



Adam Mickiewicz University in Poznań

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# **Cross-linguistic analysis of pitch range and its influence on perceived speech friendliness**

Mateusz Jekiel and Kamil Malarski

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# Outline

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- Background
  - Preliminary analysis
  - The study
  - Conclusions and plans for future research
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# Paralinguistic uses of pitch

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- all languages use gradient variations in pitch properties to signal different degrees of a certain set of meanings
    - attitude
    - confidence
    - friendliness
    - surprise
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# Paralinguistic uses of pitch

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- biological conditions that cause pitch variation across and within speakers
    - Frequency Code (Ohala 1983)
      - smaller larynxes produce higher-pitched sounds
    - Effort Code (Gussenhoven 2002)
      - change in the amount of energy is reflected in the speech signal
    - Production Code (Gussenhoven 2002)
      - supply of energy is available in breathing phases
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# The Frequency Code

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- higher pitch

- feminine
- submissive
- friendly
- polite
- vulnerable
- uncertain

- lower pitch

- masculine
  - dominant
  - confident
  - protective
  - aggressive
  - certain
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# Pitch range variation

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- pitch range: span and register (Cruttenden 1997)
  - pitch span: distance between the highs and the lows
    - the wider span, the higher register (Ladd 1996)
  - pitch register: mean pitch value of the pitch contour
    - increases and decreases of high and low pitches (Rietveld and Vermillion 2003)



# Is paralinguistic intonational meaning universal?

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- cross-linguistic variations
  - listeners with different language background rely on similar intonational cues, but differ in sensitivity to them (Scherer 2000, Makarova 2000)



# Language specific effects of pitch range on perception of universal intonational meaning

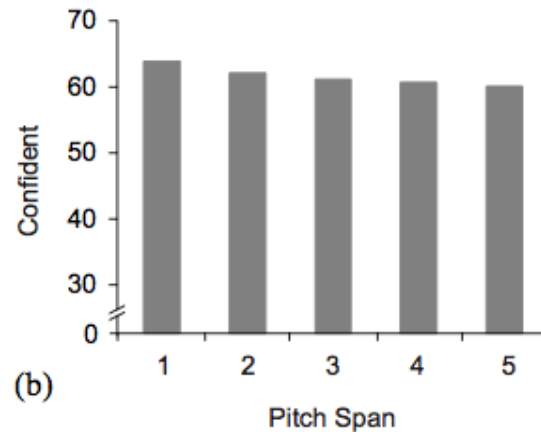
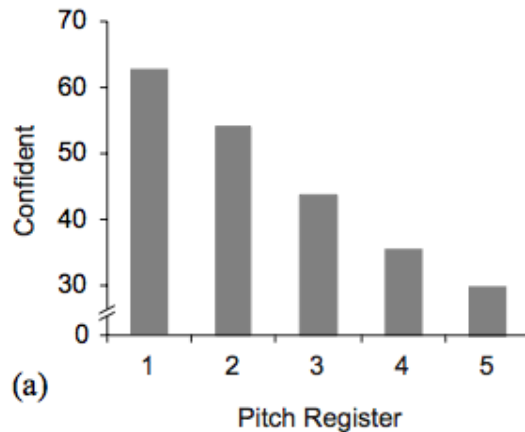
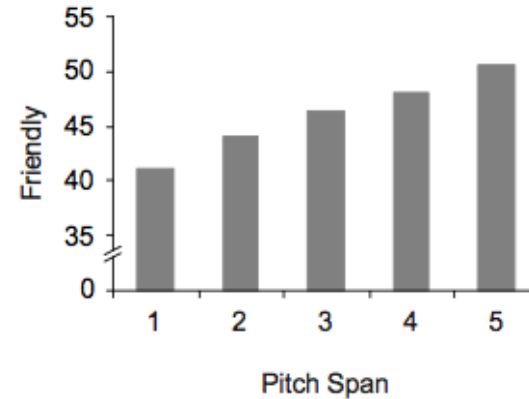
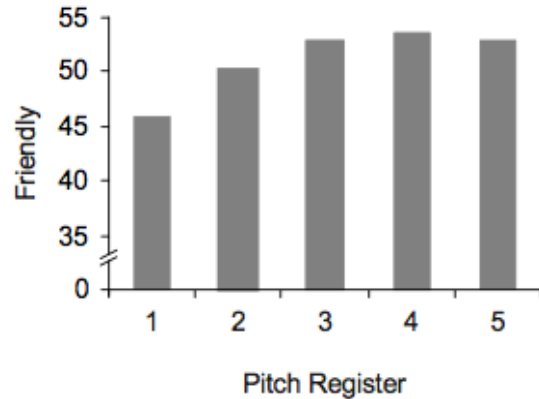
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- Chen, Rietveld, and Gussenhoven (2001)
  - lexically equivalent stimuli varied in pitch range and contour
  - perceived confidence decreased and perceived friendliness increased as pitch range was raised
  - British English more friendly than Dutch at identical pitch ranges



