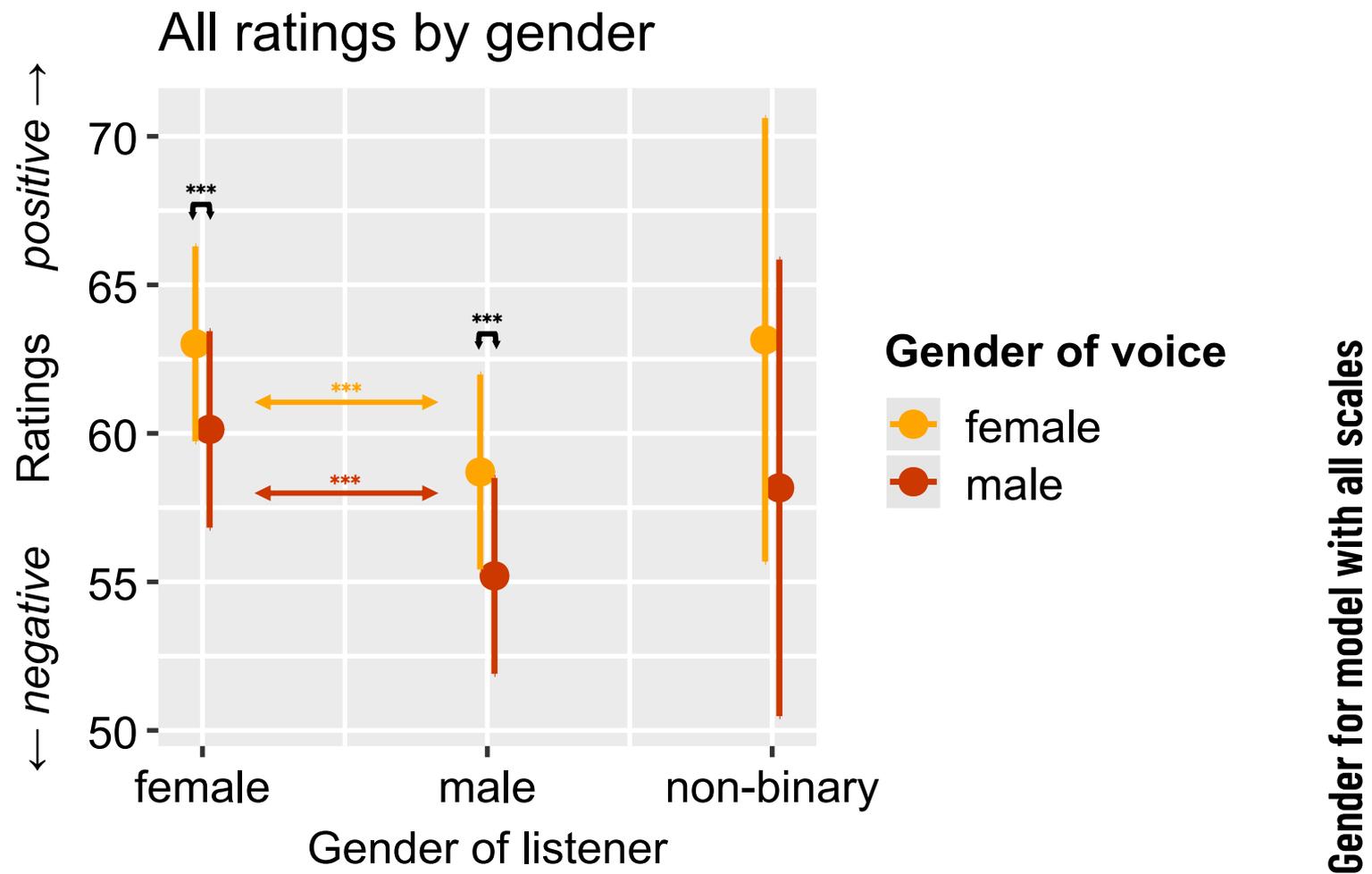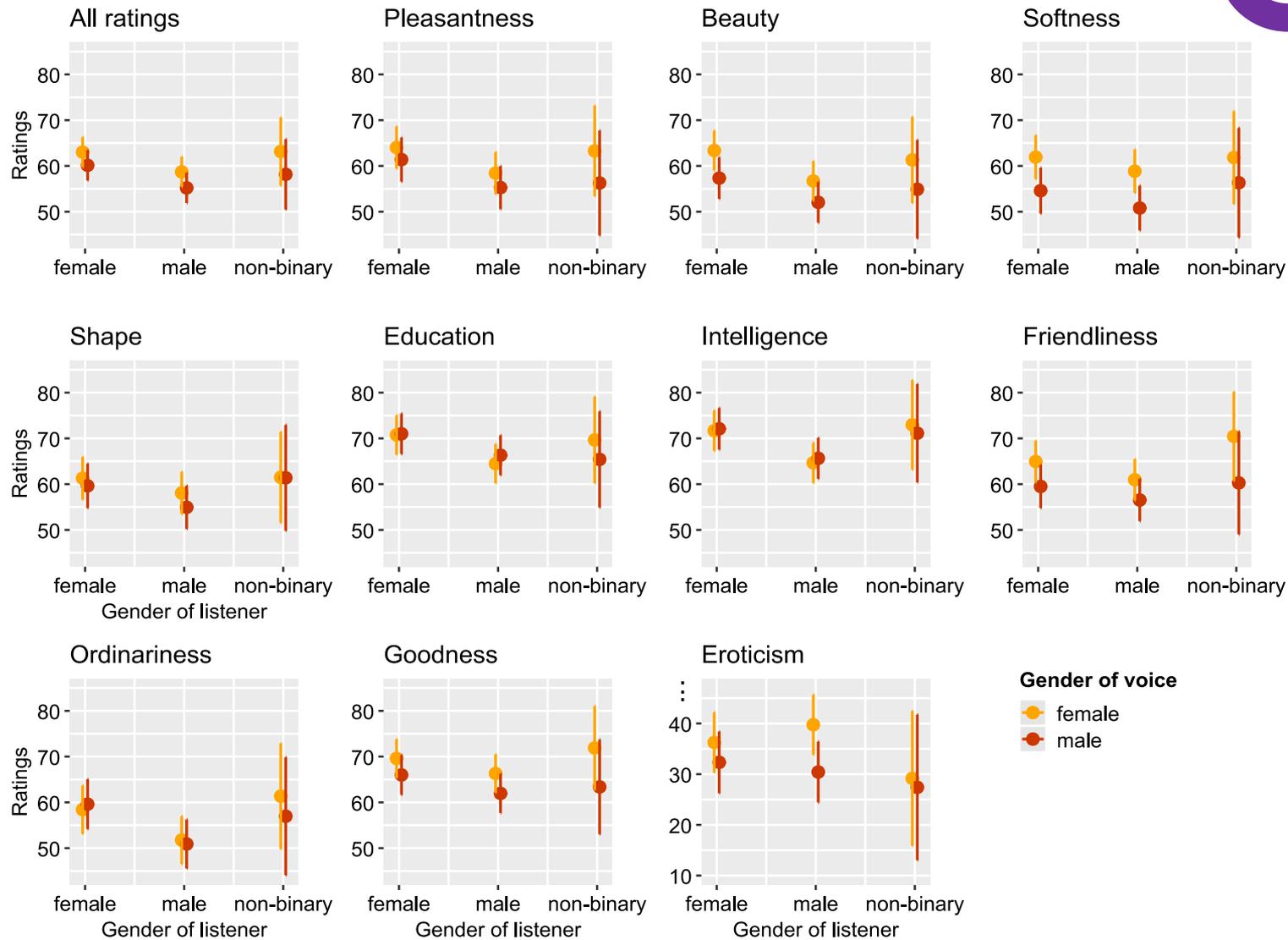
Overview of gender

Importance of variables across scales

Importance of variables across scales
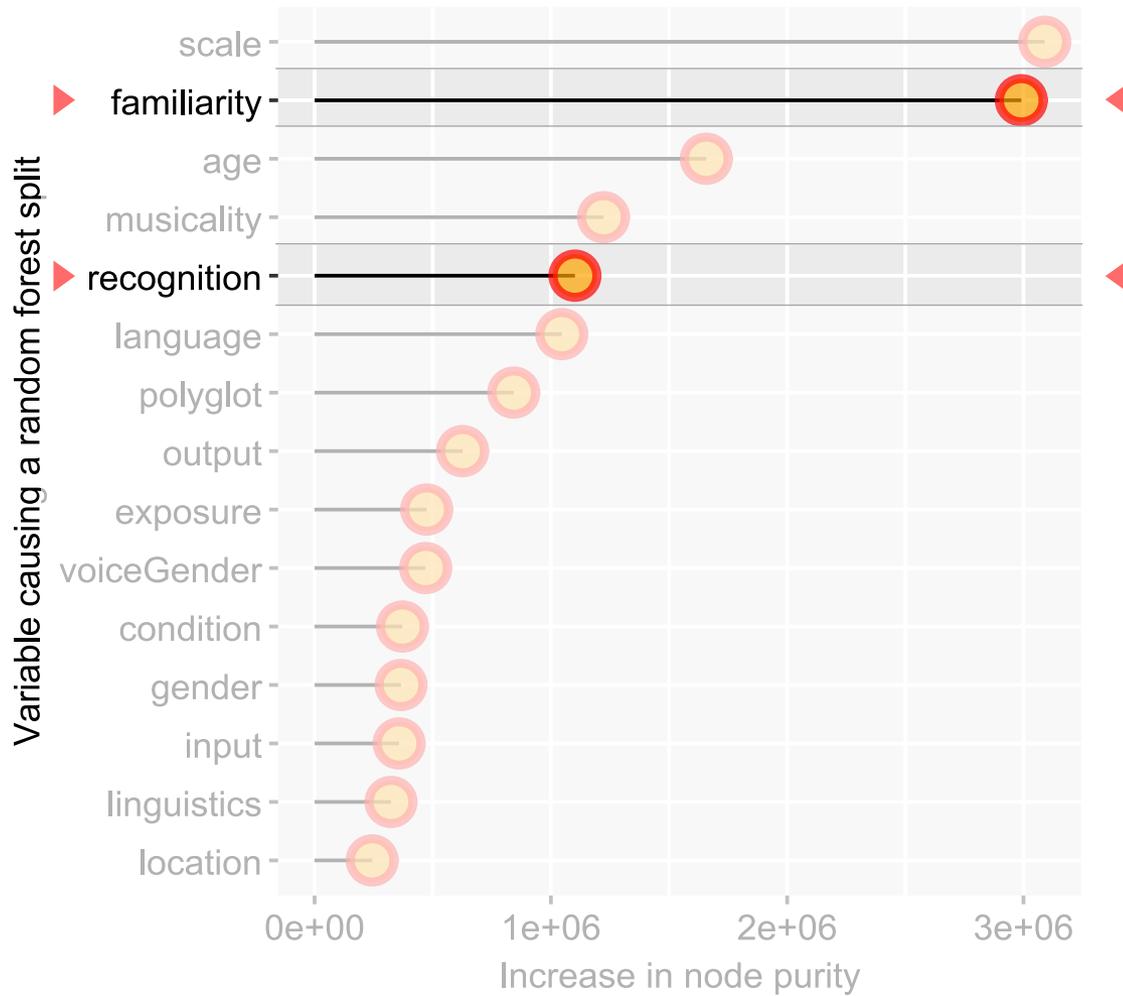
Random forest for model with all scales

Importance of variables for pleasantness
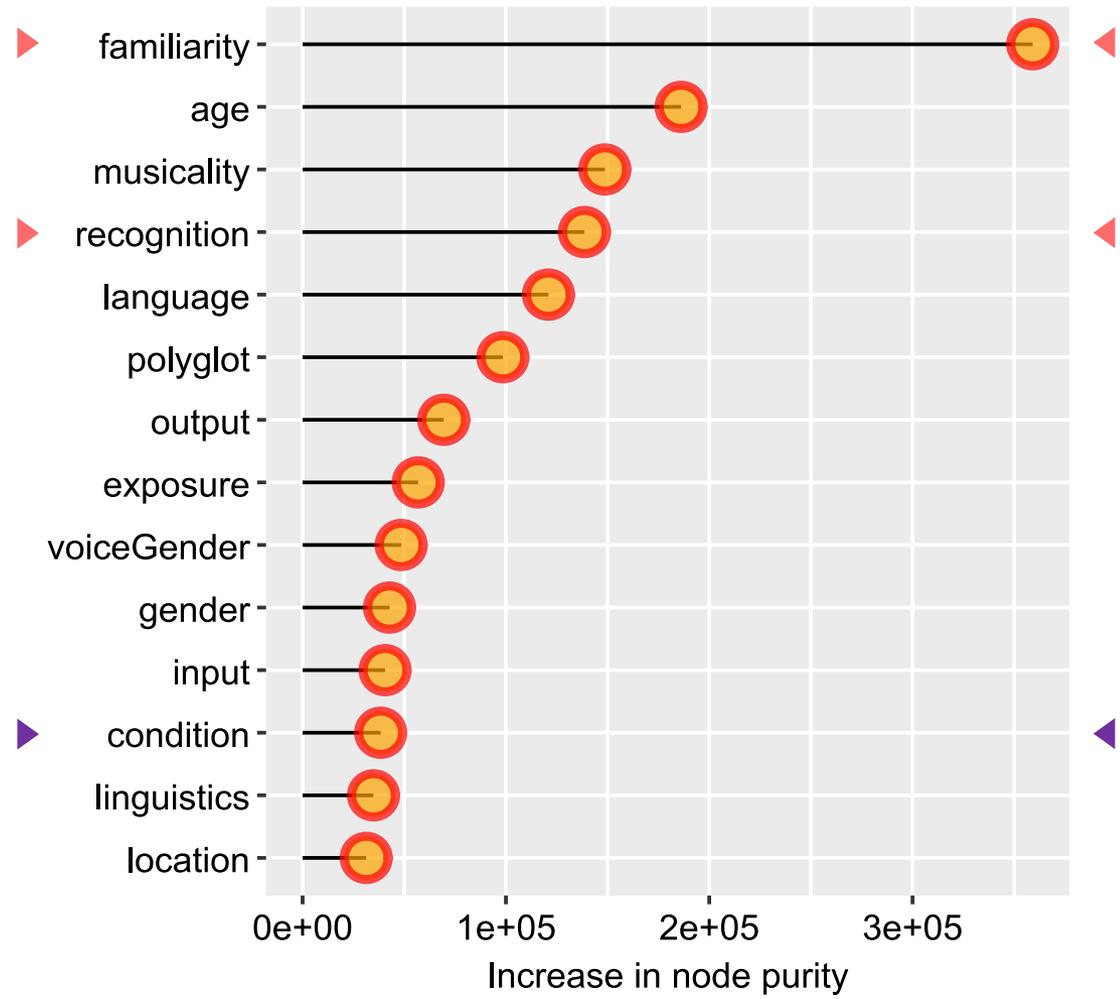
Random forest for pleasantness model

Importance of variables for beauty
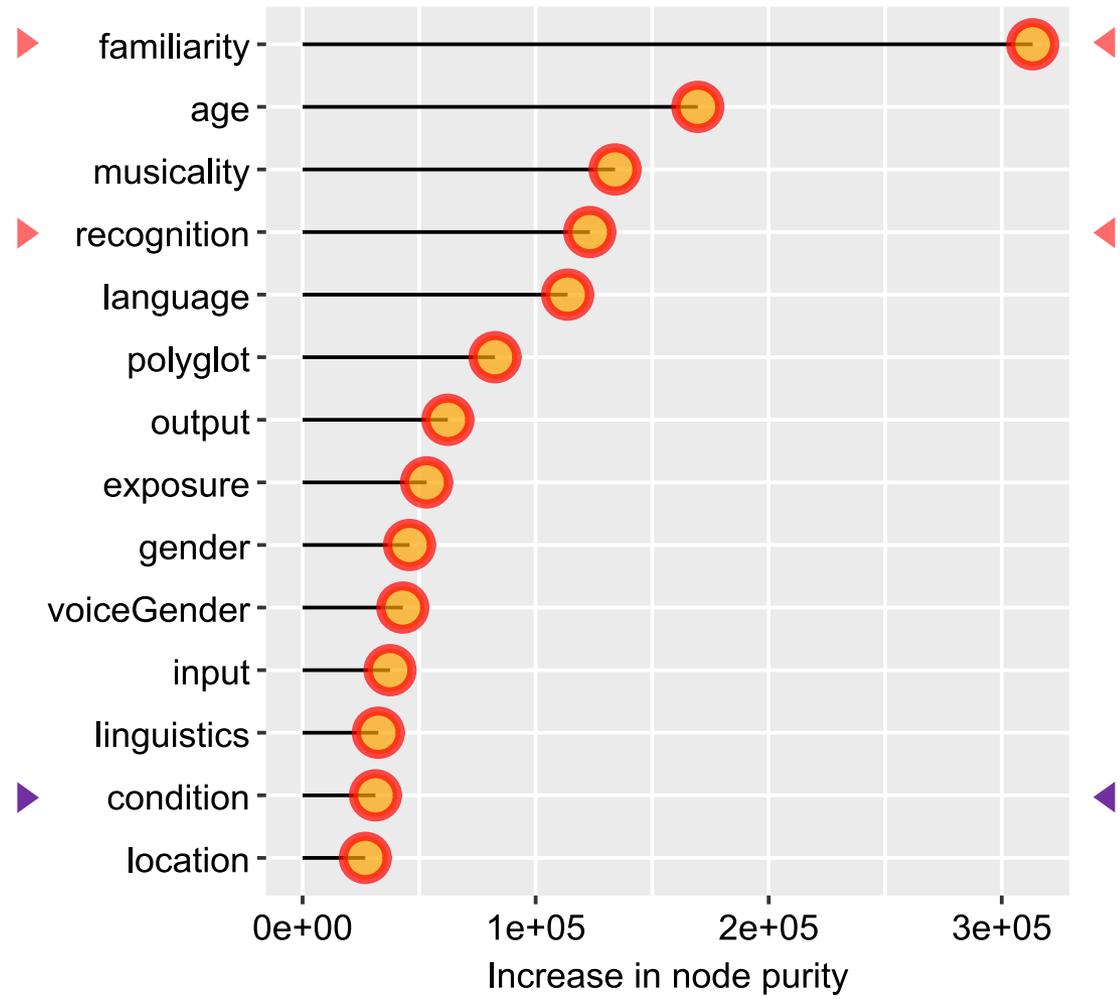
Random forest for beauty model

