Repetition reduction across multiple repetitions in American Sign Language fingerspelling

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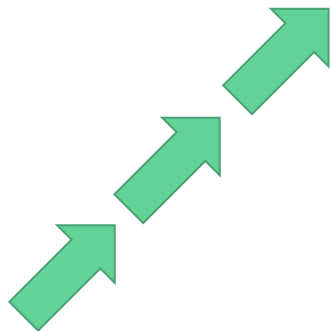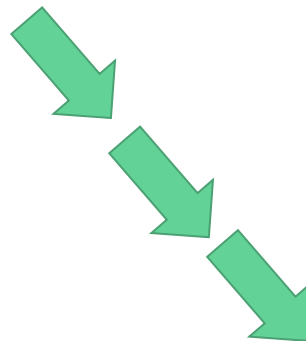
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Repetition-based reduction

Previous research has shown a relationship between the **number of times a word has been mentioned** and **word duration.**

Mention Number

Word duration

Repetition reduction in fingerspelling: An example

Repetition 1
Duration=680ms

Repetition 2
Duration=442ms

Repetition 3
Duration=238ms

Fingerspelled word: D-I-E-T

Research Questions

Primary question:
➢ What is the relationship between a fingerspelled word's previous mentions in discourse and its length?

Sub questions:
➢ How does reduction in length continue past a word's second mention?
➢ Does the time between mentions influence length reduction?

Research Questions

Primary question:

➢ What is the relationship between a fingerspelled word's previous mentions in discourse and its length?

Sub questions:

➢ How does reduction in length continue past a word's second mention?

➢ Does the time between mentions influence length reduction?

(Does phrasal position influence the length of repeated mentions?)

Presentation overview

Background

- Repetition reduction in ASL fingerspelling and speech

- Theoretical backdrop

- Research predictions

Methods

Results

Implications

Repetition-reduction in ASL fingerspelling

Word reduction in ASL fingerspelling continues across multiple word mentions:

➢ Significant increase in signing rate between second and third mentions[1]

➢ Reduction seen continuing across four mentions of two words[2]

➢ Increase in letter coarticulation across mentions[3]

[1]Wager 2012 [2]Lepic 2012 [3]Lepic 2019, Thumann 2012, Wager 2012

Repetition-reduction in speech

The givenness of a word in discourse influences its duration:

➢ Old, already given words are reduced in duration[1]

➢ Reduction does not significantly increase after a word's second mention[2]

Repetition has a binary effect

[1]Fowler & Housum 1987 [2]Bell et al. 2009, Vajrabhaya & Kapatsinski 2011

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➢ Reduction does not significantly increase after a word's second mention[2]

➡️ Repetition has a binary effect

➢ Increased distance between repetitions associated with less reduction[3]

[1]Fowler & Housum 1987 [2]Bell et al. 2009, Vajrabhaya & Kapatsinski 2011 [3]Rodriguez-Cuadrado et al. 2018

Theoretical explanations

More contextual information available about a word's identity → increased predictability.

Perceiver oriented theories:

➤ Reduction is a result of balancing conserving effort and perceiver comprehension[1].

[1]Lindblom 1990, Jurafsky et al . 2001, Aylett & Turk 2004

Theoretical explanations

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Perceiver oriented theories:

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Part of this contextual information available for production is a word's givenness

[1]Lindblom 1990, Jurafsky et al . 2001, Aylett & Turk 2004

Givenness information used for production

Given or not given?

OR

Given how many times?
Time since last mention?

?

Discourse context
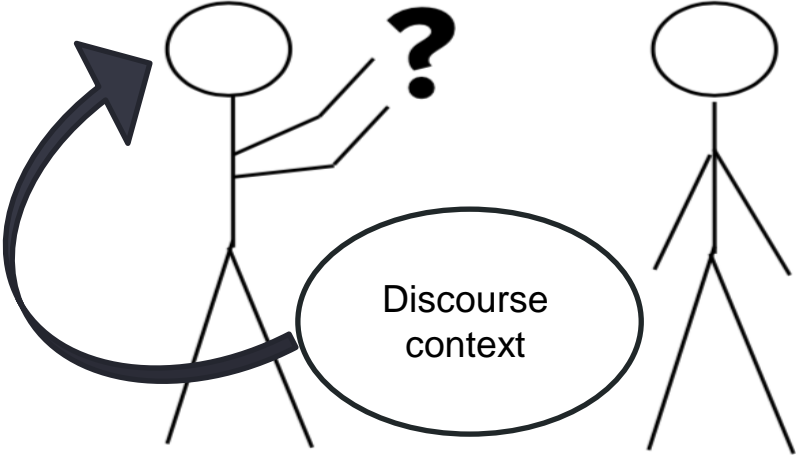
Predictions:

