

# On the Interaction of Variation and Exceptionality in Modern Hebrew Spirantization

Michal Temkin Martínez

Boise State University

MichalTMartinez@boisestate.edu

[http://works.bepress.com/michal\\_martinez/](http://works.bepress.com/michal_martinez/)

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## I. Introduction

### **Modern Hebrew spirantization**

- *Spirantization pattern*: [p], [b], and [k] alternate with [f], [v], and [χ] within root paradigms (fricatives occur in post-vocalic position).
- *Exceptions*: Stops and fricatives that do not alternate, resulting in post-vocalic stops and word-initial and post-consonantal fricatives.
- *Variation*: The literature reports variation in spirantization:
  - Schwarzwald (1981) – variation is a discrepancy between formal rules of language and children's pronunciation.
  - Adam (2002) - variation in spirantization is due to exceptionality. Alternating paradigms are heading toward non-alternation.
- Is there variation in exceptional segments?
- Can synchronic variation be used to predict directionality?

### **Experimental rating task**

- Seventy-four native speakers of Modern Hebrew
- Participants rated acceptability of the pronunciation of target words in sentences presented auditorily.
- Overall, variation is acceptable in both alternating and exceptional segments.
  - Variation is more acceptable in alternating segments.
  - Higher rates of acceptability post-consonantly than in other positions.
  - Overall trend does not show a strong preference toward stops or fricatives.

### **Outline of the talk**

- Overview of Modern Hebrew Spirantization
  - Alternation
  - Exceptionality
  - Variation
- Results of Rating Experiment
  - Acceptability of variation in alternating paradigms
  - Acceptability of variation in exceptional paradigms
- Interaction of Exceptionality and Variation

## II. Overview of Modern Hebrew Spirantization

### Stop-fricative alternation

- Spirantization traces back to older forms of Hebrew. All singleton, non-emphatic stops in Tiberian Hebrew underwent spirantization.
- Spirantization in Modern Hebrew root paradigms is confined to the alternation of [p], [b], and [k] with their fricative counterparts [f], [v], and [χ], respectively. Fricatives occur post-vocally and stops elsewhere.

(1) Spirantization pattern in Modern Hebrew

	Root <sup>1</sup>	Infinitive	3 <sup>rd</sup> Person Sg. Past.m.	Gloss
[p] ~ [f]	/pgʃ/	[lifgoʃ]	[pagaʃ]	‘to meet’
[b] ~ [v]	/bgd/	[livgod]	[bagad]	‘to betray’
[k] ~ [χ]	/ktb/	[liχtov]	[katav]	‘to write’

### Exceptionality

- Exceptions to spirantization are non-alternating [p], [b], [k], [f], [v], and [χ], which may surface as stops post-vocally or as fricatives elsewhere.
  - Historically, these sounds did not participate in spirantization (emphatic stops, geminates).

(2) Exceptions to spirantization in Modern Hebrew (underlined>

	Root	Infinitive	3 <sup>rd</sup> Person Sg. Past.m.	Gloss
/k/ (< *q)	/krʔ/	[likro] (*liχro)	[kara]	‘to read’
/v/ (< *w)	/vtr/	[levater]	[viter] (*biter)	‘to give up’

### Variation

- Variation has been reported in Modern Hebrew spirantization (Schwarzwald 1981, Adam 2002) and consists of segments that normally conform to the spirantization distribution surfacing as stops where fricatives are expected or as fricatives where stops are expected.

(3) Examples of variation in Modern Hebrew spirantization

Expected	Acceptable Variant	Gloss
jik <b>bor</b>	jik <b>v</b> or	‘will bury’
jex <b>ase</b>	jek <b>as</b> e	‘will cover’

- Adam (2002) claims that this variation is driven by non-alternation.
  - Variation in alternating forms is seen as a “*conflict [which] entails a competition between two grammars: one which allows alternation and one which blocks it.*”
  - Variable Grammar moving toward non-alternation as its final state.

