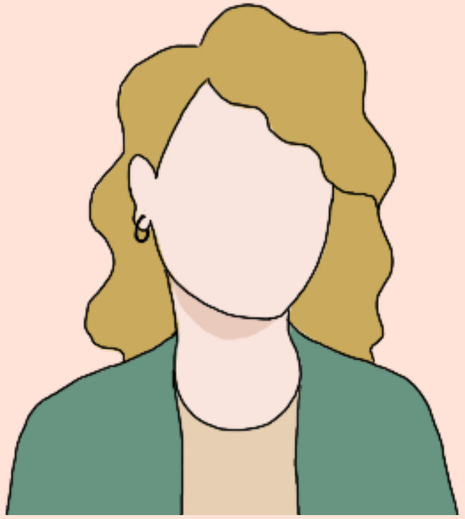
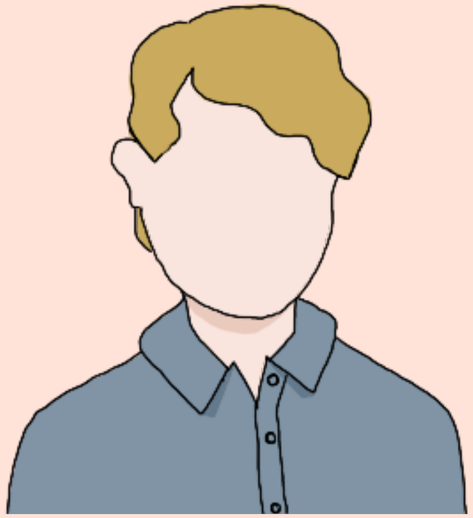
# Efficient communication drives the semantic structure of kinship terminology

**Maisy Hallam**, Simon Kirby,
Fiona M. Jordan and Kenny Smith

“sister”



“brother”

**English** speakers distinguish their siblings by gender.

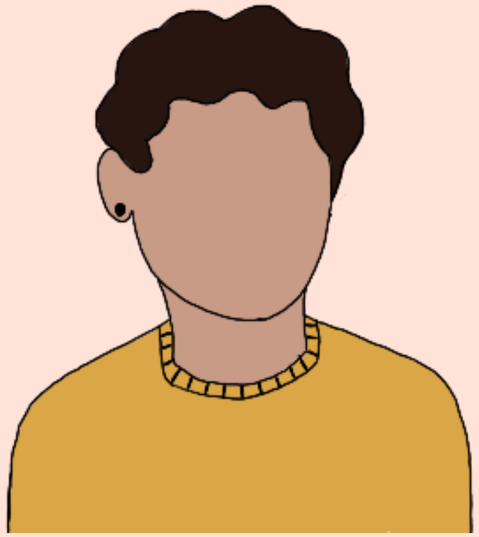
“kakak”

“adik”

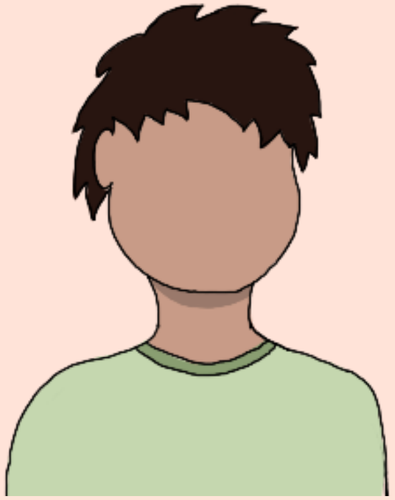
But **Indonesian** speakers distinguish their siblings by seniority.

“dīdī”

“behna”



“bhaiya”



“choṭā bhāī”

And **Hindi** speakers distinguish by gender **and** seniority!

Across the full tree, the scope of semantic diversity increases exponentially.

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spoilers!

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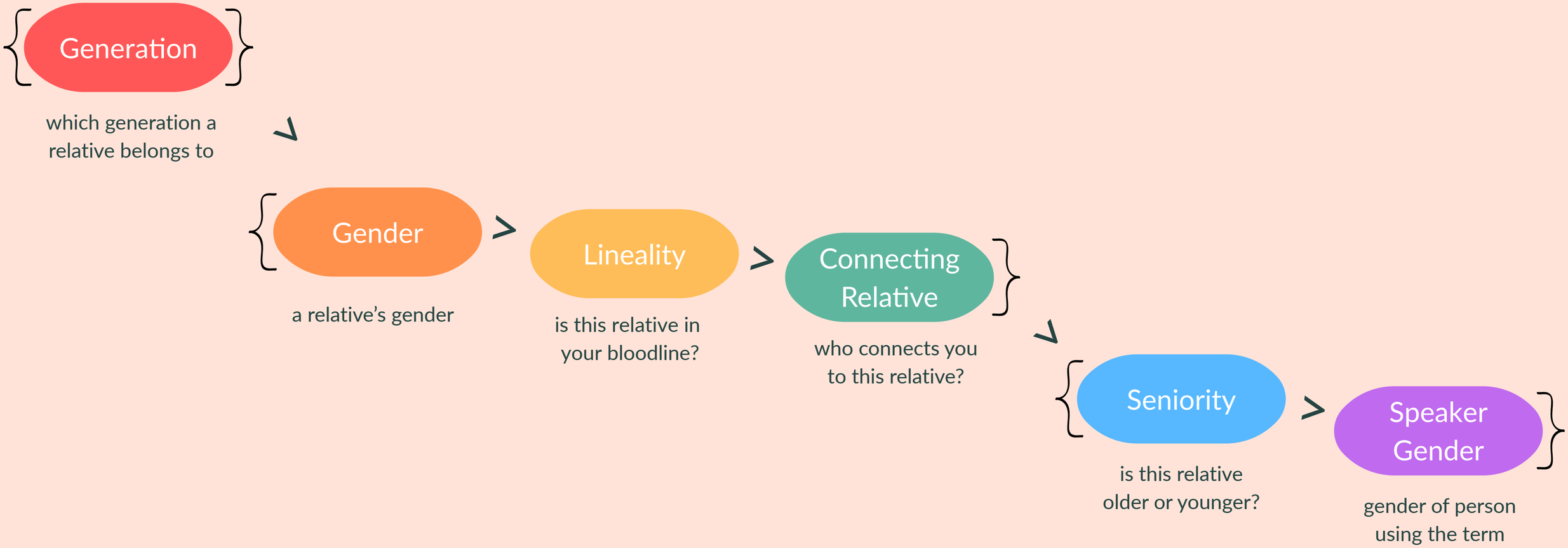
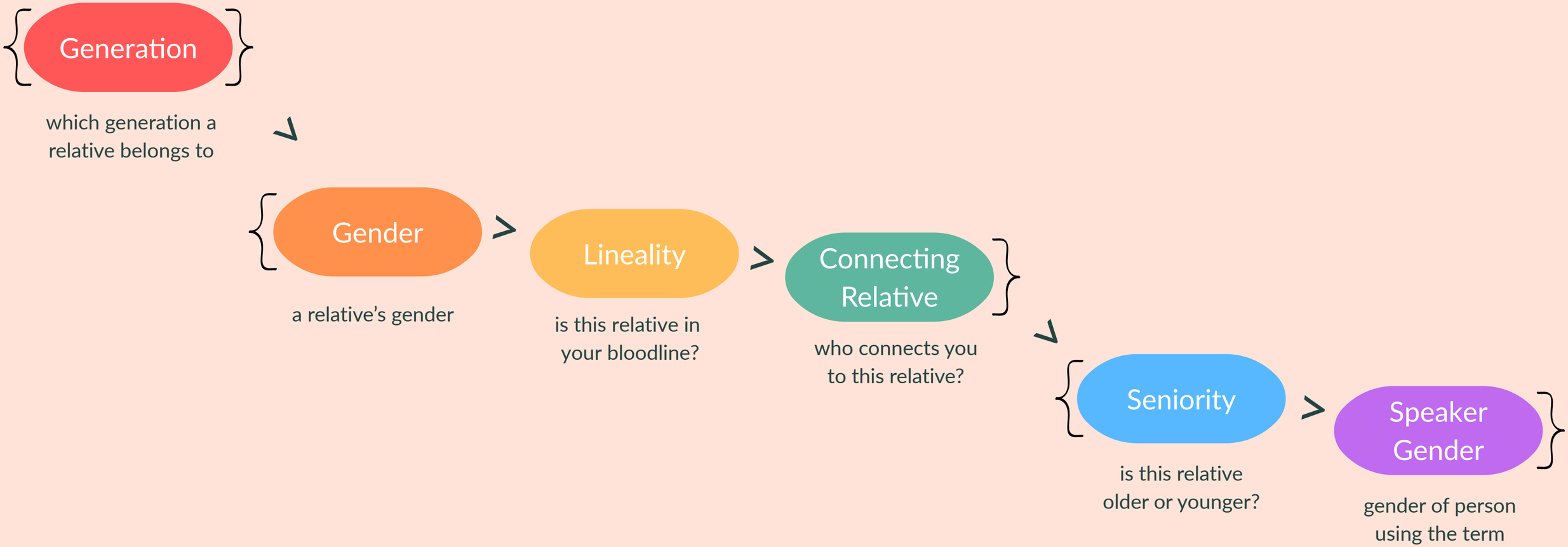


**We discovered that kin term semantics are encoded in a hierarchy,**

where some features are encoded robustly and often,



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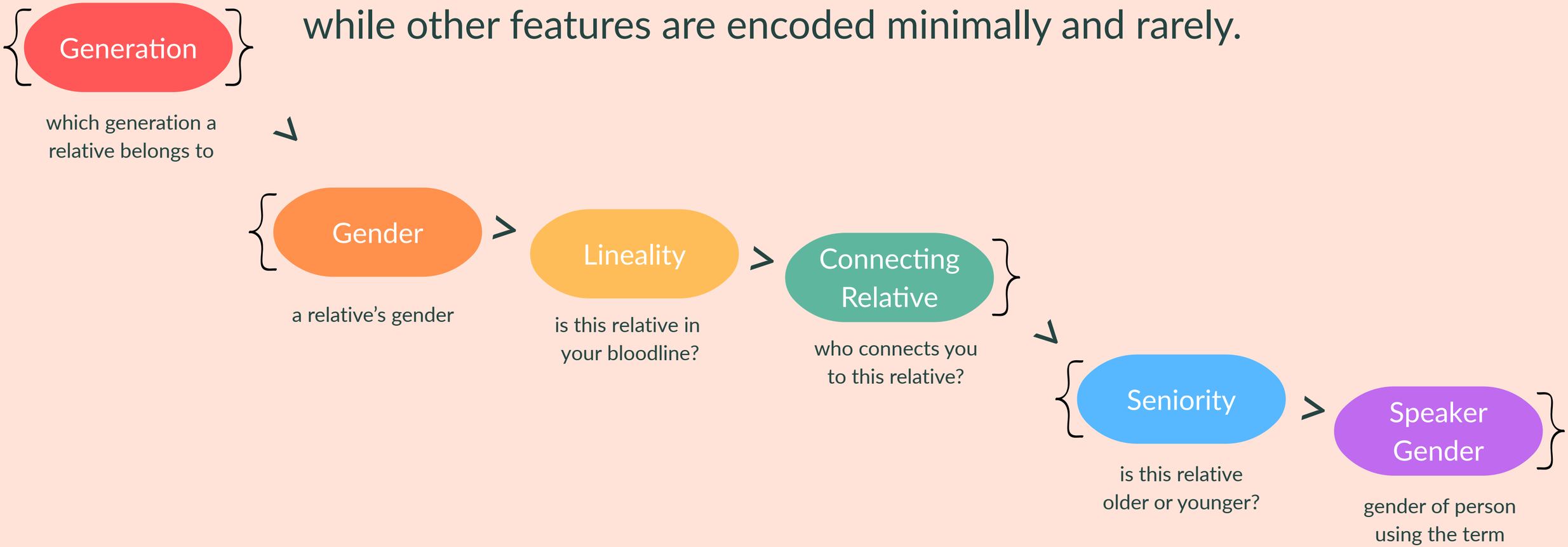