Importance of variables for softness
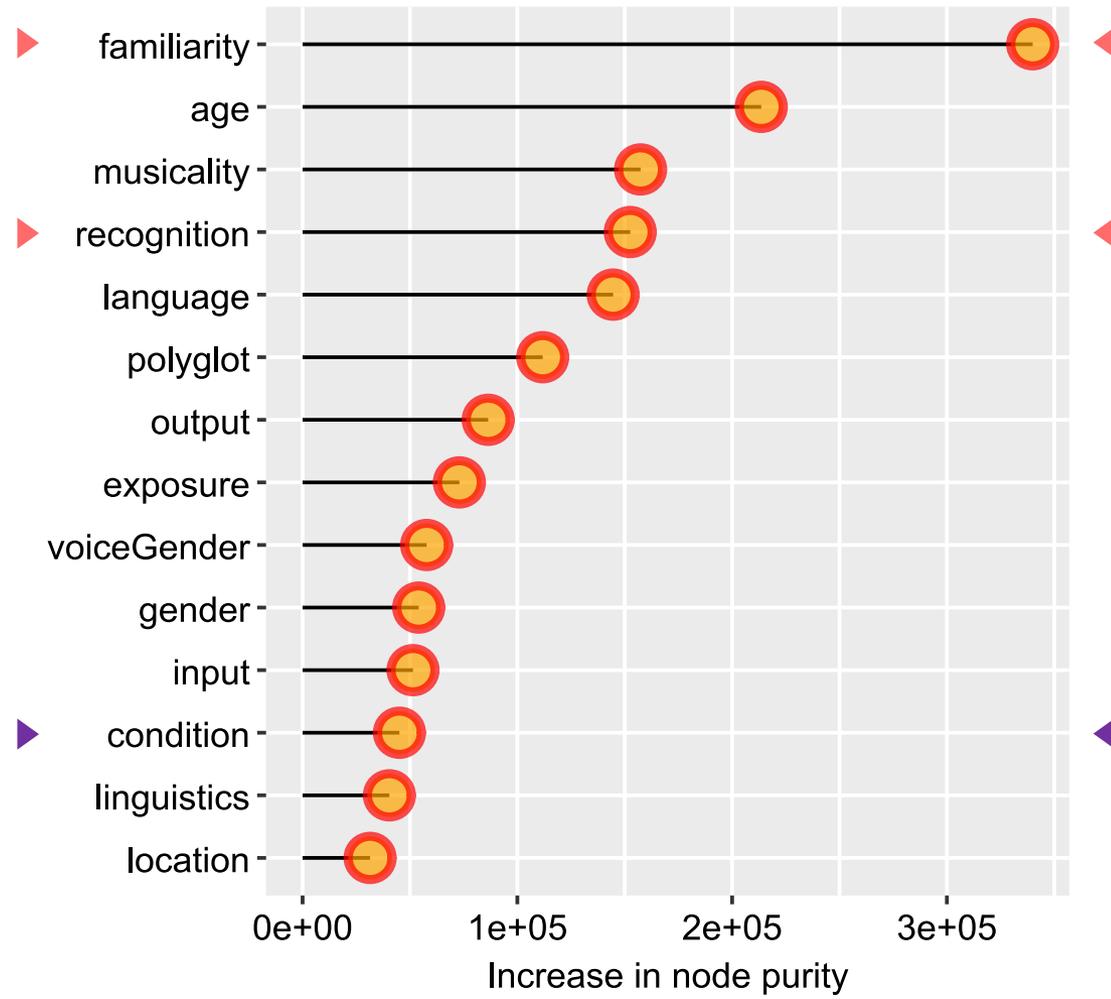
Random forest for softness model

Importance of variables for shape
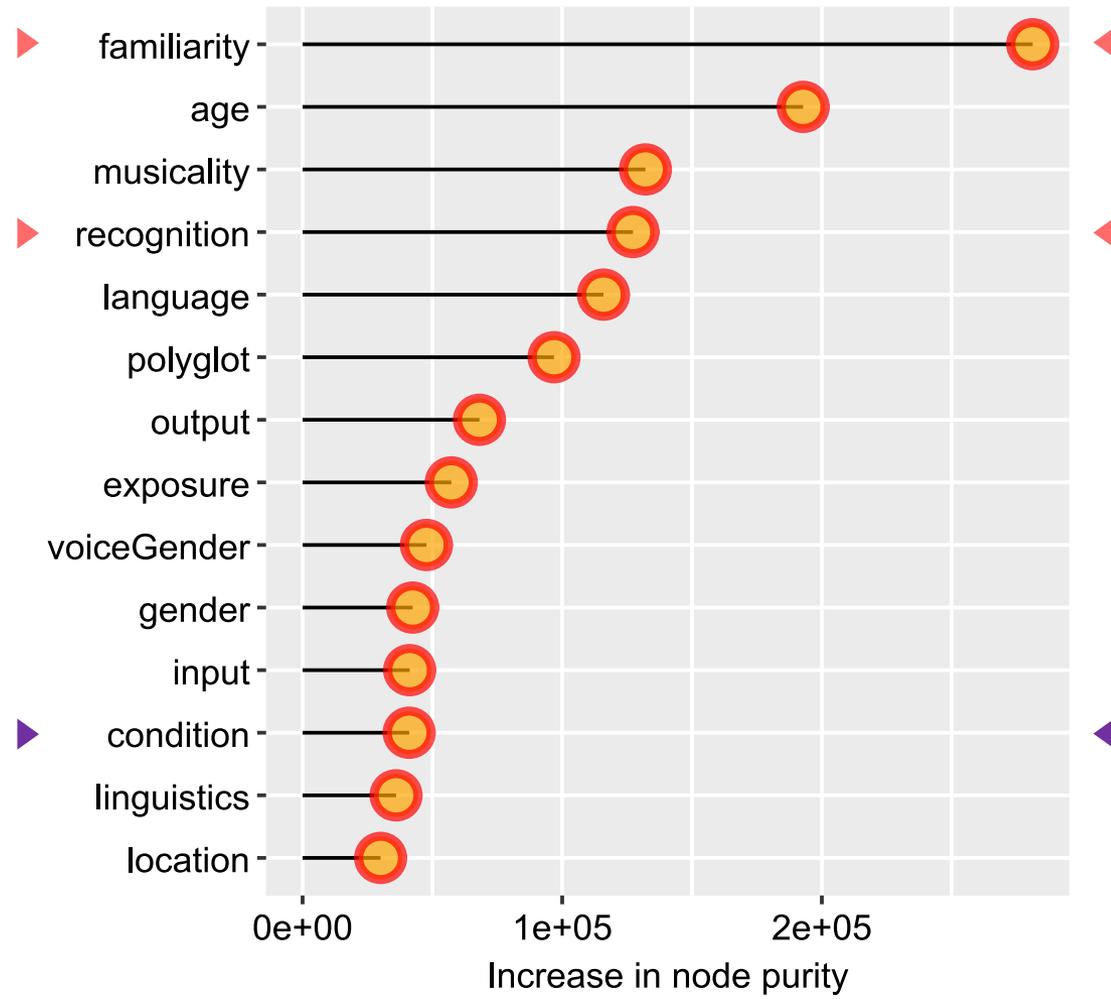
Random forest for shape model

Importance of variables for education
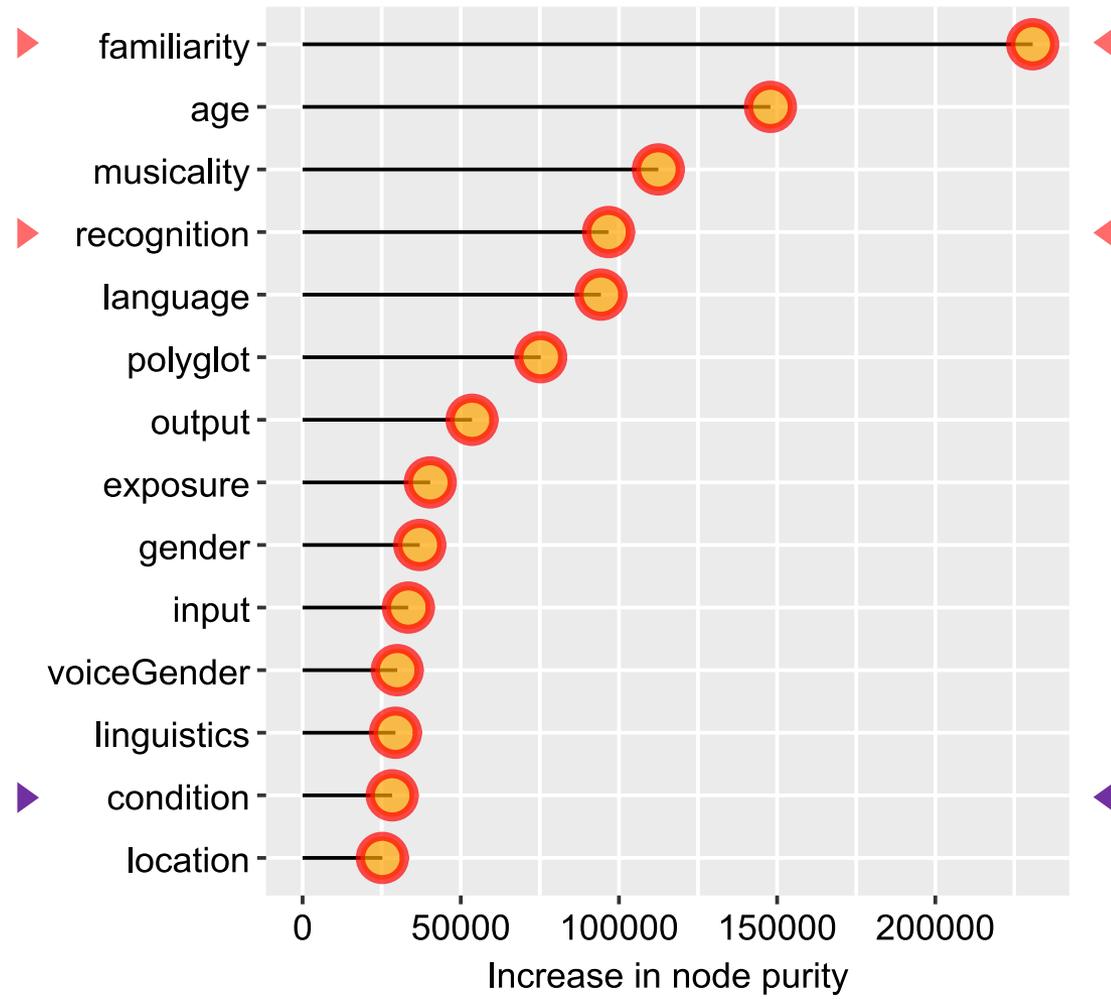
Random forest for education model

Importance of variables for intelligence
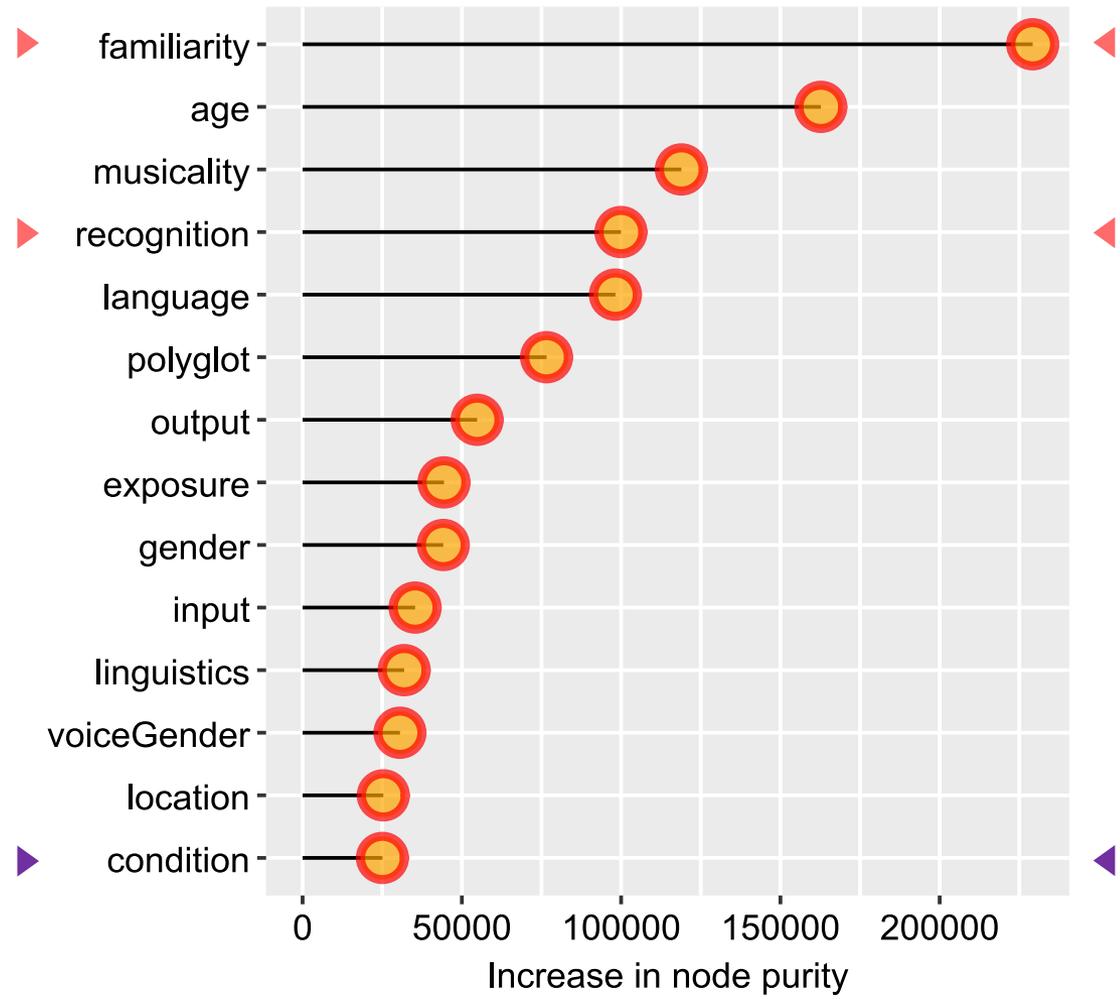
Random forest for intelligence model

Importance of variables for friendliness
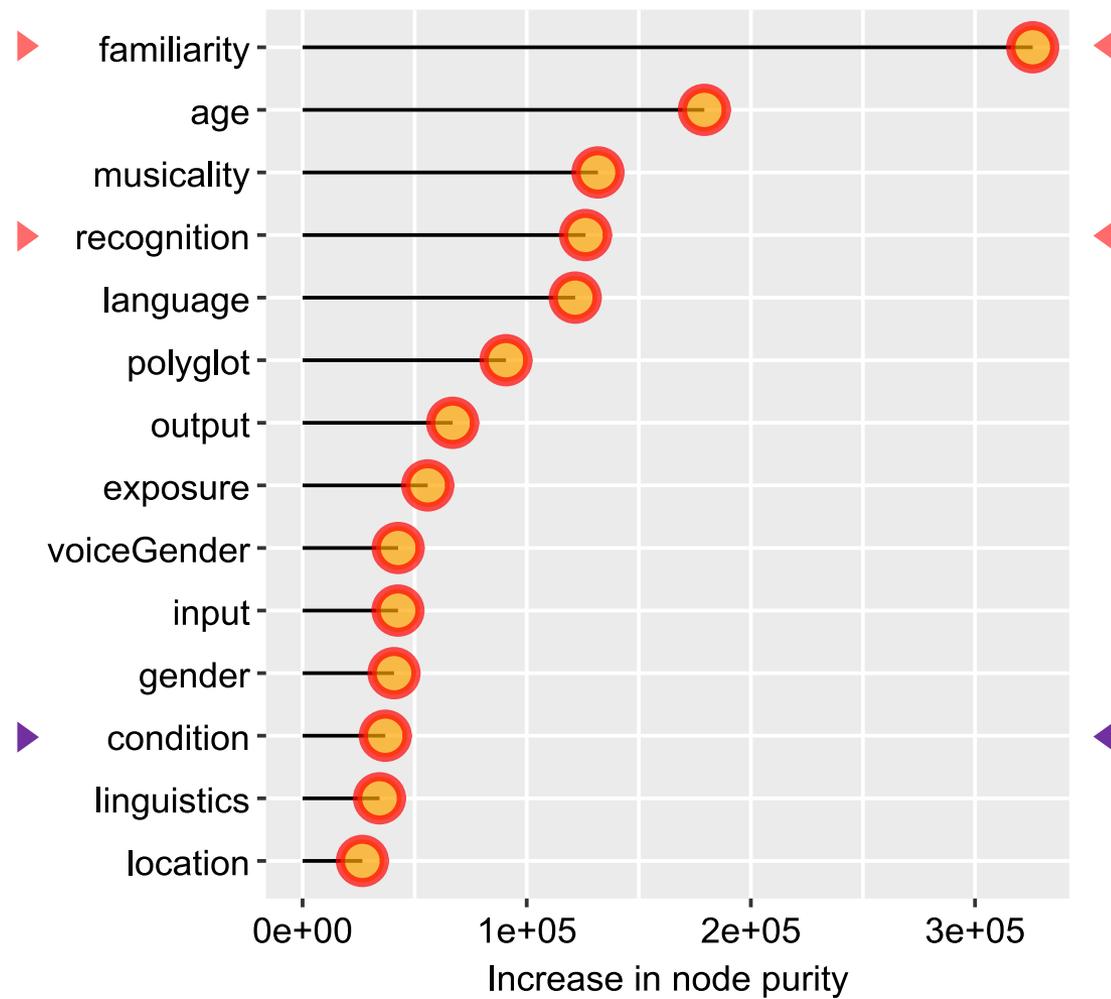
Random forest for friendliness model