<sup>1</sup> No claim is being made here as to whether the UR of spirantized segments is a stop or fricative.

<sup>2</sup> I used z-scores to control for individual variation in use of the four-point scale. However, the graphs are

### III. Rating Experiment

Designed to examine acceptability of variation in alternating *and* exceptional segments.

#### Hypotheses

##### 1. Alternating Segments

- Variation is acceptable
- The variation is not 'free': it is biased to the expected form
- Positional effects

##### 2. Exceptional Segments

- If variation is acceptable, it will be less so than in alternating segments
- Positional effects

#### Stimuli

- A total of 42 roots were used in the experiment (24 with alternating segments, 12 with exceptional segments, 6 containing two target segments—one alternating, one exceptional).
- Each root was conjugated (two conjugations per root) and recorded in the expected and variant form for each conjugation, resulting in 204 target words. Each participant rated 102 tokens.

(4) Examples of expected and variant forms following the spirantization pattern

Pair	Root	3 <sup>rd</sup> Person Sg. Past.m		Infinitive		Gloss
		Expected	Variant	Expected	Variant	
[p] ~ [f]	/prs/	[paras]	[faras]	[lifros]	[lipros]	'to spread'
[b] ~ [v]	/bnh/	[bana]	[vana]	[livnot]	[libnot]	'to build'
[k] ~ [χ]	/ktb/	[katav]	[χatav]	[liXtov]	[liχtov]	'to write'

- Target words were inserted into carrier sentences. Following each of the verbs was a semantically plausible four-syllable sentence ending.

(5) Sample carrier sentences for target words

##### Past

[amru        li        ʃedaniel        (target verb)        le/be/me/et ha \_\_\_\_\_ ]  
 told        to me that Daniel        (target verb)        to/in/from/the \_\_\_\_\_  
 "I've been told that Daniel (target verb) to/in/from/the \_\_\_\_\_"  
*e.g. "I've been told that Daniel built the hut."*

##### Infinitive

[amruli        ʃedan        holeχ        (target verb)        le/be/me/et ha \_\_\_\_\_]  
 told to me that Dan        is going        (target verb)        to/in/from \_\_\_\_\_  
 "I've been told that Dan will (target verb) to/in/from \_\_\_\_\_"  
*e.g. "I've been told that Dan is going to build the hut."*

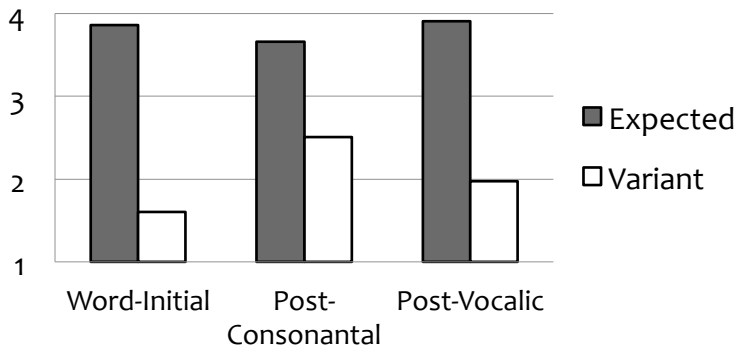
## Results

- Participants' responses to the rating task were converted into numbers (from 1 to 4)<sup>2</sup>
  - Very natural pronunciation = 4
  - Unnatural pronunciation = 1

### 1. Alternating segments

- Both *position* and *allophone* contributed to the acceptability of variation in alternating segments.
  - Main effect of *position* ( $F(2, 72) = 36.963, p < .001$ )
  - Main effect of *allophone* ( $F(1, 73) = 890.882, p < .001$ )
  - Interaction between *position* and *allophone* ( $F(2, 72) = 89.036, p < .001$ )