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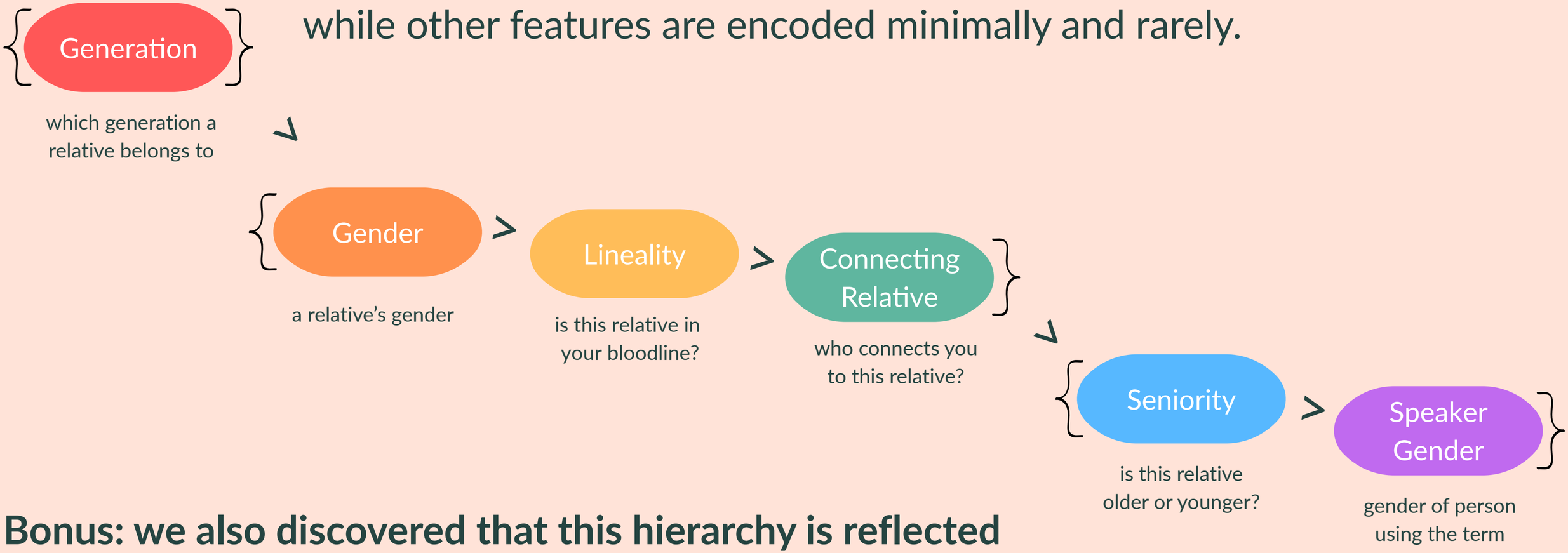


**Bonus: we also discovered that this hierarchy is reflected by similarity judgements in the minds of individuals!**


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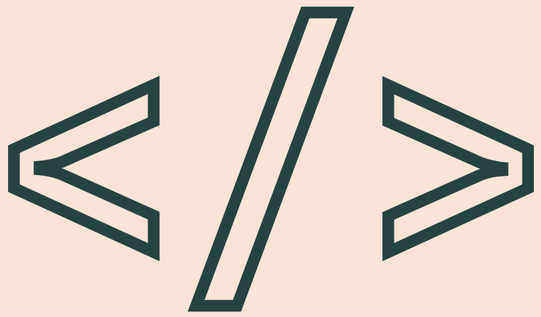

Part one:

# Kin term semantics are encoded in a hierarchy

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[3] Dautriche et al, 2017
[4] Karjus et al, 2020

Kin terms co-lexify similar concepts, and distinguish dissimilar concepts.

“aunt”

“uncle”

Kin terms co-lexify similar concepts, and distinguish dissimilar concepts.

| | |
|---|---|
| **“aunt”** | mother’s sister<br>father’s sister |
| **“uncle”** | mother’s brother<br>father’s brother |

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English (Indo-European)

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- **women**
- parents’ generation
- not a parent

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- **men**
- parents’ generation
- not a parent

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First, we make an assumption:

# Kin terms are topographic[1]:

similarity in form corresponds
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And we use this expected relationship to show how
the meaning space for kinship is structured cross-linguistically.

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Generation

Gender

Lineality

**G**ender of
**C**onnecting
**R**elative

Seniority

Speaker
Gender

There are (at least!) six semantic features
that distinguish kin cross-linguistically.


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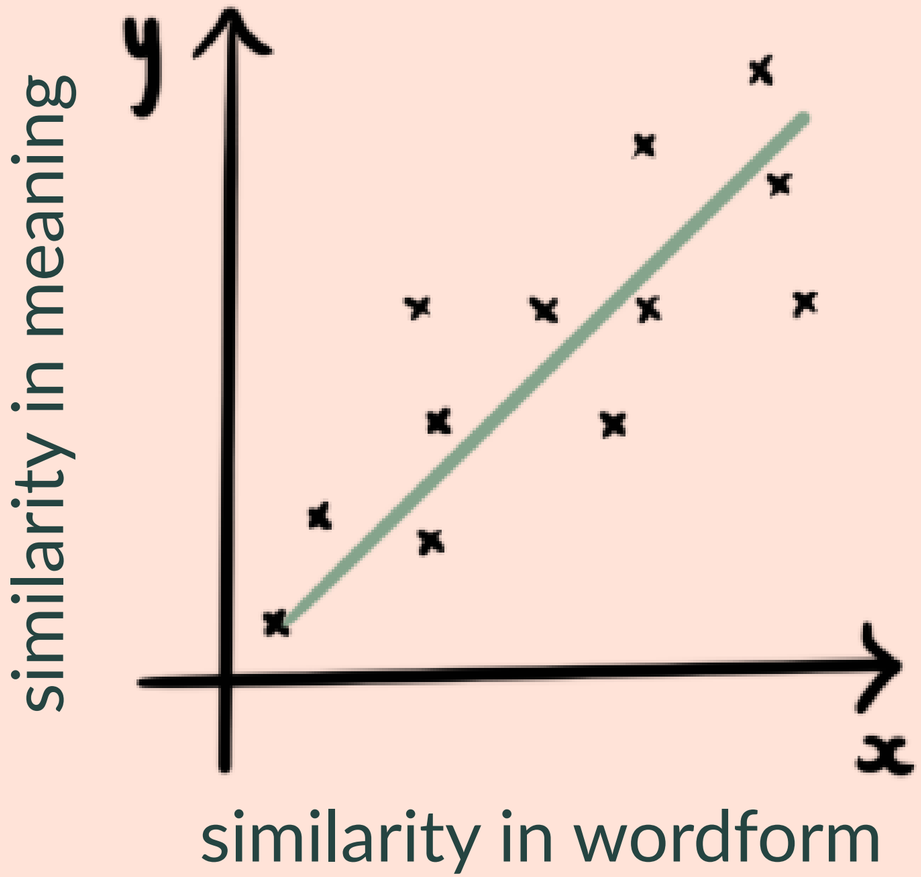
But languages don’t treat these features equally:
they encode some, but not others.




We want to create a world where the correlation between the form and meanings of words is as strong as possible.

# MAN’S MOTHER’S MOTHER vs MAN’S FATHER’S FATHER



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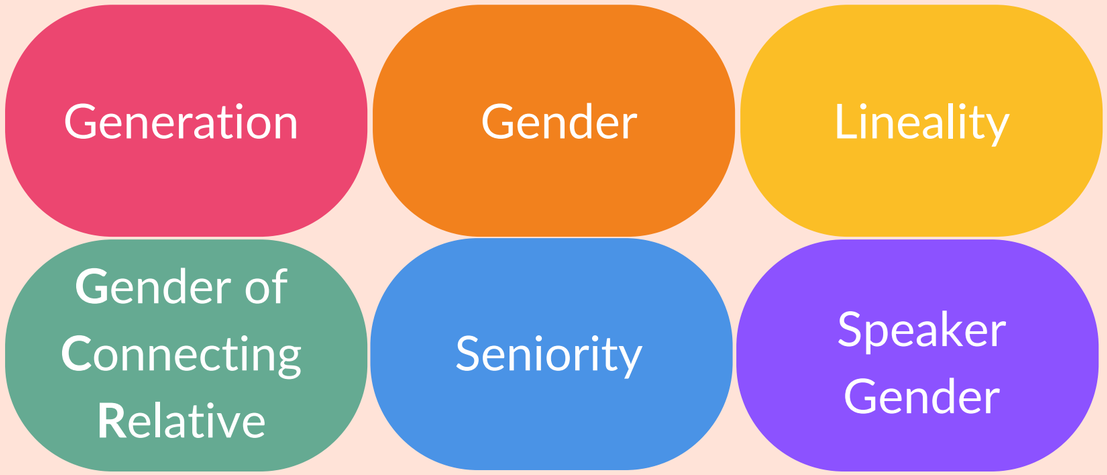


similarity in meaning =
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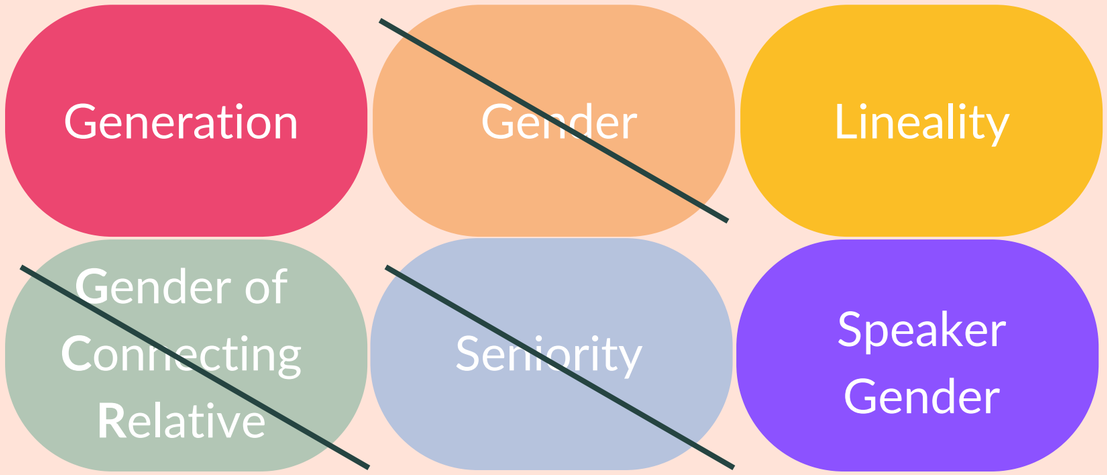