Importance of variables for ordinariness
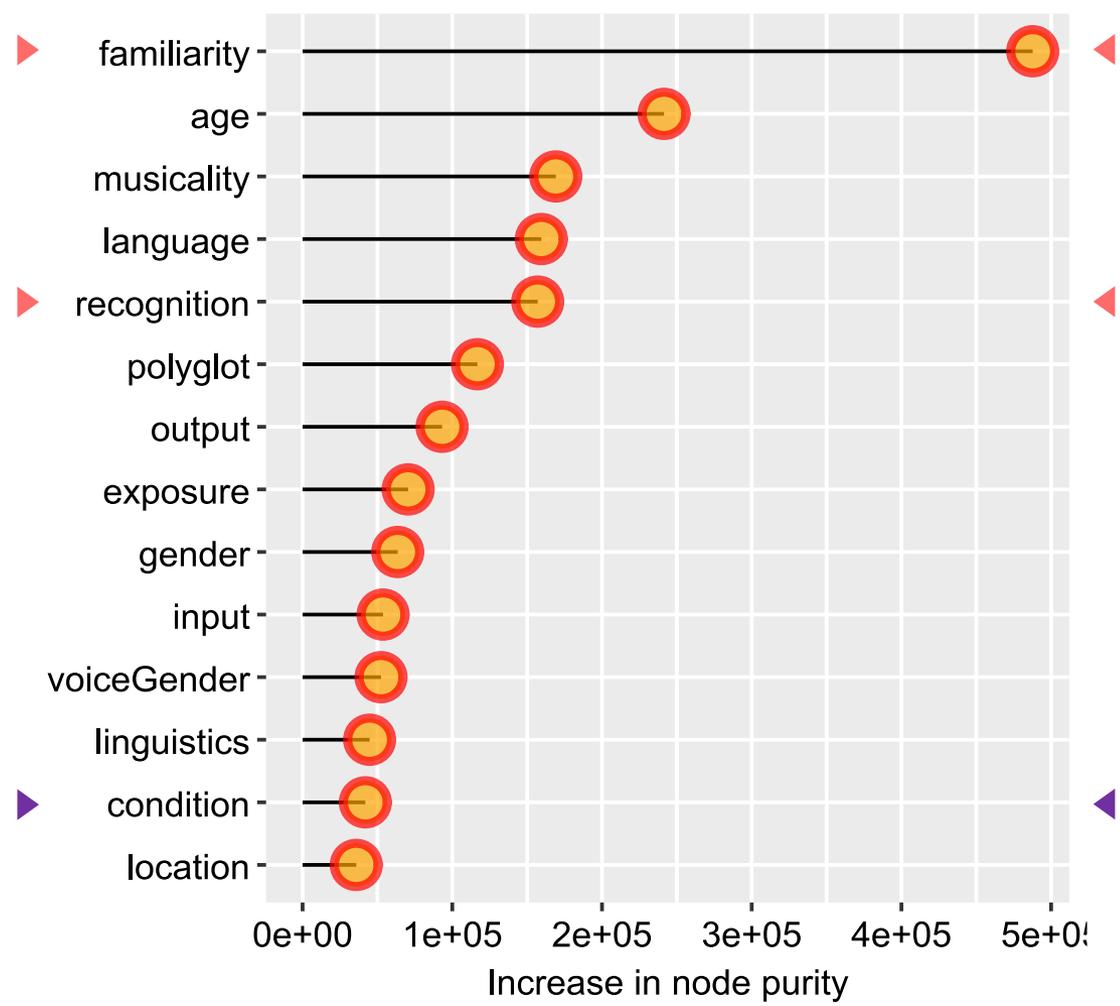
Random forest for ordinariness model

Importance of variables for goodness

Increase in node purity
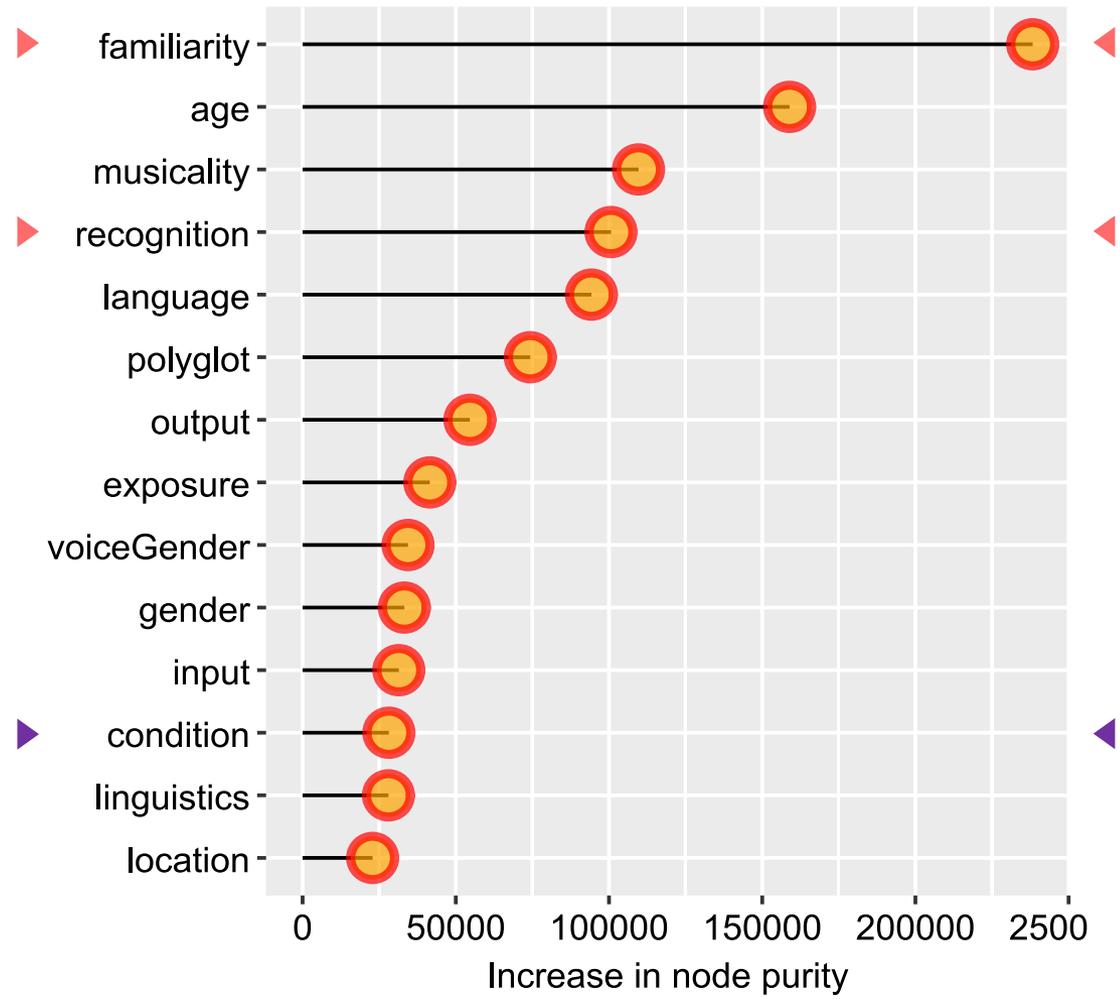
Random forest for goodness model

Importance of variables for eroticism
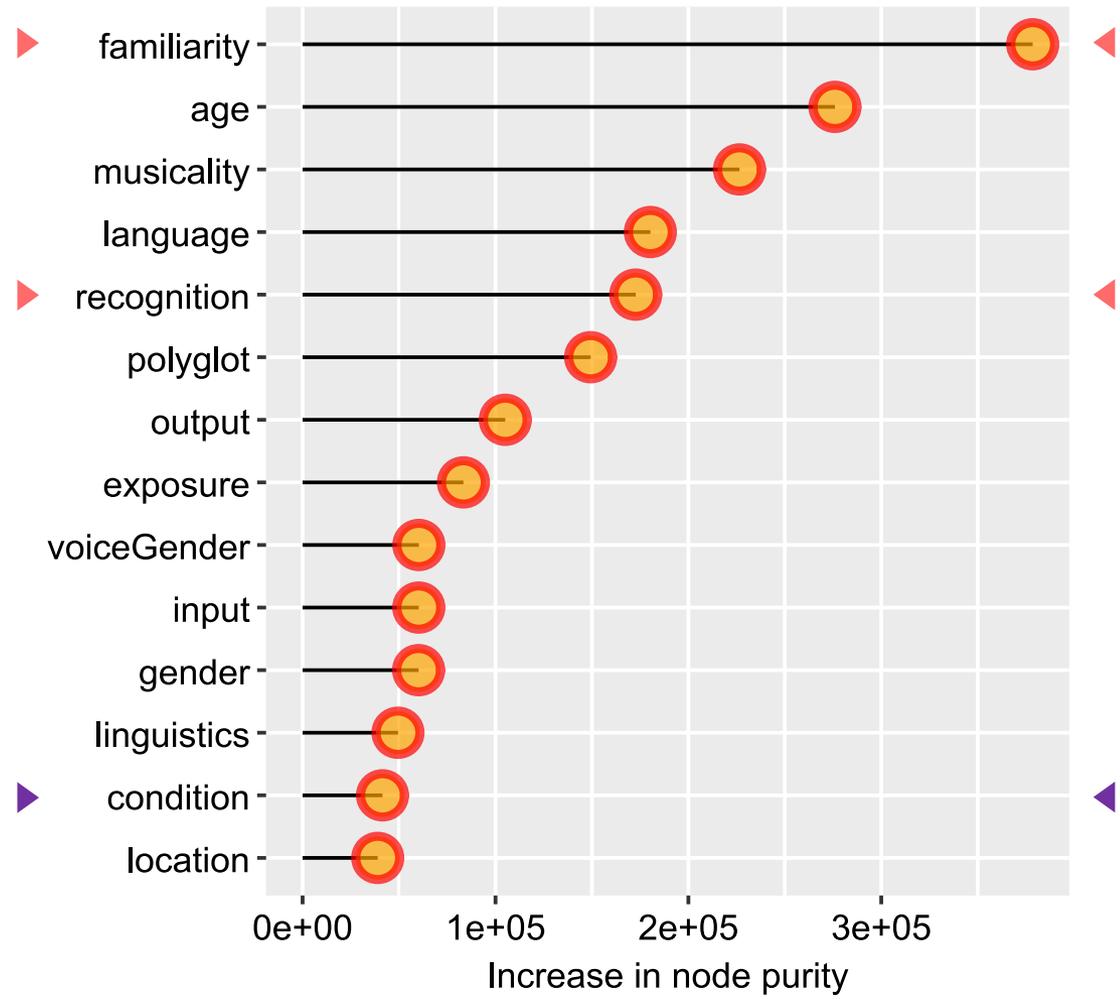
Random forest for eroticism model
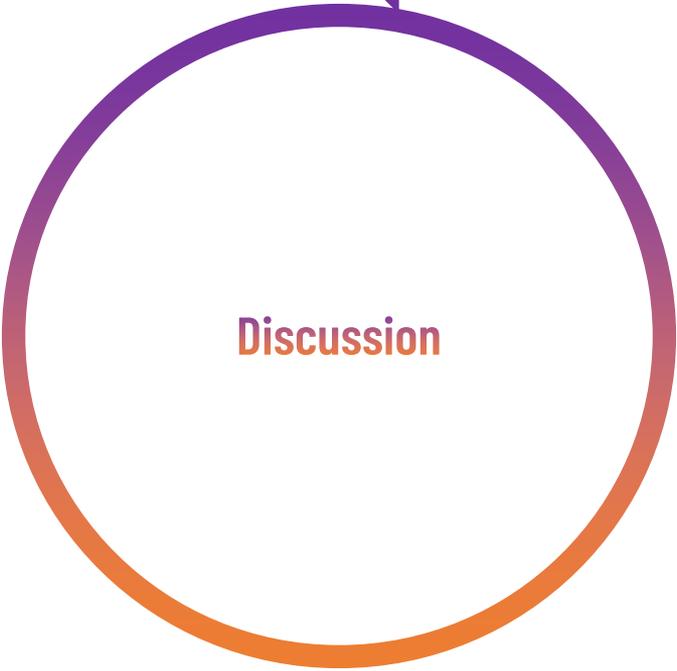
Discussion

Indexicality seems to be stronger than iconicity

‣ Ratings are not, or only weakly, affected by whether /x/ is present.
‣ /x/ is sometimes rated worse if the listener had been more exposed to it.
  ‣ Exposed listeners may be more aware of respective stereotypes.
  ‣ Thus, they rate /x/ worse despite being more used to it.

‣ The strongest predictors are sociocultural in nature.
‣ Listeners rate languages worse on almost all scales if:
  ‣ they are male.
  ‣ they perceive the language as being less familiar.
  ‣ they *felt* it resembled a language from a specific region or family.

Indexicality seems to be stronger than iconicity
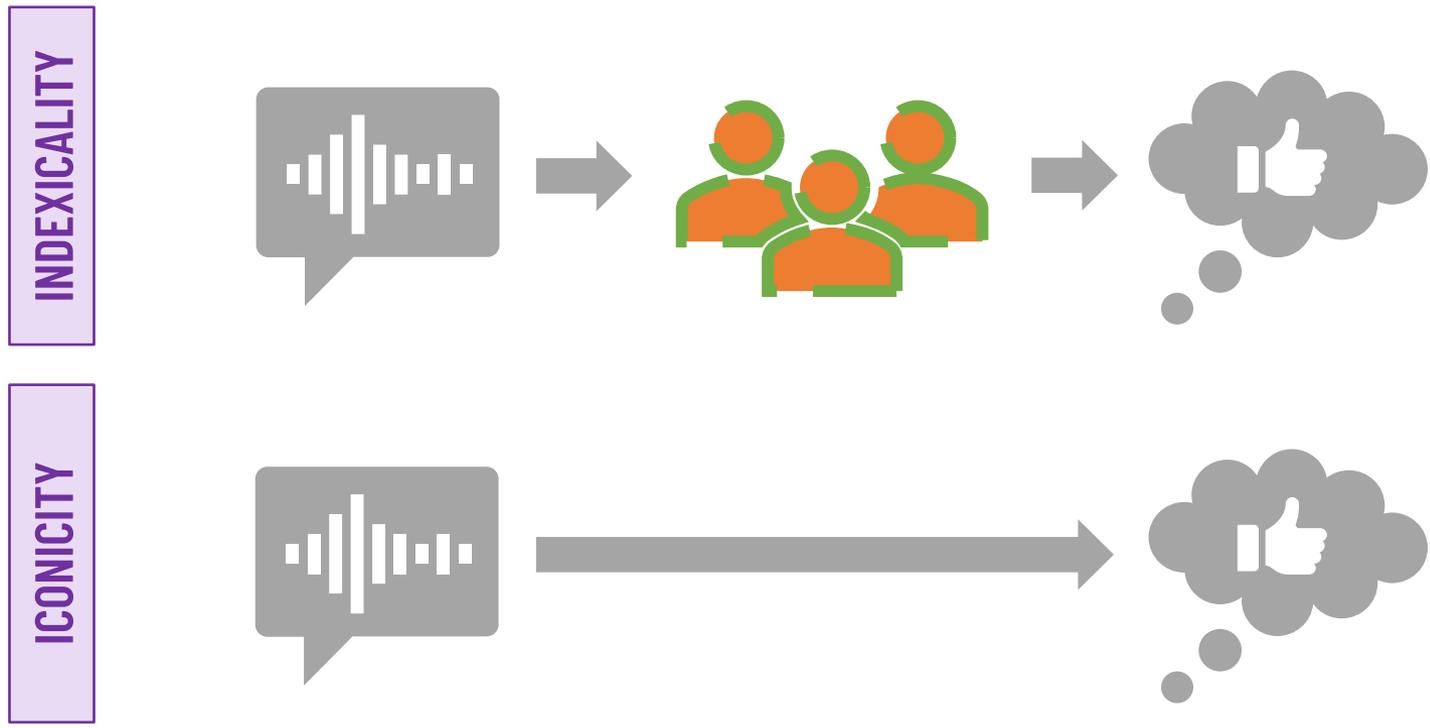
Peirce 1958; Silverstein 2003; Giles and Niedzielski 1998
Kawahara et al. 2021; Winter et al. 2022

Indexicality seems to be stronger than iconicity

Iconicity can be overridden by indexicality.
‣   **e.g., dominance in frequency code vs. creaky voice**

<div align="right">Ohala 2010;
Winter et al. 2021;
Fuchs & Ćwiek 2022</div>

What we label "iconicity" is not necessarily non-arbitrary
‣   **e.g., onomatopoeia is also partly conventionalized**

<div align="right">Kwon 2016; Anderson 1998;
Occhino et al. 2017;
Barker & Bozic 2024;
Nielsen & Dingemanse 2021;
Körtvélyessy & Štekauer 2024</div>

Listeners evaluate the same linguistic features differently
‣   **e.g., due to categorization and 'social pluripotentiality'**

<div align="right">Dragojevic & Goatley-Soan 2022
McLean & Motamedi 2022
Winter et al. 2019</div>

Indexicality seems to be stronger than iconicity

INDEXICALITY

‣ imposed norm hypothesis, social connotations hypothesis

differences in power	differences in prestige
cultural stereotypes	social conditioning

ICONICITY

‣ inherent value hypothesis, sound-driven hypothesis, lámatyávë

co-occurrence	evolved associations	shared properties
patterns	context	embodiment and imitation

Both can conspire to ontogenetically and phylogenetically bootstrap language

Giles et al. 1979; 1974;
Giles and Niedzielski 1998;
Podhorodecka 2007; Baker & Bozic 2024;
but see Li & Roberts 2023; Rácz et al. 2020
Berthele 2010; Madden 2014; Reiterer et al. 2020

Can indexicality lead to iconicity?