Prediction 1:
➢ Fingerspelled words will continue to reduce past second mentions, decreasing in the amount they reduce as they are repeated.

Prediction 2:
➢ Variation in repeated word duration can be accounted for through distance between mentions (farther apart → less reduction)

Methods: data

Wider fingerspelling corpus:

➢ Drawn from a lager crowd-sourced data-set[1] of fingerspelling videos from online (35,000 fingerspelled words)

➢ Encompasses a wide range of genres and topics

    ➢ Cooking

    ➢ Politics

    ➢ Education

➢ Signing ranges from spontaneous to semi-scripted

[1]Shi et al. 2019

Methods: data

Reduction corpus

➢ Repetition dataset targeted repeated words (3-5 repetitions)

➢ Excludes lexicalized fingerspelling

➢ Annotated for duration, letters, & phrasal position

Composition:

Dataset category	Number
Signers	34
Words	103
Individual tokens	477

Methods: Analysis

Analysis 1 tests the effect of:
➢ Mention number (1-5)
➢ Phrasal position

Analysis 2 tests the effect of:
➢ Mention number (2-5)
➢ Time distance between repeated mentions

Results: Analysis 1

Prediction 1:

Fingerspelled words will continue to reduce past second mentions, decreasing in the amount they reduce as they are repeated.
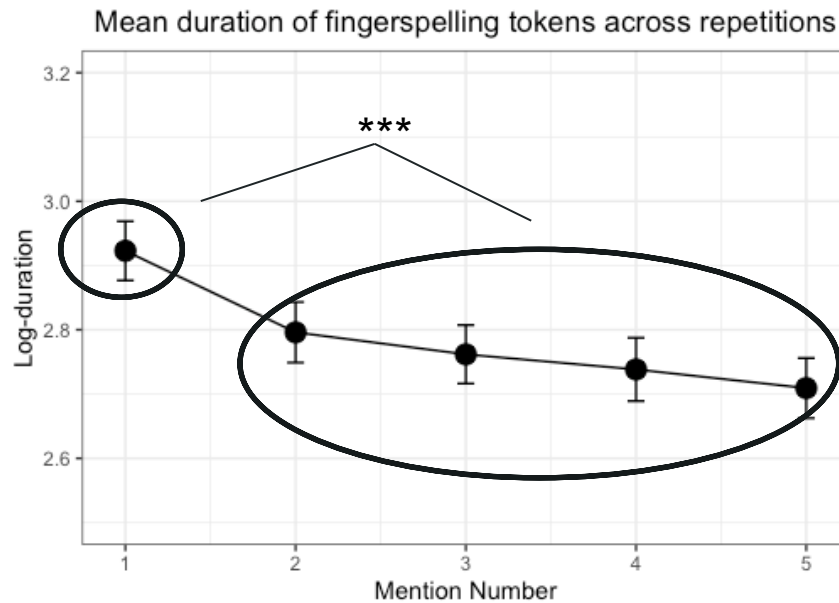

Mean duration of fingerspelling tokens across repetitions

Results: Analysis 1

Comparing mention means:

➢ 1st vs. subsequent mentions
    (E =0.154 , SE =0.014 , p < 0.001)

Mean duration of fingerspelling tokens across repetitions

Results: Analysis 1

Comparing mention means:

➤ 1ˢᵗ vs. subsequent mentions
(E =0.154 , SE =0.014 , p < 0.001)

➤ 2ⁿᵈ vs. subsequent mentions
(E =0.045 , SE =0.015 , p < 0.003)