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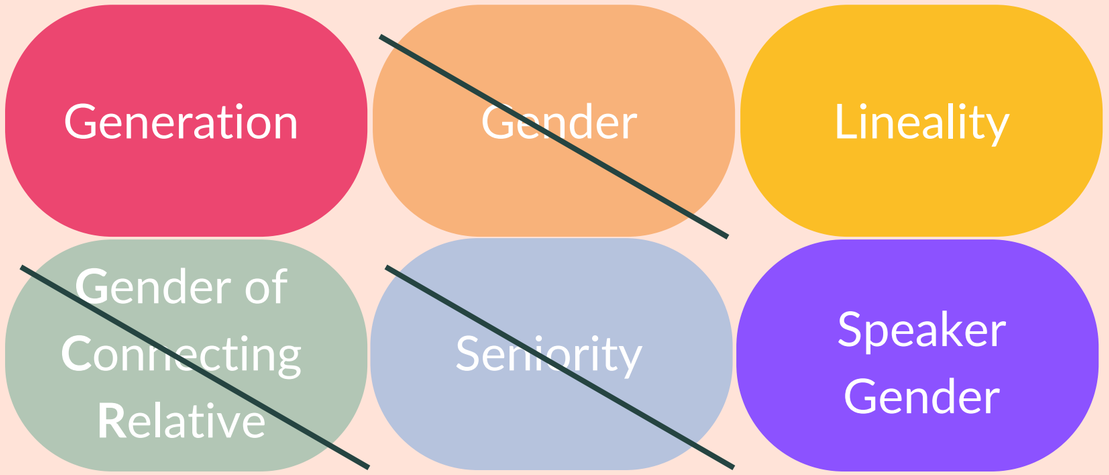


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**g r a n d m o t h e r**

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proportion of characters shared

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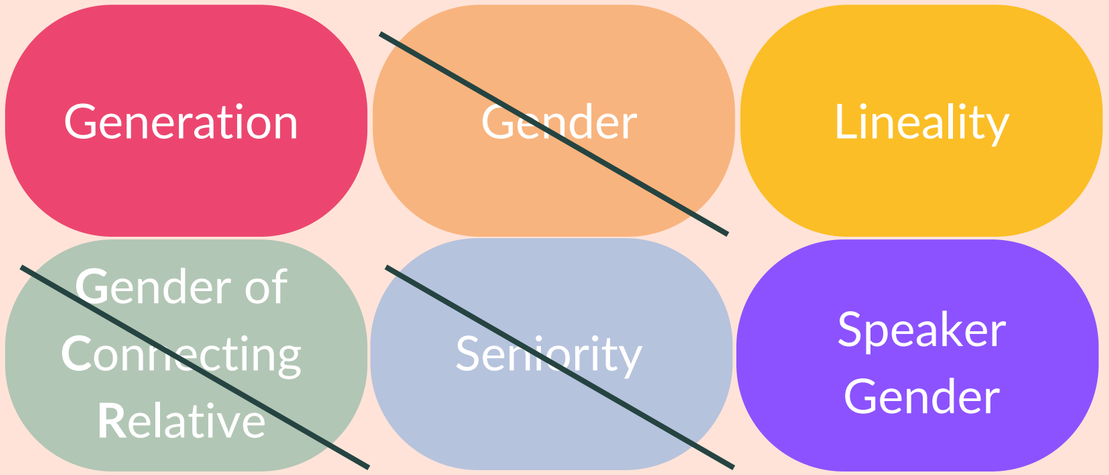


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For all pairwise meanings, in each language...

Our model optimises the correlation between
similarity in form and similarity in meaning through gradient ascent.

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Randomly assign a weight to each semantic feature setting

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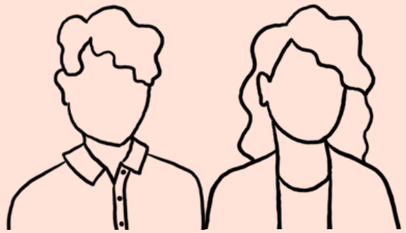

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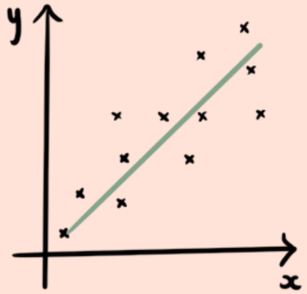


Calculate correlation between semantic and form similarity

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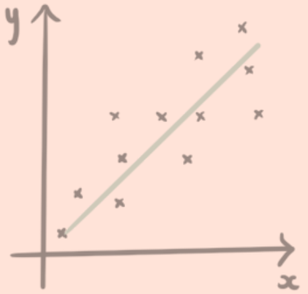


Calculate correlation between semantic and form similarity

Can any single change improve the correlation?

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Make a small improvement to the weights on each feature

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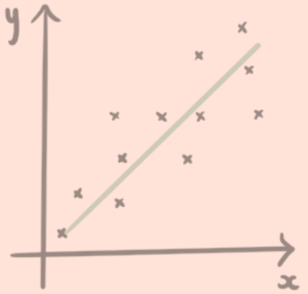


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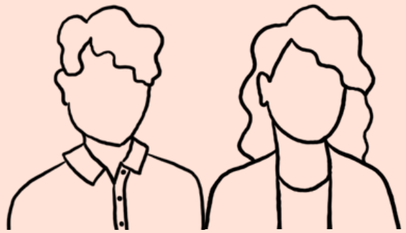

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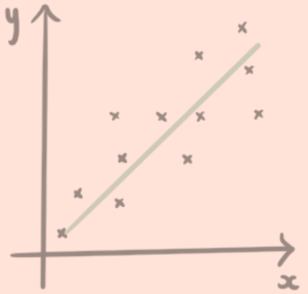


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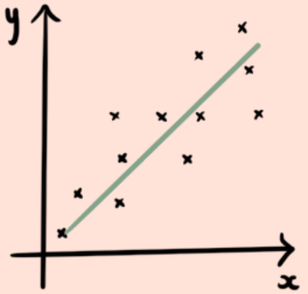


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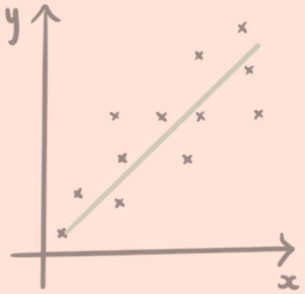


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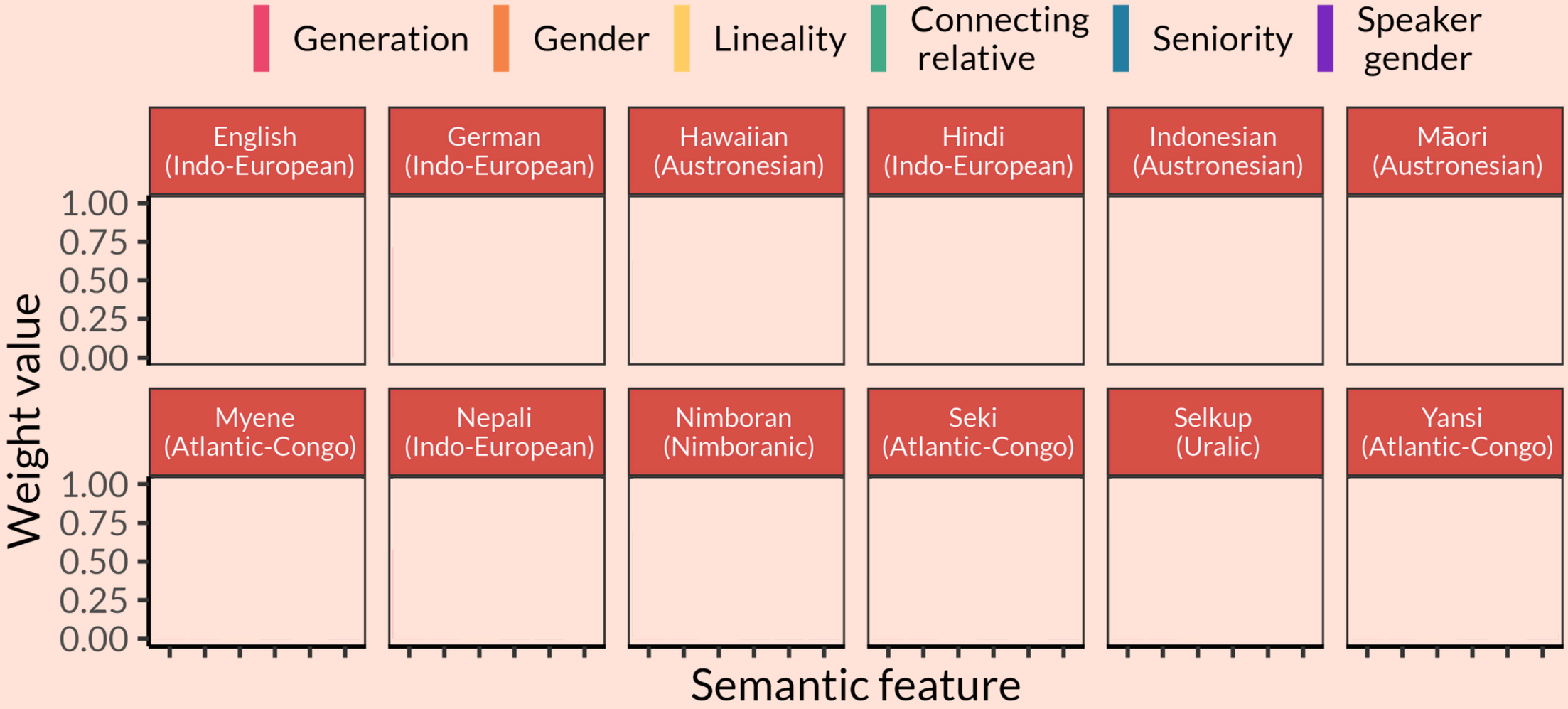
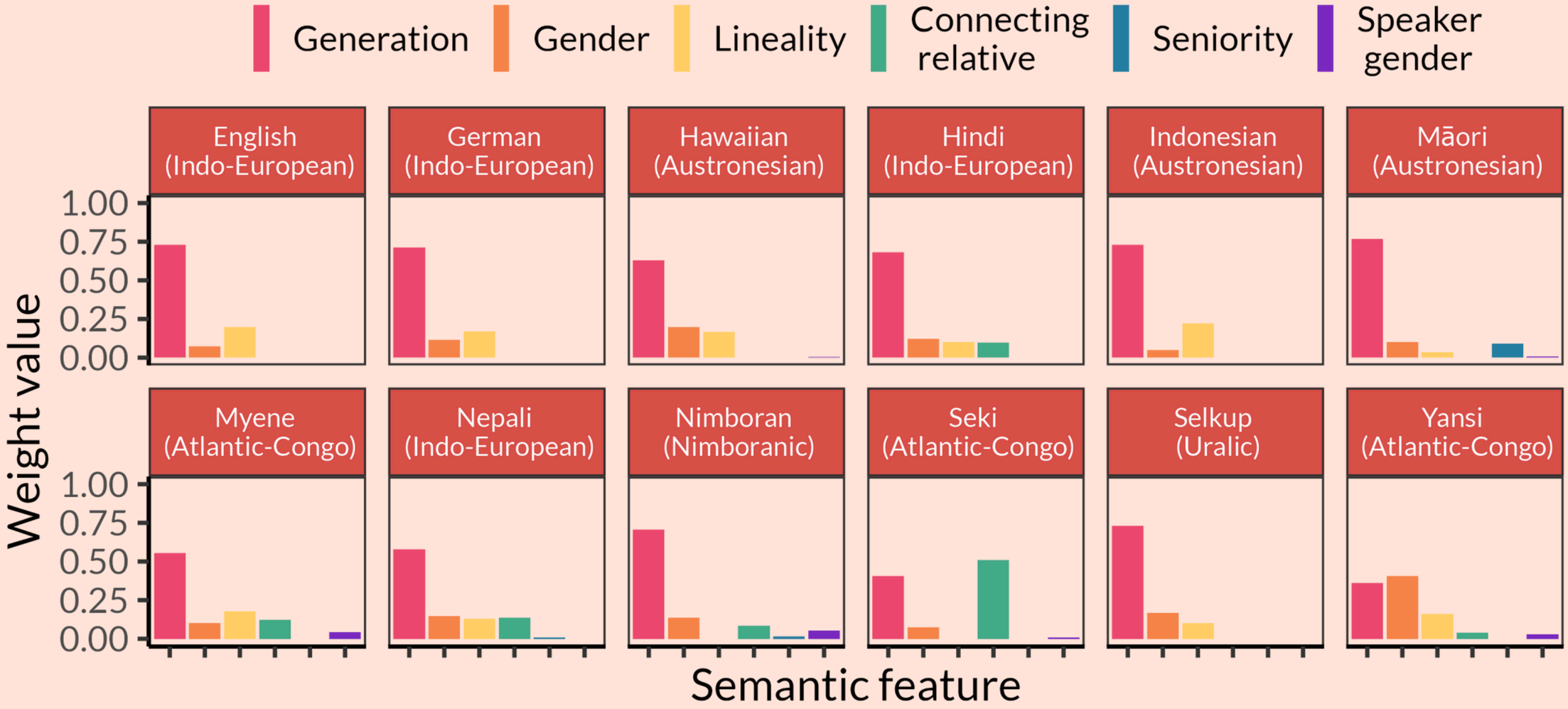