e.g., iconization, indexical iconicity

e.g., systematicity
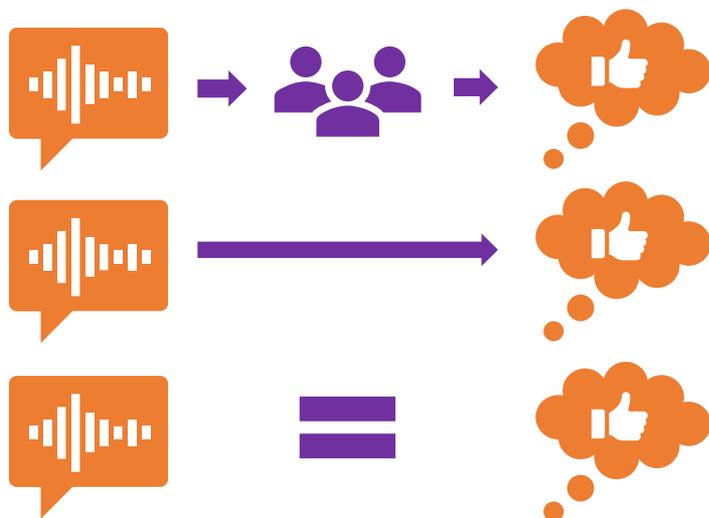
Irvine & Gal 2000, Silverstein 2003

glass
glint
glassy
glitter glossy glisten
glade glimmer
glow gloss
gloom glare
gloaming gleam
glance

cf., e.g., Haslett & Cai 2023
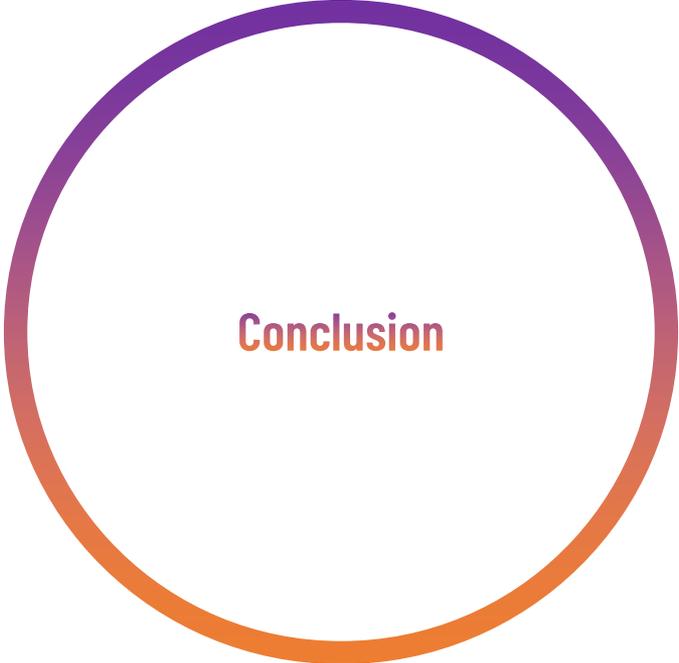
Conclusion

The takeaway

/x/ is not as bad as people think it is!
... unless social meaning *makes* it sound bad.

THANK YOU

‣ Abercombie, David. 2013. *The North Wind and the Sun*, 1951–1978. University of Edinburgh. School of Philosophy, Psychology, and Language Sciences. Department of Linguistics and English Language. https://doi.org/10.7488/ds/157.

‣ Anderson, Earl R. 1998. *A grammar of iconism*. Madison, Teaneck: Fairleigh Dickinson University Press.

‣ Anikin, Andrey, Nikolay Aseyev & Niklas Erben Johansson. 2023. Do some languages sound more beautiful than others? *Proceedings of the National Academy of Sciences of the United States of America* 120.17: e2218367120. https://doi.org/10.1073/pnas.2218367120.

‣ Barker, Harry & Mirjana Bozic. 2024. The forms, mechanisms, and roles of iconicity: A review. *Advance Preprints*. https://doi.org/10.31124/advance.171233725.51126728/v1.

‣ Barthes, Roland. 1972. Mythologies. New York: Hill and Wang.

‣ Baugh, John. 2003. Linguistic profiling. In Sinfree Makoni, Geneva Smitherman, Arnetha Ball & Arthur K. Spears (eds.), *Black linguistics: Language, society and politics in Africa and the Americas*, 155–168. London: Routledge.

‣ Bayard, Donn, Ann Weatherall, Cynthia Gallois & Jeffery Pittam. 2001. Pax Americana? Accent attitudinal evaluations in New Zealand, Australia and America. *Journal of Sociolinguistics* 5.1: 22–49. https://doi.org/10.1111/1467-9481.00136.

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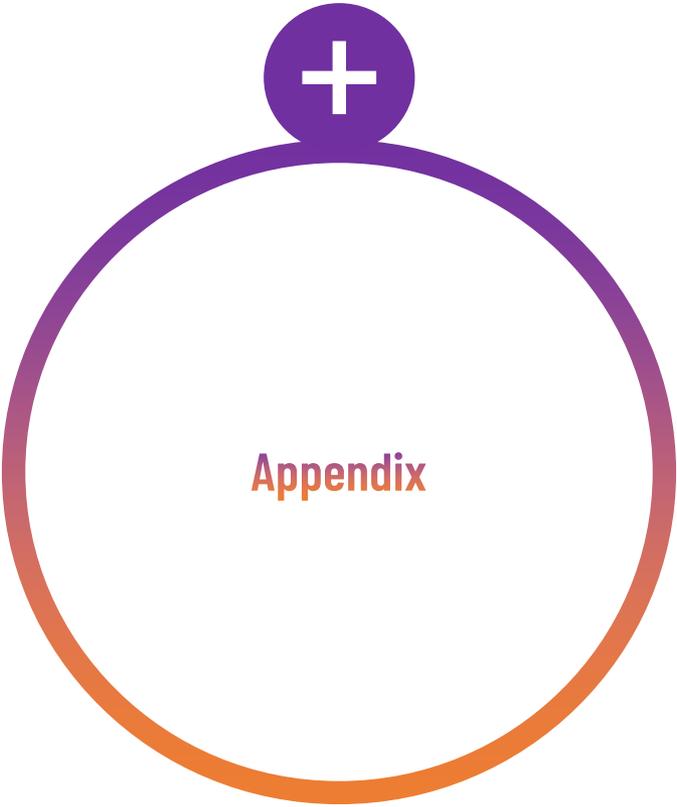
Appendix

Some consequences:

‣ **linguistic profiling**

‣ **housing discrimination**

‣ **disadvantages in the judicial system**

‣ **effects on rating of pupils by teachers**

‣ **social disadvantages and harassment**

‣ **employment and workplace marginalization**

‣ **discrimination in adoption procedures**

‣ **effects on credibility and cooperation of speakers**

‣ **linguistic self-hatred**

‣ **reinforcement in literature and the media**

‣ **language attitudes affect language change and loss**

‣ **LLMs reproduce attitudes**

Fasoli & Maass 2020, Wright & McGowan 2018, Rickford & King 2016, Lippi-Green 2012, Kristiansen 2011, Lev-Ari and Keysar 2010, Munson 2007, Baugh 2003, Dixon et al. 2002, Purnell et al. 1999, Sachdev et al. 1998, Chambers 1995, Cargile et al. 1994, Kristiansen and Giles 1992, Giles et al. 1981, Kalin et al. 1980, Williams 1973, Stein 2023; Hofmann et al. 2024

Evidence for each group of explanations

INDEXICALITY

listeners associate sounds with groups of people and corresponding perceived regions, race, ethnicity, gender, sexual orientation, socioeconomic status, character traits, ...

ICONICITY

e.g., Lambert et al. 1960, Preston 2017, Baugh 2003, Giles & Powesland 1975, Stewart et al. 1985, Thomas & Reaser 2004, Munson 2007, ...

Evidence for each group of explanations

INDEXICALITY

listeners associate sounds with groups of people and corresponding perceived regions, race, ethnicity, gender, sexual orientation, socioeconomic status, character traits, …

ICONICITY

listeners associate sounds with meanings like *maluma*, *bouba* 'round, positive', *takete*, *kiki* 'spiky, negative', /p, b/ 'full', /i/ 'small', /a/ 'large', /g/ 'hard', /s, ʃ/ 'flying', /b, d, g, z/ 'negative, dark', /p/ 'fairy, cute', /w, j, r, …/ 'not sweary', /r/ 'rough', …

e.g., Lambert et al. 1960, Preston 2017, Baugh 2003, Giles & Powesland 1975, Stewart et al. 1985, Thomas & Reaser 2004, Munson 2007, …
e.g., Köhler 1929, Ramachandran & Hubbard 2001, Domizi 2024, Winter & Perlman 2021, Wong et al. 2022, Kawahara et al. 2021, Winter et al. 2022, …

Some studies looking at both groups of explanations

INDEXICALITY

Europeans rate European languages differently depending on both familiarity and phonetic variables like sonority, vocalic share
Reiterer et al. 2020

Germans rate several existing conlangs more positively or negatively depending on both sounds and phonological familiarity
Mooshammer et al. 2023

ICONICITY

Natlangs are rated as more or less beautiful depending on familiarity, not sounds, phonetics doesn't play a role
Anikin et al. 2023

Presumably unexposed Chinese students rate Swedish as more pleasant than Danish, likely due to intonation, not social factors
Hilton et al. 2022

SSPG   Sonority-sensitive pseudotext generator

‣   The SSPG is able to let the user set a target sonority that affects random weighted sampling of sounds.

‣   The SSPG can create words with syllables that adhere to the SSP:
vowels > glides > liquids > nasals > obstruents

SSPG   Sonority-sensitive pseudotext generator

Low vowels	17
Mid peripheral vowels (not ə)	16
High peripheral vowels (not ɨ)	15
Mid interior vowels (ə)	14
High interior vowels (ɨ)	13
Glides	12
Rhotic approximants (ɹ)	11
Flaps	10
Laterals	9
Trills	8
Nasals	7
Voiced fricatives	6
Voiced affricates	5
Voiced stops	4
Voiceless fricatives	3
Voiceless affricates	2
Voiceless stops	1

Parker 2008

SSPG   Sonority-sensitive pseudotext generator

Example for control condition

<speak> <phoneme alphabet="ipa" ph="mo mutu kima le napo soteoi lubita bisi mabumopi tapesi satiu sue sobabise si painu nopu wupeto je sipawi bu nake muba no pa"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" pe ne jako u po munilawi o jetuwi nu mo kuloa wiwiji somawejo"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" nosobape juji pu kopopobo waka toajonu mi takeka jabakeja tisu tuelu kepe jewo luwo jesoa wejoniwe kasajo jujianu"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" wulusa sa ma mieto ta tojimu motutasa lo we no pika"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" nomewiju sau ta seili ni puwoja nase ju lelemi wawamonu bo pukebopo"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" wa bakolimu kuuali jiku ke sobi tosisabo kikitebi nitiwusu jupike lipu enibu mopobewa ti iwibaja kinotu wa busu bibuase kuine kosumewe"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" toinu"></phoneme> …
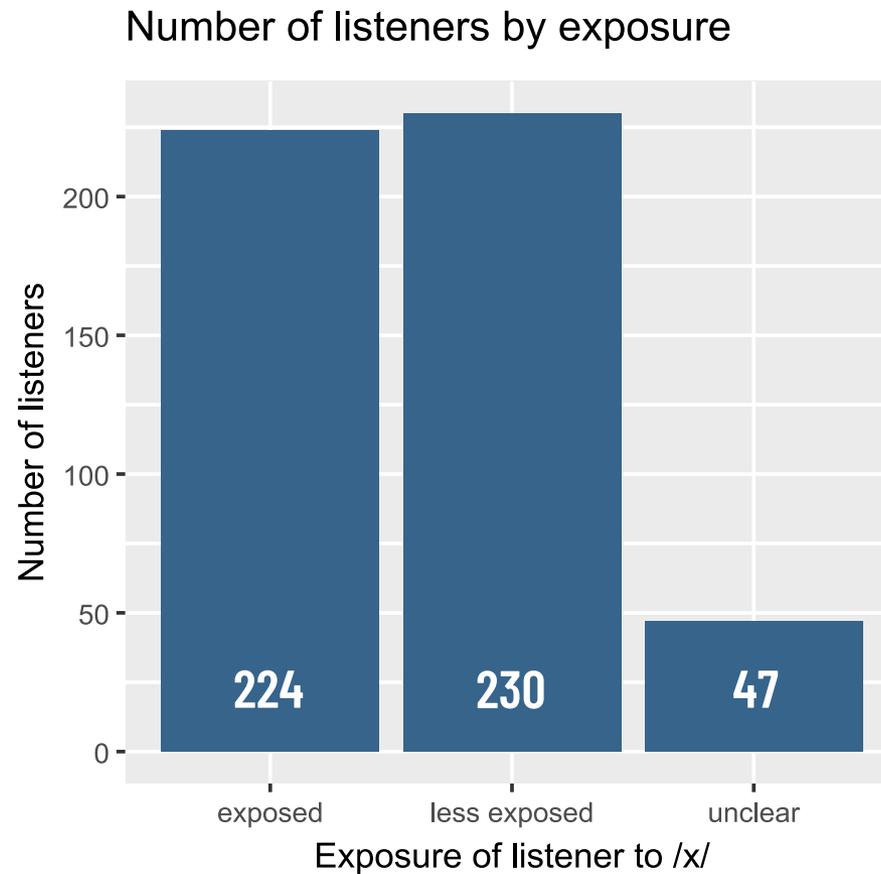
SSPG Sonority-sensitive pseudotext generator

Example for stimulus condition

<speak> <phoneme alphabet="ipa" ph="sauxi nuopo pu xo boxiliwa limuwua muneu tasasupe banepoku bano jumabise kuta wi pu pa tixu meja tupi tobimo boma"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" ku jewia mujaxito li ta"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" teloju ana epoo xitexi xotiwo no pexu kuwuto epa muwubu isiju"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" wipoxai nubunipe niopawa xane joluxoka xo buipu owilu no pu mile sitokame mupaje"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" xine nekosu"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" mapejo ja xunujiwi esi si epa naji nuxu to"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" ma naemexe beame jesobu betetumu bajotu mioxi lalo"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" pibila bi wuneomo nonamito wo pelejiwe xo pa jo"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" wokiwabi jopu xia ta masa ne jubuja sunasato ataxibu josakuto buxuwuxu telouna mele ku"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=" misa monapo ta miwi jeu so jumu enilepe lolami"></phoneme> <break strength="strong"/> <phoneme alphabet="ipa" ph=""></phoneme> </speak>
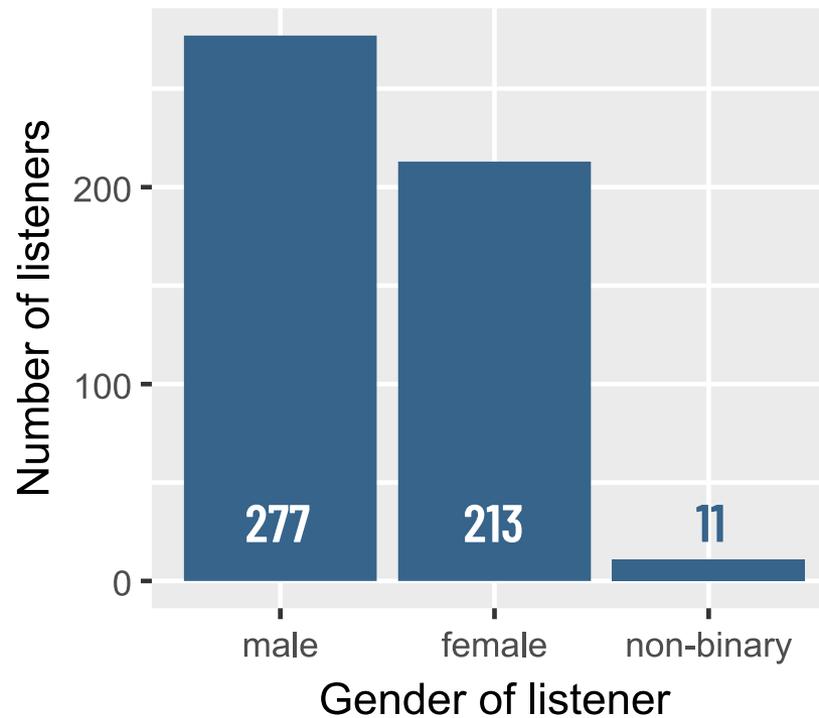
Participant demographics   n = 501