Mean duration of fingerspelling tokens across repetitions
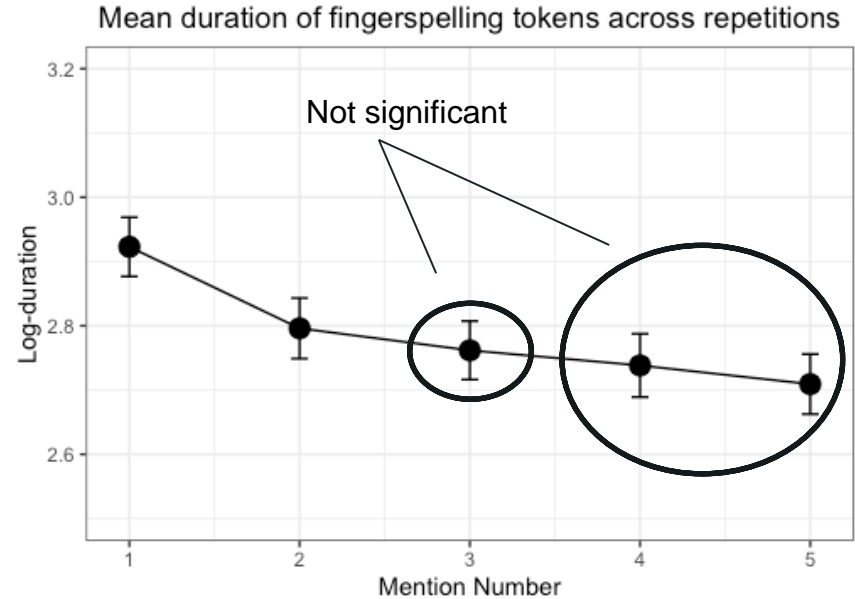
Results: Analysis 1

Comparing mention means:
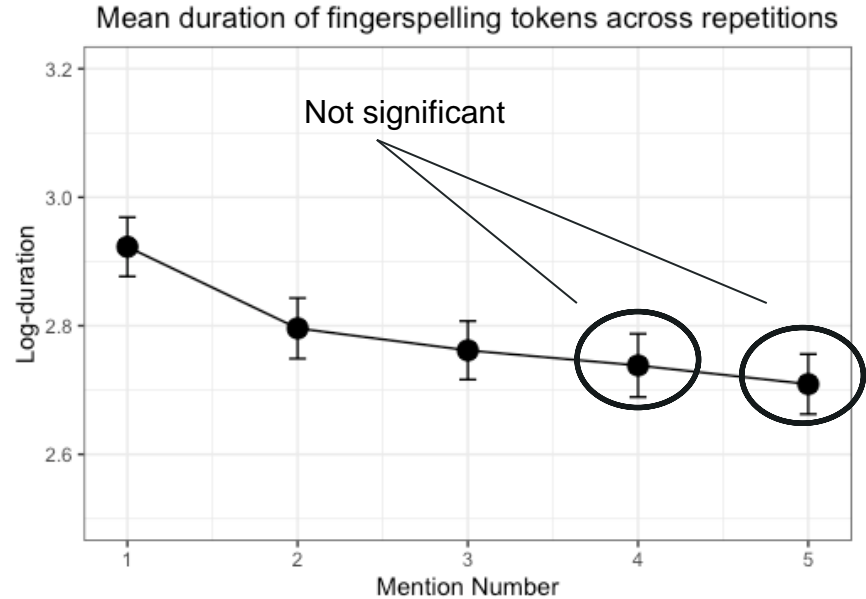
➢ 1st vs. subsequent mentions
   (E =0.154 , SE =0.014 , p < 0.001)

➢ 2nd vs. subsequent mentions
   (E =0.045 , SE =0.015 , p < 0.003)

➢ 3rd vs. subsequent mentions
   (E =0.025 , SE =0.016 , p =.128)