→ The final weight on each feature tells us how much it contributes to shared kin terms **for a particular language**.

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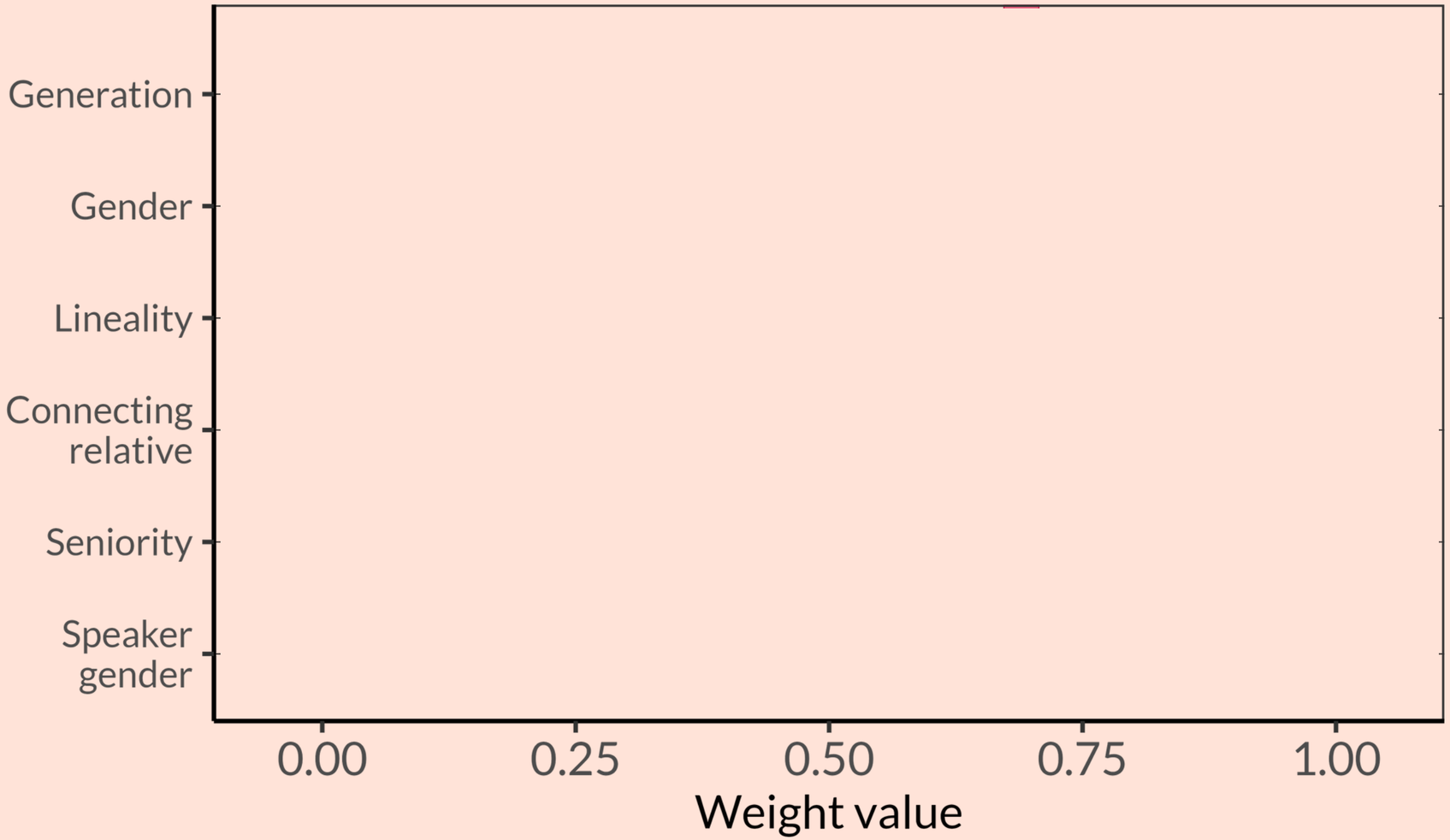


Aggregating over all languages, **we see a hierarchy emerge**:
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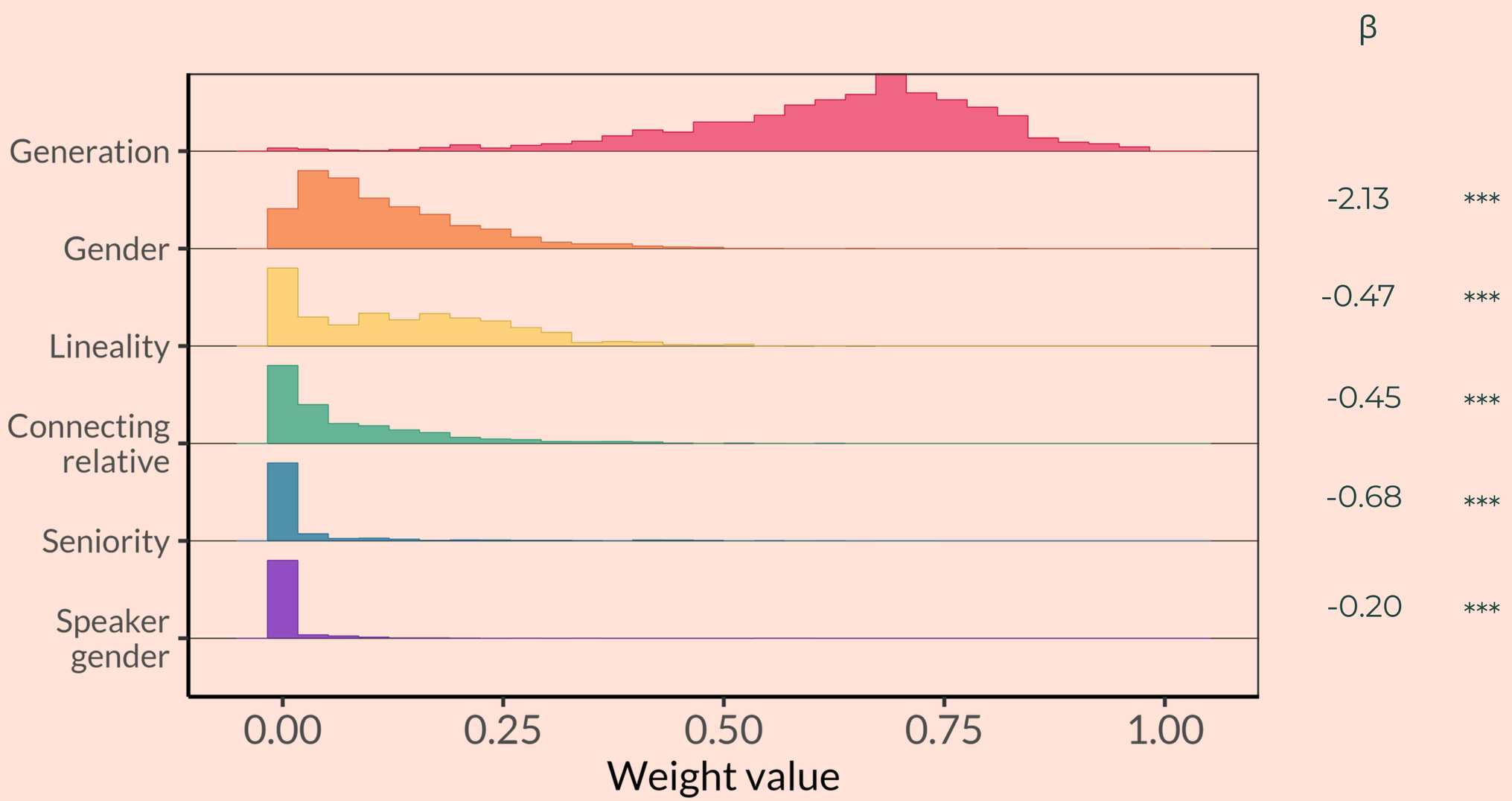