Number of listeners by exposure

Participant demographics   n = 501
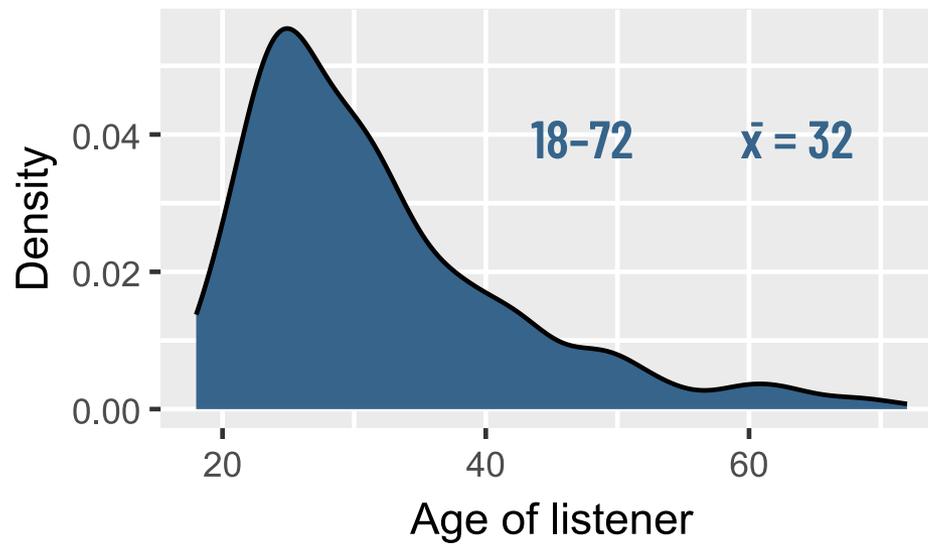

Number of listeners by gender

Participant demographics   n = 501

Density of age of listeners

Participant demographics   n = 501

Number of listeners by linguistics

Participant demographics   n = 501

Density of musicality of listeners

1–10   x̄ = 5.92
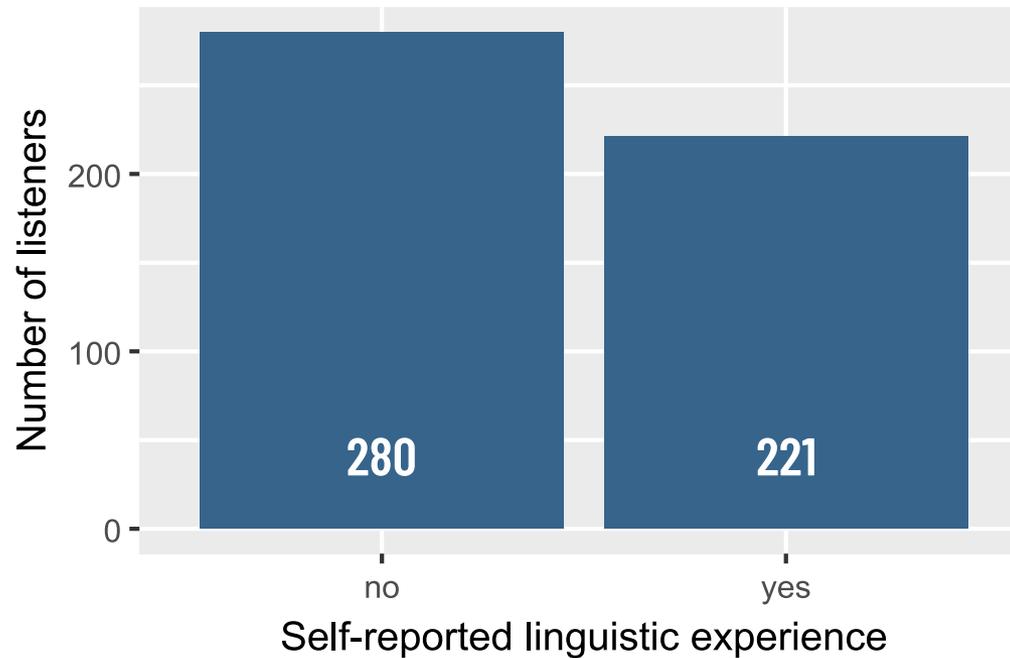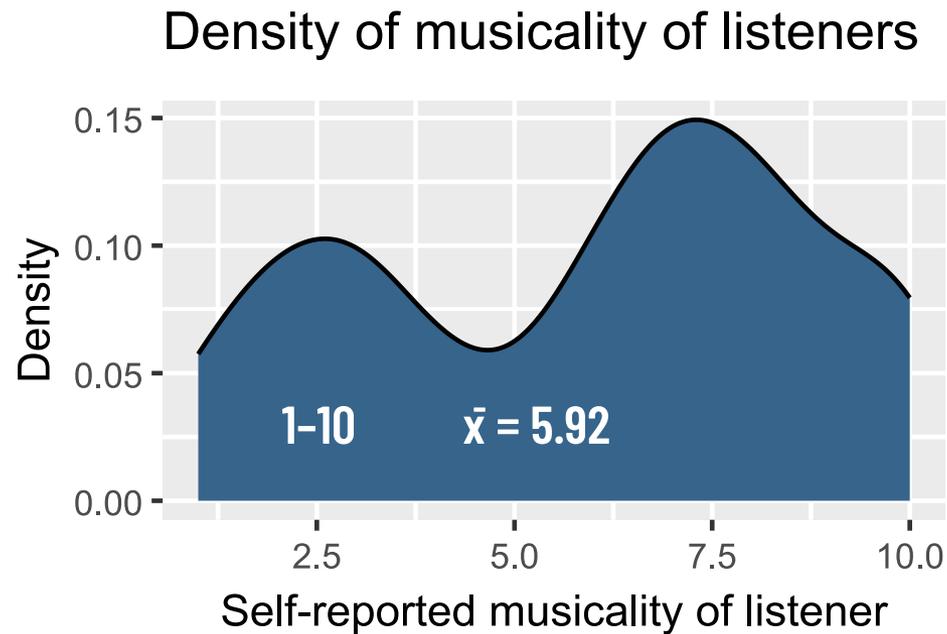
Participant demographics n = 501

Number of listeners by input device
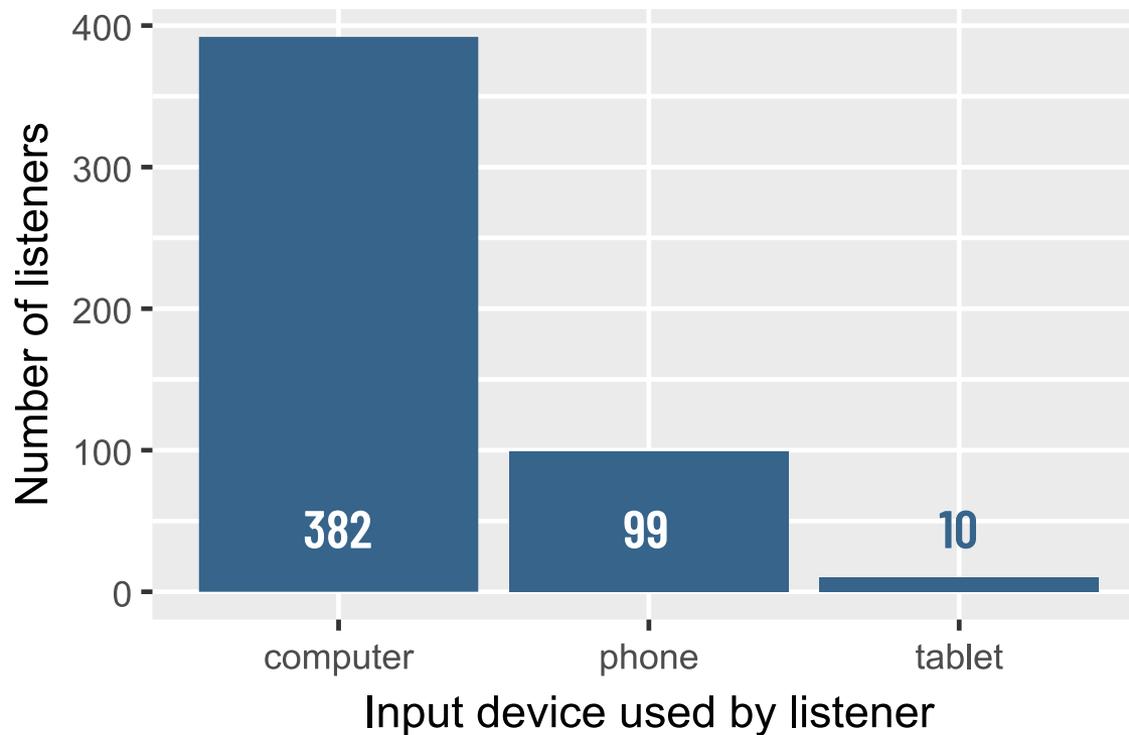
Participant demographics   n = 501

Number of listeners by output device
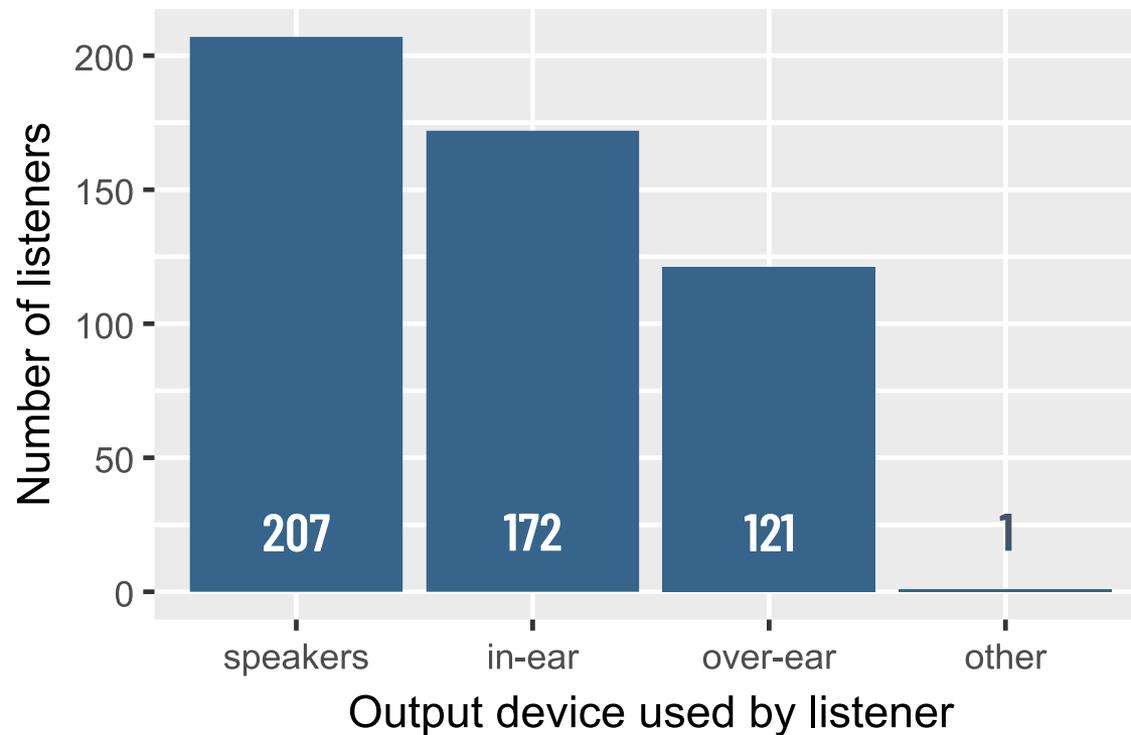
Participant demographics   n = 501

Number of listeners by location
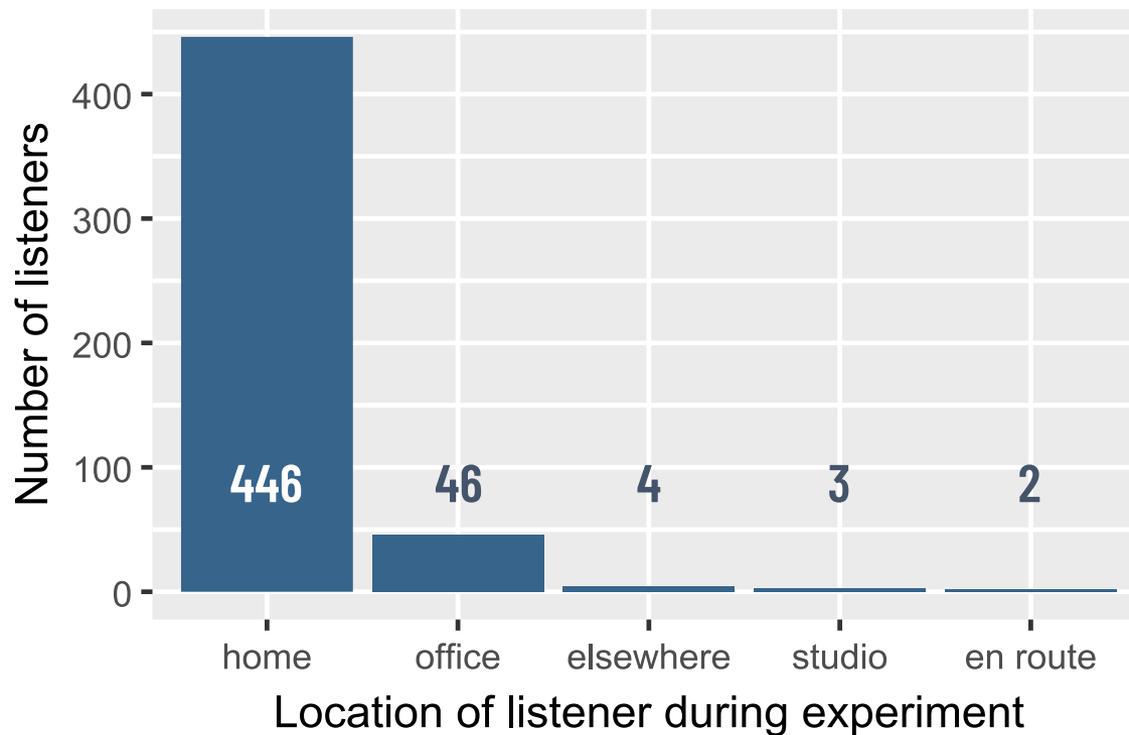
Participant demographics   n = 501

Number of listeners by polyglot factor
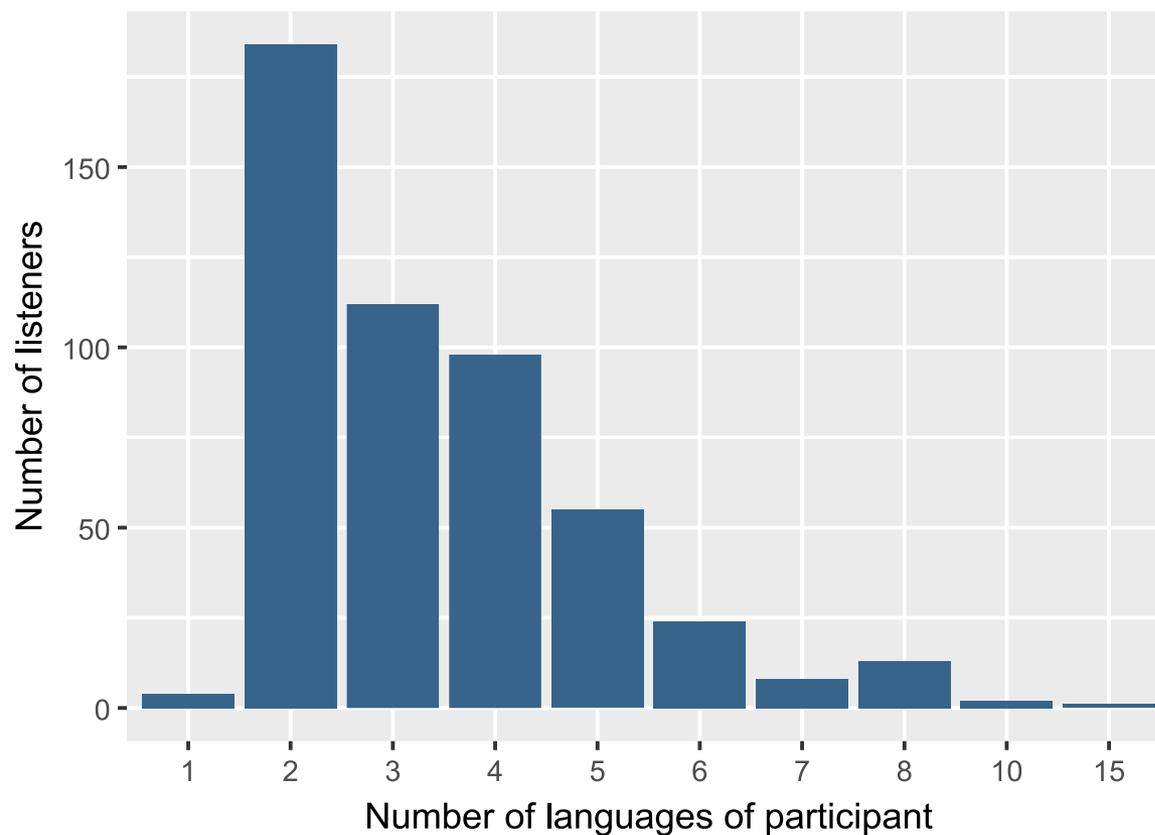
Questionnaire

You will now listen to the second pair of robots.

Please make sure you have sound enabled on your device and click "Next".

Next

Questionnaire

How does the robot sound?
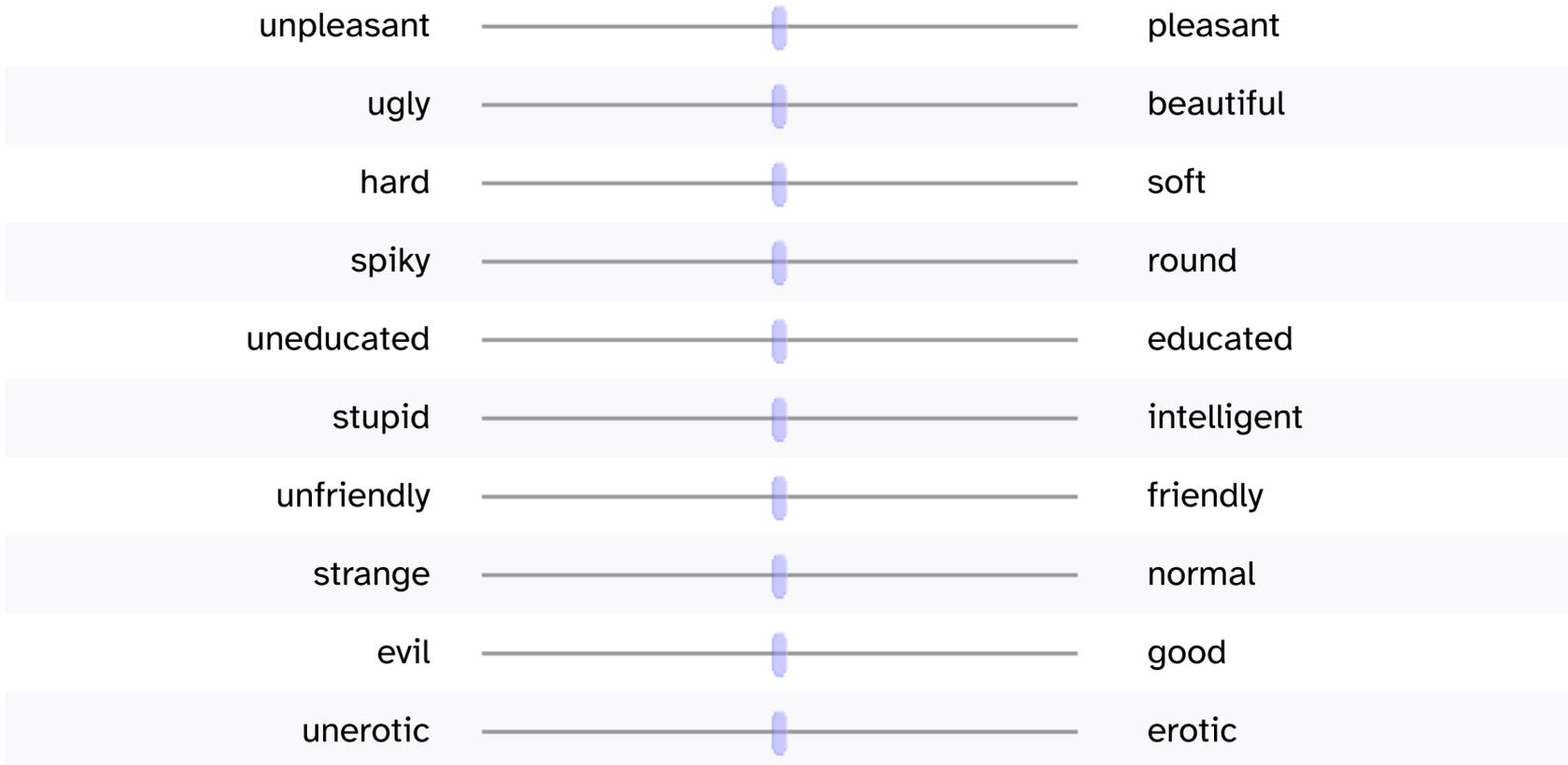
unpleasant	——————————	pleasant
ugly	——————————	beautiful
hard	——————————	soft
spiky	——————————	round
uneducated	——————————	educated
stupid	——————————	intelligent
unfriendly	——————————	friendly
strange	——————————	normal
evil	——————————	good
unerotic	——————————	erotic

Questionnaire

How familiar does this language sound to you?

not at all familiar ———————————— very familiar

Which real language or dialect, do you think, does this language resemble the most?