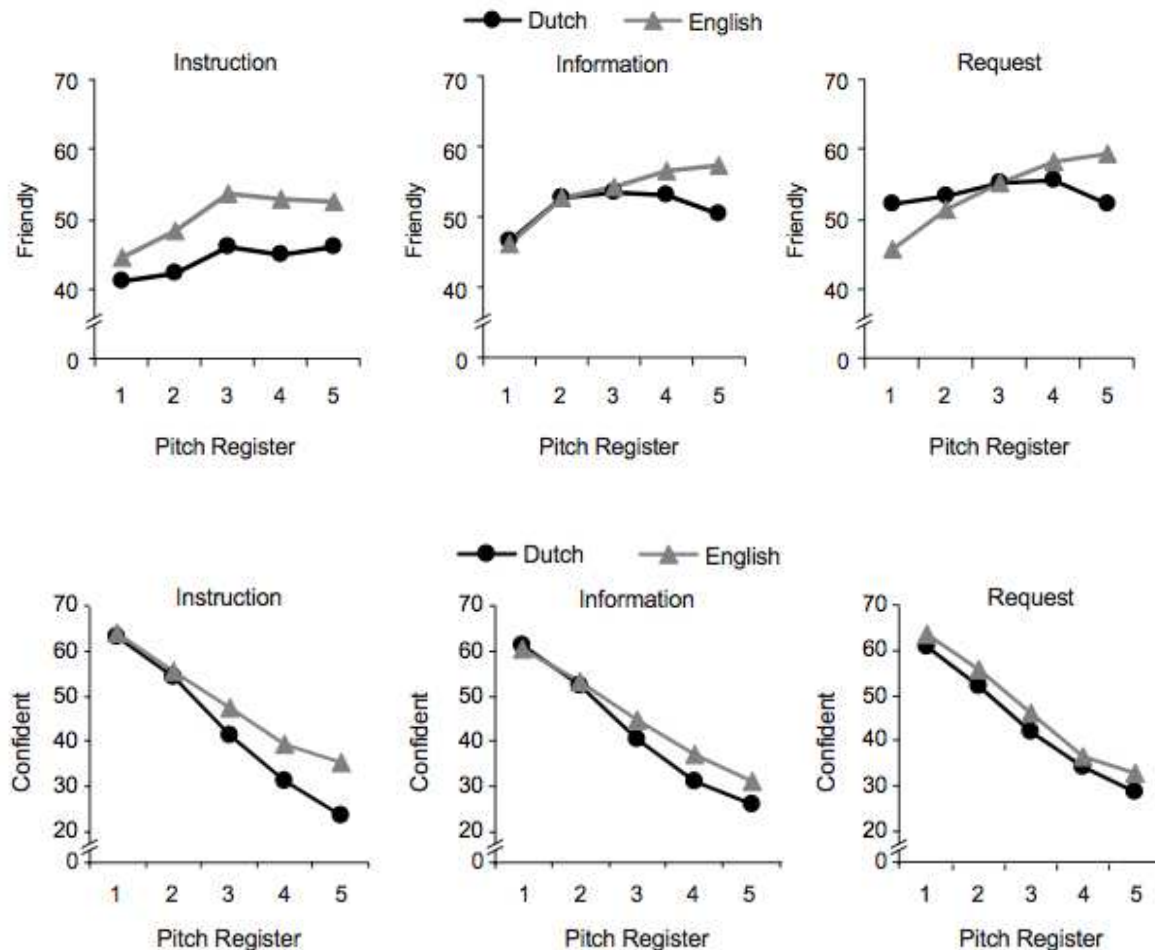


# Language specific effects of pitch range on perception of universal intonational meaning





# Language specific effects of pitch range on perception of universal intonational meaning





# The study

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- English speakers



**Speaker 1**  
(31 years old)



**Speaker 2**  
(52 years old)

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# The study

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- Dutch speakers



**Speaker 1**  
(28 years old)



**Speaker 2**  
(50 years old)

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# The study

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- Polish speakers



**Speaker 1**  
(25 years old)



**Speaker 2**  
(53 years old)

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# Stimulus

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- English

- *By the way, I didn't catch your name.*
- *You can do it on Tuesday afternoon or on Wednesday morning.*