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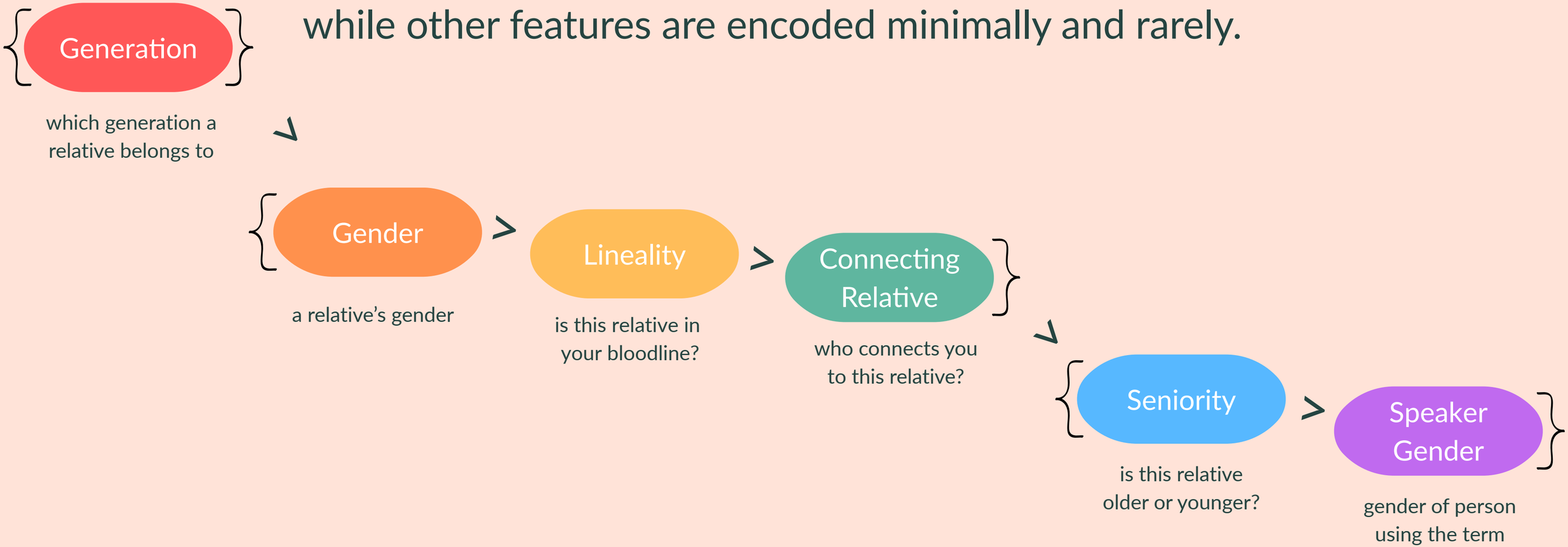

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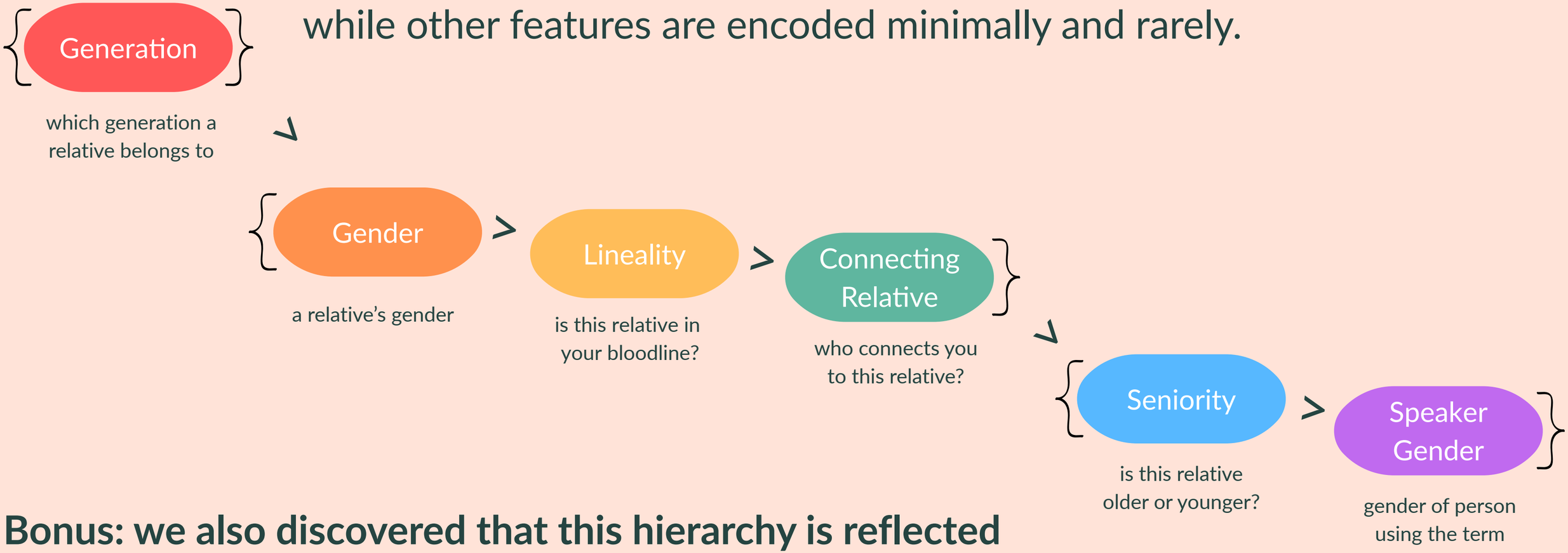


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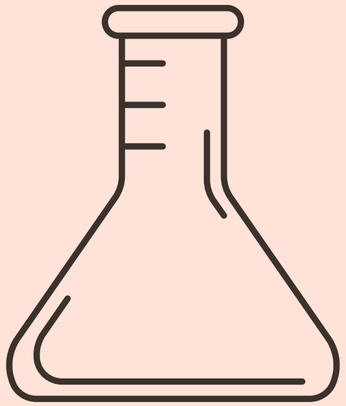
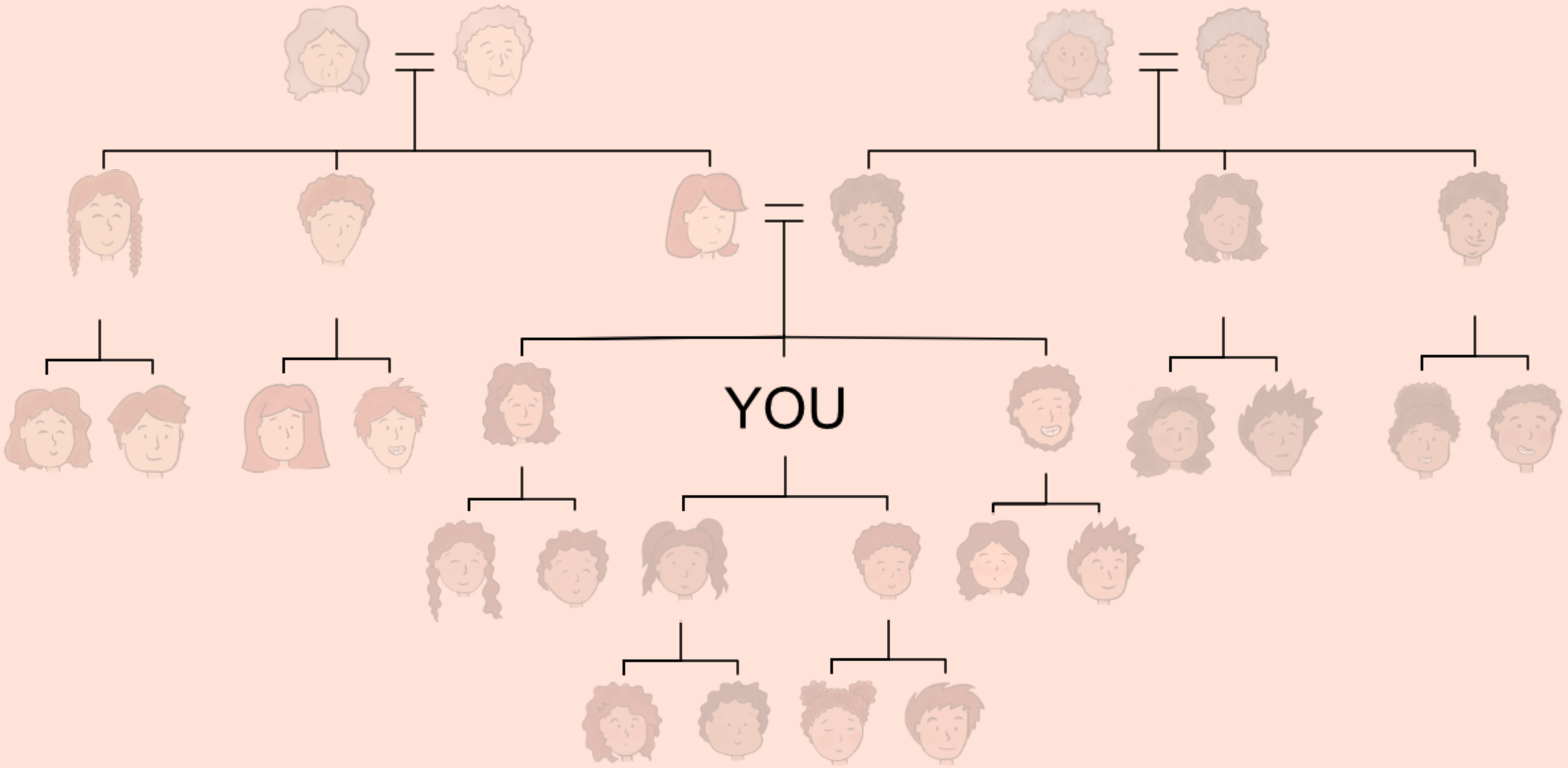
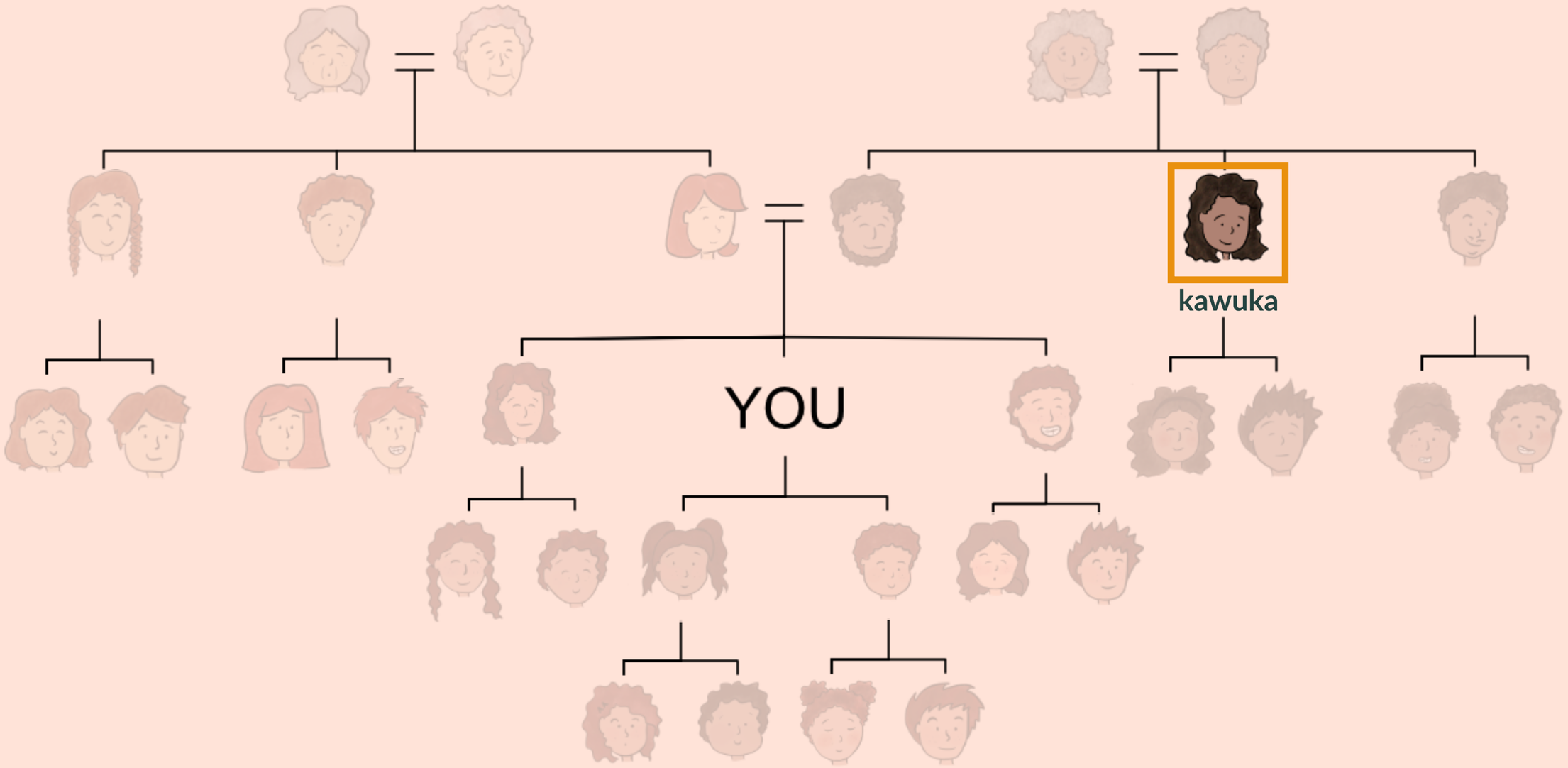