Next

Modeling

cf., e.g.,
Hilton et al. 2022
Anikin et al. 2023
Reiterer et al. 2020
Mooshammer et al. 2023
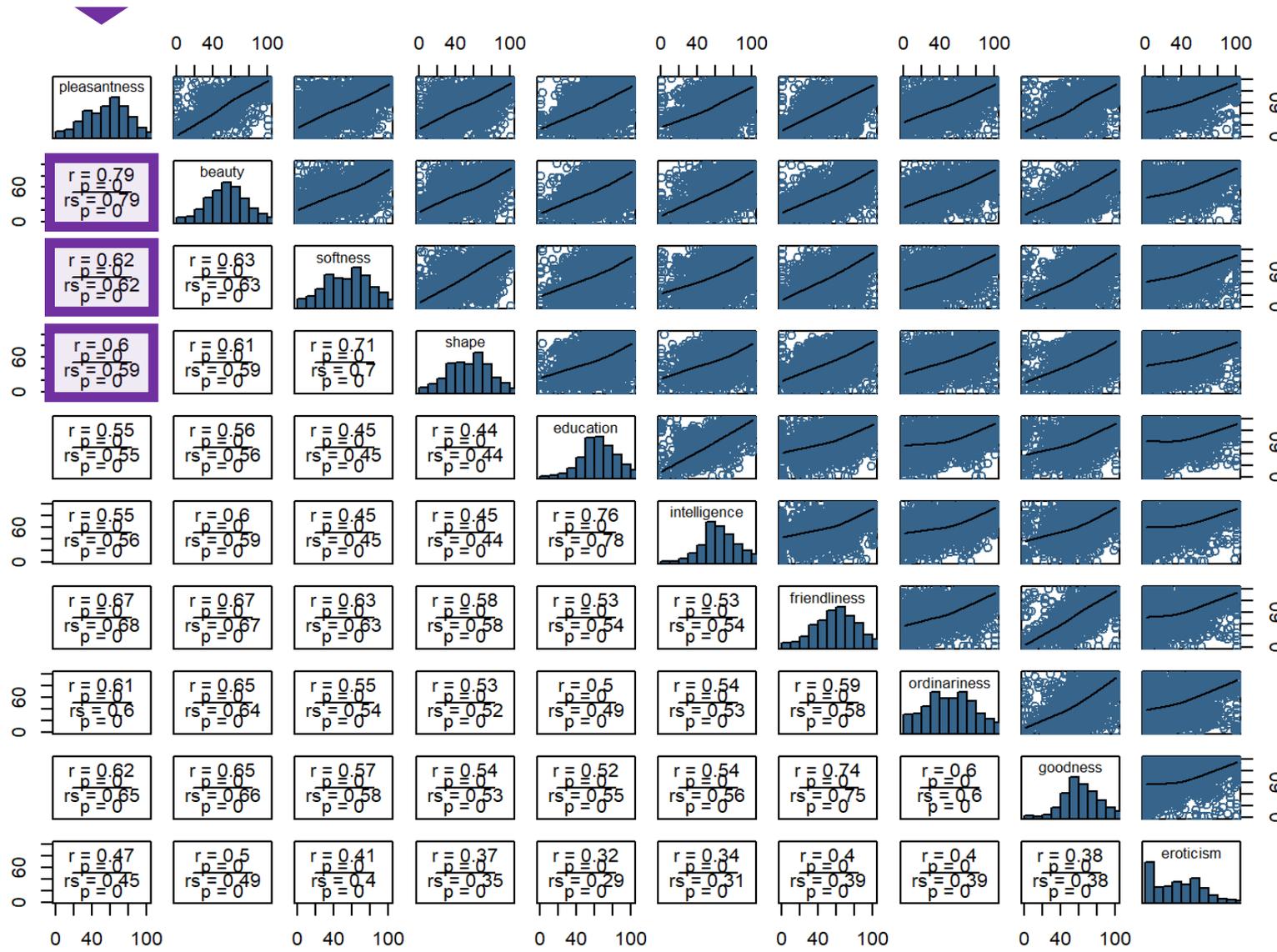
Correlation matrix of all semantic scales
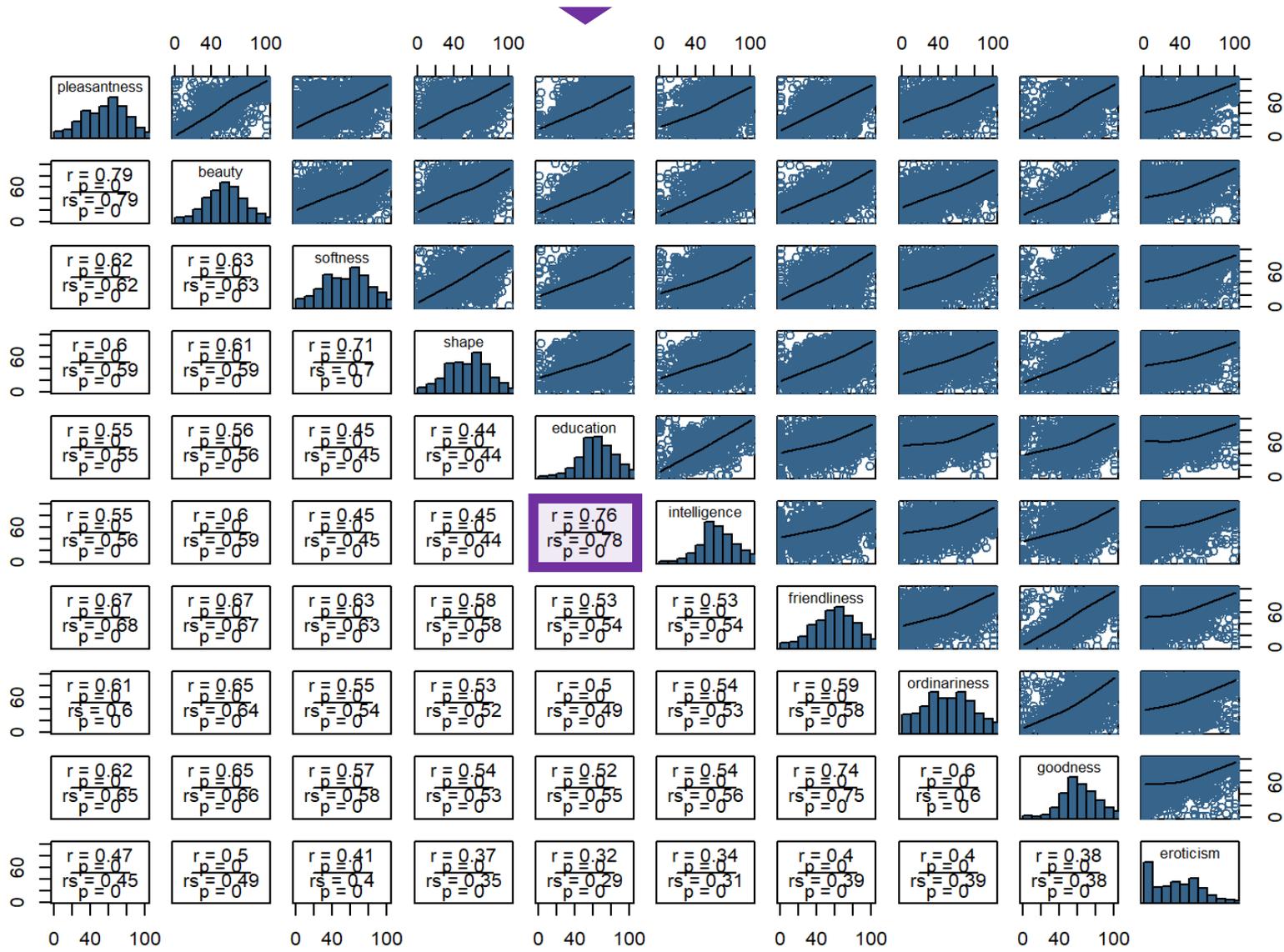
Correlation matrix of all semantic scales

Correlation matrix of all semantic scales
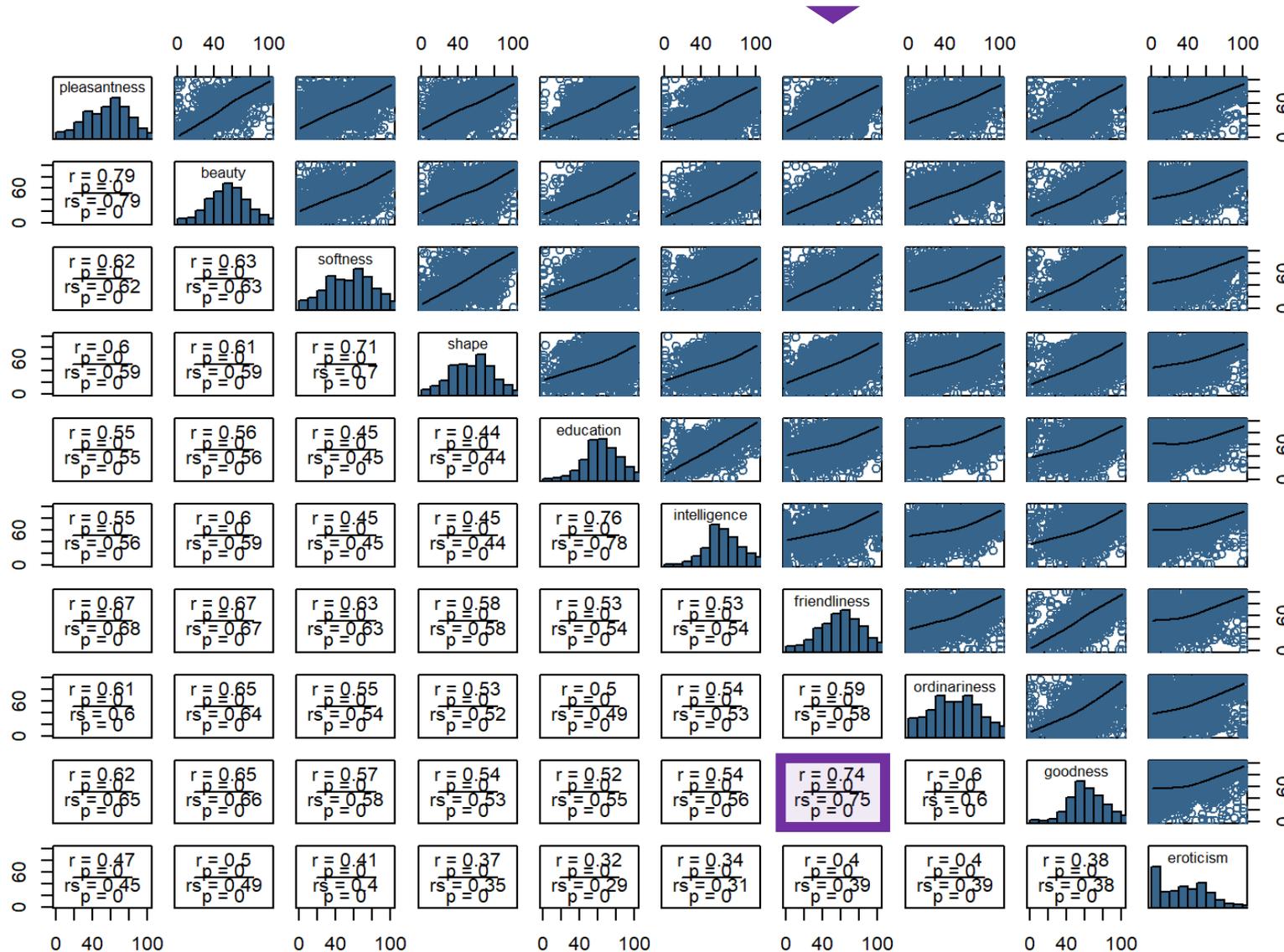
Correlation matrix of all semantic scales