#### (6) Acceptability of variation in alternating segments

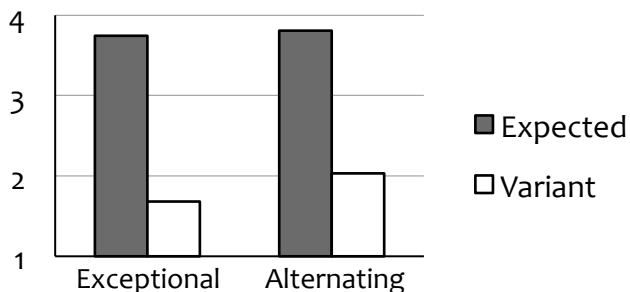


- Main effect of the segment preceding the alternating segment within a given token ( $F(1, 36) = 32.869, p < .001$ )
- Interaction of *consonant type* and *allophone* ( $F(1, 36) = 38.346, p < .001$ )
  - Driven by the higher rating of acceptability of the variant form (a fricative) when following a stop.

### 2. Exceptional segments

- Variation is acceptable in exceptional segments.
  - Significant difference between the acceptability of variants of exceptional segments vs. baseline ( $t(73) = 10.718, p < .001$ )

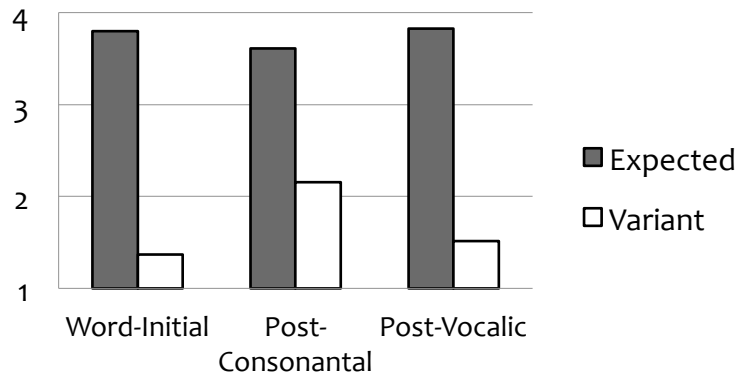
#### (7) Difference between acceptability of exceptional vs. alternating segments



<sup>2</sup> I used z-scores to control for individual variation in use of the four-point scale. However, the graphs are based on raw scores (1-4) for ease of visualization. The use of z-scores also mitigated order effects within lists.

- Variation in exceptional segments was rated less natural than variation in alternating segments.
  - Main effect of *type* ( $F(1, 73) = 80.073, p < .001$ )
- Interaction between *type* and *allophone* ( $F(1, 73) = 18.707, p < .001$ )
- Both *position* and *allophone* contributed to the acceptability of variation in exceptional segments.
  - Main effect of *position* ( $F(2, 72) = 40.481, p < .001$ )
  - Main effect of *allophone* ( $F(1, 73) = 767.518, p < .001$ )
  - Interaction between the *position* and *allophone* ( $F(2, 72) = 57.094, p < .001$ )
    - Tokens with the target segment in post-consonantal *position* drove the main effect of *position* and the interaction of *position* and *allophone*.

#### (8) Acceptability of variation in exceptional segments



### Trends within verbal paradigms

- What does variation look like within verbal paradigms?
  - Are there preferences for segment type within roots?
  - What does this tell us about the underlying representation for alternating roots?
  - In exceptional segments, does the variation point to a move toward exceptional segments behaving like alternating segments?

#### 1. Alternating segments

To determine patterns of acceptability within individuals' ratings and within verbal paradigms, the four-point scale was divided in two (3 or 4 = acceptable, 1 or 2 = unacceptable).

#### Possible patterns

- Tokens were randomized and therefore rated independently from others stemming from the same root.
  - There were 16 possible patterns of acceptability for each verbal paradigm.
    - None of the tokens is acceptable
    - Only 1 token is acceptable (4 possibilities)
    - 2 tokens are acceptable (6 possibilities)
    - 3 tokens are acceptable (4 possibilities)
    - All 4 tokens are acceptable

## Observed patterns

- Preliminary analysis looks at 25 participants' ratings of 12 verbal paradigms.
- Most common pattern – only the two expected forms are acceptable.
- When three forms are acceptable, there is no preference for stops over fricatives.
  - 45 instances of preference for both expected forms and the variant containing a stop.
  - 47 instances of preference for both expected forms and the variant containing a fricative.
- There were 30 instances of acceptability of all tokens within a verbal paradigm.