Part two:

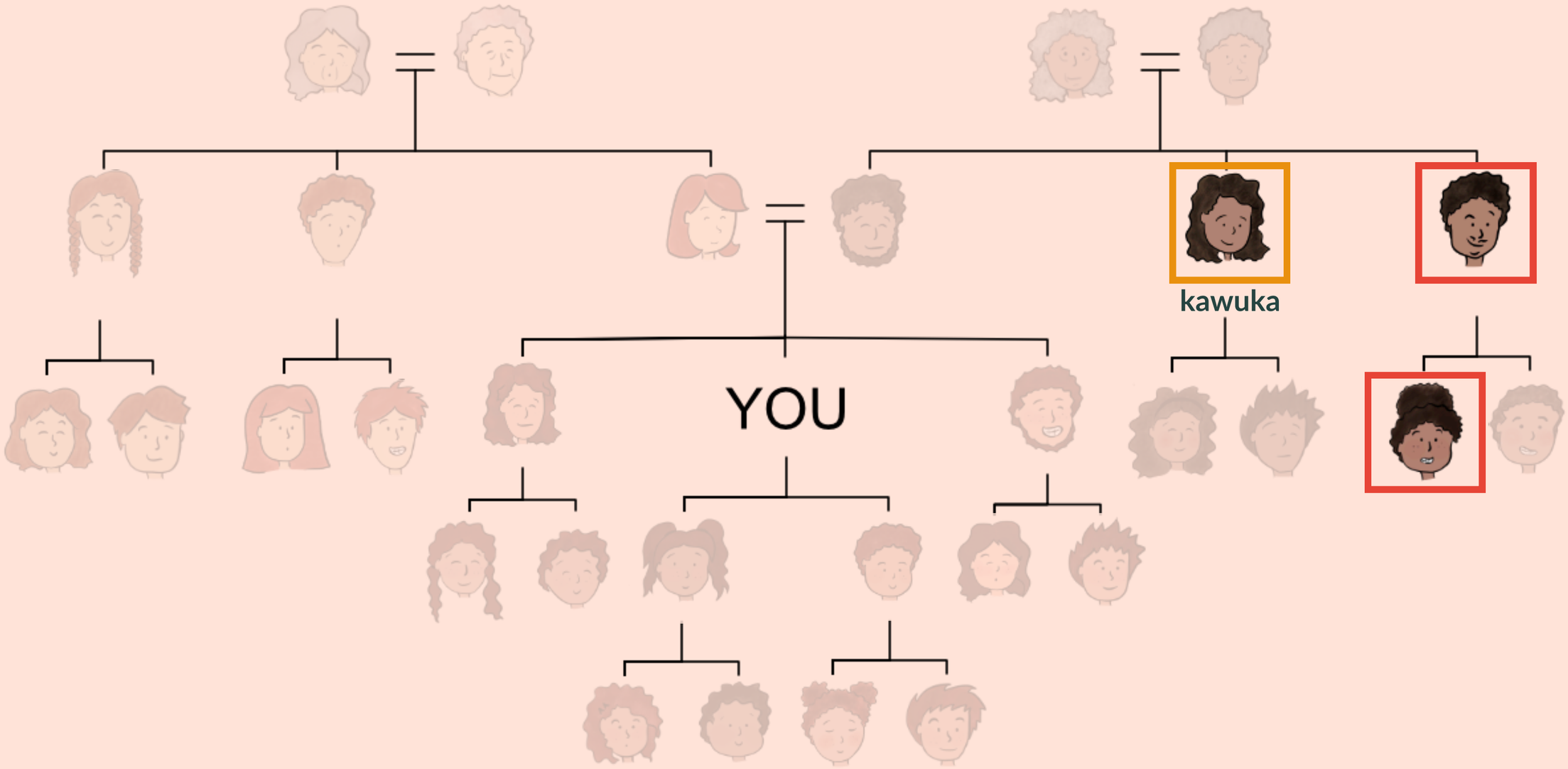
# In a novel language, participants group kin by higher ranked features


YOU

In this language, this family member is called your **kawuka**.



One of these two family members is also called your **kawuka**.



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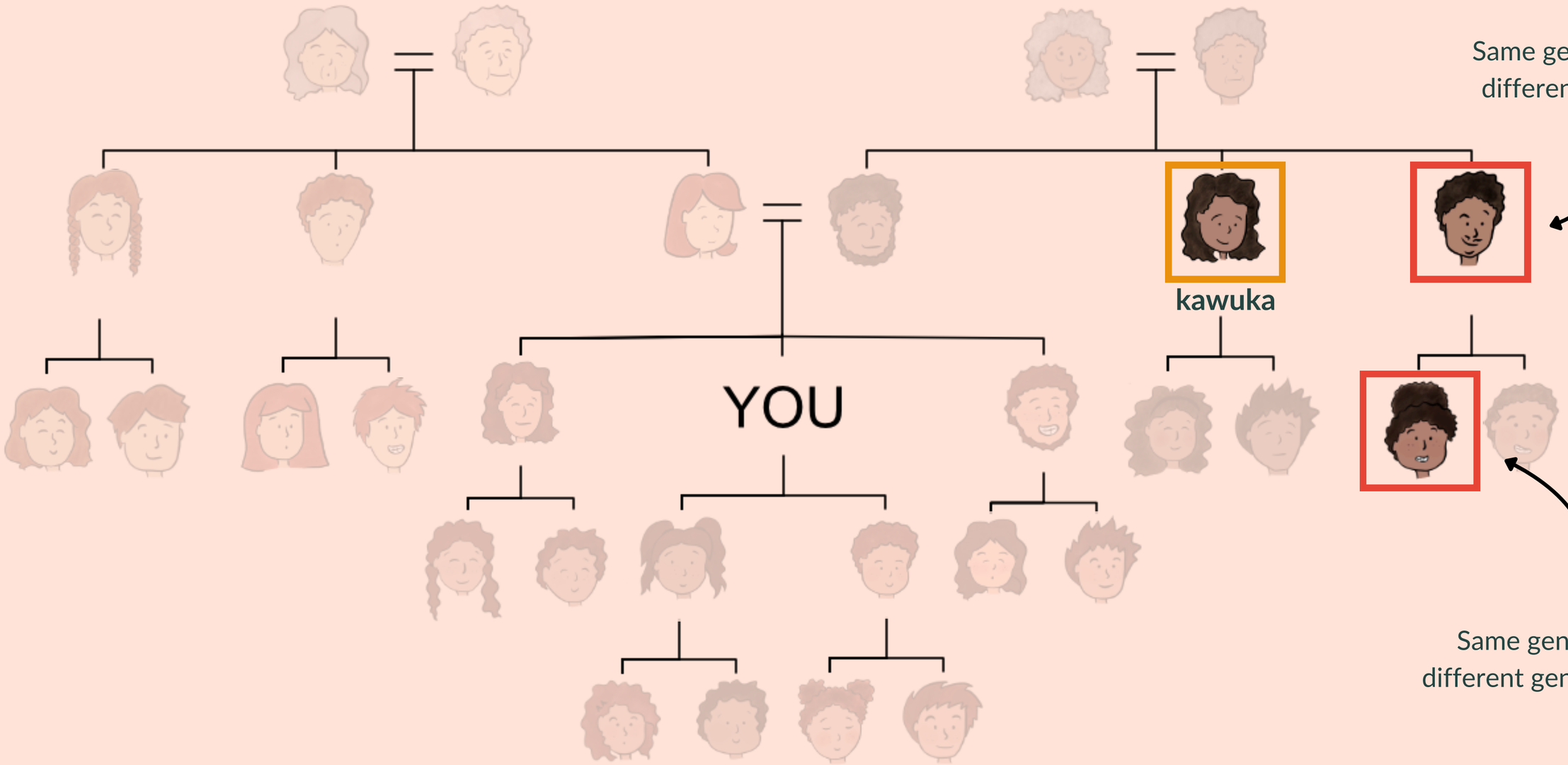
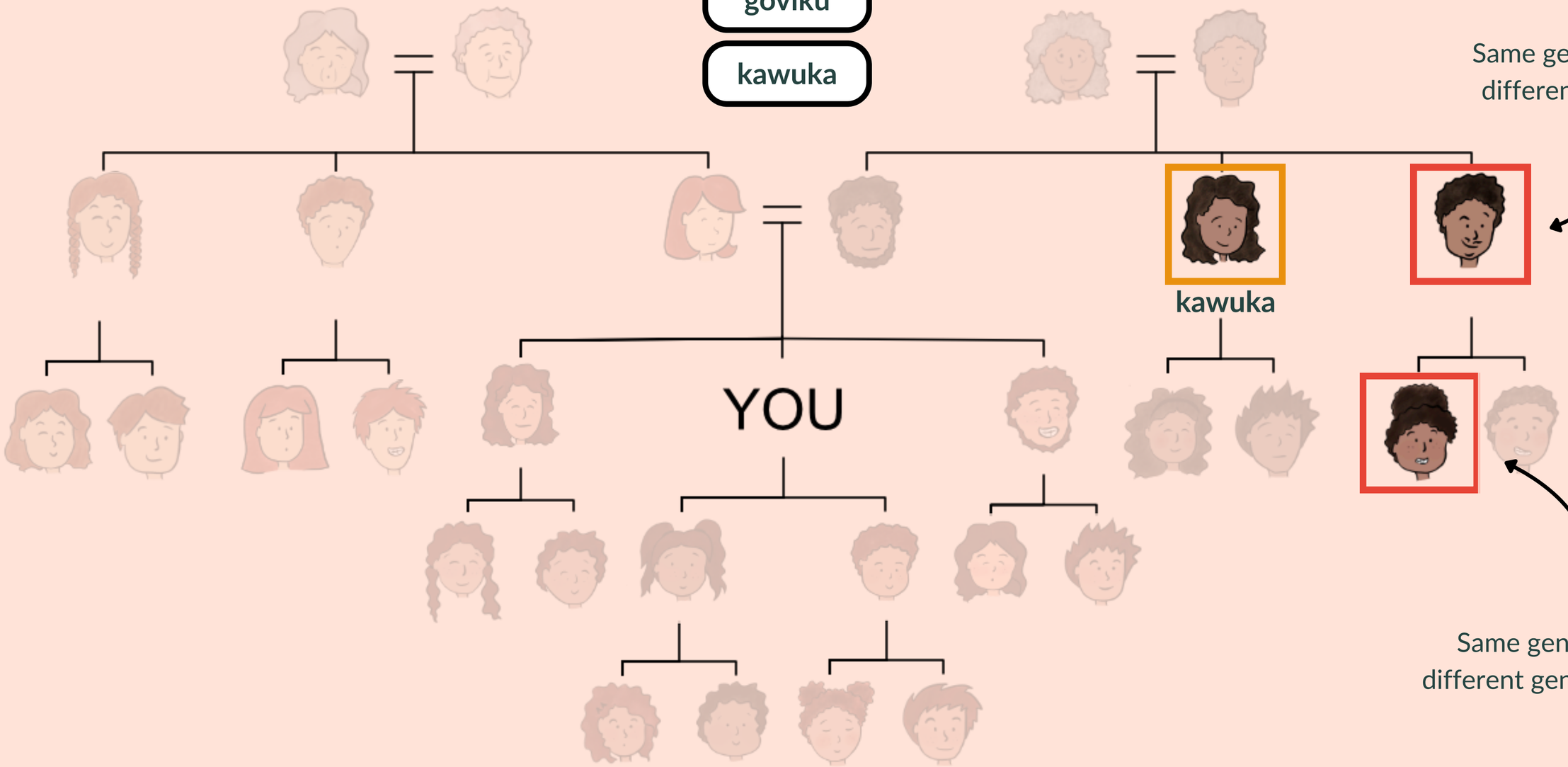


