Relative Speech Rate: An exploratory analysis of Spanish-English bilingual language use

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Introduction
This study utilizes a novel measure, the ‘relative speech rate’ (RSR) score, to measure fluency in a heritage speaker’s language and to identify which social variables and constructs correlate with the score to depict language dominance of highly proficient Spanish-English bilinguals.

- The heterogeneity of heritage speakers as a group is well known, and it poses many problems in studying this bilingual population and quantifying their language fluency/proficiency.
- Very few studies have examined heritage language speech rate. Those that have been conducted (Kagan & Friedman, 2003; Polinsky, 2008, 2011) use raw words per minute scores that cannot reflect individual speech rate differences or quantify language dominance.
- Several methods have been utilized in an attempt to operationalize language dominance among bilinguals, one of which is the use of sociolinguistic questionnaires.
- This RSR score is implemented and compared with sociolinguistic scores to test its ability to quantify language dominance among heritage speakers and their time apparent parents, late bilinguals living and working in an L2 dominant society.

Relative Speech Rate Score
- Calculated as Spanish WPM / English WPM
- Based on Spanish, each participant’s first learned language
- 0=balanced, negative score=faster in English, positive score=faster in Spanish

Research Questions
1. Will a RSR score reflect aspects of dominance differences among highly proficient Spanish-English Heritage Speaker (HS) and Late Bilingual (LB) speakers in speech rate analysis?
2. What sociolinguistic variables reflecting language dominance through use, identity, and ability correlate with RSR by and across bilingual group?

Design & Methods
Participants
- Heritage Speakers (HS) (n=37)
  - SPA
  - ENG
- Late Bilinguals (LB) (n=23)
  - SPA
  - ENG

Data Collection
- Language elicitation task: Frog. Where are You? (Berman & Slobin, 1994) in both English and Spanish
- Language background questionnaire
  - 68 questions probing language history (U. Sapienza & Zhao, 2005), demographics, language ability, current language use, and language exposure
  - 28 questions were analyzed with a subset of participants, n=32

Analysis & Results

Table 1: RSR Means and (SD) by Group
<table>
<thead>
<tr>
<th>Score</th>
<th>HS</th>
<th>LB</th>
<th>Across</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative</td>
<td>-0.08</td>
<td>0.15</td>
<td>0.01</td>
</tr>
<tr>
<td>Fluency</td>
<td>(0.12)</td>
<td>(0.10)</td>
<td>(0.14)</td>
</tr>
</tbody>
</table>

Independent Samples T-Test
- Compare the RSR score means of LB and HSs
- t(13.82) = (5.63), p<.001
Group means are significantly different

Chi-square Test
- Participants coded as “Above 0” and “Below 0” based on RSR score
- X²(1, N = 60) = 11.50, p <.001

Table 2: Chi-square Table

Results
- Shows a significant relationship between group and RSR score
- A higher proportion of the LB group had scores above 0, indicating Spanish dominance

Correlations with Sociolinguistic Dominance Variables

- 24 variables were used to run a Principal Component Analysis, which is appropriate in reducing the sociolinguistic survey items down to distinct and independent underlying constructs at play in bilinguals’ language profile rather than comparing HS and LB on each item.
- Seven rotated components were retained, cumulatively accounting for 79% of the total variance in the data set.

Principal components analysis
- Construct: Variance %
- Eigenvalue
  - English Identity 21 5.04
  - Spanish Identity 11 2.59
  - Socialization 10 2.52
  - Work 10 2.33
  - Non-specific English Use 9 2.12
  - Non-specific Spanish Use 8 2.04
  - Education 6 1.54

Table 2: Linear Regression model

- The RSR correlates significantly with 12 of the 28 sociolinguistic variables and approaches significance with 5 more variables
- 2 constructs retained from the PCA, English identity and work language, significantly predict a lower RSR score (faster in English)
- Lower Spanish identity and non-Spanish Spanish use approach significance in predicting a lower RSR score

Discussion

RSR group differences
- The mean RSR scores calculated for HS and LB reflect previous observations in the literature (Bermann, Montrul, & Polinsky, 2013) that LB tend to be dominant in Spanish while HS tend to be dominant in English.
- This suggests that the RSR score could be utilized as an objective quantitative measure reflecting language dominance among these highly proficient bilinguals.
- Additionally, by comparing each individual’s scores across their languages, this RSR score is controlling for individual speech rate variation without requiring any comparison to monolingual baselines.

Sociolinguistic dominance variables
- The correlation of the RSR with sociolinguistic variables and constructs identified by the PCA also supports that the RSR score is predicting dominance differences among these two distinct bilingual groups.
- Regression modeling shows that the more an individual identifies as English dominant in identity and work environments, the lower their RSR scores (faster in English) are. This indicates that the RSR is successfully being predicted by English dominance with these constructs.
- Lower Spanish use and Spanish identity constructs retained by the PCA also show significant lower RSR scores. As Spanish use and identity decreases, speech rate dominance in English increases.

Benefits of the RSR Score
- 1. Controls for individual speech rate differences
- 2. Orients the need for monolingual comparisons by comparing two bilingual groups to each other
- 3. Reflects differences in aspects of oral dominance

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