- Dutch

- *Trouwens ik heb je naam gemist.*
- *Je kan dat op dinsdagmiddag of woensdagochtend doen.*

- Polish

- *Tak w ogóle to nie dosłyszałem Twojego imienia.*
  - *Możesz to zrobić we wtorek po południu albo w środę rano.*
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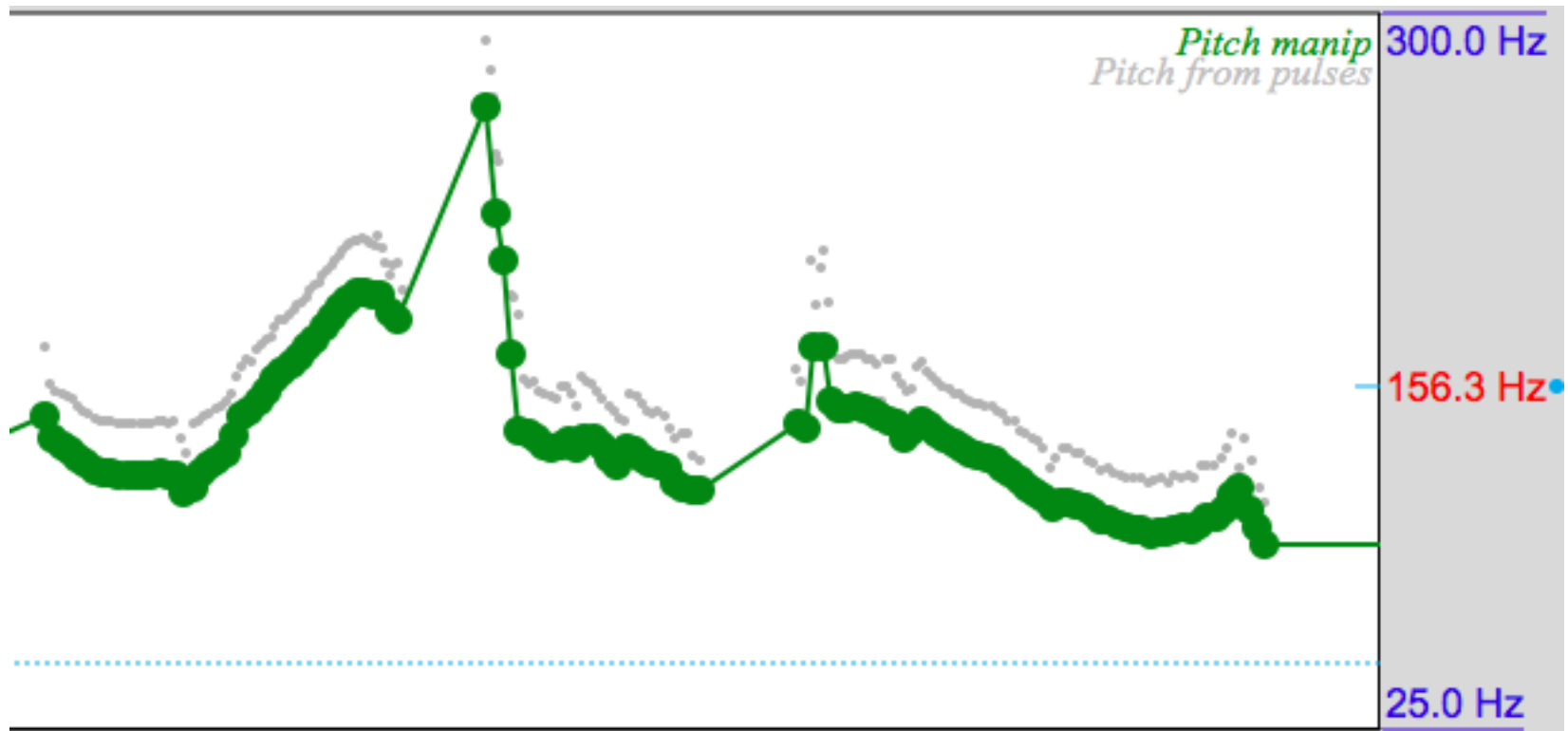
# Data