Mean duration of fingerspelling tokens across repetitions

Not significant
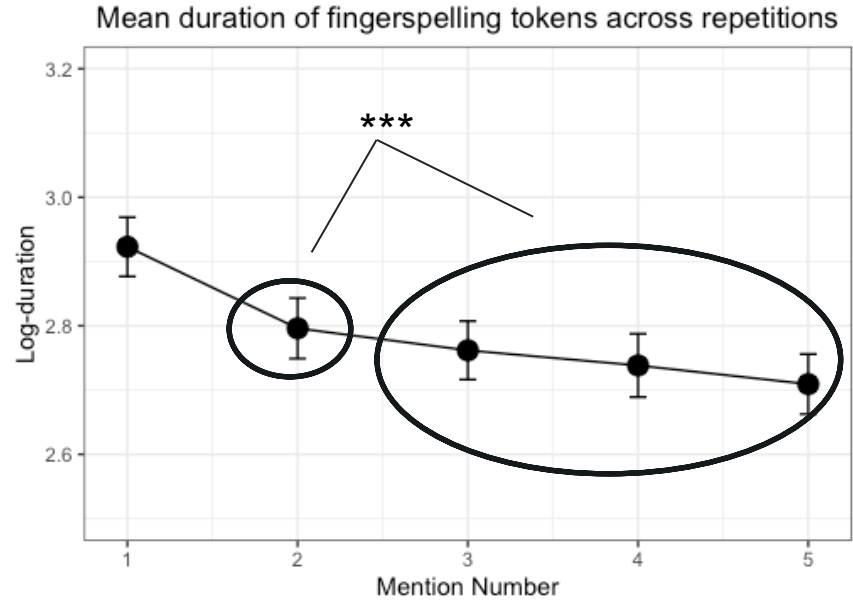
Results: Analysis 1

Comparing mention means:

➤ 1st vs. subsequent mentions
        (E =0.154 , SE =0.014 , p < 0.001)

➤ 2nd vs. subsequent mentions
        (E =0.045 , SE =0.015 , p < 0.003)

➤ 3rd vs. subsequent mentions
        (E =0.025 , SE =0.016 , p =.128)

➤ 4th vs. subsequent mentions
        (E =0.016 , SE =0.019 , p =.423)

Mean duration of fingerspelling tokens across repetitions

Not significant

Results: Analysis 1

Accounting for variation in length due to **phrasal position:**

Variation in length will be mediated by phrasal position (phrase final → longer)
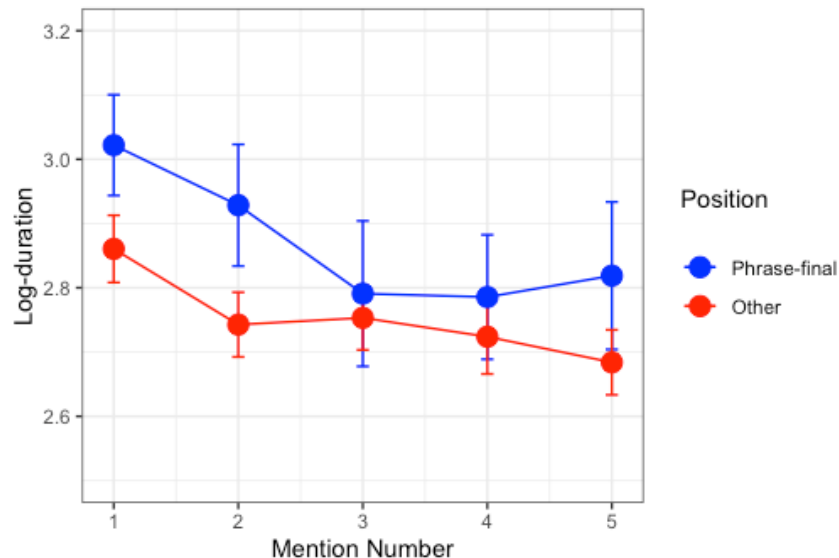