Choose a word for each family member by dragging and dropping the labels beneath them.

goviku

kawuka




Same generation, different gender

Same gender, different generation

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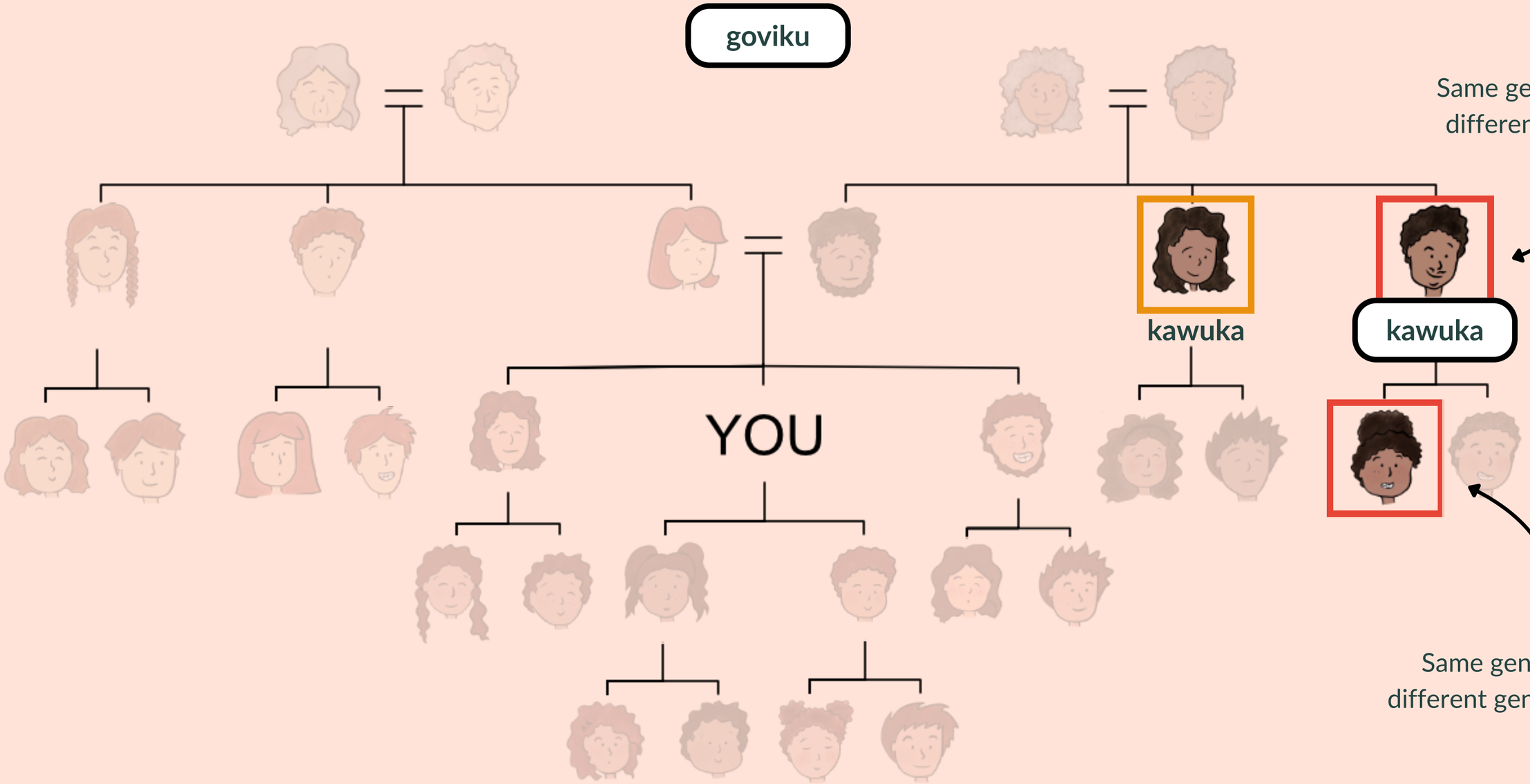