(9) Observed patterns across participants and verbal paradigms (alternating segments)

	none	1 acceptable				2 acceptable					3 acceptable				all	
Expected (fricative conjugation)		a				a	a	a				a	a	a		a
Stop variant			a			a			a	a		a	a		a	a
Expected (stop conjugation)				a			a		a		a	a		a	a	a
Fricative variant					a			a		a	a		a	a	a	a
Observed	0	4	0	2	0	0	159	7	3	0	0	45	2	47	1	30

- Overall, there is no preference for stops or fricatives.
- If the preference is not based on whether the segment is a stop or a fricative, what does it depend on?

(10) Sample roots for stop/fricative preferences

Preference for stops		Preference for fricatives	
Root	Uninflected	Root	Uninflected
/pɡʃ/	pagaʃ	/mkr/	maχar
/bnh/	bana	/ʃpχ/	ʃafaχ
/ktv/	katav	/spr/	safar

- Is the preference dependent on root position?
- Is the preference dependent on uninflected form (3<sup>rd</sup> person singular past masculine)?
  - If so, could this preference predict variation in exceptional segments as well?

## 2. Exceptional segments

### Observed patterns

- Preliminary analysis looks at 25 participants' ratings of 8 verbal paradigms.
- Looking at acceptable variants to see whether there is a preference for root position
  - Used the spirantization pattern in (1) to determine this.

## (11) Observed patterns across participants and verbal paradigms (exceptional segments)

	none	1 acceptable				2 acceptable				3 acceptable				all		
Expected (conforms with SD)		a				a	a	a			a	a	a		a	
Variant - doesn't conform with SD			a			a			a	a		a		a	a	
Expected (doesn't conform with SD)				a			a		a		a		a	a	a	
Variant – conforms with SD					a			a		a	a		a	a	a	
Observed	0	2	0	0	0	0	142	2	0	0	0	15	0	10	0	4

- When three forms are acceptable, there is no preference for whether the segment type conforms with the spirantization pattern for alternating segments.
  - 10 instances of preference for both expected forms and the variant that conforms to the spirantization pattern.
  - 15 instances of preference for both expected forms and the variant that does not conform to the spirantization pattern.

## (12) Sample roots for preferences in exceptional segments

Preference conforms with SD		Preference does not conform with SD	
/fdχ/	pideaχ	/fʃl/	mepaʃel
/tvh/	litbot	/dkr/	lidχor

- Acceptability of variants in exceptional segments does not depend on root position.
- It does not appear that the variation in exceptional segments is due to a move toward conformity with the spirantization pattern.

**Demographic influence on acceptability of variation?**

Multiple regression analysis shows that these findings hold across gender, age groups, and educational levels.

**IV. Conclusions**

Current patterns of variation in Modern Hebrew alternation and exceptionality demonstrate a possible two-way interaction between exceptionality and variation. Further research is needed to determine the nature of this pattern.

**V. Future Directions**

- Theoretical implications
  - What does the variation depend on? Can we determine its directionality?
- Production experiments in Hebrew with pre-literate children.
- Diachronic data – to examine the directionality of the variation.
- Corpus study (CoSIH) to identify instances of variation in natural speech.

## VI. References

- Adam, Galit. 2002. From Variable to Optimal Grammar: Evidence from Language Acquisition and Language Change. Ph.D. Dissertation. Tel-Aviv University.
- Schwarzwald, Ora. 1981. Grammar and Reality in the Hebrew Verb. Bar-Ilan University Press, Israel.
- Temkin Martínez, Michal. 2010. Sources of Non-conformity in Phonology: Variation and Exceptionality in Modern Hebrew Spirantization. Ph.D. Dissertation. University of Southern California.

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