Phrasal position and mean duration of tokens
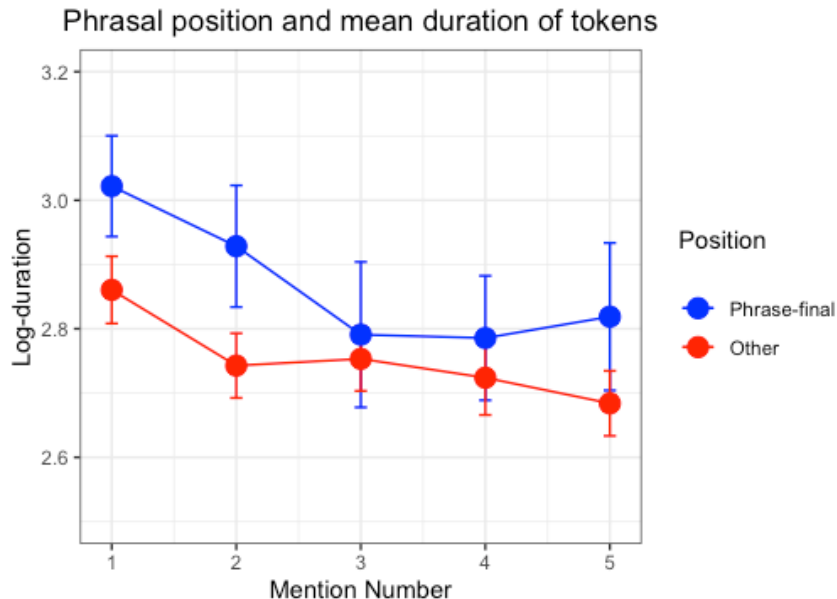
Results: Analysis 1

Accounting for variation due to **phrasal position:**

➤ Phrase-final tokens were **significantly longer**
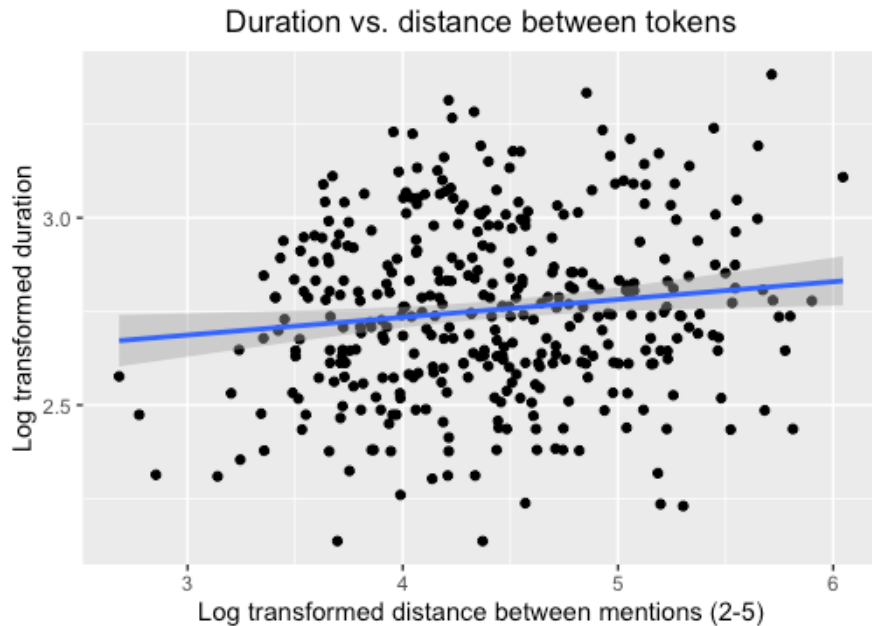(E = 0.081, E=0.015, p<0.001)

Phrasal position and mean duration of tokens

Results: Analysis 2

Prediction 2:

Variation in length will be
accounted for by distance
between repeated mentions
(Increased distance → increased
duration)

Duration vs. distance between tokens

Results: Analysis 2

Results:

➤ Distance between mentions had a **significant positive correlation** with duration within the model
      (E=0.053, SE=0.013, p<0.001)