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- 36 recordings
  - 12 unmodified recordings
  - 12 recordings with equalized pitch register
  - 12 recordings with flat intonation



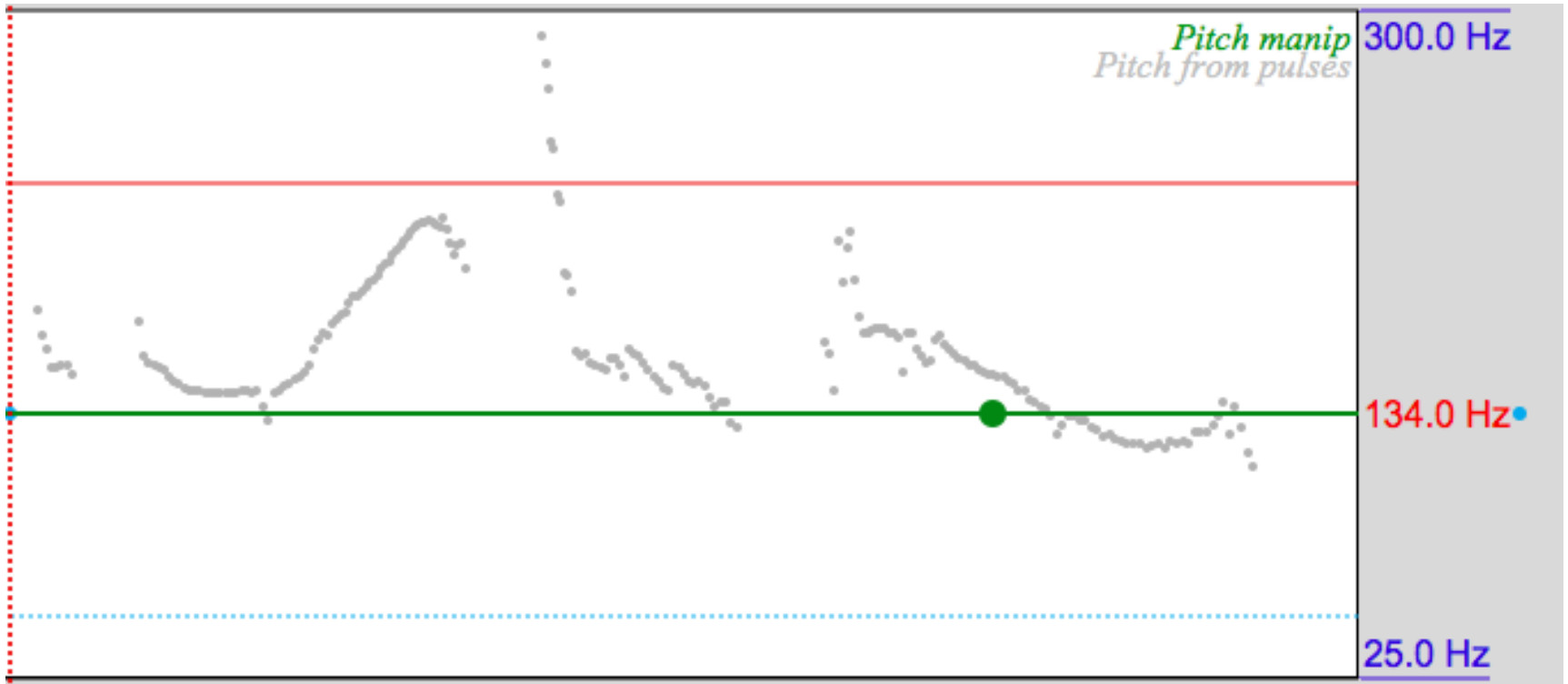
# Method







# Method





# Online survey

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<http://goo.gl/NHgEZ2>

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# Respondents

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- English respondents
    - 17 people (9 M, 8 F) | age = 33.8
  - Dutch respondents
    - 14 people (6 M, 8 F) | age = 40.9
  - Polish respondents
    - 20 people (9 M, 11 F) | age = 26.7