Correlation matrix of all semantic scales

Distribution of ratings by scale for each condition
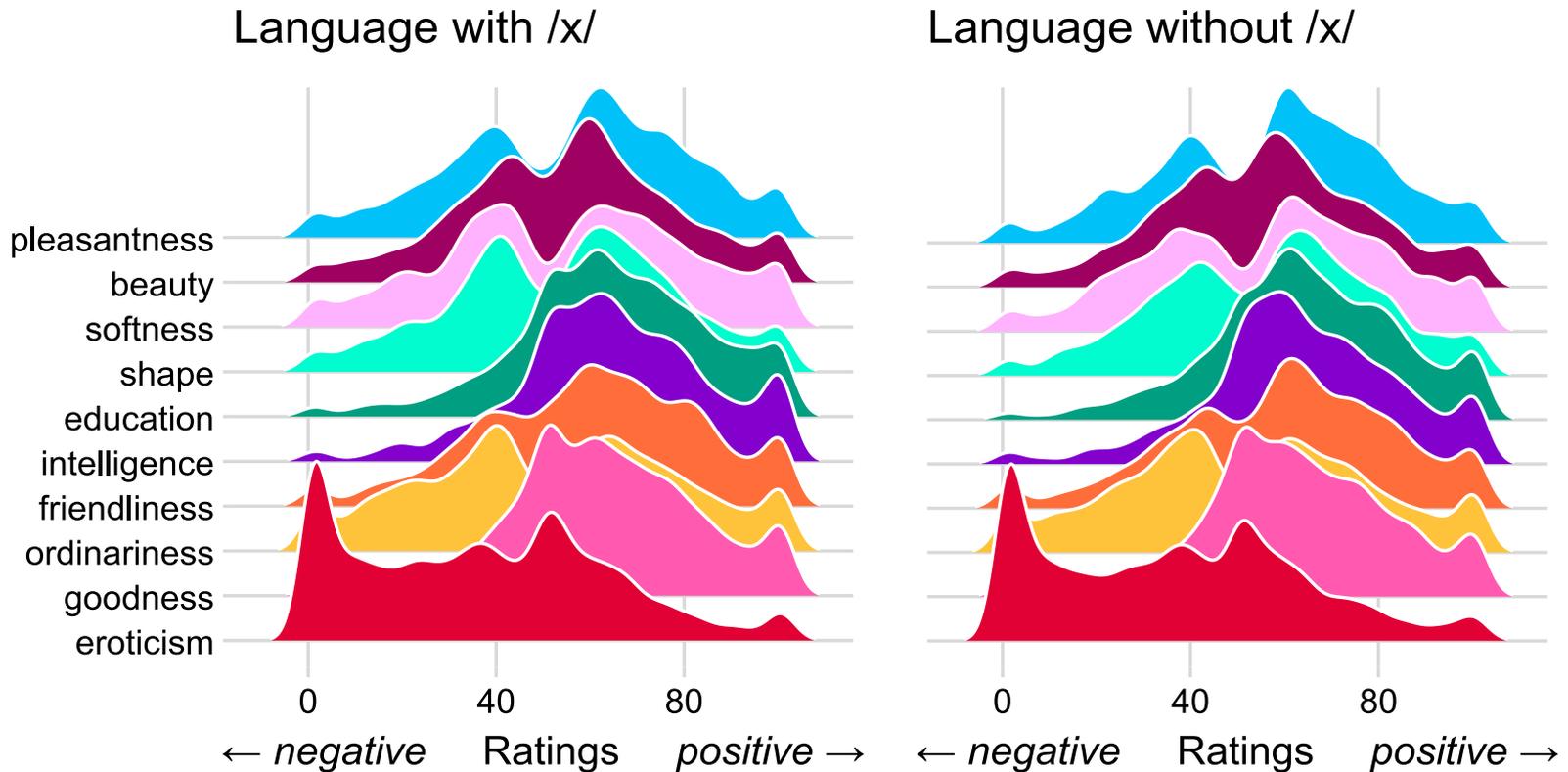
Pleasantness by similarity guess
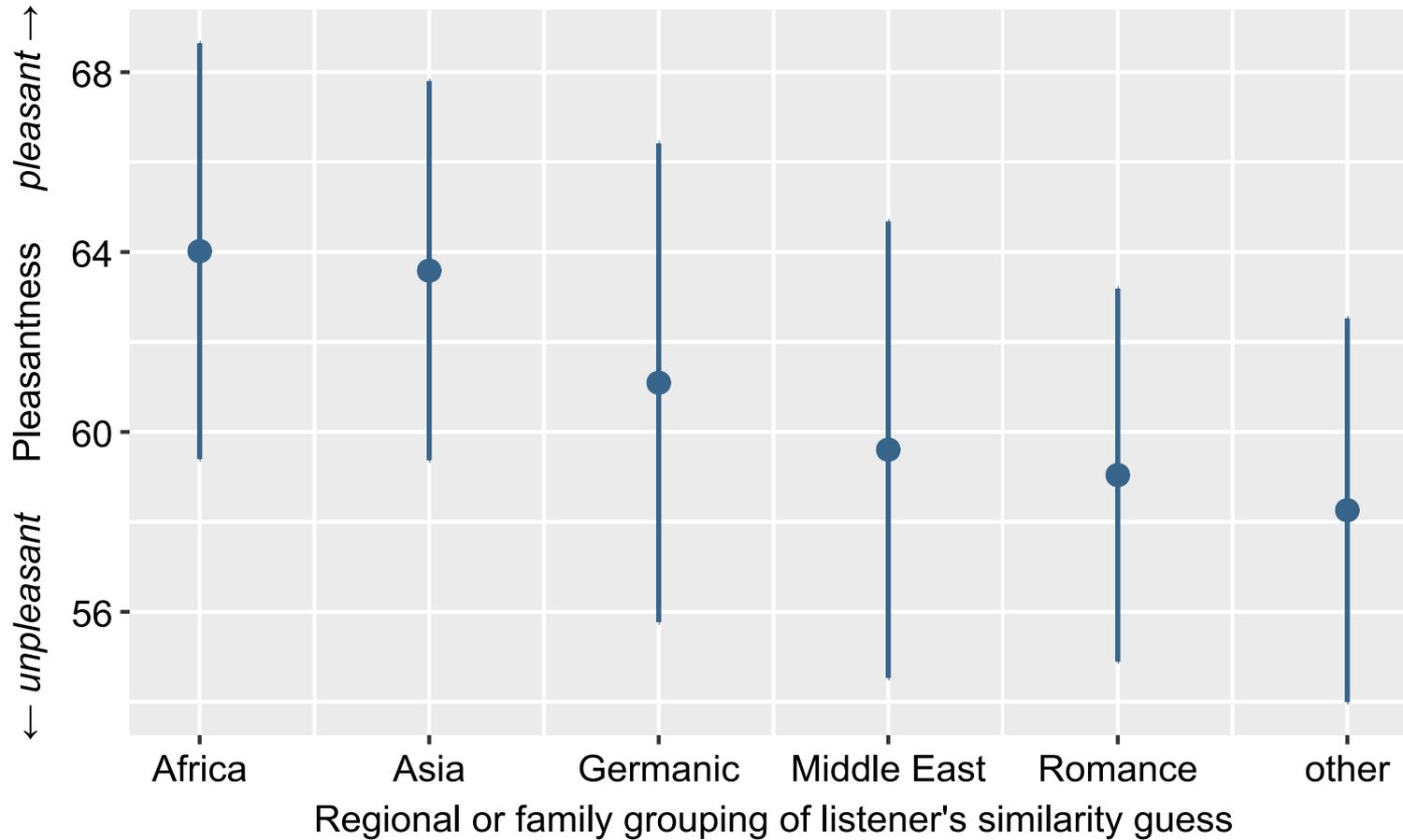
Friendliness by similarity guess
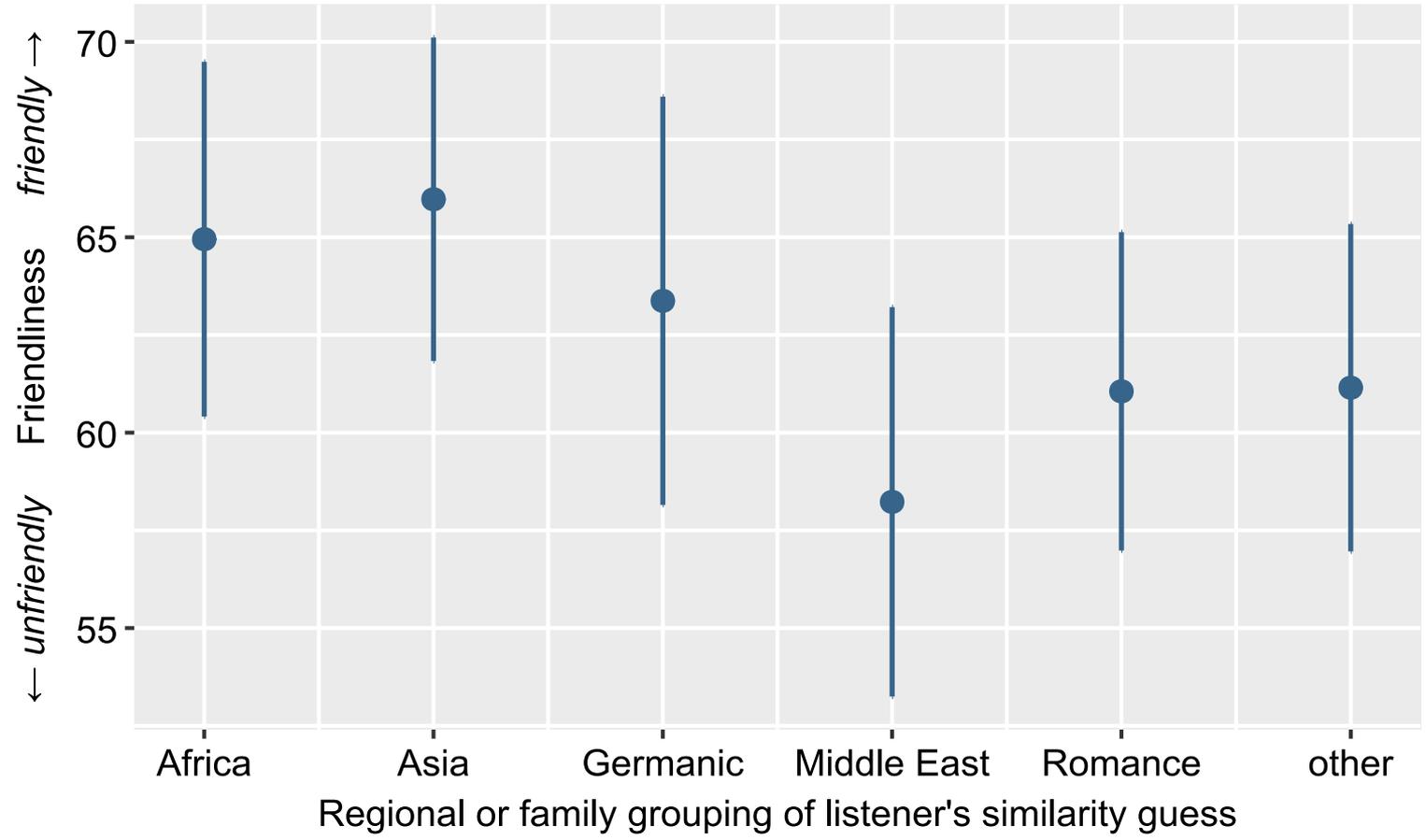
Recognition for friendliness model

Goodness by similarity guess

All ratings by language of speaker

Intelligence by gender

Education by gender

Eroticism by gender
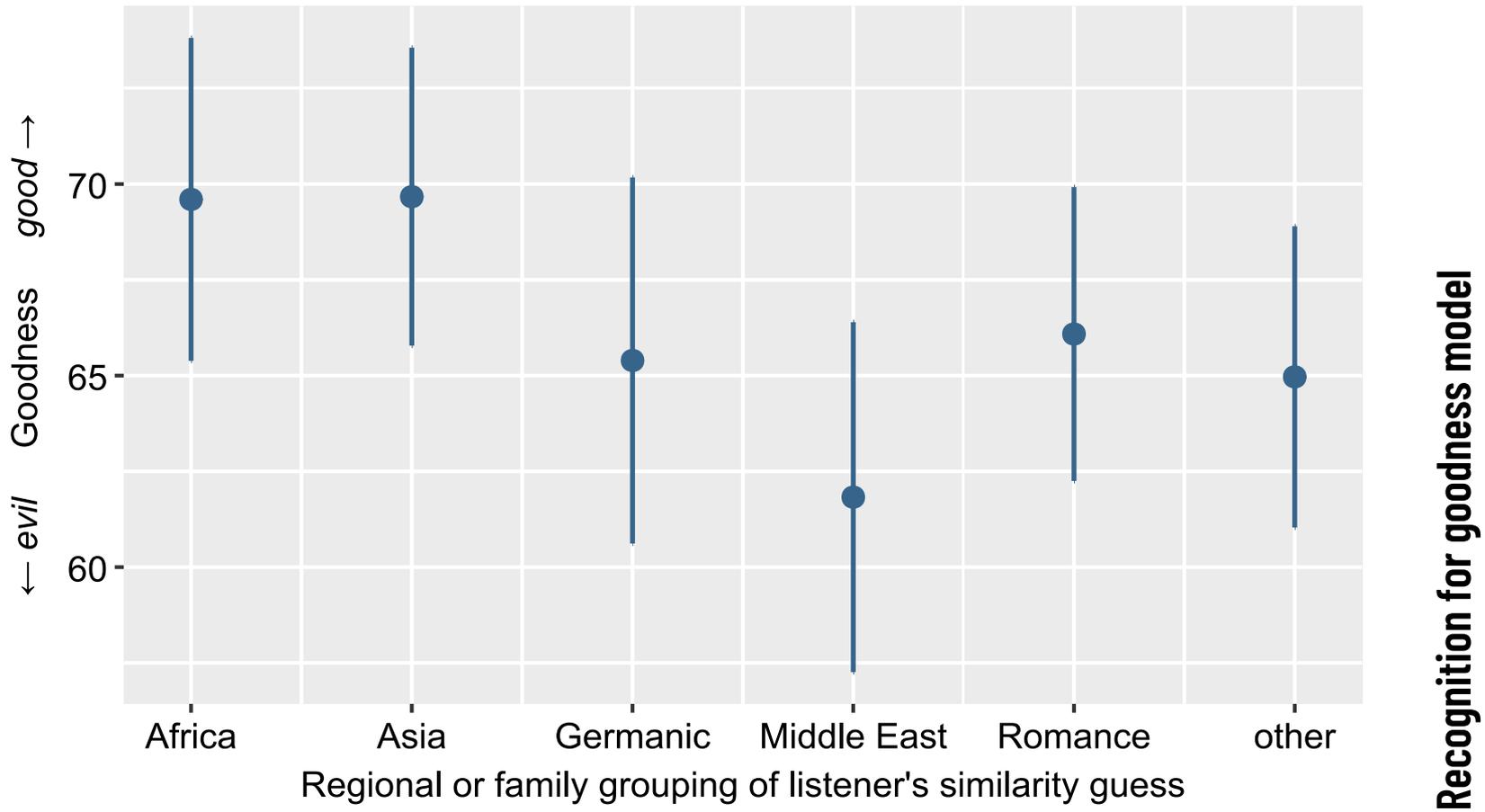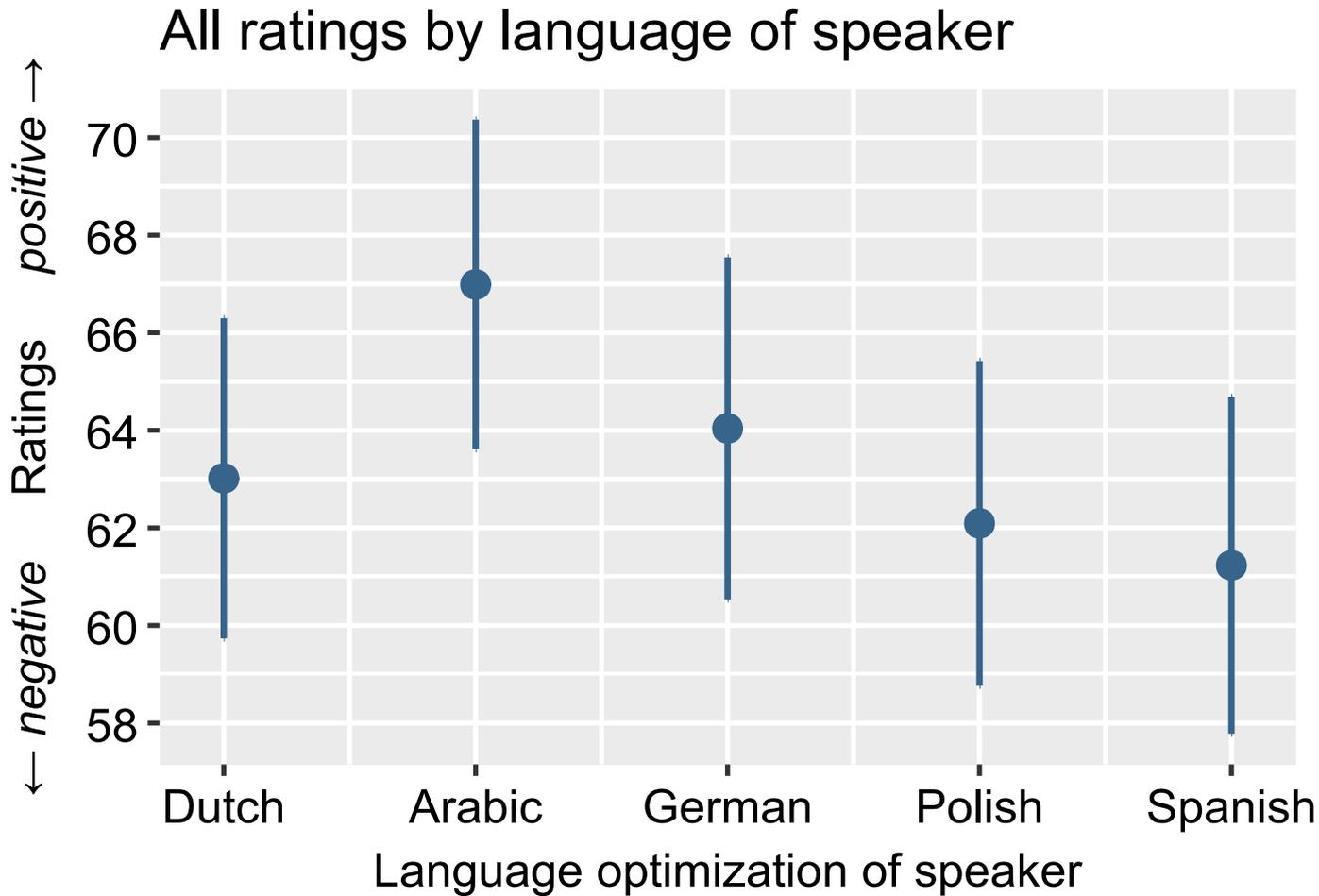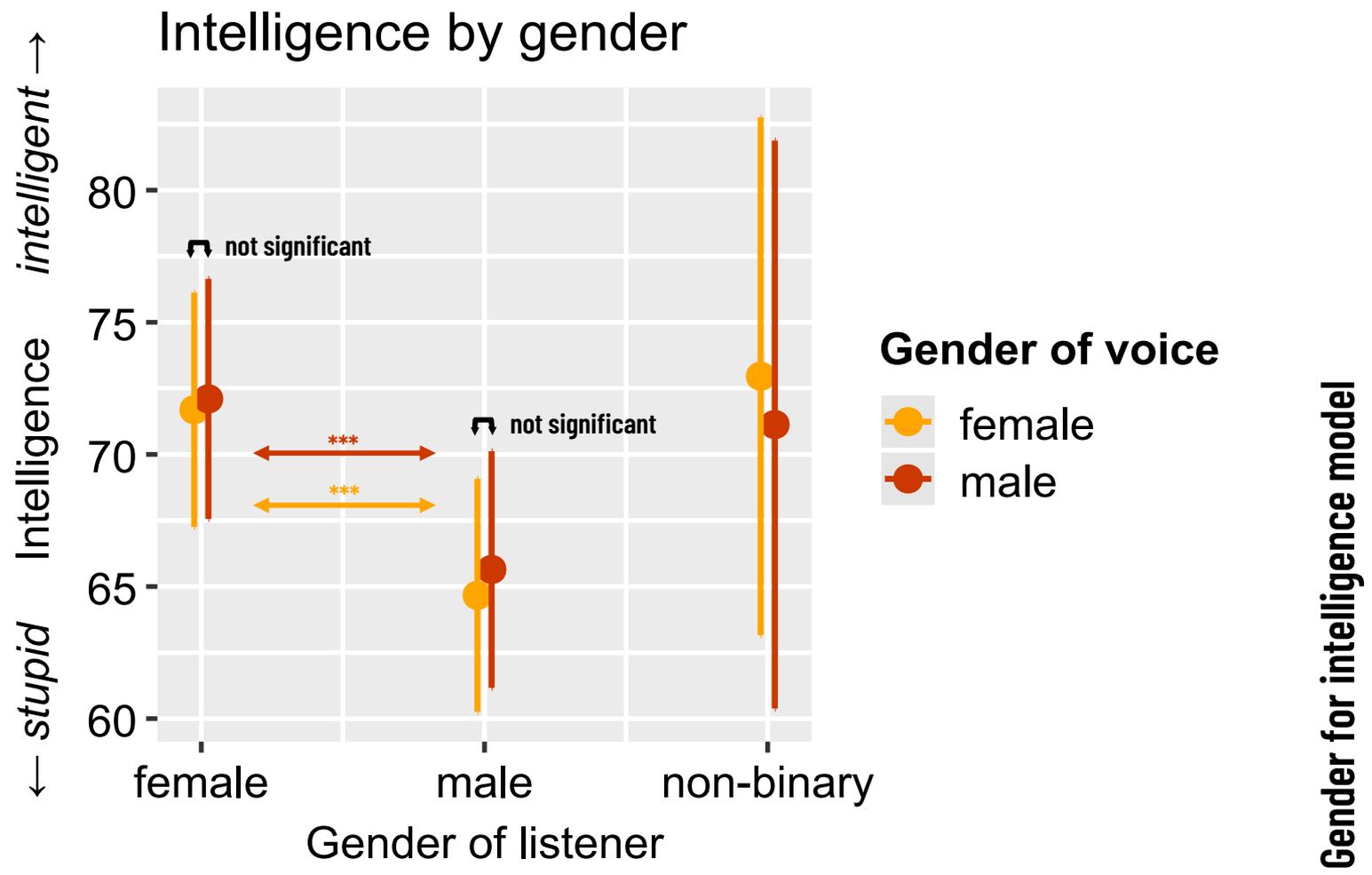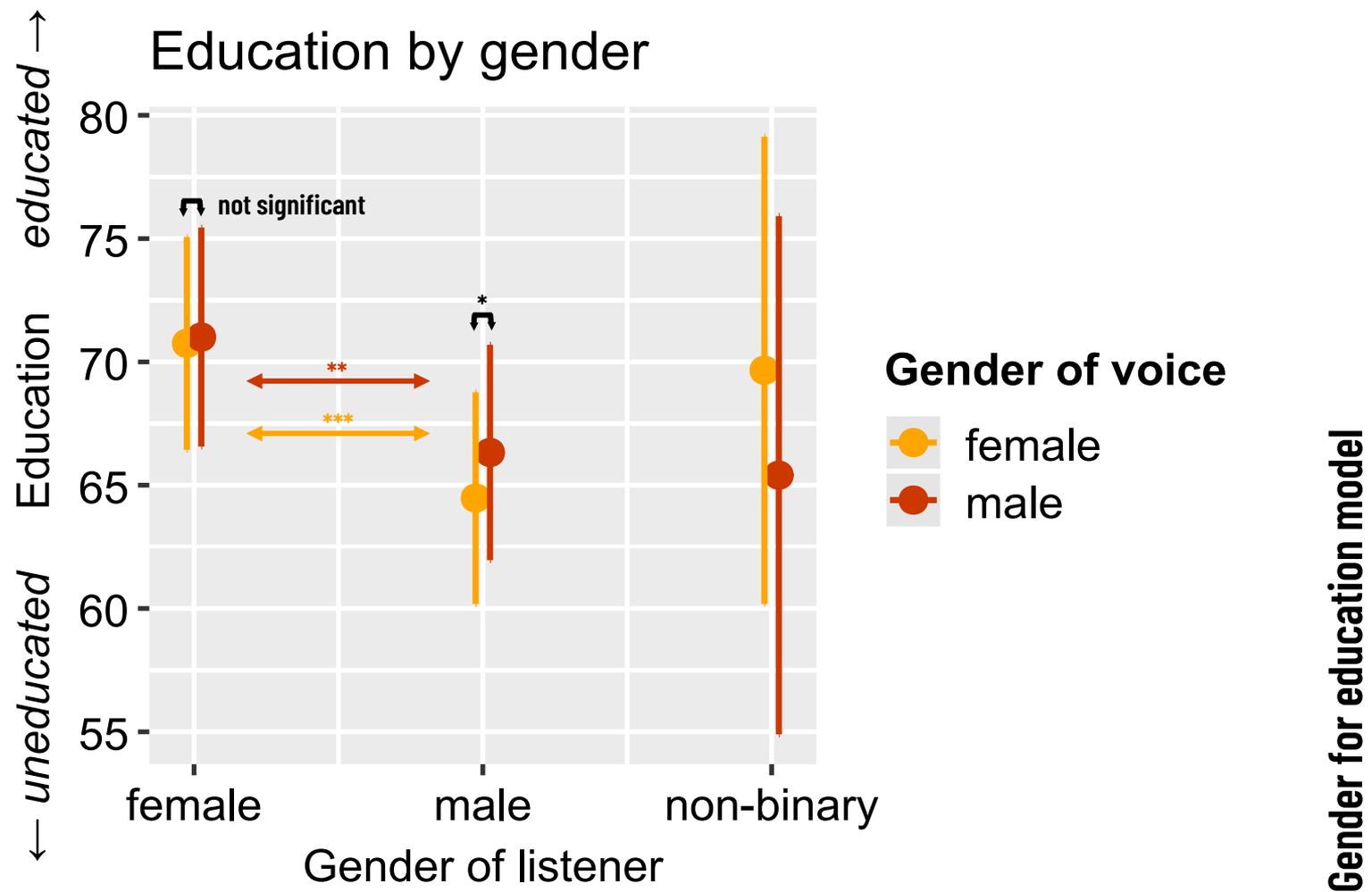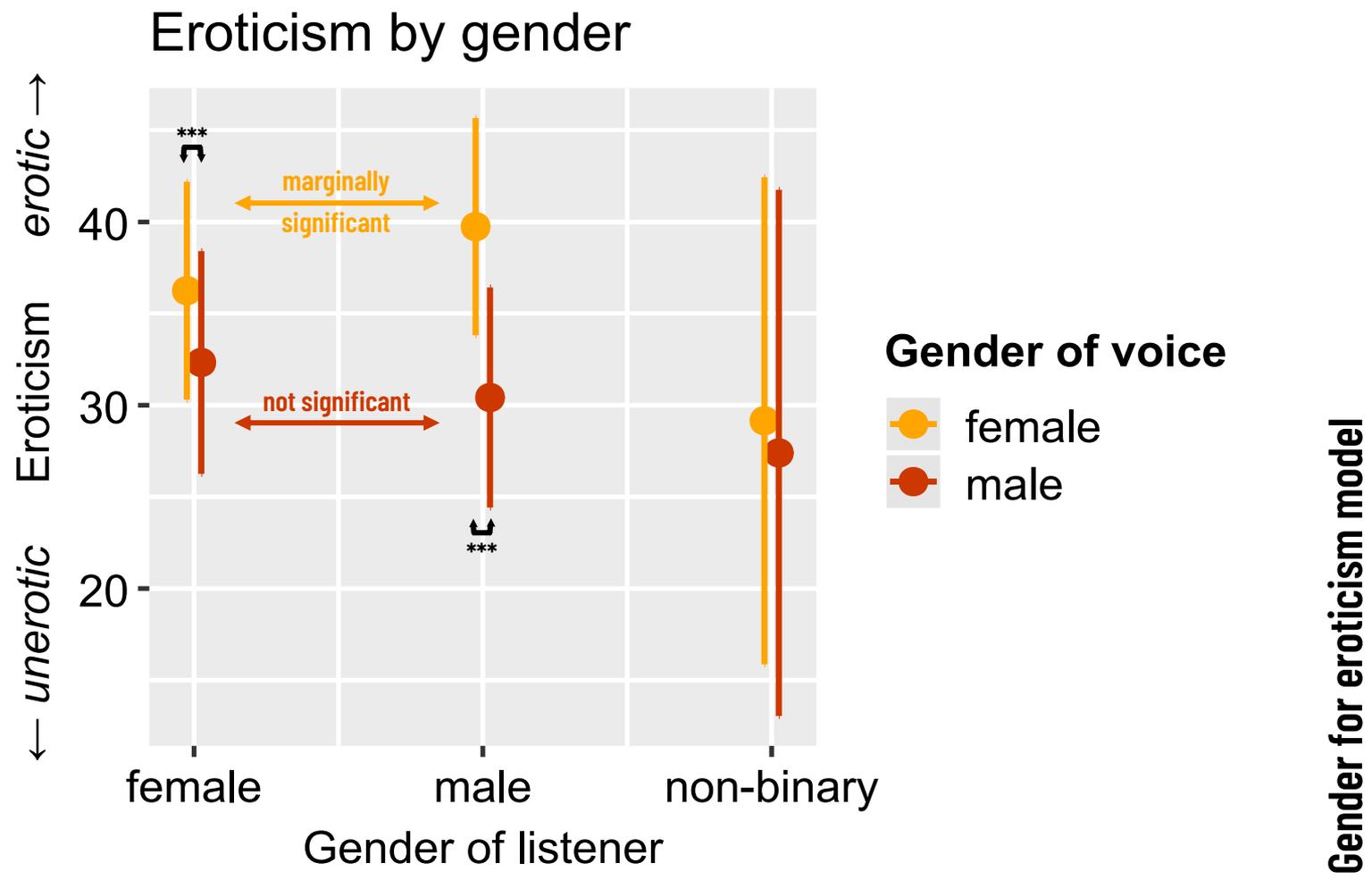
Variable ▽
condition ~~int~~
condition$^{ST[EX]}$
condition$^{ST[LE]}$
exposed$^{EX[ST]}$
exposed$^{EX[CT]}$
recognition^{AS}
recognition^{GE}
recognition^{ME}
recognition^{RO}
recognition^{O}
familiarity
vGender$^{M[GM]}$
vGender$^{M[GF]}$
gender$^{M[VM]}$
gender$^{M[VF]}$
polyglot
musicality