Duration vs. distance between tokens

Log transformed duration

Log transformed distance between mentions (2-5)
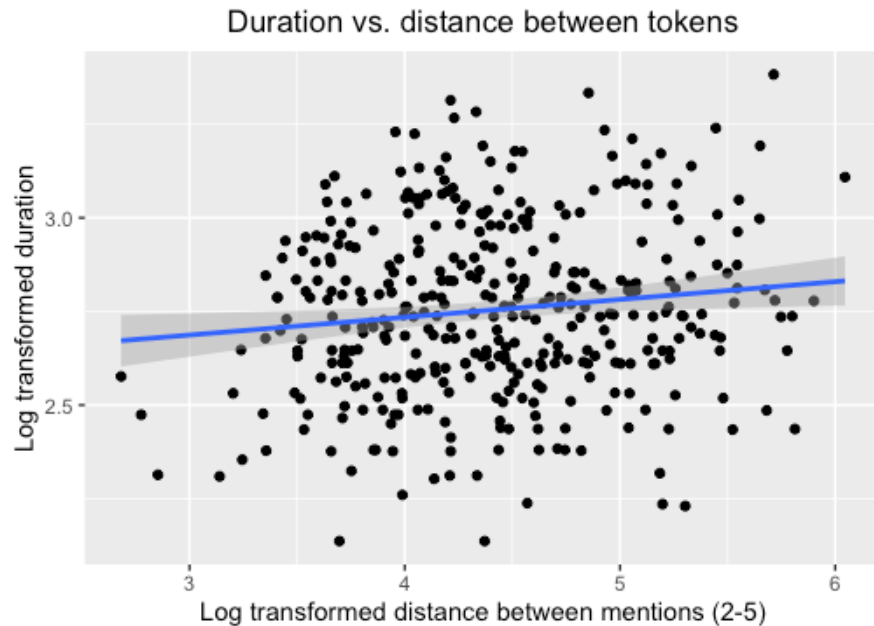
Implications

For our understanding of fingerspelling:

➤ Confirms findings from previous work
  ○ Mention number
  ○ Final lengthening

➤ Shows that reduction effect is not uniform across mentions

➤ Adds the dimension of between-mention distance

Implications

For models of language production:

➢ Language users are sensitive to more detailed information about a word's givenness encompassing:

- ○ **How many** times it has been mentioned
- ○ **Time-distance** from the last mention

Conclusions

Using ASL fingerspelling as the lens through which to examine word reduction and repetition provides us with a more complex view of how repetition can contribute to word length.

Remaining questions:
➢ How much of this reduction effect is a result of modality vs. how much is a result of the fingerspelling system?
➢ How does repetition reduction in fingerspelling impact comprehension?

Acknowledgements

Many thanks to Diane Brentari, Julia Kersten, and the University of Chicago's Modalities of Language group for collaboration, support, and feedback!

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Results: NM markers

Focus-finger results

Words with a focus-finger were not significantly longer.

(E=0.030, SE=0.019, p=0.177)

Focus-finger and mean duration of tokens
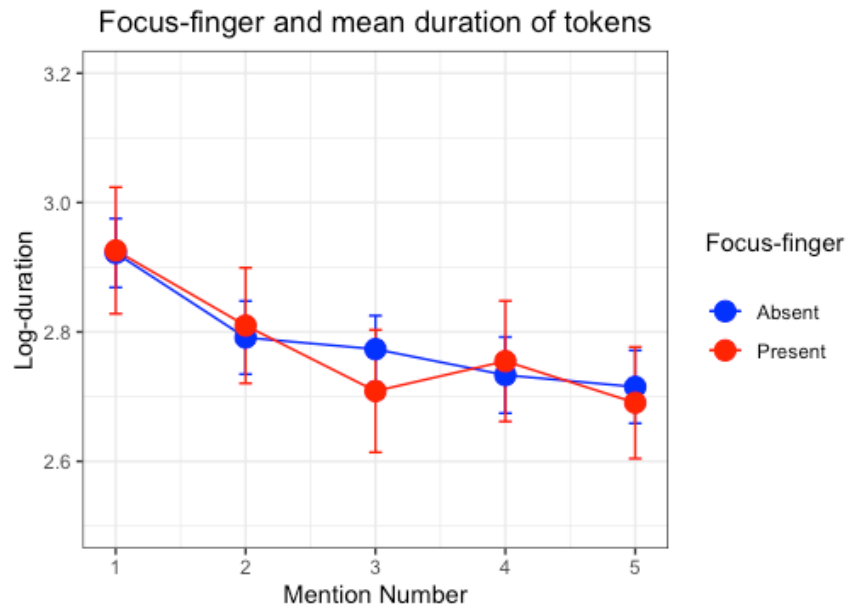
Results: NM markers

Raised-eyebrows results:

Words with raised-eyebrows were not significantly longer.

(E=0.005, SE=0.022, p=0.82)

Raised-eyebrows and mean duration of tokens