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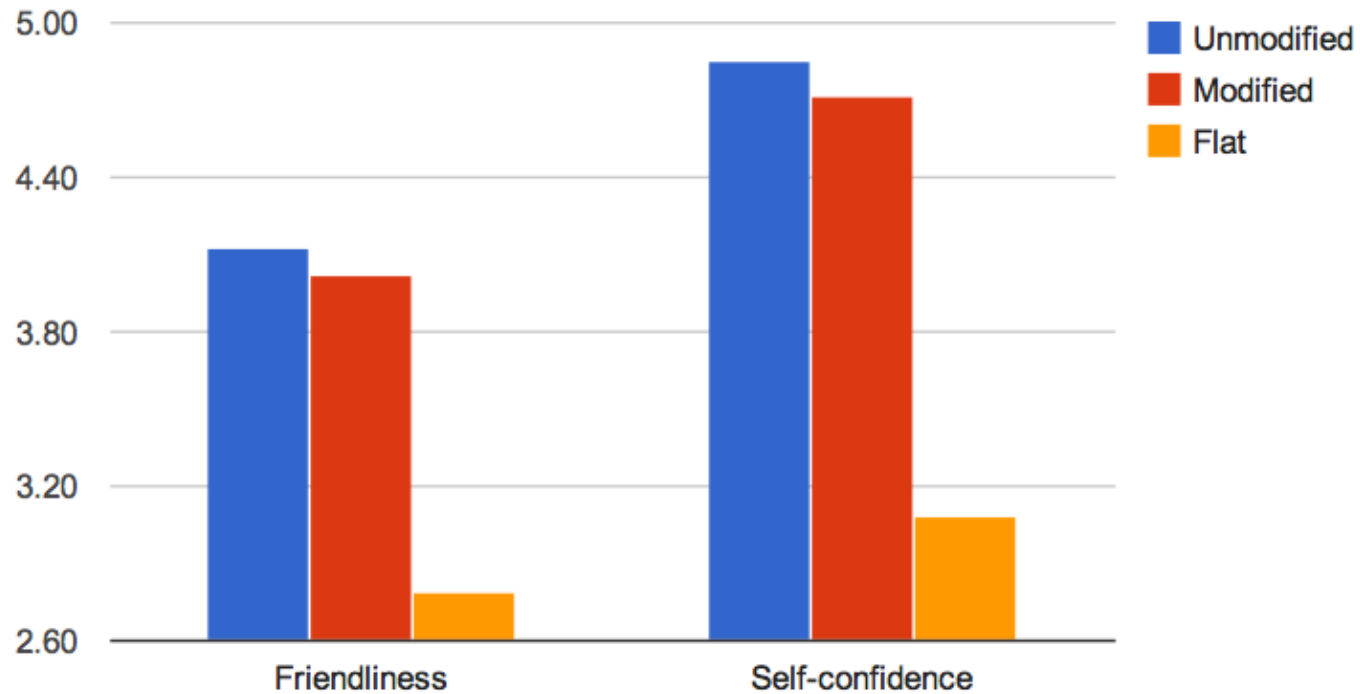
# Hypotheses

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- English should be perceived as the most friendly due to its wide pitch span
  - modified recordings should score the same
    - speakers with lowered pitch register should score worse in friendliness than with standard pitch register
    - speakers with raised pitch register should score better in friendliness than with standard pitch register
  - recordings with flat intonation should score the same
  - speakers regarded as less friendly should score better in self-confidence
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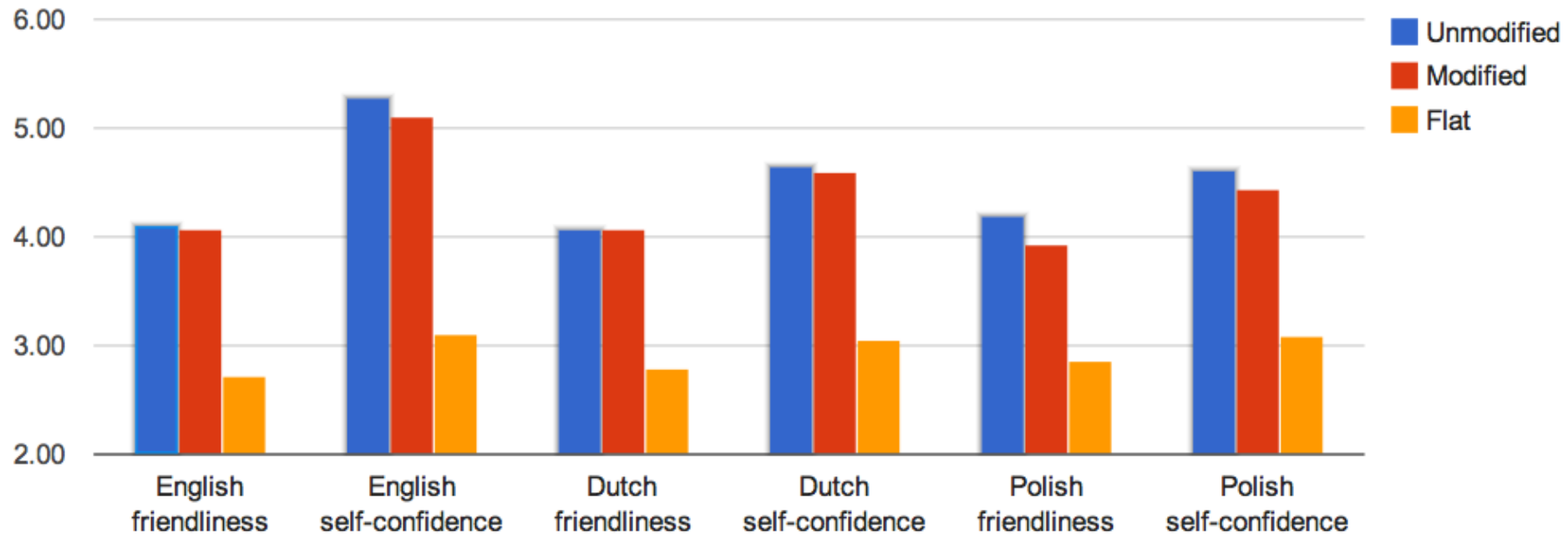