terms not included in this table: condition^{x}exposed   exposed^{UN} language$^{NL, AR, DE, PL, ES}$ linguistics   age   input…   output…   location…

Variable ▽	All scales	Pleasantness	Beauty	Softness	Shape	Education	Intelligence	Friendliness	Ordinariness	Goodness	Eroticism
condition int											
condition$^{ST[EX]}$											
condition$^{ST[LE]}$											
exposed$^{EX[ST]}$											
exposed$^{EX[CT]}$											
recognition^{AS}											
recognition^{GE}											
recognition^{ME}											
recognition^{RO}											
recognition^{O}											
familiarity											
vGender$^{M[GM]}$											
vGender$^{M[GF]}$											
gender$^{M[VM]}$											
gender$^{M[VF]}$											
polyglot											
musicality											

terms not included in this table: condition^{x}exposed   exposed^{UN} language$^{NL, AR, DE, PL, ES}$ linguistics   age   input⋯   output⋯   location⋯

Variable ▽	All scales	Pleasantness	Beauty	Softness	Shape	Education	Intelligence	Friendliness	Ordinariness	Goodness	Eroticism
condition ~~int~~	.	.			*						
condition$^{ST[EX]}$	**	*		.	*						
condition$^{ST[LE]}$										.	
exposed$^{EX[ST]}$	***	.	***	.		**	**	.	**	**	**
exposed$^{EX[CT]}$	*		**			**	**		.		**
recognition^{AS}											
recognition^{GE}											
recognition^{ME}											
recognition^{RO}											
recognition^{O}											
familiarity											
vGender$^{M[GM]}$											
vGender$^{M[GF]}$											
gender$^{M[VM]}$											
gender$^{M[VF]}$											
polyglot											
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Variable	All scales	Pleasantness	Beauty	Softness	Shape	Education	Intelligence	Friendliness	Ordinariness	Goodness	Eroticism
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exposed$^{EX[ST]}$											
exposed$^{EX[CT]}$											
recognition^{AS}						*					
recognition^{GE}	***			*	**					*	
recognition^{ME}	***	*	*	*	**			***		***	.
recognition^{RO}	***	***	.		.		.	**		**	
recognition^{O}	***	***	***		**			**	*	***	
familiarity											
vGender$^{M[GM]}$											
vGender$^{M[GF]}$											
gender$^{M[VM]}$											
gender$^{M[VF]}$											
polyglot											
musicality											

terms not included in this table: condition^{x}exposed   exposed^{UN} language$^{NL, AR, DE, PL, ES}$ linguistics   age   input$^{...}$ output$^{...}$ location$^{...}$

Variable ▽	All scales	Pleasantness	Beauty	Softness	Shape	Education	Intelligence	Friendliness	Ordinariness	Goodness	Eroticism
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condition$^{ST[EX]}$											
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exposed$^{EX[ST]}$											
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recognition^{AS}											
recognition^{GE}											
recognition^{ME}											
recognition^{RO}											
recognition^{O}											
familiarity	***	***	***	***	***	***	***	***	***	***	***
vGender$^{M[GM]}$											
vGender$^{M[GF]}$											
gender$^{M[VM]}$											
gender$^{M[VF]}$											
polyglot											
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terms not included in this table: condition^{x}exposed exposed^{UN} language$^{NL, AR, DE, PL, ES}$ linguistics age input$^{…}$ output$^{…}$ location$^{…}$

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condition ~~int~~											
condition$^{ST[EX]}$											
condition$^{ST[LE]}$											
exposed$^{EX[ST]}$											
exposed$^{EX[CT]}$											
recognition^{AS}											
recognition^{GE}											
recognition^{ME}											
recognition^{RO}											
recognition^{O}											
familiarity											
vGender$^{M[GM]}$	***	**	***	***	**	*		***		***	***
vGender$^{M[GF]}$	***	*	***	***				***		***	***
gender$^{M[VM]}$	***	***	***	*	**	**	***	.	***	**	
gender$^{M[VF]}$	***	***	***	*	*	***	***	**	***	*	.
polyglot											
musicality											

terms not included in this table: condition^{x}exposed   exposed^{UN} language$^{NL, AR, DE, PL, ES}$ linguistics   age   input$^{...}$ output$^{...}$ location$^{...}$

Variable	All scales	Pleasantness	Beauty	Softness	Shape	Education	Intelligence	Friendliness	Ordinariness	Goodness	Eroticism
condition ~~int~~	.	.			*						
condition$^{ST[EX]}$	**	*		.	*						
condition$^{ST[LE]}$										.	
exposed$^{EX[ST]}$	***	.	***	.		**	**	.	**	**	**
exposed$^{EX[CT]}$	*		**			**	**		.		**
recognition^{AS}						*					
recognition^{GE}	***			*	**					*	
recognition^{ME}	***	*	*	*	**			***		***	.
recognition^{RO}	***	***	.		,		.	**		**	
recognition^{O}	***	***	***		**			**	*	***	
familiarity	***	***	***	***	***	***	***	***	***	***	***
vGender$^{M[GM]}$	***	**	***	***	**	*		***		***	***
vGender$^{M[GF]}$	***	*	***	***				***		***	***
gender$^{M[VM]}$	***	***	***	*	**	**	***	.	***	**	
gender$^{M[VF]}$	***	***	***	*	*	***	***	**	***	*	.
polyglot	.			.		.	.			.	.
musicality		*									*

terms not included in this table: condition^{x}exposed   exposed^{UN} language$^{NL, AR, DE, PL, ES}$ linguistics   age   input$^{...}$ output$^{...}$ location$^{...}$

The ontology of the rating scales

Is everything underlyingly simply positive or negative?

Maybe not:

‣ **e.g., trustworthiness independent from attractiveness for pitch**   O'Connor & Barclay 2017

‣ **e.g., participants distinguish between moral descriptors**   Anonymous in JLPOP, in press

Maybe yes:

‣ **round is positive, spiky is negative**   Domizi 2024

‣ **soft, smooth, sweet are positive, hard, rough, bitter is negative**   Winter et al. 2019

‣ **here: all scales correlate with the basic scale pleasantness**   the present study

Limitations

‣ **social salience — do we need it, after all?**   **Li & Roberts 2023**

‣ **the ancient enemy: the social desirability bias**

‣ **there is no "language-neutral" realization of phoneme strings**

‣ **variables like exposure and recognition are hard to code**

‣ **some scales could actually drive each other**   **Domizi 2024**

What's next?

| SYLLABLE STRUCTURE | MEAN SONORITY | INDIVIDUAL PHONEMES | ... |

/x/
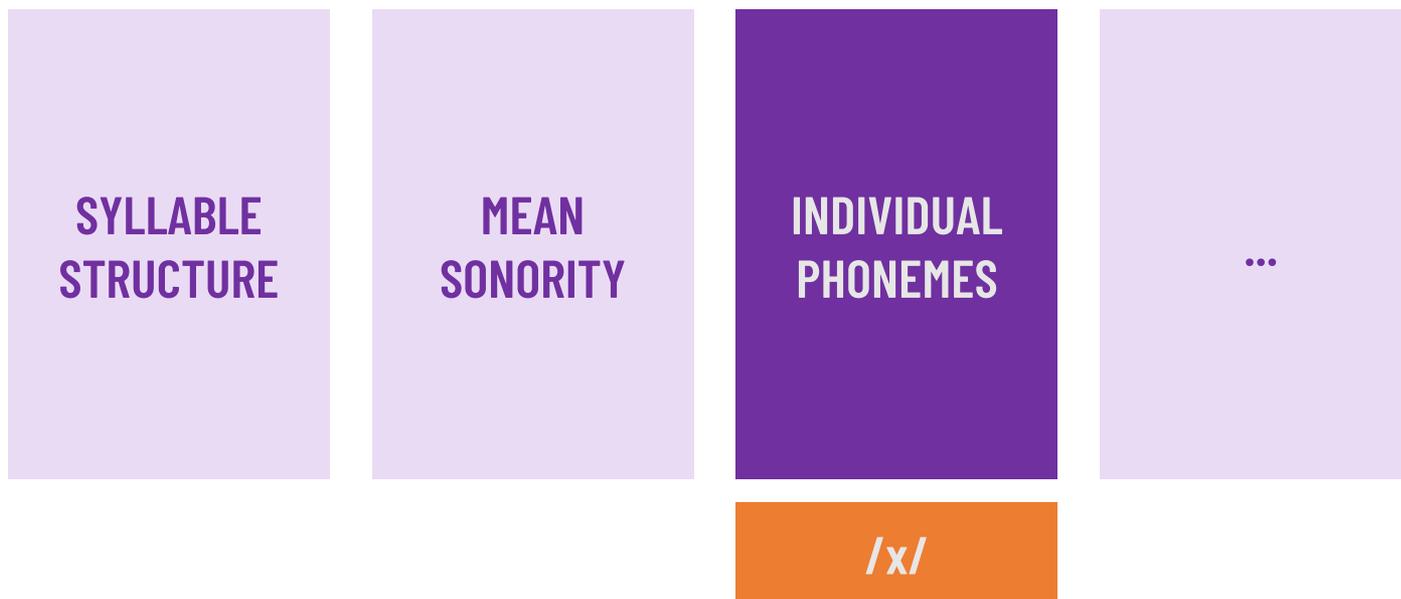
Further ideas

▸ vary speaking rate, pitch, timbre with SSML tags
▸ use only varieties of English with English voices and L1 English listeners