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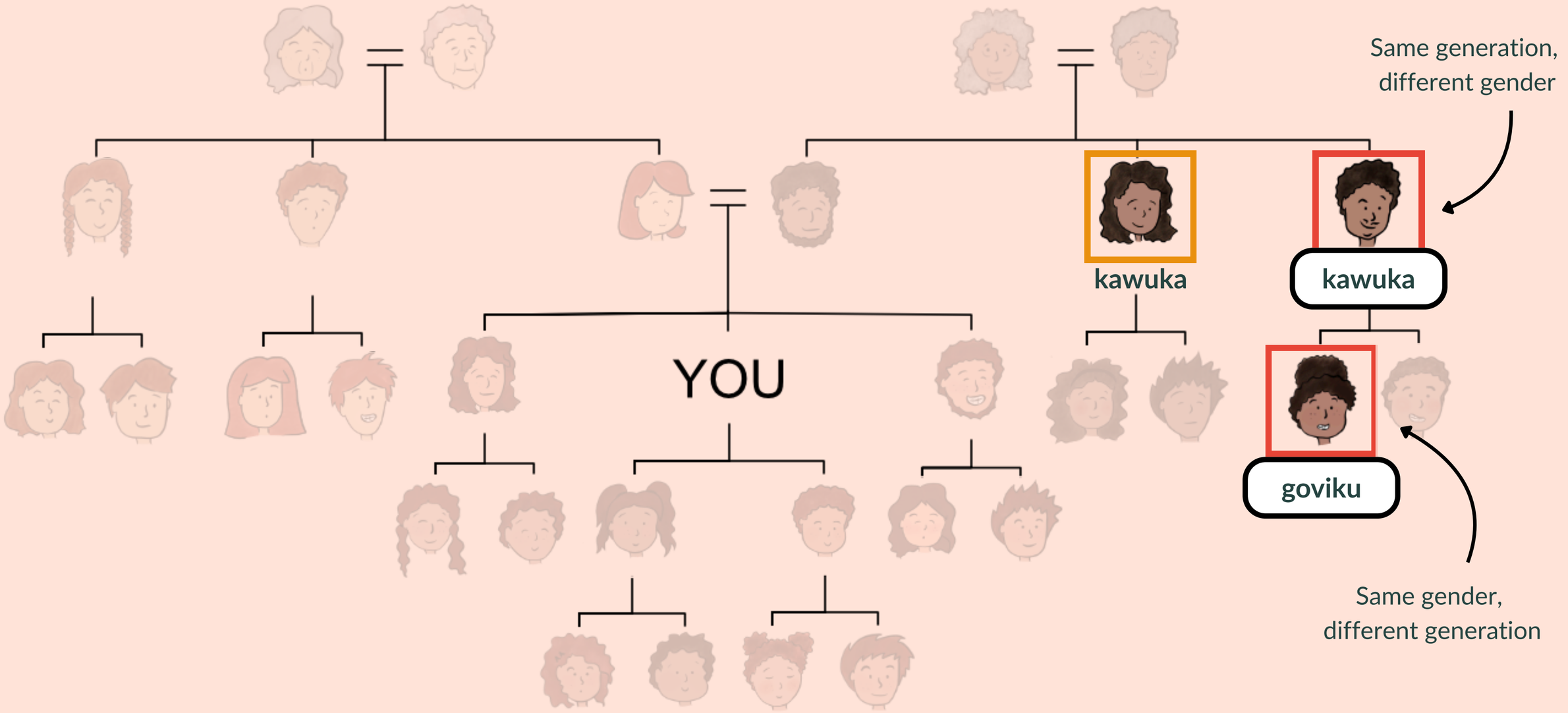
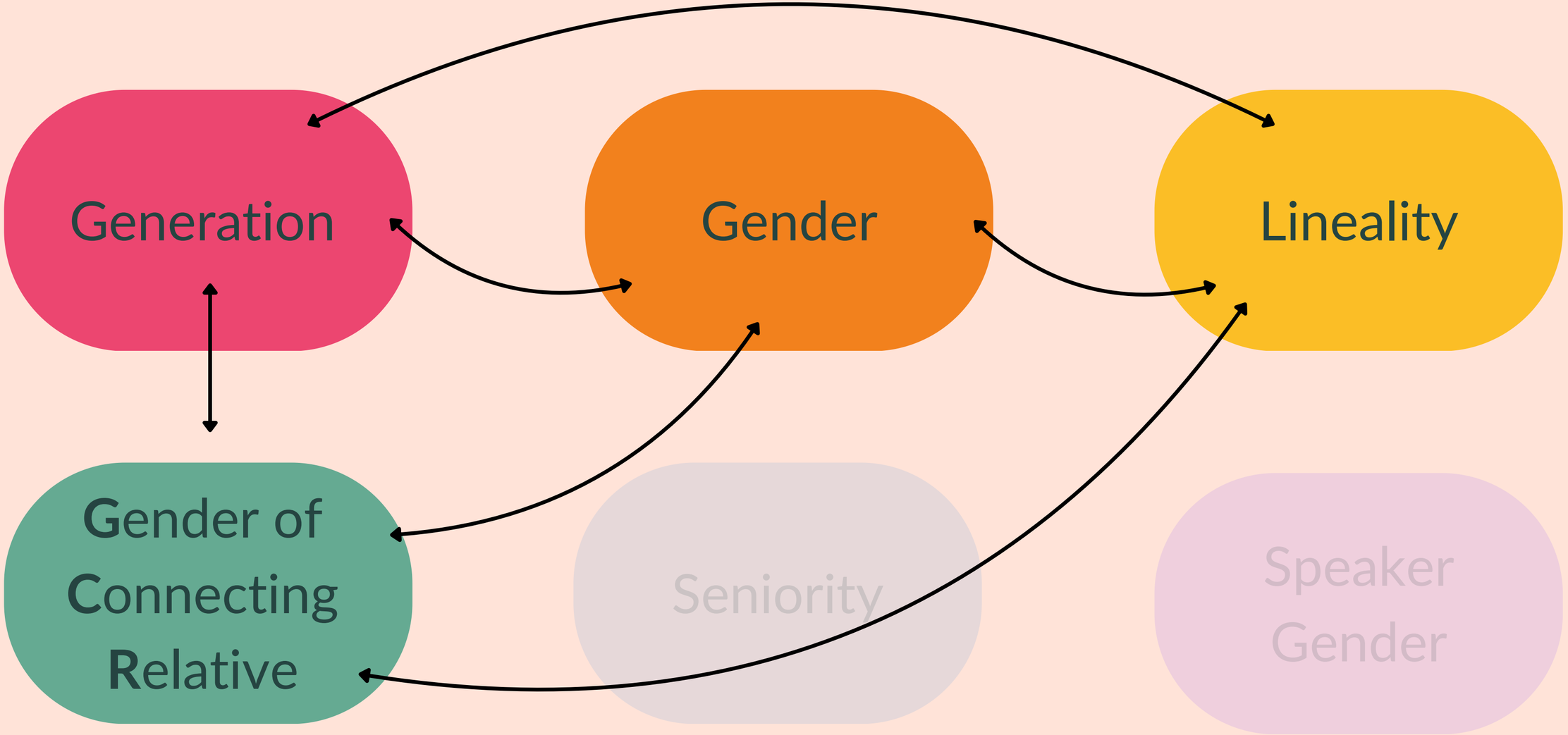
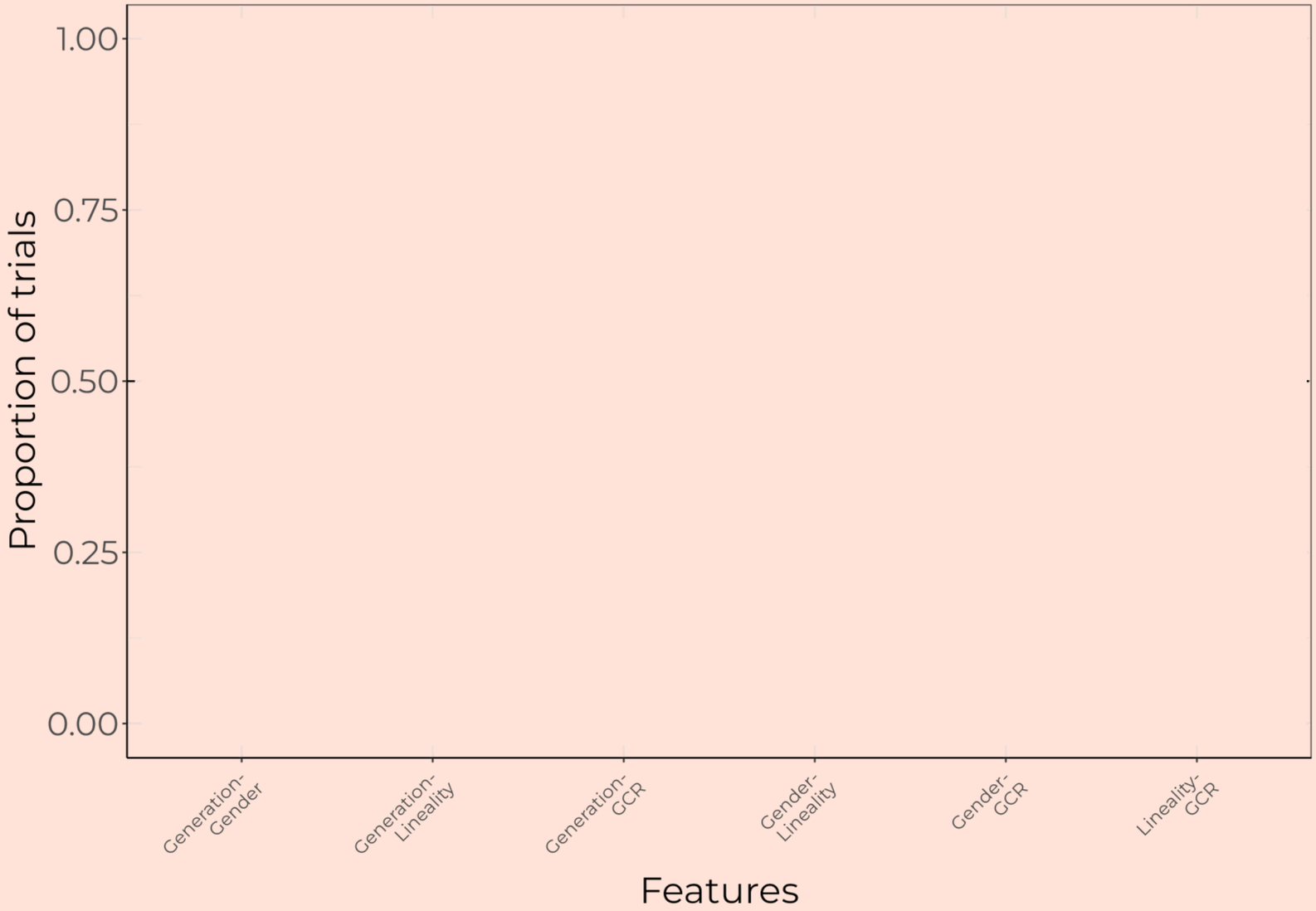
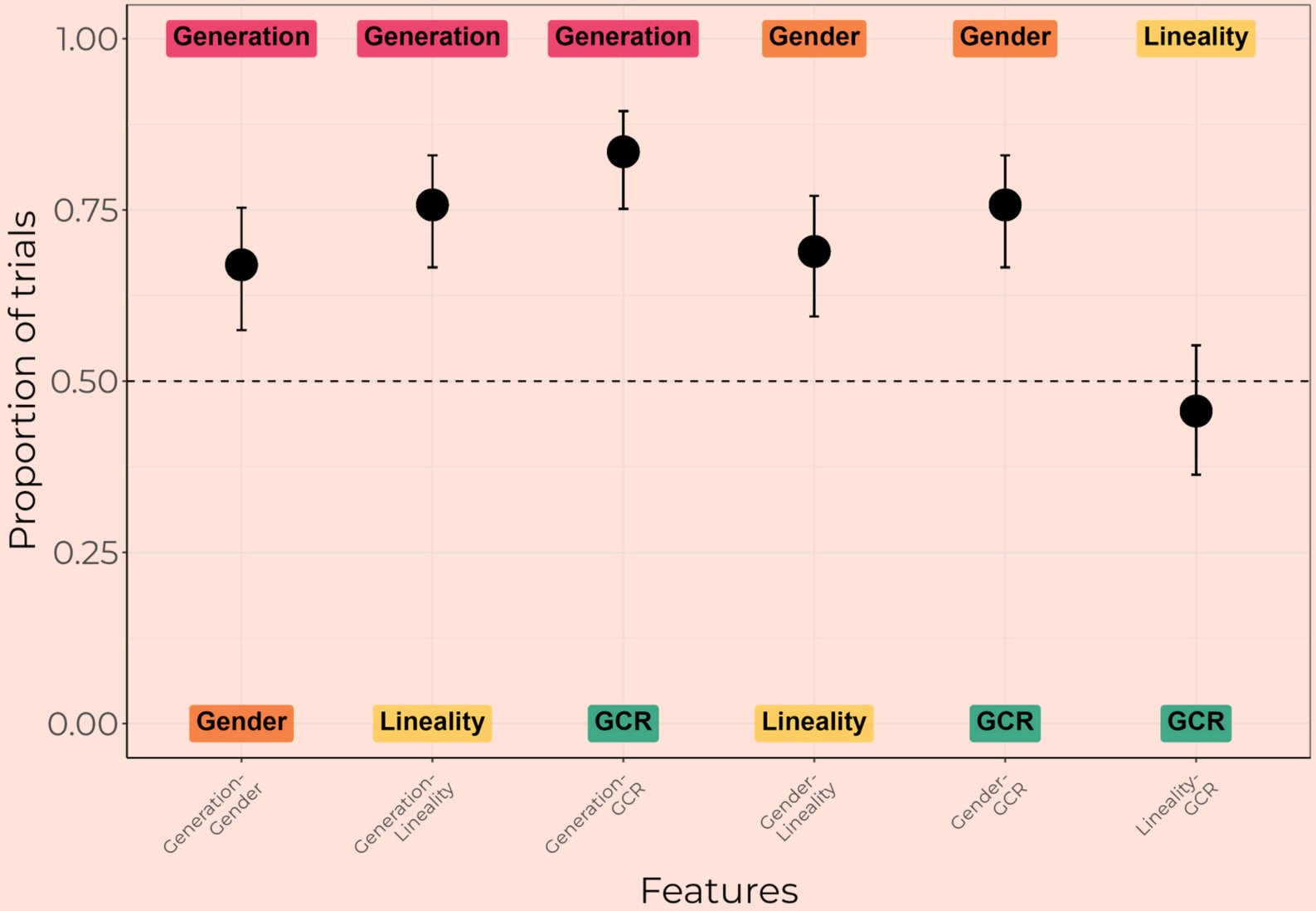





6 trials total




Our participants prefer to categorise kin who shared higher weighted features.

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Intrinsic properties of individuals

Relational properties

## Intrinsic properties of individuals

Generation

Gender

## Relational properties

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- Generation
- Gender

## Relational properties

- Lineality
- Connecting Relative
- Seniority

## Intrinsic properties of individuals

Generation

Gender

## Relational properties

Lineality

Connecting Relative

Seniority

?

Speaker Gender

5 possible categories

2 possible categories

<2 possible categories

5 possible categories

2 possible categories

<2 possible categories

Generation

| 5 possible categories | 2 possible categories | <2 possible categories |
| --- | --- | --- |
| Generation | Gender | |
| | Lineality | |
| | Connecting Relative | |
| | Speaker Gender | |


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## 5 possible categories

Generation

## 2 possible categories

Gender

Lineality

Connecting Relative

Speaker Gender

## <2 possible categories

Seniority

Different kinship systems use different features, but there is a reliable difference in weight between each feature and the next.

And this hierarchy is psychologically ‘real’ - it reflects people’s similarity judgements about kin.

# Thanks for coming!


## Maisy Hallam


Efficient communication drives the
semantic structure of kinship terminology


**https://maisyhallam.github.io/**

maisy.hallam@ed.ac.uk


extra extra, read all about it!
(CogSci Proceedings 2025)