# Mean values / all languages



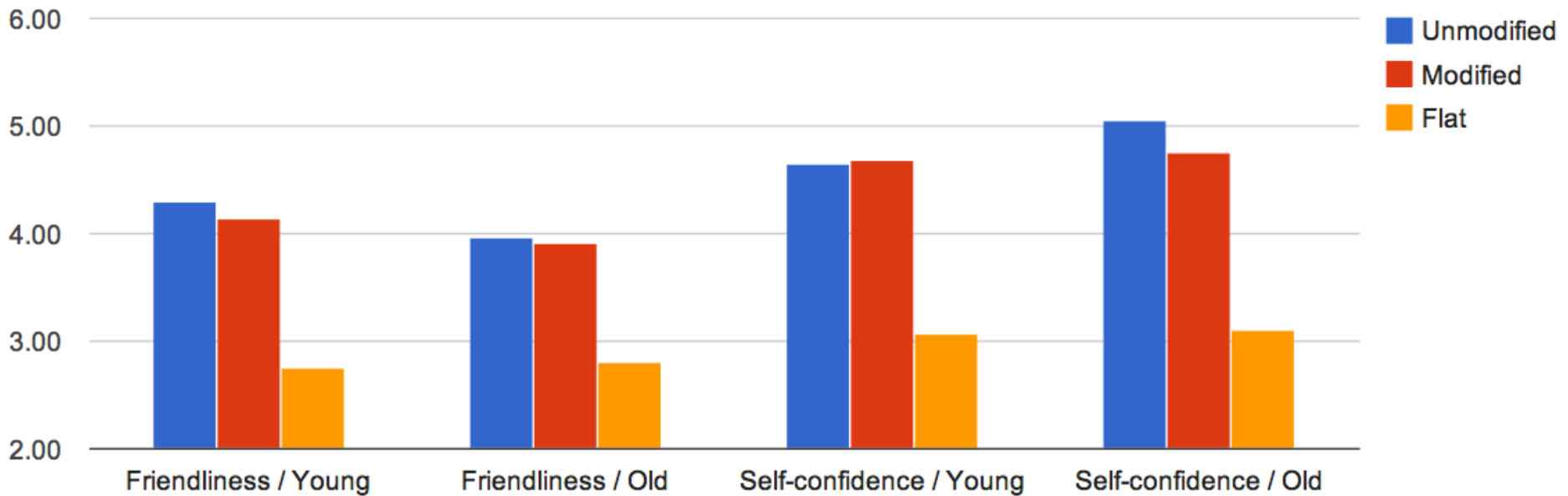


# Mean values / individual languages





# Mean values / speaker's age







# Conclusions

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- speakers with lowered pitch register were perceived less friendly than originally
  - speakers with raised pitch register were perceived more friendly than originally
  - large differences in pitch are noticeable as expected by Polish and English listeners
  - even small differences in pitch are noticeable as expected by all listeners in Dutch
  - Polish respondents find flat intonation less striking than Dutch or English speakers due to lower pitch span of their native language
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# Future research

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- perform more tests for pitch span
  - find more respondents
  - include cross-dialectal differences
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# Selected references

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